ILLUSTRATIONS

OF THE

BOTANY

AND

OTHER BRANCHES OF THE NATURAL HISTORY

OF THE

HIMALAYAN MOUNTAINS.

FRONTISPIECE.

Reduced from a Drawing by Lt. Col. R. Smith.

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Engraved by J. Clark.

View of the HIMALAWAN MOUNTAINS, from the Vicinity of ALMORAH, elevated 5000 feet.

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Text

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BOTANY

AND

OTHER BRANCHES OF THE NATURAL HISTORY

OF THE

HIMALAYAN MOUNTAINS,

AND OF THE

FLORA OF CASHMERE.

VOL. I.

By J. FORBES ROYLE, M.D., V.P.R.S.,

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Professor of Materia Medica and Therapeutics, King's College.

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BOTANICAL
GARDEN.

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1839.

TO

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SIR HENRY WILLOCK, K.L.S.
JAMES WEIR HOGG, ESQ., M.P.

DIRECTORS

OF THE

Honourable East-India Company,

THIS WORK,

Illustrating the Botany and other branches of the Natural History of the stupendous Mountains which form the barrier between the British dominions in India and the territories of the Chinese; in which the Geographical Distribution of Plants, as connected with Climate, is considered, their Useful Properties detailed, and the principles which should guide their culture in new situations deduced;

Being the result of investigations when in charge of a Scientific Institution of the Honourable Company, and assisted by the information which has accumulated from their long-continued patronage of Botanical Science in India,

IS DEDICATED,

BY PERMISSION,

AS A TRIBUTE OF THE RESPECT OF

THE AUTHOR.

London, 28th November 1839.

PREFACE.

The Author having been for several years Superintendant of the Honourable East-India Company's Botanic Garden, at Saharunpore, in 30° of N. latitude, and near the foot of the Himalayas, had, necessarily, great advantages in acquiring a knowledge of the Botany and other branches of the Natural History of that little-known portion of the British dominions in India. These opportunities he was not disposed, either by duty or inclination, to neglect. Therefore, (as described in the Introductory Observations, where the sources of information are detailed, pp. 1 to 3), with the Plants introduced into the Botanic Garden, preserved in the Herbarium, or drawn by the Hon. Company's Painters, he collected specimens of the rocks he met with in his journeys, made observations on their dip and direction; preserved the skins of Mammalia, of Birds, and of Reptiles, with the skeletons of some, and made a collection of the Insects both of the Plains and Mountains of N. W. India. He also made Meteorological Observations with the Barometer, dry and wet Bulb Thermometer, Rain-Guage, &c., all of which have served as bases for the observations in the Introductory Chapters of this Work. But his duties consisting also of the medical charge of the Station of Saharunpore, including two Hospitals, and the European residents, afforded less facility for travelling than was necessary for Natural History investigations.

In making public the materials which had been collected, two courses appeared open to the Author; either to treat of the several individual specimens, as objects of Natural History, entering minutely into their descriptive or distinctive characters, and interesting points of structure; or as the collections were brought home, arranged according to the Natural Method of Classification, submitting the whole to the examination necessary for ascertaining the identity of old, or the certainty of new species; make use of the information obtained, for treating generally of the Flora of the Plains and Mountains of India, with respect to Geographical Distribution. This course has been preferred, as giving the most interesting and important general results, in consequence of the distribution of Plants being so much connected with soil and climate, and as leading to a just appreciation of the influence of physical agents on vegetation, and elucidating those principles which require to be attended to in the culture, both of new, and of old plants in new situations. This also afforded great facilities in treating of the properties of plants as connected with structure, and for showing the immense resources of British India, both as regards whatever is necessary for the Agriculture, Manufactures, and Internal trade of the people, as for the supply of a much extended External Commerce. Much attention has also been paid to the Materia Medica of India, as this formed a principal object of the Author's studies there, and the results of which are recorded in the MS. work on Materia Medica, alluded to by his friend Mr. James Prinsep, in the Journ. Asiat. Soc., vol. i. p. 459, 1832, and which he hopes soon to have leisure to publish.

Before concluding, the Author begs to take this opportunity of expressing his grateful thanks to the several Friends who have assisted him in different parts of this Work. To Mr. De La Beche he is deeply indebted for the trouble he took in constructing the Geological Sections, from the Author's notes and specimens, and which are also useful as indicating the precise localities and elevations at which many of the Plants were found. To Capt. Cautley his best thanks are due, for the beautiful Drawings of Himalayan Fossils; and to Dr. Falconer for recent Geological and Botanical information.

The Author is also much indebted to his Friends, the Rev. Mr. Hope, late President of the Entomological Society; and to Mr. Ogilby, Secretary of the Zoological Society, for having enriched this Work

with their very valuable Dissertations, on the distribution of the Insects and Mammalia of the Plains and Mountains of India, in which he has been much gratified by finding that their observations coincide so fully with the results which he obtained from investigating the Flora of the same regions.

In the Botanical portion of the Work, the Author feels equally indebted to Dr. Robert Brown, "Botanicorum Princeps," for placing in his hands the Herbarium, collected in Kunawur by Mr. Inglis, of Canton, and for the character of *Incarvillea;* to Mr. Bentham, for those of the *Sileneæ*, *Leguminosæ*, and *Boragineæ*; also for describing, in his own works, the *Labiatæ* and *Scrophularineæ;* to Professor Nees Von Esenbeck, of Breslau, for the kindness with which he has arranged and described the new Genera and Species of *Gramineæ* and *Cyperaceæ*. The Author much regrets that want of space has compelled him to omit the characters of the former, which he has therefore made over to the Linnean Society. To Professor De Candolle, of Geneva, for examining and naming the *Synanthereæ*, and for the description of them published in his "Prodromus;" to Sir W. J. Hooker, for naming the Mosses. To Professor Don, also, the Author feels much obliged, for assistance in comparing his collection with the East-Indian and other Herbaria, deposited in the Museum of the Linnean Society, and for his account of the Genus *Ranunculus*, of *Gentianeæ*, and the specific characters of the *Smilaceæ* and *Tulipaceæ* figured. To Professor Lindley, for his Notes upon some of the Himalayan *Umbelliferæ*, as well as for examining the *Orchideæ* of his Collection, and for the valuable advice he has received from him respecting every department of the Work.

As the Work contains so much of Detail, combined with General Views, it would have been comparatively useless without easy means of reference. This has been supplied by the Analytical Table of Contents at the beginning, and the Alphabetical Indexes at the end of the Book: for all of which the Author is indebted to his Wife. In the former, the Plants figured by Drs. Roxburgh and Wallich have been referred to by the number of the Plate, and the number of species in the East-Indian Herbarium, according to the enumeration of Professor Von Martius, has likewise been added, as well as the number of genera and species in the Author's Herbarium, according to the List which he published, in the Journal of the Asiatic Society, at Calcutta, in March 1832.

The Author has to express his extreme regret, for the very long delay which has taken place in the appearance of the latter part of the Work. As this proceeded from his accepting the Professorship of Materia Medica and Therapeutics in King's College, and thus finding it impossible to give the Work the exclusive degree of attention which it required, and had hitherto received, he hopes that the delay will be excused, as he found it was the only way in which he could do justice to the task he had undertaken. This has, however, given him the satisfaction of seeing many of the suggestions which he has made, carried out in India. He has also to apologize for the Work not being completed in Ten Numbers; but if the Details, together with the General Views which have been entered into, be considered, as well as the constant comparisons made between the Flora of the Mountains and of the Plains of India with that of other parts of the world, and also the application of the results to the probable means of improving the resources of India, it will probably be readily admitted, that it was not possible to calculate the exact quantity of letter-press into which the information might be compressed.

In conclusion, the Author must express his conviction of the skill which Mr. Gauci has displayed in the representations of the Plants figured, and in which he has been well seconded, first by Mr. Clarke, and latterly by Mr. Barclay in the Colouring. He considers it also but justice to the Publishers, Messrs. Allen and Co., to state, that they have in every instance acceded very liberally to the suggestions of the Author, for whatever was considered to be of advantage to the Work.

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60	TEREBINTHACEÆ	23	13	29	174	174	174	174	175	175	31. fig.2. Odina Wodier.	12.282.262. 207.208.	11.12.283.	Bdellium. Olibanum. Myrrh tree.
61	MORINGEÆ	1	1	1	180	180	180	—	—	180	... ... —	—	—	Ben nuts and oil.

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INTRODUCTION.

In a work on the Botany and Natural Productions in general of the Himalaya Mountains, any reference to the Climate and Natural History of other parts of India may by many be considered out of place, but if we are desirous of observing the changes in animal and vegetable forms dependent on climate, it is necessary, before we proceed to notice the European types found on the declivities of the Himalaya, to take a cursory view of those found at their bases which are characteristic of India.

This, though involving a consideration of some of the causes which produce a difference in climate itself, will have the advantage of exhibiting that the great diversity of soil and climate to be found in the British possessions in India, is capable of supporting almost all the natural productions of every region of the globe.

Though the British possessions do not extend beyond 31° of northern latitude, India, according to its natural boundaries, stretches from 35° to 22°, with its peninsula extending to 8° of northern latitude, and from 67° to 95° of eastern longitude. Its extreme length from Cape Comorin to Cashmere is about 2,000 miles, and its greatest breadth from the bend of the Burrampooter to the mouths of the Indus must be nearly as great; but from its irregular figure, the superficial area is not estimated higher than at 1,280,000 English miles. It is bounded on the S.W. by the Indus, and on the N.E. by the Himalayan mountains, while the Indian ocean washes its two remaining sides: the whole forming a kind of irregular diamond figure, to which the island of Ceylon forms a pendent.

From the southern portions of India approaching so near to the Equator, while its northern provinces are nearly in the latitude of the southern parts of Europe, we may form some idea of the great extent of territory, and be prepared to find great diversities of climate, and consequently of the productions of every kingdom of Nature, from its long extended coasts, washed by a tropical ocean, to the tops of its several ranges of mountains, among which, as among those of the world, the Himalayas stand pre-eminent, whether we consider their extent or elevation, their diversity of climate or of production.

As the form and slope of the country, the direction of the rivers, and the climate of the different parts, depends in a great measure on the direction and elevation of the mountain masses, as well as the soil on their mineralogical composition, it is obvious, that before proceeding to other subjects, we should first obtain a general idea of the number and position of the several mountain ranges of India, and this may be

conveniently done, by taking them as they naturally form four separate ranges: first, the Western and secondly the Eastern Ghauts, which run parallel to the Malabar and Coromandel coasts; thirdly, the Vindyha range, which runs east and west across the central part of India; and, fourthly, the Himalayas, which form its north-eastern boundary.

The Western or Malabar Ghauts extend nearly north and south from Candeish to Cape Comorin, or from 21° to 8°, and form a nearly unbroken chain, except at the chasm, nearly sixteen miles in breadth, which opens into the valley of Coimbatore, and through which the river Poonyani escapes into the sea.

The western face of this range is much more abrupt than its eastern, and its northern parts less elevated than the southern, as the former seldom exceeds three thousand feet in height. Between 17° and 18°, the Mahabuleshwur Hills, giving origin to the different sources of the Krishna, and resorted to by invalids from Bombay, form a table-land of nearly five thousand feet; but between 10° and 15° N. there are peaks of granite which rise to five and six thousand feet. Mr. Babington, indeed, describes Bonasson Hill as being seven thousand feet above the sea; and Dr. Young, in his recent description of the Neelgherries, assigns eight thousand seven hundred feet as the height of the peak of Dodapet, situated between 11° and 12° N. latitude. It is at these hills, as Mr. Calder remarks, that the junction of the Malabar and Coromandel ranges takes place; for here the Neelgherries or Blue Mountains "rise into the loftiest summits of the Penin-"sula, and form the southern boundary of the great table-land, and the northern "boundary of the remarkable valley of Coimbatore:" from the opposite side of which, the continuation of the united chains proceeds in one central range to the southern extremity of the Peninsula, with a gradually diminishing elevation.

The Eastern or Coromandel Ghauts, less elevated and less continuous than the Western, from which all the rivers flow towards and through them, are at the same time more rugged and barren. They may be said to diverge into a separate chain from the Neelgherries, and to proceed northwards and eastwards, "breaking into a succession "of parallel ranges, and, after branching off into subordinate hilly ranges, occupying a "wide tract of unexplored country, and affording vallies for the passage of great rivers; "this eastern range may be said to terminate at the same latitude as that of the com-"mencement of the western." Their elevation about the latitude of Madras, which is the highest part, is estimated at three thousand feet.

These two ranges support between them a great extent of elevated table-land, of which the climate and productions differ from the belts of low land which intervene between the sea and the bases of these mountains. The rise of this table-land is on the west very abrupt, but its declension to the eastward is so gradual by a succession of distant terraces, so as not to appear remarkable. Like the mountains by which it is supported, the elevation of this table-land increases from north to south, being in Aurungabad and the Dukhun about eighteen hundred feet above the level of the sea, while many parts of Mysore attain an elevation of from two thousand five hundred to three thousand feet,

and

and the table-land of the Neelgherries is about seven thousand feet, whence the country again declines towards Coimbatore. Colonel Sykes informs us, that in the Dukhun, on the top of the Ghauts, there are numerous spurs or ranges of mountains extending to the E. and S.E., the vallies between which are either narrow, tortuous, and fissure-like, or wide and flat. This observation will apply in a great measure to the table-land in general, which is rather undulating than flat, and covered with numerous smaller ranges of hills.

This table-land, accessible from the coast by various passes, is by the natives called *Balaghaut*, or country above the Ghauts, and the lowlands, *Payin-ghaut*, or country below the Ghauts. This low country, stretching and gradually declining from the Ghauts to the sea, is in the Concan thirty-five miles in breadth, intersected by ravines, which are traversed by small streams; in Canara the Ghauts approach within a few miles of the sea. In South Malabar the coast is low, much broken, and, like that of Travancore, distinguished by the peculiarity of being intersected by long narrow inlets of the sea, which run parallel with the coast, sometimes at the distance of a few hundred yards, at others of three or four miles, into which the numerous mountain streams flow, and with which the sea communicates by six shallow openings, of which the only one navigable for ships, is that on the south bank of which Cochin is situated. By this backwater a system of inland navigation is carried on, which is always safe, and, by artificially connecting approximating inlets, has been extended to nearly three hundred miles. The breadth varies from twelve and fourteen miles to two hundred yards, and the depth from many fathoms to a few feet. "In other parts where there are none "of these salt inlets, the lowlands on the sea coast within the downs are overflowed, "and the fresh water stagnates and evaporates."

On the eastern coast of the Peninsula, the Carnatic presents a long strip of low land, and the plains of the Coromandel coast form a broad, though unequal belt between the mountains and the sea. The soil is in most places described as being composed of either sand or gravel; in others of the debris of granite and trap-rocks, and the alluvial deposits of all the rivers which descend from the table-land, some of them conveying much decayed vegetable matter from the extensive forests through which they flow. Parts of the Carnatic and Coromandel coasts are described as being composed of plains of marine sand, in which remains of oysters and cockles are found; but these may have been of very recent origin, as the whole coast may formerly have been overflowed, as Cuttack is at the present day, whenever a great storm occurs, as was the case in May 1830, and again on the 31st of Oct. 1831, when the inundation extended from Kedgeree to Cuttack, but its greatest fury was spent in the Midnapore district, and on the unfortunate coasts of Kedgeree, Hidgelee, and Balasore. The large bunds (embankments) of those coasts, behind which a numerous population slept in fancied security, were suddenly overwhelmed by a tremendous wave, which swept away with resistless force every house and every article of property in the native villages, at the same time destroying the rice crops, all the cattle of an extensive tract of country, and a large

portion of the inhabitants. (*Vide* Mr. G. A. Prinsep's Work on Saugur Island.) These tremendous storms were repeated in October 1832 and in May 1833, the last more severe than any of the former, when ships were left stranded on dry land, the whole country covered with water, and the wretched inhabitants, who had escaped drowning, were in danger of dying not only of hunger, but excessive thirst. (Vide *Calcutta Courier*, 25th May 1833.) The tract extending between the sea and mountains in Orissa or Cuttack, is a plain level country, undisturbed by a single elevation; near the sea-shore, marshy and woody; having much resemblance to the *sunderbuns* (or Delta of the Ganges) in its swamps and marshes, innumerable winding streams, dense jungles, and noxious vapours. The Chilka lake on this coast, is supposed to have been formed by an inundation of the sea.

The third great range of Indian mountains is the Vindyha or Central Zone: of this it is difficult to assign the length, breadth, or thickness, as the geography of Central India is but imperfectly known. But if the map of India be examined, it will be observed, that the Ganges and Jumna, after their junction at Allahabad, take an easterly course, though they had previously descended in a south-easterly direction. This deflection is caused by the extension of the Sandstone-hills to Mirzapore and Chunar, and maintained by the projection of the central mass at Monghir and Rajmahl. From this it crosses the whole continent of India, in its broadest part from east to west, terminating in the mountainous country of Guzerat. By Mr. Calder it has been considered as uniting "the northern extremities of the two great ranges already described, which terminate nearly in the same parallel of latitude, forming as it were the base of the triangle that elevates the table-land of the Peninsula. This range has numerous divisions, and a multitude of names, almost every district giving a change of denomination: but to the eye of the geologist, who considers things on an extended scale, there is a parallelism in the different parts, and a general connection and dependence on the central range; the substrata prove this fact, for in every case they preserve that parallelism." The Chandore and Gawilgurh ranges, running east and west between 20° and 21° of latitude, form the separation between the streams which flow towards the Bay of Bengal, and those which flow towards the Gulf of Cambay. They are elevated about three thousand feet, and the descent from both is rapid on the north towards the Poorna and Tapty rivers. The Satpoora range divides the latter river from the Nerbuddah, both flowing in a parallel direction towards the west. On the north of the Nerbuddah, the Mandoo or proper Vindhya range rises abruptly, and supports the elevated table-land of Malwa, which is elevated about two thousand feet in the southern parts, declining gradually towards the north. Shaizghur, the highest point of the range, is said to be elevated two thousand six hundred and twenty-eight feet above the sea; but, though little explored, the high country around Omerkuntuc, in lat. 28° and long. 82°, must be supposed to be the most elevated tract of country, as such rivers as the Nerbuddah and Sone flow from it, the one to the west, and the other to the east, and others to the south. Numerous ramifications being given off from this central range, the whole of the country

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to the northward is of a hilly nature, including much table-land in Malwa, Rajast'han and Bundlecund, where the soil is rich and the climate mild. The country declines generally towards the north, and also towards the east, so that the rivers descending from the crests of the Vindhya range take at first a northerly course, and winding round the different elevations, or taking advantage of chasms in the table-land, proceed subsequently in an easterly direction to fall into the Jumna. The Aravalli range, for a knowledge of which we are indebted to the zealous researches of Colonel Tod, the able author of the Annals of Rajast'han, has sometimes been considered a prolongation of the Eastern Ghauts, and at others a ramification of the Vindhya range, with which it is connected towards Champanair. From the latitude of 24°, or near the insulated Mount Aboo, elevated five thousand feet, and which overtops them by fifteen hundred feet, the Aravalli Mountains run in a north-easterly direction, gradually diminishing in height, until reduced to low rocky hills in lat. $28\frac{1}{2}°$; in the neighbourhood of Delhi they reach the Jumna, and cause it to deflect from the south-westerly course, with which, like the Ganges, it had descended from the Himalayas, and take a south-easterly direction to reach the Bay of Bengal, instead of, as its original course would have carried it, to the Gulf of Cutch.

Westward of the Jumna and the Aravalli range the country is flat, with but few hills, and gradually declining towards the valley of the Indus. The soil is sandy, and covered with saline efflorescence; the water brackish, and far below the surface, so that the wells are from one to three hundred feet in depth. The "Sand-hills of the desert" are soon reached, but the most interesting object in this arid region, as observed by Colonel Tod, "is the salt river, the Looni, with its many arms falling from the Aravalli to enrich the best portion of the principality of Jodpoor, and distinctly marking that line of ever-shifting sand, termed, in Hindu geography, *Maroosthuli*, corrupted to Marwar. The Looni, after a course of more than three hundred miles, terminates in the great salt marsh called the Rin, which is one hundred and fifty miles in length and about seventy in breadth." This Colonel Tod considers as having been formed by the deposits of the Looni, and the equally-saturated saline deposits from the southern desert of Dhat. By Dr. Govan, it is described as a dead flat, hardly elevated above the level of the sea, and compared to an arm of the ocean from which the water had receded, as it is covered with saline incrustations and marine exuviæ.

Besides this saline efflorescence and brackish water, this tract of country is remarkable for containing many salt lakes, which, by evaporation during the heats of summer, yield a tolerably pure muriate of soda, which is much used in the upper provinces. Many alkaline plants are also produced, which, when burnt, yield an impure carbonate of soda, exported in large quantities into the more populous districts of Hindoosthan. Small oases and large towns are found in many parts of this desert, which is traversed in every direction, as we learn from Mr. Elphinstone and Colonel Tod. The northern parts of the tract westward of the Jumna must be excepted from the character of barrenness,

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as Hurriana is celebrated for its pasturage grasses, and for the herds of cattle which it supports. The Seik country also is very fertile.

The elevated land of Central India having on the N.W. the desert, is separated on the N.E. from the Himalayas by the alluvial plains of the great Gangetic valley. The valley of the Indus, stretching from the ocean to the foot of the Himalaya, must evidently, from the slow winding course of the river, be a very gradual slope. Its eastern apex approaches the western bank of the Jumna, as the streams on that side, even in the vicinity of that river, flow towards the Indus, instead of into the Gangetic valley. Though the points where the Sutlej and Jumna rivers emerge from the hills are separated about eighty miles, the separating line of the two vallies is within twenty miles of the latter, or just beyond the sources of the Sombe, which is known to flow across the direction of the Delhi canal.

The great Gangetic valley stretches along the foot of the Himalaya for about twelve hundred miles, parallel to the mountain range, from this point to the ocean, in the Bay of Bengal, varying in breadth from eighty to two hundred miles, being at least the latter at Agra, and not more than the former at Monghir, while near Delhi it is about one hundred miles; the contraction at both places being evidently caused by the projection of ramifications from the great central mountain mass of India. The elevation of this great plain or alluvial valley, varies in different parts from the level of the sea to at least one thousand feet near Saharunpore, which is within nine miles of the eastern bank of the Jumna, but so gradual is the slope, that the Ganges is every where a slow and winding river; and if perpendiculars be raised at the latitudes of Saharunpore, Delhi, Benares, and Calcutta, and the ascertained heights one thousand, eight hundred, three hundred and twenty-eight, and fifty feet of these places be laid off on them, a straight line will nearly pass through all the points.

The four great systems of mountains, which, according to Humboldt, cover the surface of Central Asia, are—1st. The Altai; 2d. The Thian Chan; 3d. The Kuenlun; and 4th. The Himalayas; which are the most southern and western, forming the north-eastern boundary of Hindoosthan, and extending in a N.E. and S.W. direction from between Cashmere and Fyzabad, where they join the Kuenlun to Bootan, or from 35° to 24° of latitude, and from long. 75° to long. 90° E.; beyond this they extend through much unknown country, but may be supposed dividing into two branches, one forming the N.E. boundary of Assam, Ava, and terminating in the Malayan Peninsula; the other penetrating to the Chinese province of Yunan, opposite to which the island of Formosa may be considered the termination of the chain. The first portion is that only of which any part of the Natural History will be illustrated in the present work. Beyond Cashmere, and to the westward of the Belor range, the united chains of the Himalaya and Kuenlun form the range of the Hindoo-kho, which Humboldt regards as a continuation of the Kuenlun, though it is generally considered a prolongation of the Himalaya. In this case the latter would form a range extending nearly from the Line

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to 45° of latitude, and over 73° of longitude. But the recent journey of Lieut. Burnes and Dr. Gerard across the Hindoo-kho, between Caubul and Balkh, has shown, that in their rounded nature and secondary formations they resemble rather the mountains to the northward of Kunawur, than the primary-structured Indian Himalaya.

The Himalaya, Himmaleh, Himachal, or Snowy Mountains, remarkable for their extent, are not less so for their elevation, seen from Kurnaul near N. lat. 30°, or from Patna 5° more to the southward, and from both at a distance of about 150 miles, these stupendous mountains present over 15½° of longitude a long line of snow-white pinnacles, which, on a nearer approach, are seen towering above the dark line of lower, but still lofty mountains. Those which are seen at the greatest distance, being situated within the Chinese boundaries, and only approachable through the territories of Nepal, still remain unexamined, as the Goorkhas have adopted the Chinese policy of excluding all strangers from their kingdoms. Dhawalagiri, or the White Mountain, supposed to be situated near the sources of the Ghunduc river, in its early course called Salagrami, from many of the stones containing remains of Ammonites, is stated by Mr. Colebrooke, on a mean of the two nearest observations, to be elevated (allowing $\frac{1}{8}$ for refraction) 26,462 above Gorukhpore, or 26,862 above the level of the sea; but (allowing $\frac{1}{11}$ for refraction) 27,551, and from the mean of three observations, and with middle refraction, the whole height is more than 28,000 feet above the level of the sea. Chamalari, near which, after traversing Bootan, and crossing the frontier of Tibet, Captain Turner and Mr. Saunders passed on their journey to Teshoo Loomboo, is the same mountain, in their opinion, which is seen from Purnea, Rajmahl, and other places in Bengal, the most remote of which is distant not less than 232 English miles. This, as Mr. Colebrooke states, requires an elevation exceeding 28,000 feet to be barely discernible at so great a distance in the mean state of the atmosphere, though much less elevation may suffice, under circumstances of extraordinary refraction. Mr. Moorcroft was of opinion, that some of the peaks which he saw on his journey to Lake Manasarowur were elevated at least 30,000 feet: one of the surveyors in Kunawur, from the angles of altitude which he obtained from the crest of a pass elevated 15,000 feet, thought some of the peaks he saw to the northward could not be less than 29,000 feet, and more recently Dr. Gerard, from some observations at great barometrically-ascertained heights, inferred that some snowy peaks which he also saw to the northward could not be less than 30,000 feet above the level of the ocean. These latter are only mentioned in conjunction with the former, as indicating the probability of the highest pinnacles being still to be ascertained in the Kailas portion of the great Himalayan range.

Fortunately we do not depend upon these approximations only for a true estimate of the height of the Himalayan peaks. These mountains have been so carefully and scientifically surveyed from the Sutlej to the Gogra by Captains Hodgson, Webb, and Herbert, and with a bias apparently to take the lowest rather than the highest results which their observations gave them, that it would not perhaps be advancing too much

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to say, that if they err, it is rather on the side of deficiency than of excess. Before proceeding to give, as cursorily as possible, the results of these observations, it may be premised that the great mass of snowy peaks of the Indian Himalaya attain their greatest elevation between the sources of the Jumna and those of the Kalee or Gogra, and that the range declines in elevation to the N.E. towards Cashmere, and also, as far as we have information, towards the S.E. The passes leading into Cashmere are stated by M. Jacquemont to be not more than 8,000 or 9,000 feet, and the flanking peaks, judging from what they are in other parts of the Himalaya, cannot exceed this height by more than 2,000 or 3,000 feet. Dr. Gerard, in his enterprising attempt to reach Ludak by crossing the mountains which intervene between it and Belaspore, found the passes, less than he had been accustomed to climb, a little more to the S.E., as, for instance, the Rotung Pass elevated 13,000 feet, below which the Bias or Hyphasis originates.

The survey of Captains Hodgson and Herbert, comprising the tract of the Himalaya, included between the Ganges and Sutlej rivers, is more especially interesting, as the majority of the objects of Natural History, illustrated in the present work, are from the same tract of country. The survey commenced at Saharunpore, from the house called Belville, of the late R. Grindall, Esq., Judge and Magistrate of that station, which was found to be elevated 1,013 feet,* and extended to the snowy peaks, which add so much sublimity to the view on the northward of Saharunpore. A base line of 21,754 feet, or about four miles, was measured in the Deyra Doon, elevated 2,350 feet, and the first stations of the small triangulation formed on the hills, which rise to 3,286 feet, within five miles of the base line, whence they were extended to such stations as Budraj, elevated 7,510, and Surkunda 9,271 feet, $15\frac{1}{2}$ miles in a direct line from Deyra, both on the range which rises from and forms the boundary of this valley to the N.E. From these points the principal stations in the survey could be seen within a distance of from twenty to fifty miles, so that there was little probability of error, with excellent instruments in the hands of such practised observers in so clear and uniform an atmosphere. From the result of the survey, it appears that refraction is greater when one of the stations is in the plains, and the mean of all the observations stated to be $\frac{1}{11.19}$; but when both stations were in the Hills refraction was found to be $\frac{1}{16.81}$ for heights varying from 7,000 to 14,000 feet. Although the elevation of the snowy peaks far exceeds the latter height, Captains Hodgson and Herbert say, "we might safely take a much smaller rate than $\frac{1}{16}$, yet, to be within the mark, we will content ourselves with that quantity."

The low range of hills frequently separated from the true Himalaya by diluvial vallies or doons, such as that of Deyra, seldom attains an elevation of more than 3,500 feet, or 2,500 feet above the plains of Northern India. The principal passes across this range were 2,339 and 2,935 feet before they were cut down. The second zone of mountains, extending between these and the snowy range, vary in height from 5,000 to 8,000

* From my barometrical observations, Mr. James Prinsep calculated that my house in the vicinity of the Botanic Garden, was as near as possible 1,000 feet.—V. *Journ. Asiatic Society of Bengal*, I. p. 2.

8,000 or 9,000 feet. Within this tract is the military station of Sabathoo, elevated 4,200 feet, many hill-forts, and the summer residences of Simla 7,486, Mussooree 6,700, and Lundour at 7,559 feet of elevation. Many of the mountains, however, included in it, much exceed the average height, as Surkunda 9,271 feet, rising immediately above the N.E. angle of the Deyra valley; Kedarkanta, the peak of the ridge separating the Tonse and Jumna rivers, was ascertained geometrically to be elevated 12,689 feet. Barometrical observations since made by M. Jacquemont give the height 12,756 feet. Changshill, separating the Pabur and Roopin rivers, is 12,871; and Uchalaroo, a peak of the ridge which rises between the Jumna and Bhagirethi rivers, is elevated 14,302 feet, or 2,500 above the limit of forest, and on which only a few patches of snow remain unmelted in the month of September. Whartoo, connected with the Choor by a ridge which runs southerly, separating the waters of the Pabur and Tonse from those of the Giree (the only river of any note which does not originate in the snowy chain), is elevated 10,673 feet. The Choor, "the highest central point in the lower belt of mountains, sending out ridges, spurs, and ramifications, in every direction," is a conspicuous object from whatever point it is viewed, and being only 3° 25′ 05″ to the westward of north, at a distance of sixty-one miles from the principal station, Saharunpore, in the plains, was admirably adapted for the second, or northern station. Its summit is upwards of 11,000 feet higher than the station at Saharunpore, or 12,149 feet above the level of the sea. The actual station is 10,676 feet higher than that at Belville. Respecting the difference of level Colonel Hodgson makes the very interesting remark, that by cotemporary observations with two barometers by Lieutenant Herbert on the Choor, and himself at Saharunpore, the result was only fifty-two feet less than the true geometrical height, which Colonel Hodgson is inclined to ascribe to chance; but it will probably be found another instance of his and Captain Herbert's extreme accuracy, as the mean of the barometrical observations which I made on the same spot, approach within sixty-two feet of the geometrical height 11,689 feet assigned to the station in the survey. The series of snowy peaks, forming what Colonel Hodgson calls the Southern or Hither Himalaya, and which separate the feeders of the Sutlej from the sources of the various branches of the Roopin, Pabur, and Andrytie, were found to be elevated from 16,982 to 19,512 feet, and the passes which from the river beds lead between, and are flanked by these peaks, from 15,000 to 16,000 feet. The three peaks of the mountain standing between the sources of the Roopin and Tonse were found to vary from 20,501 to 20,688. The Jumnotri Peaks or Bunderpooch Mountains, whence the Tonse (the largest river), the Jumna and Berai Gunga, have their rise, range from 20,122 to 21,155 feet of elevation. At Jumnotri, or the hot springs of the temperature of 194°, near the sources of the Jumna, Colonel Hodgson found the barometer stood at 20·48 inches, which, taking 30·04 inches for the level of the sea, gave him 10,489 feet as the height of these springs. Subsequent observers have given 10,500 as their elevation, which is a near approximation. The bed of snow which covers the

 stream,

stream, is here about forty feet in thickness, the steam from the hot springs melting all the snow which it reaches, dome-like excavations are formed early in the season, which have a very striking appearance when seen from within. The snow-bed is bounded to the right and left by mural precipices. About 500 yards beyond the springs, part of the base of the great Jumnotri Mountain begins to rise, and its face, cased in ice and snow, is visible to the height of about 4,000 feet, closing up the defile in which the Jumna originates, which is seen falling in a shallow rill about three feet wide from the rock, where this becomes abrupt. The Jumna is separated from the Ganges by a ramification of the Jumnotri cluster of snowy peaks, which was first crossed by Mr. J. Fraser in 1816; and then by Captains Hodgson and Herbert, at the Bamsaroo Pass, elevated 15,447 feet, over deep snow in August 1818; lastly by Lieutenant James Stephen, to whom I am indebted for many specimens of the rocks and plants from the neighbourhood of this very interesting locality. In tracing the Ganges to its source, the Bhagirethi branch of this river was found, forming a junction at Bhairo-ghatti, elevated 8,511 feet, with its foaming rival, the Jahnavi. This, the larger stream, by which there is a pass to Tibet, has its source to the northward of the ridge, which bounds the Bhagirethi to the N.E. It forces its way through the Himalaya, about three marches above Bhairo-ghatti. Beyond the snowy range its course appears to be N. 70° E., while that of the Ganges is considerably to the S. of E. above Bhairo-ghatti. It is not until it reaches Sookhee, that the Ganges, forcing through the snowy peaks within which it has been produced, assumes a course of about S. 20° W. By barometrical observation, the elevation of Gungotri, first visited by Mr. J. Fraser in 1816, was ascertained to be 10,319 feet. Beyond this Captains Hodgson and Herbert reached a very extensive snow-bed, and bivouacked at 11,160 feet of elevation. Next day, ascending the course of the snow-bed, they reached an elevation of 12,914 feet, and finding a piece of level ground, a primary base of 319 feet was measured, and with it a longer base of 667·2 feet obtained; the heights of three peaks, St. George, St. Patrick, and the Pyramid, were then found to be 9,326, 9,471, and 8,052 feet above the station, or 22,240, 22,385, and 20,966, above the level of the sea. Here Colonel Hodgson, justly "struck with seeing so near these peaks which viewed from the plains of Hindoosthan, inspire the mind with ideas of their grandeur," exclaims "how much more must they do so when the whole bulk, cased in snow from the base to the summit, at once fills the eye! It falls to the lot of few to contemplate so magnificent an object as a snow-clad peak rising to the height of upwards of a mile and a half, at the short horizontal distance of only two and three-quarters miles." Beyond this, or at an elevation of 13,800 feet, they found the Ganges issuing from under a very low arch, from which great hoary icicles depended, at the foot of the great snow-bed, here about 300 feet in thickness. They still proceeded for some thousand paces up the inclined bed of snow, which seemed to fill up the hollow between the several peaks which Colonel Hodgson called Mount Moira and the Four Saints, geometrically ascertained to vary in height from 21,379 to 22,798. On the N.E. of the sources of the Ganges are two peaks, Roodro Himala and

Surga

Surga Rooer, which are still more elevated, being 22,390 and 22,906. These approach the lofty mountains in the neighbourhood of Kedarnath, measured in Captain Webb's survey.

This survey is not less interesting than the former, embracing the space included between the Bhagirethi branch of the Ganges on the N.W., and the Kalee river, which separates the British from the Nepalese territories on the S.E.; tracing the sources of the latter river, as well as of the Aluknunda branch of the Ganges, and extending from the plains of Rohilcund to the snowy passes: the whole embracing a space of about 10,967 square miles, which constitutes the present province of Kemaon. Proceeding from the plains of Rohilcund, where Captain Webb ascertained Pilibhit to be elevated 560 feet; and Casipore, further to the north, on the same inclined plane (v. p. x.) 757 feet; the first range, through which there are several passes, is found elevated 4,300 feet; and the second, or Ghagur range, between 7 and 8,000 feet. In the interior, the mountains are of less height, but the peaks from 8,000 to 9,000 feet in elevation. Serinuggur, the capital, being in a valley, is found to be not more than 1,708 feet, if ascertained by cotemporaneous observations at Paoree, but 1,834 feet, if compared with the barometer at Calcutta. Paoree itself is 5,238 feet from the mean of numerous observations. Hawulbagh is 3,976; Almora 5,400; Pethoragurh 5,462; Lohooghat 5,562. Nearer the snowy peaks we have the temple at Chundur budunee 7,427 feet if compared with Calcutta, 7,389 if with Paoree (7,666 in map.) The temple at Kedarnath is 11,753; that of Budrinath 10,294; of Milum 11,682; and Pilkonta churhaí 12,620 feet.

The mountain masses and snowy peaks have been arranged into several groupes by Mr. Colebrooke, and as this mode will best serve the general purposes of this abstract, they are here enumerated. First, a cluster extending from Kedarnath to Budrinath presents six peaks, varying in height from 22,130 to 23,441, and three contiguous ones from 19,178 to 21,683. Secondly, in a group of still loftier elevation, in the district of Juwahir, four peaks rise from 22,385 to 25,741 feet; the latter, the Juwahir peak, is the highest point in the surveyed portion of the mountains. Two contiguous ones on the west are 20,758 and 15,805, and a multitude of positions towards the east have been measured, and found to be from 10,653 to 12,228 feet. In the third group on the westward of the Dhoulee river, leading to the Darma Dhoulee Pass, the loftiest peak is 22,707 feet high, encompassed by four others, towering from 18,066 to 21,511. Between this and the Byans Pass, three peaks were measured, varying in height from 19,171 to 21,222, and two others nearest to the pass, of which the highest is 22,513. On the S.E. of the Byans Pass, there is a peak 19,929, followed by others of less elevation, which lead to a fifth group of lofty peaks, of which the most elevated is 22,799 feet, followed by others declining from 22,310 to 20,995. The loftiest of this fifth group is distinctly visible from Pilibhit, as is the highest of the third cluster, and the southernmost of the second group. Their heights, as determined from the result of several measures by Captain

Webb, are 22,799; 22,707; and 22,385. One of these, as observed by Mr. Colebrooke, is no doubt the mountain which was observed by Colonel Colebrooke from his stations, Pilibhit and Jethpur; and the mean of his observations, calculated with an allowance of $\frac{1}{11}$ of the intercepted arc for terrestrial refraction, gave 22,768.

The loftiest of the second group (No. xiv.), commonly called the Juwahir Peak, was seen by Captain Webb from Casipore: it is also distinctly visible from Saharunpore, and had its position, as well as a few others, determined by, and afforded unexceptionable means of joining the two surveys. Captain Webb gives 25,741 as its height, the observed height of Casipore being 757 feet.* In Colonel Hodgson's survey, 25,749 feet is given as the height of the same peak; that of Saharunpore having been ascertained to be 1,000 feet above the level of the sea.

To the S.E. of this survey there is a considerable tract of unexplored mountainous country, before we come to Cathmandoo, where Colonel Crawford, in 1802, by careful observation, ascertained the distances of several selected points from various stations in Nepal, of which the relative situations were ascertained by a trigonometrical survey, proceeding from a base of $852\frac{3}{4}$ feet, carefully measured four times, and verified by another base of 1,582 feet, measured twice. The positions of the same mountains were also settled by observations made in the plains of Behar. The mountain, called Dhaibun, distant $35\frac{5}{7}$ g. ms. seen under an angle of 5° 4′ 21″, was found to be elevated 20,140 above the station from which the angle was taken, and which is itself more than 4,500 feet above the level of the sea; another exceeds the elevation of the same station by 17,819; another by 20,005; another by 18,662. The height of Gosainthan is marked 24,740 feet in Dr. Wallich's Map. All these are visible from Patna, the nearest being nearly 170 English miles distant, and the furthest about 226 miles. Still further to the eastward, the continuation of the Himalayan range, which bounds Assam on the northward, still presents a long line of snowy peaks. Some in 28° of N. latitude, and between $92\frac{1}{2}$° and 93° of E. long. are mentioned in Lieutenant Wilcox's Map, as varying in height from 20,720 to 21,600 feet; and the Himalayas are continued to beyond 98° of E. longitude.

Though extensive tracts of the Himalaya remain unexplored, the uniform result of every observation, and many of them within twenty miles, establishes the great elevation of the Himalayan chain; so that, Captain Herbert, speaking only of the surveyed portion

* For the corrected heights here given of Casipore, and of the snowy peaks included in the Kemaon survey, which however correspond with those given in the large 4-inches to a mile-map, which has been published of this survey, I am indebted to the kindness of Captain Webb, who originally estimated the height of Casipore above the level of the sea, before any observations had been made, at 650 feet; but subsequently found this estimate to be too low. The mean of a month's observation, in Feb. 1818, with excellent barometers, gave 748 feet, and the mean of nearly another month in January and February 1819, gave 766 feet, as the difference of height between Casipore and Mr. Colvin's barometer in Calcutta; the mean 757 feet has been taken at the height of Casipore, and as this exceeds the first estimate by 72 feet, this number requires to be added to all the elevations *geometrically* deduced, which were published in the 13th vol. of the "Researches of the Asiatic Society." Some addition still requires to be made for the height of Calcutta above the level of the sea.

portion of these mountains, has justly observed, that "whilst in South America there is but one peak, Chimborazo, which exceeds 20,000, and not more than five which are about 18,000, there are no fewer than twenty-eight peaks in the Himalayas which overtop Chimborazo, one of which is above 25,000 feet, forty-four which exceed the three next of the American elevations, and more than a hundred which tower above the next in height; facts more satisfactory, as proofs of the superior elevation of these mountains, than the greater loftiness of an isolated summit."*

From the foregoing observations, the great length and enormous height of the Himalayas are evident; but to form a true estimate of these mountains, it is necessary also to take into consideration their breadth. This is supposed to be greatest in the vicinity of the lofty peaks near which the great rivers have their rise; but as the whole extent has not yet been surveyed, this can only be considered as conjectural. Crossing from the plains of Hindoosthan to the snowy passes, the distance is not less than 80 or 100 miles: the superficial extent of that portion comprised within the British territories, is estimated by Captain Herbert at 23,000 square miles. In no part is there any thing like table-land to be found; but seen from the plains of Northern India, the Himalayas seem formed of a succession of parallel ranges, though nothing of this kind is apparent when we enter the mountains themselves; for in ascending any of the principal points, a number of arms are seen radiating in every direction, separating deep ravines, connecting the different mountains together, and throwing the waters of the several rivers in opposite directions: but notwithstanding this irregularity, the ridges generally run parallel to the direction of the mountain mass; for in proceeding transversely across it, we have constantly a series of ridges to ascend and descend, and narrow vallies to cross. In the bottom of these generally flow the rivulets collected by the various ravines from the surrounding peaks and ridges. At the foot of the Himalaya there is generally a longitudinal valley, but in the neighbourhood of the snowy passes, as the Messrs. Gerard have remarked, the glens are for the most part perpendicular to the range, or from N.N.E. and N.E. to S.S.W. and S.W. The face exposed to the N.W. is invariably rugged, and the opposite one, facing the S.E., shelving. The great rivers also may be observed making their way across the direction of the range; they may therefore be supposed to have taken advantage of natural breaks in the range, rather than to have been able to open a way for themselves through this great mountainous mass. The deficiency of level space the industry of the inhabitants has in a great measure supplied by cutting the slope of each mountain into a series of terraces, supported in front by dry stone walls, as is done in China. By this means, and from the diversity of climate, the agriculturist is enabled to cultivate rice near the beds of the rivers,

* These remarks were made previous to our being informed that Mr. Pentland had measured some peaks in the Andes, which were more elevated than Chimborazo; as the Cerro Nevada de Illimani 24,350, and the Cerro Nevada de Sorata 25,250 feet above the sea, both in the Eastern Cordillera of Bolivia: but as these are still only isolated summits, Captain Herbert's inferences apply with nearly equal force, particularly as a multitude of peaks, extending over several degrees of latitude and longitude, are not included in his estimate.

rivers, where the broadest levels are naturally found, and wheat and barley on the different elevated terraces of the mountain sides.

Notwithstanding this general want of vallies, those of Nepal, p. 28, and of Cashmere, p. 27, form striking exceptions. Smaller ones, as of Noakote to the northward of Nepal, and Rama Serai on the S. E. of Kedarkanta, may be mentioned, besides the longitudinal vallies at the plainward base of these mountains, which will be more fully treated of, with their geological structure. From the numerous transverse breaks by which the great rivers make their way to the plains, and towards which are inclined the various slopes and ravines which collect the streamlets from all the neighbouring mountains, few situations occur favourable for the formation of lakes; many therefore are not met with; that of Cashmere, commonly called *Dul*, is best known: one called Bheemtal, of considerable depth, occurs on the road from Bhamouree to Almora, of which the length is about one mile, and the breadth about five furlongs, with an elevation above the sea of 4,271 feet. To the northward of Nahn there is another called Ruenka tulao, which is also about a mile in length, and a gun-shot across. It is remarkable for containing crocodiles.

The river-beds, besides giving exit to the drainage of the mountains, and affording spaces for cultivation, serve also as entrances for penetrating into the Himalaya, and reaching the passes (v. p. 32) by which travellers are enabled to cross from one face of these mountains to the other. The first notice we have of any of these being crossed by an European, is that of the Jesuit Antonio d'Andrada, who set out in 1624 from Agra to Serinuggur, and thence proceeded to Budrinath, whence with great difficulty he crossed into Tibet. More recently the Neetee Pass was crossed by Messrs. Moorcroft and Hearsay; the Shatool, in 1816, by Colonel Hodgson; the Gonas Pass, in 1819, by Captain Herbert; and the first, as well as the Byans, and other passes measured by Captain Webb, in 1816. Among the other adventurous travellers, the Messrs. Gerard require particular mention as second to none in energy and enterprize. Besides the Paralassa 16,500, and the Rhotung Pass 13,000, below which the Acesines and Hyphasis have their rise, and which were traversed by Dr. Gerard, little is known of the passes, except in the surveyed portion of the Himalayan Mountains. To the westward of Shatool Captain Gerard enumerates three passes, Julsoo, Khealig, and Soongree; but these are from 2,000 to 4,000 feet below the line of congelation. From Shatool to Budrinath no less than fifteen passes are enumerated by the same officer. These are generally from eighteen to twenty-four miles in length, forming about three stages for loaded people and two for those who are not so.

1. Shatool...	15,555	Rol to Atharabees, 14 miles without fuel, open from June to November.	5. Neebrung	16,035	From Choora to Sungla.
2. Soondroo	16,000	Tangno to Rasgranee.	6. Gonas ...	16,026	
3. Yooso ...	15,877	Joonglee to ditto.	7. Ghasool	15,851	
4. Broang...	15,171	Jungleeg to ditto, seven miles without fuel, open seven or eight months.	8. Roopin...	15,480	Doodrookoom to Sungla, an easy pass.
			9. Nulgaon	14,591	Ditto to ditto.
			10. Charung...	17,348	Chitkool to Cheerung.

11. Bunga

11. Bunga ...	From Sungla, Rakchurn, and Chitkool to Lewar of Gurhwal, like 5, 6, and 7, are crossed in different months; 11 is the easiest; open from May to Dec.
12. Lumbeca...	
13. Marja	
14. Seenga ...	
15. Kimleea ...	Chitkool to Lewar, in May, June, and July.
16. Sugla.....	Chitkool to Boorasoo of Gurhwal.

The first nine are across the S. Himalayas, the rest from the Buspa into Gurhwal. The last seven are crossed by loaded sheep, but none of the first seven.

The rivers which have their sources in the snow-beds, from under which they generally flow out in a stream, and of which the lower limits are about 13,000 feet of elevation in the south-eastern entrances of these passes, are the Andrytie, below the Shatool Pass, where the snow commenced in June, at 13,450 feet of elevation; the Pabur, below the Broang Pass, at 12,914 feet; the Roopin, below the Gonass Pass, nearly at the same elevation. The Buspa is on the northern face, and has a feeder from the last-mentioned pass, nearly at 14,000 feet of elevation. There are many other feeders of the above rivers, which it is unnecessary to particularize. The Tonse, the Jumna, and Berai Gunga, have their origin near the great Bunderpooch cluster of mountains; the first at 12,784; the second at 12,489; and the Jumna at about 12,000 feet. The Bhagirethi branch of the Ganges has already been mentioned as having its origin at 13,800 feet of elevation.

The passes to the eastward are fewer in number, but more elevated. The Bhotea tribes, of whom we have an interesting account from Mr. Trail, in the 17th volume of the *Asiatic Researches,* inhabit the space which extends on the north from the commencement of the table-land of Tibet, to the plainward base of the southern row of Himalayan peaks. The villages are all on the northern face of these; and the country being more level, as indicated by the better roads and more moderate currents, as well as by the hills sloping more gradually and being enclosed between high mountains, heat is reflected from every side, and the temperature raised much above what would be supposed at such elevations. Spring, summer, and autumn, are comprised in five months, from May to September. These passes cannot be visited before the middle of June or beginning of July, as even that to Budrinath is not open before the beginning of May. By the commencement of October the cold becomes severe. Roads of communication exist, as Mr. Trail informs us, between the passes from east to west, but these are passable during a few days only in each year, and are considered dangerous by the Bhotias themselves. The crest only of these passes can now be visited, as every one is prohibited from crossing the frontier, for fear of exciting the jealousy of the Tibetan authorities, and disturbing the trans-Himalayan trade of the province of Kemaon. The passes are five in number. The Mana and the Neetee on the Saraswati, and the Doolee branches of the Ganges. The Neetee Pass was ascertained by Captain Webb to be elevated 16,570 feet; and the Mana estimated not less than 18,000, as a barometrical observation by his assistant, Mr. Tate, gave 17,172 feet as the height of Jograo, which is considerably below the Pass. Juwahir, Darma or Lebong, and Byans, are the three other passes on the Gouree, Dhoulee, and Kalee rivers, branches of

of the Gogra. Mr. Trail gives 16,585 feet as the height of the Juwahir, and 17,777 as that of the Darma Pass. Captain Webb ascertained that the Mandarin's camp, in the Byans Pass, was elevated 14,506 feet, and that the crest was about 3,000 feet more elevated. Captain Herbert, from the barometrical observations of a traveller who visited the Pass, computes it to be elevated 16,844 feet above Calcutta.

To the eastward of the province of Kemaon, there must be many passes between the territories of the Chinese and those of Nepal; but the jealous policy of both powers has prevented their being visited by those qualified to make interesting observations. The pass between Lahassa and Catmandhoo was crossed by the Jesuits, Grueber and Dorville, in 1661, and is probably that by which the Chinese army invaded Nepal in 1792, when it "advanced to Noakote, within twenty-six miles of Cathmandoo, and sixty of the British territories in the province of Bengal." The road and passes between Teshoo-loomboo and Bengal were traversed by Messrs. Turner and Saunders in 1783, and the natural appearances described exactly coincide with those subsequently observed by Messrs. Moorcroft and Gerard, in the more western parts of the same elevated tract. Many other passes are cursorily mentioned in Dr. Buchanan's account of Nepal, which are probably of easy access, as we read of their being crossed by bodies of men. Some of these lead by the chasms through which such rivers as the Gunduck, the Arun, the Kosi, and the Teesta, which having their origin on the northern face, pass through the Himalayas, and take a south-easterly course to join the Ganges. Further to the S.E., and more recently, Messrs. Bedford, Wilcox, and Burlton, have attempted to cross from Assam into Tibet. In tracing the Burhampooter, and its several feeders, the difficulties were in every case considerable, but none were so insurmountable as the prejudices of the natives, who prevented their further progress at the very time when their object was almost accomplished.

Crossing the Himalayas, the descent on the side of Tibet, according to the concurrent testimony of all travellers, is gradual, and not of great extent, though the ascent up the southern face had been so considerable; it is evident, therefore, that the land on the northern face is much elevated. It was traversed by Captain Turner in his route to Teshoo-loomboo, and by Moorcroft in his journey to Ghurtope and Lake Manasarowur; but as neither of these travellers carried barometers, we are unable to ascertain the elevation with the precision which is desirable. Captain Webb, from the angle which he obtained from the crest of the Neetee Pass, of the Sutlej flowing in the plain below, and taking the distance* measured by Mr. Moorcroft, which he had generally found to be correct, estimated the height of the table-land at 15,000 feet.

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* These distances having been given in paces of four feet, it has been objected that a man being employed to stride these, instead of stepping his usual paces, must have been a source of error. But the fact is, that according to the native mode, only one foot was counted, so that each step taken by the Pundit was only half the quantity generally supposed, and what a man would naturally take in a hilly country. This fact I learnt from Captain Hearsay, who was one of the party, and protracted the route. It has been long known to Captain Webb. who is well satisfied with the general correctness of Captain H.'s Map.

feet. The Messrs. Gerard, in crossing the Keubrung Pass, which is reckoned the boundary between Kunawur and that part of Chinese Tartary which is under the authority of the Grand Lama of Lahasa, descended on the more western parts of this elevated land, and found Zamsiri 16,500 feet above the sea; but they saw only gently sloping hills and tranquil rivulets. Zinchin, the furthest point they reached, is 16,136 feet, and the eminences in the vicinity rise many hundred feet higher. In every direction horses were seen galloping about, and feeding on the very tops of the heights. This elevated plain is described as being of a gravelly nature, intersected by deep and broad ravines. Though the rivers on the southern face of the Himalaya, Mr. Moorcroft observes, are narrow and steep, those on the northern face have broad flat channels, the water draining into them more slowly from the table-land, and the more gradual and gentle slope of the hills. Looking to the south, the Himalayas were seen marked with snow in stripes; on the north the snow lay in distinct masses on the Cailas mountains, the bases of which descend by easy slopes and diminishing swells. Further to the N.W., and beyond the hilly tracts of Kunawur and Kooloo, Dr. Gerard pitched his tent on the table-land of Tartary, nearly at 16,000 feet of elevation, where the Indus, at the distance of only three days' march, intervened between him and Ludak. The appearances here are similar to those described by Mr. Moorcroft and by Captain Turner. Everywhere along the whole tract we have extensive plains, having on them moderate sized hills and gently flowing streams; a dry, cold, and clear atmosphere, little snow in comparison, arid-looking vegetation, and numerous flocks of cattle. This table-land is not continuous, but interrupted by transverse ridges, which join the Indian to the Cailas or Tibetan range of the Himalayas.

Of these ranges, one locks in the lakes Manasarowur and Rawan-hrad, as well as the sources of the Sutlej and Indus on the N.W.; and on the S.E. gives origin to the Sampoo or Burhampooter. This, flowing parallel to the Himalayan chain and on its northern face, over the lofty table-land of Tibet, breaks through another transverse range before it descends by numerous rapids to the plains of Assam, where it is at first known by the name of the Dihong, but joined by numerous tributaries, it assumes that of Brahmputer or Burhampooter, which it relinquishes in the plains of Bengal for that of the Megne, where uniting with the Ganges, near the sources of which it had arisen; their united streams flow into the ocean, in the midst of the numerous islands which themselves have formed. The Indus and Sutlej originating on the northern face of the great chain, which on its southern aspect gives rise to the Ganges and its feeders, flow first in a north-westerly direction; the former over the high land of Little Tibet, until north of Cashmere, in 35° of latitude it breaks transversely through the mighty mass of Himalayan Mountains. Here, passing Attock, and forming the N.W. boundary of Hindoostan, it enters the sea by thirteen mouths, and is navigable for 1,000 miles for vessels not requiring more than twelve feet of water. The Sutlej, supposed to take its rise from Lake Rawan-hrad, flows at first parallel to the Indus, but then, encountering the transverse mountainous mass interposed between Great and Little Tibet, and

extending from the Himalayas to the Indus, descends from the table-land, and entering chasms in the mountains, passes through the province of Kunawur, v. p. 34, to the southern face of the Himalayas, with a gradually decreasing elevation of its bed from 10,005 at Shipkee, to 5,200 near Wangtoo, to the S.W. of which the snowy mountains terminate; whence to Roopur there is a further fall of 4,000 feet to about 1,100, the elevation of the river, where it enters the plains of India, distant about eighty miles from the Jumna. As the elevation of these rivers is much the same, both gradually declining to the sea, the distance by which they are separated not too great, and the country consisting of level plains, it is not unreasonable to hope that they may one day be joined by a canal navigable for boats, by which the produce of Central Asia might be conveyed down either the Ganges or the Indus, and that of other parts of the world conveyed up the same rivers.

One striking peculiarity of Central Asia is the lakes by which it is covered. Of these, Manasarowur has excited particular interest on account of the anomalous nature of the information, first communicated by Mr. Moorcroft. He described it as being fifteen miles long, and about eleven broad, and as having no streams issuing out of its northern, southern, or western sides, nor on its eastern, according to the accounts brought by two natives, whom he sent to examine the point. Captain Herbert also learnt from a Lama, who lived within four days' journey of the lake, that no rivers issued out of it. Other testimonies contradict this evidence, and it is difficult to ascertain the truth, as it has been thought an improbable circumstance that a mountain-lake, fed by such vast snows, should dispose of the waters pouring into it by mere evaporation. Lake Rawan-hrad, supposed to give origin to the Sutlej, but which Mr. Moorcroft had not an opportunity of examining, he estimates to be four times as large as Manasarowur. Though we are not likely to have any direct testimony on the subject at present, it is interesting to find that Dr. Gerard records a similar set of phenomena, as characterizing Lake Chimororel, along which he skirted on his return from his attempt to reach Ludak. This he found elevated 18,000 feet, and in travelling along its shores found its whole circumference embayed by mountains, which on its N.E. shore entered the region of snow only at 19,000 feet of elevation above the sea. Neither this, nor another lake, which Dr. G. met with, had any exit, thus confirming the information given by Mr. Moorcroft respecting Manasarowur, on this point. He also found, at the time (July) he visited this lake, that its waters were much below its maximum of elevation; as the dry channels of water-courses, and the highest water-marks upon the shore being nearly five feet higher, made it probable that these lakes attain their maximum of elevation in spring, when "returning warmth breaks up the frozen surface, and thaws the immediate snow." Dr. G. further remarks, that if we consider the dryness of the climate, and the increased evaporation in so rarified an atmosphere, the phenomena are not so unaccountable as they may appear to be at first sight. As instances of the aridity of the atmosphere, he mentions, that frost is not visible upon grass, even "though the thermometer "be at zero, and that the traveller beholds ice permanent and unthawed in a tempera-

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"ture of 50°, and torrents frozen fast in a medium almost 20° above the freezing "point."

Beyond this elevated table-land rises the lofty snowy range, which appears to overtop even the Indian Himalayas. This has been already mentioned at p. xi., as the Cailas or Kailas portion of the Himalayas, and is sometimes called the Tibetan Himalayas, and is that in which probably the most elevated peaks, as Dhawalagiri, &c. remain yet to be more accurately measured. That there is such a range would appear probable, even if we had no evidence on the subject, by considering that the Indus flowing N.W., and the Burrampooter S.E., both retain a course parallel to the Himalayas, instead of proceeding eastward towards the lower levels of the greater portion of China. The portion of this range which separates the valley of the Sutlej from that of the Indus, near the sources of these rivers, was crossed by Mr. Moorcroft on his way to Ghartope. At Zinchin, elevated 16,136, the most eastern point which has been reached by visitors proceeding from Kunawur, the Messrs. Gerard saw a lofty snowy range, which seemed to run N. 60° W. to S. 50° E. beyond the rounded mountains, which are seen across and to the eastward of the Sutlej. One of the surveyors (probably the late Capt. Gerard) who has been already mentioned, states, from the crest of the Hungarung Pass, he saw in font a granite range, upon which the snow found a resting place only at 19,000 feet; beyond it, through a break, were seen snowy mountains, appearing to rise out of the table-land on the banks of the Indus, "pale with distance, and like the memory of something that we have seen." From the angles of altitude which he observed, their pale outline, and the broad margin of the snow, he estimated that they could not be less than 29,000 feet in elevation. Dr. Gerard, in his visit to lake Chimororel, near the most westerly point he was able to reach on this elevated tract of country, remarks, that looking southward towards the Spiti, the landscape appeared very sharply peaked, and in clusters of white tops; but in the N.E. the mountains were of a vast contour, and the snow more uniformly defined.

The three preceding pages, having been in type ever since the previous parts were published, might now be greatly extended, as much interesting information has been obtained by the travels of Mr. Vigne and of Dr. Falconer, still further to the N. W. than was reached by Dr. Gerard; but as this would require considerable space, I confine myself to a few points.

Mr. Vigne (who resided much in Cashmere, crossed the Indus, traced a part of its course, and attempted to do so with the Nobra branch, visited Astore and Iskardo), has favoured me with a small collection of plants, which I will take some future opportunity of noticing. With respect to the Passes into Cashmere, he informs me, that though some are not more than 9,000 feet high, others are elevated as much as 12,000 feet. Speaking of the lakes, he says that Cashmere is full of them; the principal is called the Wullur lake or dul, and is thirty miles from E. to W. The most extraordinary is the Kosah nag, among the peaks of Peer Punjal, which is above the region of birches, and about three-quarters of a mile in length, has two outlets, but both are underground, one towards the plains and the other towards the valley. Baron Hügel, J.A.S., March 1836, states, that the passes from Bimbur to Cashmere, and from this to Iskardo, are the same in height—13,000 feet. The highest point of the Peer Punjal is 15,000 feet by the boiling point. The city of Cashmere (Srinuggur), is 6,300 feet above the sea. Lat. 34° 22′ 58″, long. 75° 12′ 30″.

The Mountains of Tibet are usually at much the same elevation: that is, from 15,000 to 16,000 feet; but from any open summit, several mountains are seen that rise far above them, as Nanga Parbat, or Diarmal,

which Mr. V. conceives to be 18,000 or 19,000. From the summit of the Passes between Ludak and Nobra, the Muztagh presents a most noble appearance, and Mr. Vigne thinks that the Hindoo Koosh may be said to be joined to the Himalaya of Tibet by the Laureh Pass between Chitral and the valley of the Dair; that which joins the Kabul river at Hashtnagur, or the valley of Peshawar: Vide Journ. As. Soc. Calcutta, Sept. 1837; Proc. of the Royal Asiatic and of the Geographical Society, for November 1839.

Mr. V. also informs me that there is no snowy range connecting the Muztagh with the Spiti mountains, but that there are a few isolated peaks of great altitude that rise above the others; and there certainly is a break in the Himalayan chain, if this may be called one, as he has distinctly seen it, both from Acho and the Passes to Nobra.

Dr. Falconer, in travelling north from Cashmere, crossed the lofty ridge which separates the drainage of the Krishna Gunga from that of the Indus. He crossed the Pass over extensive beds of snow, and descended through a steep and narrow gorge to Sookarun Murbul, a bleak rocky tract abounding with Tibetan Marmot. The great plain called Bearsah or Deosah, also described by Mr. Vigne, constitutes one of the principal features of the Tibetan region near Cashmere. Elevated 13,100 feet above the sea, and surrounded by lofty snowy peaks, it forms a nearly level plateau, about fifty miles in length and forty in breadth, occupying the interval between the Indus and the Krishna Gunga. High above the forest, or *birch region*, its vegetation is restricted to herbaceous species and a few dwarf willows, but these are so abundantly produced as to clothe it with verdure. At one extremity of this, he ascended the Boorgee Pass, the summit of which he found to be elevated 15,600 feet above the sea. This commands an extensive view of the mountains which stretch beyond the Indus towards Toorkistan, and of part of the immediate vicinity of Iskardo; they looked down upon a level tract below, and countless lines of mountains running off into the remote distance; but there, no signs of vegetation were visible; sterile sand and naked rugged rocks met the view on every side. Dr. F. crossed the Indus, with the object of pushing north in the direction of the Muztagh range (Kuenlun of Humboldt), which separates the valley of the Indus from Chinese Tartary, and proceeded to Askolee in a Pass which leads from Little Tibet towards the Muztagh, in N. latitude 35° 30′, and reached the limit of cultivation; all beyond, on to the Pass across the Muztagh, was reported to be a region of ice. On returning, on the 30th of August, he crossed the Braldoh river, whence the road led over the lofty mountain of Skora, which was crossed at 16,200 feet above the level of the sea, while a pass between Iskardoh and Astore was 15,822 feet.

With respect to the vegetation, Dr. F. writes me, under date of January and June, 1838, from Cashmere, whither he had proceeded on a Botanic mission in connexion with Sir Alex. Burnes' Expedition, that "The Flora of the Punjab is exactly that of the neighbourhood of Delhi; *Peganum Harmala* everywhere, with *Capparideæ, Crotolaria Bushia, Calotropis Hamiltonii, Alhagi Maurorum, Tamarix, Acacia modesta*, &c. &c. Near Lahore I got what I believe to be a new Asclepiadeous genus, exactly intermediate between *Calotropis* and *Parotropis*, which I have called *Eutropis*. It is in great abundance in the Punjab. I met with the Dhak (*Buteafrondosa*) as far as the western bank of the Jhelum. The Flora begins to change at Rawul Pindee, which is elevated and continues so, on to the plain of Chuch, along the banks of the Attock. Here I first came on the famous Zuetoon, the wild olive, *Olea* ——? and further on, at Hussan Abdal, I found Himalayan *Rubi* and a Cashmere *Dianthus*, white flowered and new to you. The lower part of the plain of Peshawur is sandy, and has exactly the Flora of the arid tracts of the Punjab; *Salsolas, Chenopodeæ, Alhagi, Calotropis, Peganum, Tamarix*, &c. But when we got to Peshawur, so much do the seasons differ, that peaches were coming into fruit the 15th August, and the Kurreel (*Capparis aphylla*) out of flower only lately. From Peshawur, I made an excursion to Cohaut, and from thence to the Salt Hills and the valley of Rungush. In the Salt Hills I got a Stapeliaceous Asclepiad, unfortunately neither in flower nor fruit, very probably one of Wight's *Carallumas* or *Boucerosias*. Also the *Cassia obovata*, the Egyptian senna, in flower. I had previously got the same plant from near Delhi: no doubt about the species, certainly not the *obtusa* of Roxb.; the legumes always crested over the bulge of the seeds. From Attock, I made an attempt to run up the Indus into the hills; I got on three marches, and was forcibly stopped at Durbund, and threatened with rather rough usage. I then turned across the hills, and rejoined Capt. Mackeson in the noble valley of Huzara. The vegetation along the banks of the Indus, from Attock to Durbund, surprised me much. It is quite that of the characteristic forms of the Deyra Doon, and, taking difference of latitude and altitude into account, with the great distance westward, this might not have been looked for: *Grislea tomentosa, Rottlera tinctoria, Hastingia coccinea, Acacia Catechu, Holostemma*, &c. On the banks of the Indus, in the valley leading up to Cashmere from Huzara, I found the *Dodonæa Burmanniana*. You remark, in your notice of the *Sapindaceæ*, its absence from the Bengal and Hindoostan region; its occurrence with a leap so far north is remarkable. From Huzara, we marched on by the military road to Mosufferabad. Near Drumber I came on the *Hovenia dulcis*. At Mosufferabad I got on a high ridge, and followed it on to Cashmere, where we arrived early in October. It was now

too

too late in the season to exhaust the Flora of the valley and neighbourhood, so I made up my mind to winter here, and made a fresh start in spring. It would take pages to describe what I have observed about the Flora here, late as I came, but I have made many acquisitions.

"The Flora of Cashmere has several anomalies : few, if any oaks descend on the northern side of the Peerpunjal into the valley; I have not seen one yet. I have selected oaks as a very characteristic type. The same holds with respect to the plants that are associated with the oaks, &c. about Mussooree, as *Andromeda, Rhododendron arboreum, Mahonia nepalensis,* so common in the Hills elsewhere. The *Coniferæ* are, as to the eastward, 3 pines, 2 or 3 firs and Deodar, but I have not seen the *Cupressus torulosa*, the lofty cypress of the Mussooree hills. In the lake you see *Nelumbium* and *Euryale ferox*, growing along with *Menyanthes trifoliata;* and cotton, a poor sort, growing on the banks, while the sides of the bounding hills are skirted with pines. I got *Staphylea Emodi* growing along with *Ribes Grossularia* (your *Himalense?*) while it grows, as you know, at Mussooree, on low slopes near Budraj.

"Among *Ranunculaceæ*, I have got species of *Hepatica, Ceratocephalus*, and *Callianthemum*, all of which I believe to be new, and making up the very blanks you notice in your 'Illustrations.' Of *Callianthemum*, I have no knowledge, besides your quotation, but my plant has leaves with umbelliferous habit, eight white strap-shaped clawed petals, with the nectariferous pore high up on the claw, and a *pendulous* ovulum. It cannot, therefore, be a *Ranunculus*, nor your *R. pimpinelloides*. Further, I have got a new Ranunculaceous genus, new unless Jacquemont has got it, having the habit of *Trollius* in its leaves and mode of inflorescence, eight herbaceous sepals, twenty-four strap-shaped petals, plane, with no fovea at the claw, and solitary *transversely attached* ovula, being neither pendulous nor erect. It forms a transition from *Adonis* to the *Ranunculeæ*. This is another blank filled up in the desiderata so pointedly mentioned by you. I have called the genus *Chrysocyathus*. It grows intermixed with *Trollius*, 'inter nives deliquescentes,' and till I examined it I took it for a *Trollius*. I have got a new species of *Adoxa*, forming, I believe, the second of the genus *A. inodora* (mihi), a larger plant than the *A. Moschatellina*, and with the lateral flower 12-androus, and six segments in the flowers. I have also a new *Epimedium*, a large handsome leaved herb, *E. Hydaspidis* (mihi), and two species of *Alchemilla*. *Fritillaria imperialis*, the Crown Imperial of English gardens, grows wild in the shady forests of Cashmere. The Cashmerees regard it to be unlucky, and grow it only near musjids and over graves. I have *Dodonæa* brought to me from above Jummo, in the heart of the hills, growing along the banks of the Chenab. *Fothergilla involucrata* (mihi), belonging to the *Hamamelideæ*, exists in vast abundance in Cashmere, forming whole tracts of low jungle;—strange that it should not have been brought before, either to you or to me. It occupies the place that the hazel (*Corylus Avellana*) does in England, and at a little distance does not look unlike it. Thus, *Hamamelideæ* are found at opposite ends of the Himalaya range, *Bucklandia* and *Sedgwickia* in Assam, and *Fothergilla* in Cashmere, but none of the family have yet been met with in the intermediate tracts. *Prangos pabularia* I have found in vast abundance in several directions, most so on Ahatoong, a low trap hill, in the valley, but it is not here so vigorous a plant as in its Tibetan habitat. The Cashmerees do not know it for any useful purpose, except as a plant highly prized by Europeans. They sometimes use the roots to destroy worms, by steeping them in Dhan fields as Calamus aromaticus (*butch*) is used in Hindoostan." With respect to the Amomum and *Koot*, or Costus (v. p. 360), which I had requested him to inquire about, he writes: "Amomum, Humama, or Amamoon, is not known in Cashmere, nor to be had at the Punsarees. *Koot* is exported from Cashmere. It is a plant of the natural family of Compositæ, and grows on all the mountains surrounding Cashmere." Dr. F. has formed it into a new genus,—*Costia*, and has introduced the plant into the Himalayas. He concludes: "I have already seen enough to convince me, from a trip to near Durass, on the Thibet frontier, that the Flora there will bear a close resemblance in many general relations to that of the Altai Mountains, shown by Ledebour and yourself."—*Proceedings of the Linnean Society, Feb.* 19, 1839.

GEOLOGICAL FEATURES OF THE HIMALAYAN MOUNTAINS.

HAVING noticed the extent and physical features of the Indian empire, we might proceed to describe the materials of which its mountains and its plains are composed, as well as the soils produced by their disintegration. But the most cursory notice of the Geological features of so extensive a field would require more space than can be allotted to the subject; the Author must, therefore, confine himself to the part with which he is best acquainted, and which can be elucidated by his specimens and observations, which have attained some value from the kindness, as stated in the Preface, of his friend Mr. De la Beche. But the sections can only be considered as giving a general idea of the dip, direction, and nature of the formations met with. The sections of the Himalayas correspond with that given, as far as it goes, by Dr. Falconer, in his Report on Tea cultivation, though he informs me that mine are erroneous; in the parts near the Snowy Peaks, where the Author relied for his information on Capts. Herbert and Hodgson, as, instead of consisting of gneiss, they are formed by one of the grandest outbursts of granite in the world. The sections of the Central range of India, from Sherghatty to Roghonautpore, formed by Mr. De la Beche, from the Author's specimens and observations, correspond with that previously published by the Rev. Mr. Everest, in 1831, in the third volume of the Gleanings of Science.

The great Gangetic valley consists of an extensive plain, which is very gradual in its slope from Saharunpore to the Sunderbunds, v. p. x. The structure is not easily detected, from the universal flatness, and the horizontal nature of the depositions, while water being near the surface, wells, the only works, reveal only a few feet in depth below. The surface soil is generally sandy, with a varying proportion of clay, which predominates in the substratum, and is in most places sufficiently pure for making bricks. Calcareous particles are intermixed with the soil and substratum in most parts. These in many places assume the form of spongy cavernous nodules: in some the form of stalactites or of roots, and are then apparently of modern origin; in other places they are in masses sufficiently large to be worked and used as a building stone. But the nodular appearance is the most remarkable, especially from the nodules being so abundant in some places as to cover the soil, and give the appearance of the surface being covered as if with a fall of large hail-stones. This forms the extensively diffused *Kunkur* formation of India.

In Calcutta, in deepening a tank, a group of full-grown trees were found standing erect, and apparently lopped off, three or four feet above the roots. In boring for water, rubbish and mould were first met with, then sandy clay, and, at twenty feet, a vein of pure sand, the source of the common springs of wells. Blue clay, with sand,—then black, above a stratum of peat; with pieces of wood, that of the Soondree, and at sixty feet, Kunkur nodules; reddish well-sand at seventy-five feet, whence the river springs rise. Clays and sands, with some Kunkur, are found below this: a quicksand at 120 to 136 feet; and at 176 feet, quartzy sand and granitic gravel; and from 350 feet below the surface of Calcutta, the auger brought up a fossil bone, which is figured in J. A. S. for March 1837. At Benares, Mr. Prinsep, in cutting a tunnel and sinking shafts, found, fifteen feet below the surface, a number of half-quarried stones of a large size, on what he conceives must formerly have been the level of the ground; at thirty feet, some kunkur was met with. At Saharunpore, in digging a well, after ten feet, coarse moist sand was found, mixed with round pebbles, chiefly of quartz, and about twenty feet from the surface, pieces of kunkur or tufaceous limestone, were raised, together with dicotyledonous wood, apparently of one of the Coniferæ. At Bihut, twenty miles north of Saharunpore, Capt. Cautley discovered the site of an ancient town seventeen feet below the present surface of the country. The

Indo-

Indo-Scythic Coins which had been entombed in this oriental Herculaneum, Mr. Prinsep refers to the commencement of the Christian era. Capt. Cautley is of opinion that the enormous discharge of sand, clay, and shingle from the lower hills during the periods of the rainy season, are gradually causing a rise of the country skirting their base, and to this and the action of wind on sand, he ascribes the inhumation of this ancient city. The structure of the plains may also be seen in the raised hills which skirt the base of the Himalayas, and the banks of the Jumna afford a very interesting series of sections, of which the structure may be treated of either with that of the Gangetic valley or of Central India, as some of the peculiar formations of the latter seem to extend even to the beds of that river.

Proceeding from the plains of India to ascend the Himalayas, we every where meet with a lower range of hills, which have been variously denominated "the Lower Hills, the Sandstone, Sub-Himalayan or Sewalic Hills." These hills, in many parts, rest immediately upon the Himalayas, but in others are separated from them by a series of longitudinal valleys. The part with which the Author is best acquainted is the direct road from Saharunpore to Deyra and the Himalayas, through the Kheree pass, which is the broad, generally flat, stony bed of a hill stream, ascending by degrees to the crest of the pass, now much cut down, but from which there is a gradual descent to the valley or Doon of Deyra. Along this pass flows in a winding course a small stream of very clear water. On either side, and about fifty yards apart, arise the hills, and, according to the windings of the stream, are seen sometimes sloping, sometimes abrupt; in the former case, covered with vegetation, in the latter, presenting a barren and precipitous display of their stratified structure. These strata dip to the N.E. or towards the Himalayas, at various angles from 20° to 38°, and the hills display every variety of appearance, partly from the destroying effects of water on so destructible a material, and partly to this being sometimes defended from its influence by a covering of a boulder stone. They are formed by a succession of parallel ridges, abrupt towards the plains, and sloping towards the Himalayas. In many places, each hill, if separated, might be represented by a right angled triangle, the base resting on the pass, the perpendicular facing towards the S.W., and the hypothenuse sloping towards the N.E., and corresponding in dip with the strata. This side is sometimes continued to the level of the pass; at others, another hill, with its perpendicular side, seems to arise from the middle of the last, and is itself, in like manner, succeeded by a third, forming a succession of abrupt and sloping sides, like the teeth of a saw. At Hurdwar, the sandstone character is complete, and the rock is sufficiently hard to be used as a building stone. About fifty or sixty feet were cut through to make a road between the river and the hills, by Capt. De Bude, of Engineers, at the back of whose house, on the Hill, rolled stones might also be seen lying upon the sandstone. These hills are composed of a series of clays, of a loose-grained sandstone, with much mica interspersed; beds of gravel and rolled stones, which consist of the debris of every variety of rock: as granite and trap-rocks, limestone and clay slates, gneiss, micaceous and hornblende schists; in fact, of all the rocks of which the Himalayas are composed. Carbonate of lime is interspersed throughout the formation, forming stalactites and encrusting leaves, &c. Carbonate of soda is also found effloresced in many situations. In some moist situations the boulders are sometimes so soft, that quartz crumbles in the hands more easily than a piece of sugar.

The gravel and boulders found on these hills are very extensively diffused. They are abundant in the series of longitudinal vallies which are bounded to the S.W. by the Sand-stone range, and on the N.E. by the Clay-slate formation of the Himalayas. These have been enumerated by Capt. Herbert as the Mokowala or Ropur, Pinjore, Kyarda, Deyra, and Patle, all between the Sutlej and the Gograh, and again, that of Chetuan, which lies to the north of Bettiah. They are from twenty to twenty-five miles in length, and of variable breadth, the widest being about fifteen miles. They have two outlets for their drainage, and their highest level is usually near the middle. The surface is level or undulating, intersected by ravines, or river beds; the rock is seldom seen, except on their boundaries. The soil of the

Deyra

Deyra Valley, in most of the uncleared parts, as well as in many of those long cultivated, is intermixed with these rounded pebbles and boulders, which are also found at great depths. In the well dug by the Hon. Mr. Shore, they were brought up from two hundred and fifty feet; but I observed that those from the greatest depths were angular, and composed of clay-slate and limestone similar to that of the nearest, or Mussooree range; but like the shingle of the Sandstone range, or that found in the beds of rivers, they are usually composed of every variety of rock. Though so deep in the centre of the valley, the debris thins off towards its extremities, where the sandstone is seen underlying the beds of shingle; these boulders are also found filling up the vallies of the great Himalayan rivers, as those of the Ganges, Jumna, Tonse, Pabur, where flat terraces of considerable extent, sometimes cultivated, may frequently be seen, composed chiefly of great masses of boulders, with gravel and sand, with the river flowing at some depth below the flat terrace, and through which it appears to have cut its way. These exactly resemble the boulders in the channels of the rivers, or those found in the longitudinal vallies, or on the Sandstone hills, and may be traced, but smaller in size, to considerable distances: that is, to twenty or twenty-five miles in the plains, as may be seen in digging wells. They would be displayed in the same way as the Sandstone, or Sewalic range, if any portion of the present plains were by any means to be raised from their horizontal into an inclined position.

This Sandstone range may be traced along the plainward base of the Himalayas, from Roopur, on the Sutlej, to the foot of the Siccim Hills, in lat. 26½° long. 88½°, where it was recognised by Capt. Herbert, in his trip to Darjiling. Dr. Buchanan, in entering Nepal in long. 85°, describes the Hills as composed in general of clay, intermixed with various proportions of sand, mica, and gravel, disposed in strata, either horizontal or dipping towards the north, at an angle less than 25°, and that incrustations are abundant, from the deposition of calcareous matter, also lignite. The prolongation of these Hills from the Kalee to the Sutlej, or from long. 80½° to 76½°, has been minutely examined by Capt. Herbert, when employed on the Mineralogical Survey of the Himalayas, and their structure found to correspond with what has been described, and lignite found throughout. The dip is usually to N.E.; at Chikoom S.W.; but between Chilka and Dikoolee the beds are almost horizontal. At Hurdwar and Chandneepuhar, on opposite sides of the river, the strata dip in opposite directions. On the N.E. side of the Deyra Valley, in ascending to Mussooree, by Beejapore, I found the sandstone dipping S.W., at an angle of 25°, and at Kalsee sandstone is also observed dipping to the S., and gradually passing to a dip E. by N. Capt. Cautley has observed, that though we may, on a large scale, lay down the dip and direction with accuracy, the former as varying from 15° to 35°, and the latter from N.E. to S.W., local details give very different results, and that near Nahun the mass of mountains have been upheaved from a variety of centres, as if the upheaving power had been exerted irregularly over the face of the district. He has observed a section which gives an anticlinal point under the village of Derria, on the Murkunda river. My observations also give irregularity of dip in the mountains in the vicinity of Nahun.

The elevatory force does not any where appear, by which these hills have been raised from the horizontal position in which they must have been deposited, into their present inclined one; but Dr. Falconer and Capt. Cautley have both seen appearances of trap in the neighbourhood of these disturbances. My specimens and observations indicate its vicinity on the northward of Nahun; also in the vicinity of Khalsee, and in the ascent to Mussooree by Kuerkoolee. The nearest points to the southward where indications of trap are seen, are in the bed of the Jumna, and one of these is alluded to by Col. Sykes (Proc. Geol. Soc. Jan. 1832), when tracing the trap formation to the north, which I observed in a small island called Oudhar, below the village of Kuttea, and about three or four miles higher up the river than the Seeta Puhar, and about thirty miles above Allahabad, and therefore near Mhow, which is twenty miles below Murka, the two localities where volcanic rocks have been noticed by Mr. Dean, in the Journal of the Asiatic Society.

These

These hills have, however, in the last few years, attained great celebrity, from their containing one of the most extensive deposits of Fossil remains, which has any where been discovered, and which have been made public by several officers of the Bengal Army, whom I am proud to call my friends: as Dr. Falconer, my successor at Saharunpore; Capt. Cautley, Superintendent of the Doab Canal; Lieuts. Baker and Durand, of the Bengal Engineers, in a series of excellent Papers in the Researches and Journal of the Asiatic Society of Calcutta, and in the Transactions of the Geological Society of London. To the two former, this Society, the fountain of Geological honours, awarded two Wollaston Medals, in Feb. 1837, for their discoveries in Fossil Zoology, especially as displayed in their description of the *Sivatherium giganteum*, a huge Ruminant, which, they conceive, serves to fill up the blank which has always intervened between Ruminant and Pachydermatous quadrupeds, for it combines the teeth and horns of the former with the lip, face, and probably proboscis, of the latter. Lieuts. Baker and Durand are entitled to hardly less credit, for their Papers on the Fossil Horse, Hyæna, Bear, &c., and for having had the skill to detect, and for being the first to have the boldness to publish, in their Paper in the Journal of the Asiatic Society of Calcutta for November 1836, the discovery of Fossil Quadrumana. This was two months previous to the presentation, on the 16th January 1837, to the Academy of Sciences at Paris, of a Memoir, by M. Lartet, respecting the discovery of the lower jaw of an ape, in the tertiary fresh water formation of Simorre, Sansan, &c. in the department of Gers, in the south of France, and at the foot of the Pyrenees, and which in its genera so closely resembles that of the fossil Sewalik Hills, found, it is curious, in the district of Sirmore. These dates are adduced, because Dr. Buckland, in the Supplementary Notes to his Bridgewater Treatise, has announced M. Lartet as the first discoverer of Fossil Quadrumana. It is highly creditable to the Bengal Army that the only four officers in that part of the country should each and all have so highly distinguished themselves, in a science foreign to the pursuits upon which they are employed by the Indian Government, but which they have treated so as to merit the applause even of those who have made Fossil Zoology the business of their lives, v. Mr. Lyell's Address to the Geological Society in 1837.

The discovery of Fossils in the Sewaliks is recent, and its history easily traced; but it is difficult to ascertain who first discovered them in any part of the Himalayas. The Gunduck has long been known to bring down Fossil Ammonites, which are called *Saligrammi*, and are much esteemed by the Hindoos. The Fossils represented in the upper part of Plate 3, from the elevated land on the N.E. of the line of Snowy peaks, have also been long known in India by the name of *Bijli ke har*, or *Lightning Bones*, being employed by the natives in medicine. Capt. Webb and Mr. Traill were probably the first to bring them to the notice of the public; the specimens figured are from the collection of the Geological Society, having been presented by Mr. Colebrooke, to whom they had been sent by those gentlemen. The fossil shells figured in the lower part of the same Plate, are due to the researches of the late Dr. Gerard, who, I believe, first discovered them in the elevated valley of the Spiti, N.W. of Kunawur, though the date when, is not well ascertained; several, however, were figured at Calcutta in the Gleanings of Science for September 1831, where Capt. Herbert's paper on the Geology and Fossils of the Himalayas is published.

These fossils are all from the northern face, beyond what may be considered the true Himalayas. Nothing had then been discovered on the southern aspect of the mountains, with the exception of some at Caribari, in the small state of Cooch Behar, on the banks of the Brahmaputra, which were noticed by Mr. Colebrooke, in his account of the Geology of the N.E. border of Bengal. But this point was so remote from the parts of the Himalayas usually visited, that it was long before it was discovered that they formed a true clue to the nature of the formations at the base of these mountains. The Author also, in December 1831, discovered some fossil fragments on the banks of the Jumna, which, though at first doubted, were afterwards proved to be such by chemical analysis, v. J.A.S., p. 457. Abundance of

fossils have since been discovered there by the engineers employed in improving the navigation of the Jumna: v. papers by Capt. E. Smith, and by Mr. Dean, J. A.S. ii., p. 622, iii., p. 302, iv., p. 261.

Dr. Govan, in September 1831, discovered some Himalayan limestone which bore the impression either of a reptile or of one of the crustacea, which has not yet been described, but with this exception, nothing had been found on the southern face of the Himalayas, or from the Plains to the Snowy Peaks, and yet diligent search had been made for fossils in the Sewaliks themselves, but chiefly from the Kheree Pass to Hurdwar, by Capt. Herbert, and by Mons. Jacquemont at Nahun and in the Kheree Pass, as professed geologists; by Capt. Cautley and the author in their occasional visits to the latter and to Hurdwar. Capt. De Bude of the Engineers, when cutting down the rock at Hurdwar, and the shingly summit of the Kheree Pass, had been requested to look out for any appearance of fossil remains; and one of the officers of the Engineers, who has since distinguished himself in such discoveries, almost threw himself upon what he conceived to be a deposit of fossils, when the police officer who is stationed near the head of the Kheree Pass came up and informed the party that a camel had died there in the previous year. Lignite had been discovered here, and described by Capts. Herbert and Cautley. To this the author projected a visit, before leaving that part of India, with Dr. Falconer; but, as time was wanting, the latter went alone, and "returned loaded, not only with lignite, but with noble fossils of the monsters of the deep; bones of crocodilidæ, fragments of the shell of large turtles, and a fragment of a bivalve shell as large as an oyster."—Journ. As. Soc., i. p. 97,—as announced by the author in some notes read to the Asiatic Society in February 1832, when he was led to inquire whether those fossils did not probably belong to the same formation as those discovered by Dr. Wallich and Mr. Crawford on the Irawady. No further progress seems to have been made until April 1834, when Dr. Falconer picked up the shell of a fossil tortoise in the Timly Pass; Capt. Cautley immediately proceeded to the Kaloowala Pass, where he had discovered the lignite in 1827, when Dr. F. recognized a bone, and in the course of the digging, they found teeth of crocodiles; shells of tortoises; teeth, apparently of squalus; and bones and teeth of a pachydermatous animal, apparently Anthracotherium, v. Plate 3, fig. 4 to 15. The lignite lies between two beds of marl, or clay conglomerate; and in the upper of them the remains were found. Lieut. Durand, in September 1834, met with this marl, or clay conglomerate, on the north face of Nahun, with tortoise, Saurian, mammal, and fish remains.

But this discovery was eclipsed by that of the more extensive and important deposit of remains of fossil mammalia on the same range of hills to the westward of the Jumna, to which the duties of the Canal officers often led them. Attention was directed to this by Lieut. Baker having had given him, by the Nahun rajah, the fossil tooth of an elephant (Elephas primigenius) which had been picked up at Sumrotee, near the Pinjore valley. Lieut. B. proceeded to the Ambwalla Pass, on the western side of the Jumna, and found a large bone of some huge animal; Capt. Cautley, with his characteristic zeal, immediately joined Lieuts. Baker and Durand; when they carefully examined the ravine and slip, and brought away from the *upper strata of sandstone* seven fragments of bone, some of very large elephants, and the tibia, apparently, of a camel. A thin bed of blue clay, or blue marl, underlying the sandstone, and dipping at an angle of 20° to 30°, was found full of fresh water shells, as of Planorbis and of Paludina, v. Journ. As. Soc., iii. p. 393.* Specimens were also procured from other parts of the range, proving that from the Jumna to the Pinjore valley these mountains abound in fossils; and, in March 1837, Dr. Falconer announced the discovery of a few of the same fossils near Hurdwar, and in large quantities to the eastward of the Ganges in the low hills which skirt the province of Kemaon. Since then, the progress of discovery has

* Though the Author refers to the Journal of the Asiatic Society, &c. as showing the publication of the information, yet he quotes chiefly from letters addressed to him by Capt. Cautley, and which are those referred to by Mr. Lyell in his address in presenting the Wollaston medal, in 1837, to the Author, to be forwarded to Capt. Cautley and Dr. Falconer.

has been rapid, and is fully recorded in the works quoted. A more particular account of the localities, with sections of the mountains, is given by Capt. Cautley, in his paper read to the Geological Society (9th March 1836), and published in the Transactions, 2d Series, vol. v., p. 267, to which I gladly refer, and have only to give a brief enumeration of the genera and some of the species which have been discovered in the Sewalik hills. Capt. C. states particularly, that to the westward of the Jumna these hills are less abrupt; gravel beds are less frequent and abundant, and they are composed of varieties of clay-slate, and quartz, which can be traced to the neighbouring and nearest mountains. He distinguishes the lower marl strata from the upper sandstone beds; the fossils of the former are figured in the middle of Plate 3, and those of the latter in Plate 6.

List of Fossils found in the SEWALIK RANGE, *by* MESSRS. FALCONER, CAUTLEY, COLVIN, BAKER, *and* DURAND.

QUADRUMANA.

Three species of Quadrumana, v. Messrs. Baker and Durand, Jour. Asiatic Soc. Calcutta, Nov. 1836, Tab. 6, fig. 2; Messrs. Falconer and Cautley, J.A.S., May 1837. One allied to Semnopithecus.

PACHYDERMATA.

Elephas primigenius.

Mastodon elephantoides { M. *latidens*, Clift. / — *Elephantoides*, Clift.

——— angustidens

Hippopotamus sivalensis, F. & C., v. Tab. 6, fig. a. b.

——— dissimilis, F. & C.

Anoplotherium posterogenium, F. & C.

Rhinoceros angustistrictus, F. & C.

Rhinoceros sivalensis, F. & C., v. Tab. 6, fig. 4, a. b.

Anthracotherium silistrense, v. Tab. 3, fig. 12—15.

Chærotherium, F. & C., sivalense, F. & C.

Sus, (sp. undetermined).

RUMINANTIA.

Sivatherium, F. & C.

——— giganteum, F. & C., v. Tab. 6, fig. 1, a., b., c., d.

Camelus (sp. undetermined: two undoubted).

Cervus, (sp. undetermined: numerous).

Antilope, (sp. undetermined: numerous).

Bos, (sp. undetermined: 1 new section in the genus), v. Tab. 6, fig. 5, a. b., and fig. 6, a. b.

SOLIPEDA.

Equus Sivalensis, F. & C., v. Tab. 6, fig. a., b., c.

CARNIVORA.

Felis, (number, and character of species, undetermined).

Cats.

Canis, (species undetermined).

Bears.

Hyæna, (species undetermined).

Amyxodon, F. & C.

——— sivalensis, F. & C.

Indications of other Genera.

RODENTIA.

Hystrix, one, (sp. undetermined).

Mus, (species undetermined).

Castor.

Lutra.

REPTILIA.

Ghurial, (Gavial of Naturalists), or
Leptorhynchus gangeticus.
Crocodile, (Muggur of Natives), or
Crocodilus biporcatus, v. Tab. 3, fig. 7 to 9.
The head of a very large Crocodile.

Emys, (several species undetermined).
Trionyx, (several species undetermined).
Megalochelys, F. & C.
——— sivalensis, F. & C.

PISCES.

Heads, vertebræ, and scales, &c. of unknown genera and species.
Teeth of Squalus, v. Tab. 3, fig. 4 & 5. Tongue of Raya? v. Tab. 3, fig. 6, being the only appearance of marine remains.

TESTACEA.

Univalves and Bivalves, chiefly undetermined, but apparently — Unio, Cyclas, Cyrene, Paludina, Planorbis, Helix.

For detailed descriptions of these Fossils by the above gentlemen, see Asiatic Researches, Calcutta, 1836, Vol. xix., Part I., and Journal of the Asiatic Society of Bengal, No. 35, Vol. iii., p. 527; No. 45, 46, 48, Vol. iv., p. 495, 565, 706; No. 49, 53, 55, 57, 58, 59, 60, Vol. v., p. 38, 291, 294, 486, 579, 661, 739, 768, as quoted by the Editor of the Transactions of the Geological Society, Second Series, Vol. v., p. 278.

The Geological system of the Himalayas is extremely simple in the line of the sections, which are about fifty miles apart, and have been constructed from the Author's specimens and observations, commencing from the plains in both, extending to Kedarkanta in the one, and to near Shalma in the other. The formations may be treated of under the heads, 1st, of the Stratified, and, 2d, of the Unstratified rocks. The Stratified rocks consist of Clay-slate, with Limestone imbedded in, or alternating with it, and surmounted by a Quartz conglomerate, often called in India Greywacke or Grauwacke. Clay-slate continues for some time, and this is succeeded by Micaceous and other Schists and Gneiss. The Unstratified rocks consist of Trap-rocks and of Granite.

Stratified Rocks.—The Himalayas, between the Ganges and Sutlej rivers, like the Sewaliks, present towards the plains abruptly steep fronts, and a comparatively gradual slope in the opposite direction, from the strata dipping towards the north-east. As this is frequently repeated, we have a succession of steep ascents and sloping sides, with a deep valley intervening between two successive ridges, in which usually runs a small river, flowing either towards the Ganges or into the Jumna, or their feeders, or into those of the Sutlej. The drainage of these great rivers is everywhere separated by transverse ridges, which connect the parallel ridges, having the points of junction often projected into peaks, (v. p. xvii). By proceeding along these ridges, we may penetrate far into the interior, without having occasion to descend into the valleys; but the mountain paths usually take the direct course, and we have thus a succession of ridges and of vallies to cross, and to experience great vicissitudes of climate, as well as a repetition of the geological structure and of the animal and vegetable forms which are dependant on this and on the climate. The plain-ward face being thus abrupt towards the south-west, has the solar rays falling on it more perpendicularly, and therefore experiences greater heat and dryness. The strata dipping towards the north-east, also produce, from their disintegration, a greater accumulation of earth on that side, while the springs following the natural slopes are more frequent on the north-eastern than on the south-western face of these mountains, and therefore the vegetation of the two sides varies much more than would be anticipated by any one who had not observed the difference (v. p. 16).

Clay-Slate.—In ascending the Himalayas, between the Ganges and Jumna, Clay-slate is invariably met

met with, of great variety of colour as well as of texture, and in many places most remarkably contorted, as at Rikikes, &c. below Surkunda Debee. In the ascent to Mussooree it is soft, variously coloured, and crumbling into small quadrangular pieces. At Mutrogh, below Budraj, near the spring which supplies water to the village, it may be seen of a fine texture, blue colour, nearly perpendicular, and easily splitting into large slabs, is used as roofing slate. It may be seen of a still finer quality, and in still larger slabs on the ascent to Choor. In many places, nodules of quartz are seen imbedded in clay-slate, and in some places this is found passing into micaceous schist. Copper is found in it, in the neighbourhood of Khalsee.

Limestone. — In the ascent to Mussooree, alternating with the clay-slate, we find Limestone, usually compact and hard, but often honey-combed and cavernous, bluish in colour, passing to grey, whitish and chalk-like in some places, and becoming in others even black. It occurs first at Jureepanee, and then at the top of the range; it is also met with at Sahunsudhara, alternating with clay-slate and dipping east. It is found also in the Suen range, in the Kaphnul valley, as well as in that of the Riknal, and very conspicuously, and of enormous thickness, and overtopping the clay-slate, at Deobund. It is not, however, found constantly alternating with the clay-slate, even in the range which intervenes between the Jumna and Ganges rivers, as it is wanting near Budraj; also between Landour and Surkunda, though very abundant in the neighbourhood of Dhunoultee, one of the places which the Author recommended as an excellent site for a Sanatarium. The Limestone, though in such enormous, apparently amorphous masses, is rather partially diffused, when compared with the Clay-slate. Sometimes it is harder, and even non-effervescent, becoming also siliceous, and like chert; though the pure blue limestone, in connection with clay-slate, is the most common. In some situations it passes into beautiful calc spar, as at Dhunoultee; in others, into white saccharine Limestone, formed of large crystals, as in some places in mica slate and gneiss, as well near the granite of the Choor Mountain, and of Gungotri. Gypsum is found associated with the Limestone in some situations, as at Sahunsudhara, below Mussooree, and at Jurreepanee, v. Herbert and Cautley (As. Res.) Heavy Spar, or Sulphate of Barytes, is found in the ascent to Landour, of which, as well as of the rocks, specimens were sent by the Author to the Asiatic Society in 1828. The sulphurous spring in the vicinity of Sahunsudhara, with the dripping rocks and numerous stalactites hanging down from the roof of the cavernous limestone, with the leaves, &c. encrusted with carbonate of lime, have often attracted the attention of, and been described by travellers.

Quartzose Conglomerate.—The Clay-slate formation is, in many of the peaks, surmounted by strata of a rock which Mr. De la Beche has denominated Quartz conglomerate. It varies much in appearance, being light grey coloured on Landour, coarse-grained and reddish on Budraj, formed of rounded grains of quartz, and therefore usually called sandstone. This varies in appearance, but is usually found at the summits of the peaks, as on Budraj, Landour, and Surkunda, and even on Deobun, in thin isolated strata above the limestone. In other situations, it alternates with the clay-slate, and then, as described by Mr. Everest, "it becomes a distinct greywacke, consisting of a greyish green base, with numerous angular fragments of clay-slate imbedded. No such appearances could be observed in the slates which alternate with the Mussooree limestone; and this circumstance, coupled with that of super-position, seems to mark the quartz sandstone as the newest formation of the two."

Section No. 2.—The clay-slate met with in the interior is usually more uniform in appearance, especially in the line of the section, as on Tuen, where, however, it is much waved and crossed by veins of quartz, so on Acharanda and Jountgurh, and on to Bhok tibba. In the Khulan valley, clay-slate is alone found, and a precipitous slip shows the whole to be of uniform structure. At the head of the valley limestone is met with in masses. The dip is very generally to the N.E., as shown in the Section.

Micaceous and other Schists.—Mica slate occurs in ascending the south-western face of the Bhok tibba,

tibba, though clay-slate forms the mass of the mountain, and is immediately succeeded by the mica slate and gneiss series. The clay-slate sometimes passes insensibly into what has been called quartz rock and even grauwacke in India, and in others into mica slate, which is, in some instances, fine grained and dark coloured, so as hardly to be distinguished from clay-slate. Mr. Everest, in proceeding from Mussooree, along the Ganges to its sources, mentions that quartz sandstone soon became the predominant rock, and that the slate had nearly disappeared, being only found in the lowest ground, opposite Ballahaut. The line of junction of the two was seen only a few feet above the level of the river. Somewhat before this, the slate had partly assumed the appearance of talc-slate, having a faint glimmering lustre and a soapy feel. Beyond Ballahaut, he continued travelling near the line of junction of the two formations, the slate gradually passing into a perfect talc-slate, and the quartzy sandstone becoming rather more crystalline than before. Perhaps the name of quartz-rock might be more appropriate to it, though it still exhibited, in some places, traces of round grains agglutinated together. About Batwaree, the quartz sandstone ceases on the low ground, and the slate contains a mixture of quartz and felspar, forming a talcose gneiss, with hornblende occasionally intermixed. Traces of the quartzy sandstone yet remain upon the cliffs above, for some miles farther to the north, where a gradual passage of it may be observed into the talcose gneiss.—J.A.S., Dec. 1835, p. 692.

In the upper Section, No. 1, after the sandstones of the Nahun and Jytuk ranges, red marl, with veins of carbonate of lime, is seen in descending to the Julal river; and this is succeeded by the limestone and clay-slate series. About Booraree, mica slate, with crystals of hornblende, is met with, and iron pyrites in the valleys on both sides; mica slate succeeds, occasionally fine textured, and scarcely to be distinguished from clay-slate: in ascending to Phagonee, it becomes coarse grained, and in some places abounds in garnets. Near Phagonee, a large vein of iron is seen, and some coarse grained crystalline limestone; after which we pass to gneiss, before reaching the projecting masses of granite which form the summit of the Choor Mountain. Above Chowrass, a granite vein, running east and west, is seen crossing the mica slate. In descending, on the N.E. gneiss and mica slate, with garnets, are again seen. Near Chepal, iron ore occurs, and the slate becomes talcose in the bed of the rivulet, and a coarse plumbago slate is seen near the Soonth. The same formations are repeated in proceeding towards Changshill and Kedarkanta. In ascending to Bumpta, the slate becomes very quartzose, with layers of mica, occasionally assuming a granitic structure. On Urukta, mica slate, with garnets, is found, and often with nodules of quartz. In the descent by Deyra, the slate is met with containing grains of magnetic iron, in sufficient quantity to be profitably worked, and which has been named Hornblende Slate by Mr. De la Beche (Manual, 3d Ed., p. 435): it is associated with gneiss and mica slate.

Gneiss.—The system of slates is succeeded in the section by a more uniform formation of gneiss. The extent of which will vary according to our view of what is gneiss. Capt. Herbert calculated the gneiss to be of great breadth, forming a band of which the lowest point is 2,800, and the highest 25,709 feet high, thus including the lofty peaks and the snowy range; as he says: "The highest peaks are everywhere composed of gneiss, the strata of which may be clearly distinguished, when bare of snow, through a telescope. Granite has nowhere been found except in veins, and these veins are generally small, with one exception—Whangtoo on the Sutlej." In this Capt. H. was incorrect, according to the testimony both of Dr. Falconer and of the Rev. Mr. Everest (v. infra). "The gneiss is of very various character, as far as colour and grain are concerned, though always very regular, consisting of the usual ingredients, united in the usual proportions; garnets, schorl, kyanite, carbonate of lime, green quartz, and hyacinth, are the most ordinary imbedded minerals. A speck of native gold has been found in a specimen from one of the granite veins."—*Gleanings of Science*, v. 3, p. 268.

Gneiss is found in many of the Passes, associated with chlorite and hornblende schists, as well as quartz rock, sometimes passing into micaceous schist; it is often found in the vicinity of granite, but is soon succeeded

succeeded by micaceous schist, and this sometimes becoming talcose. The strata in general dip to the N.E., but great irregularities exist, and many instances are seen of their dipping in an opposite direction, but only to a limited extent.

Unstratified Rocks.—Trap-rocks, though frequently met with in fragments, were not until lately, recognized as forming a remarkable feature in the structure of the Himalayas. They were noticed by Capt. Herbert, and compared by him to Greenstone, as the schist in the descent to Khalsee, which he calls a Protean green slate, passing into a rock like greenstone. He also observes, that a trap-like rock is found in the vicinity of Bheemtal, and mentions a "Toadstone, of which the original mass is doubtless to be detected." But a vein of greenstone was discovered by Dr. Falconer in the neighbourhood of Mussooree, and the presence of trap-rocks has since been detected in numerous situations. Previous to this, the elevatory force was supposed to depend upon granite, which is revealed at the surface in so many places in Kemaon, and was supposed to be concealed under the surface to the westward of the Ganges, and raised to a great elevation only at the Choor Mountain. Hot springs abound in the Himalayas, and evidences of recent volcanic action were observed by Mr. Vigne in Cashmere, and have been seen by Dr. Falconer.

The igneous rocks, Dr. F. says, which have been found in the outer tracts, are of the green trap series, and are very generally met with in dykes, intersecting and rising through the regular strata, which are in all directions fractured or comminuted, and the limestone broken up into masses. The Mussooree vein is composed in some places principally of compact white felspar and pyroxene, and in others chiefly of hornblende, and may be traced for half-a-mile in a direction nearly parallel to the range of the mountains. Trap is also met with in one of the ascents to Mussooree, in the bed of the Jumna, and in the neighbourhood of Khalsee, and therefore abundantly displayed even within a limited extent. Mr. Everest mentions having crossed three different masses of greenstone in his journey from Mussooree to Gungotri: first, on the ridge before descending into the valley of the Ganges, and two others in the clay-slate and talc-slate. He could not in either case trace their connection with the surrounding rocks, but infers that it probably crossed them nearly at a right angle, and if so, their range must approach to a parallel with that of the granite.

Granite.—From the foregoing extract from Capt. Herbert, the comparative absence of granite in the Himalayas might be inferred, though in the line of section a magnificent outburst is observed on the summit of the Choor Mountain, which is greyish coloured, coarse grained, with veins of quartz, and is porphyritic towards Roundee. Enormous boulders of it may be seen in the valleys, both to the north and south. It was suspected to occur in other places, as boulders and hand specimens were well known and totally different in character from the Choor granite. Capt. H. was well acquainted with its existence in many places, as he says: "Granite displays itself on the southern face in several places, as at Champawut, Dhie, Almorah, Shaee Debee, Dooarahath, Pale dhore, Kunyoor, and Choor, situated, except the latter, in beds in a zone of minimum elevation, and a line passing through them all, has a direction to N. 60° W., the same as that of the strata and mountain range. West of the Ganges no such beds are found, but the granite occupies the summit of Choor; and this is the highest of the mountains of the southern slope of the Himalayas, excepting only those which form the snowy peaks and passes." In colouring these on the large map of the Himalayas they form a line beautifully parallel to the direction both of the Sandstone and the Himalaya range. On the higher belt and northern face, according to Capt. Herbert, and towards the central and highest parts, Granite veins are frequent, as at Whangtoo or Huttoo; and it is mentioned by himself, in his section of the Gonass Pass. But, notwithstanding this, he seems not to have recognized it at the sources of the Ganges, as Dr. Falconer writes me that "the section about the formation of Gungotri, instead of being of gneiss, is all, to the northward of Sookhee, purely granite, and most palpably so, a binary compound of felspar and quartz, with crystals of

of tourmaline. It is the grand granitic axis of the Himalaya, and one of the greatest and most magnificent outbursts of granite in the world." He went across the direction of it for many miles (up the Bhaghiretty, beyond the temple at Gungotri, and saw no end of it. The granite escarpments shooting up into the highest peaks, and the huge cairns of granitic blocks, many of them as large as a house, he describes as inconceivably grand.

The Mines and Mineral productions of the Himalayas have been detailed by the late Capt. Herbert, Superintendent of the Mineralogical Survey of the Himalayas, in a Paper in the Asiatic Researches, Trans. of the Physical Class, 1829, Part I., p. 227, and may be enumerated as Sulphur, Sulphate of Iron, Alum, Bitumen, Graphite, Gypsum, Limestone, Dolomite, Potstone, or indurated Talc. To these Calc Spar and Heavy Spar may be added.

Gold, in many of the streams, and specks of it in the Granite, near Kedarnath.

Copper, Grey Copper, and Copper Pyrites, and Green Carbonate.

Iron.—Red Oxide, Red Hæmatite, Micaceous, Scaly, and Specular Iron Ore, Compact Red Iron Ore, Magnetic Iron Ore.

Lead in form of fine granular Galena. Of the value of the mines we may expect a fuller account from the investigations of Captain Drummond, accompanied by his Cornish miner.

Kunawur and the northern face of the Himalayas. The Geology of this tract is little known, but we may expect a detailed account from the results of Mons. Jacquemont's investigations. Capt. Herbert, Gl. iii., p. 269, has briefly indicated its characteristics.

The Gneiss zone being stratified, and dipping at no great inclination to the N.E., the consequences to be expected are, that in proceeding to the north-eastward, the same succession of strata would be found, but at greater elevations. And this is the fact: although the development of rocks to the north is not equal in extent to those on the south side. Micaceous schist, with it sassociates, gradually gives way to grauwacke slate or grauwacke, which rocks are found at considerable elevations. Limestone, with organic remains, is found in beds in these rocks, and at such an elevation that the tertiary strata may be expected to occur at very great heights, and even the superficial deposits which have been called *diluvium*.

From the physical features of the country, v. p. xxi., the existence of tertiary strata might be *expected*, but these have been proved to exist by the Fossils, v. p. xxix, which have been figured in Plate 3, fig. 1 to 3, including the skull and lower jaw of a hollow-horned Ruminant (Antilope), that referred to by Capt. Herbert, Gl. iii., p. 270, with the tooth of a Rhinoceros. Those of the Horse, and Ox are also mentioned as having been found. The locality of these is not known, but Capt. H. concludes that they are from the northern face of the ridge which separates the basin of the Ganges from that of the Sutlej, and not far from the town of Dumpa.

The Fossils figured in Plate 3, fig. 16 to 27, are described by Dr. Gerard, Gleanings iii., p. 92, as found by him in a loose stratum of black schist, elevated 13,000 to 15,000 feet upon the declivity of the Spiti. The Terebratulæ were particularly remarked on the Laitche Lang Chain, the third great ridge of the Himalayas, at an elevation of 17,000 feet, altogether distinct from the above formation. From the examination of the shells, the Rev. Mr. Everest concluded that there exist in the Himalayan range strata analogous to the early secondary and transition formations of Europe; Gl. iii., p. 30. Specimens of the shells having been sent to Mr. J. D. C. Sowerby, he coincides in this view, and considers some of them as identical with shells of the mountain Limestone, Inferior Oolite, and Lias of England. J.A.S. 1., p. 248. The species in my collection, obtained chiefly from Dr. Gerard, consist of Astarte, fig. 16, a genus of which it is extremely difficult to determine the species. *Arca* or *Cucullæa*, fig. 17; Avicula, fig. 19; Terebratula or Atrypa, fig. 20 and 21, with a species not figured. Fig. 18, genus not determinable in my specimens: Delthyris? fig. 23; Ammonites, two species, fig. 22 and 24. The markings of

of both indicate that they belong to that division of the genus which range, from the Lias to the Chalk, both inclusive. Belemnites two species, fig. 25, 26, and 27.

A section having been given of a portion of the Central Range of India, that is, from Sheerghatty to Rogonautpore, some details might be given respecting their Geological structure, but as the Author has already exhausted his space, he can only refer to the valuable papers of Dr. Voysey and of Colonel Sykes, as well as to that of Dr. Malcolmson, for the Geology of Central India, and to the Geological observations made by the Rev. Mr. Everest, on a journey from Calcutta to Ghazipore. Gleanings, iii., p. 129. In the Section No. 4, is seen that the rocky basis of the range is composed of Gneiss, passing occasionally into mica slate; and that this alternates with hornblende rock, which is most conspicuous at the several Ghauts; and that they have both an anticlinal dip from the Granite and Trap, which make their appearance at the Suspension Bridge, and in the Bulbul rivulet. The Granite is also seen in outliers, and on both flanks of the range. On the Gneiss, a gray micaceous sandstone is horizontally deposited, but much disturbed in some situations. With the shale, &c. impressions of fossil vegetables are found, as well as Coal.

The Chinnakooree Coal formation, Section No. 3, resembles that of Ranigunj, on the Damooda, described by Mr. Jones and the Rev. Mr. Everest, and noticed by Mr. De la Beche in his Manual, p. 399, from the Author's notes, but which he is compelled to suppress. Gneiss was seen near Pachette, but the hill over which the Author passed was found to be composed of Red Sandstone and Conglomerate. The Coal is imbedded in shale, with loose-grained gray Sandstone, both above and below. See the above Authors, as well as Mr. Mc'Clelland's able report of "A Committee for investigating the Coal and Mineral Resources of India" (Calcutta, 1838), where the discovery of a raised beach of tertiary shells in the Kasya Hills is noticed, and a list is given of all the sites of Coal (and Lignite, as those in the Himalayas,) at present known to exist on the continent of India. They may briefly be enumerated as follows,—Burdwan, Ranigunj, Chinakooree, Adjai Seedpoorie, Pariharpoor, Darbadanaghat, Benares Road 149th mile stone, and other places; Hazareebagh, Rajmahal, Patsandeh Baghelpoor, Skrigully, Hurra, Palamoo, two principal beds, Amarath. Bidjegurh. Nerbudda, Towar river, Hoshungabad, Jubulpoor, Sohagpore, Chanda, Warda nala. Cuttack, Mahanadi. Assam Deuphapanee near Bramakoond, Namroop river, Suffry or Disung river, near Rungpore, Dhunsiree river, Jumoona river, Kossila river near Gowahate, Chilmari and Doorgapoor. Silhet, Laour and other sites, Kasya hills Chirrapunjie, Sarrarim, Manipur near capital, Gendah on Kuenduan river. Arracan Sandoway District, Kyook Phyoo Island. Moulmein, Anthracite at Bothoung. Southern India, Travancore, fossil seeds carbonized. Himalaya, Kemaon lignite, Moradabad, lower range. Indus, Cutch, Peshawur. To these may be added the indications of Coal discovered in boring to a depth of 400 at Calcutta and 300 feet at Goga in Gujerat.

The Shales of Ranigunj and Chinnakooree contain abundant remains of Ranigunj Reed; *Vertebraria indica*, nob., Plate 2, fig. 1, 2, 3, and of another species, *V. radiata*, nob., fig. 5, 6, 7. *Trizygia speciosa* referred formerly to Sphenophyllum? De la Beche, Manual, p. 400, and mentioned by Mr. Jones as "impressions of flowers." This appears to belong to the natural family of *Marsileaceæ*, v. p. 431. Of this new genus there is a second species found in Germany, and the Author has a third species lent him by Dr. Mantell, from the Anthracite of Mount Carbon, in Pennsylvania. *Pustularia Calderiana*, nob., *Pecopteris Lindleyana*, fig. 4, and *Glossopteris dancæoides*, fig. 9, are the other plants obtained from the same locality. *Glossopteris angustifolia*, and *G. Browniana*, are other species mentioned by M. Adolphe Brongniart. The presence of the latter is remarkable, as it was originally found in the carboniferous series of Eastern Australia by Dr. Robert Brown, v. De la Beche, Manual, p. 401.

It would have been interesting to have concluded this cursory view of the Geology of parts of India with a notice of the various mineral resources of that country, which though little developed are very abundant, and some of which have long been known to, and formed articles of commerce to both the ancient and modern civilized nations of the Earth, as the Author has endeavoured to prove, from p. 40 to 47, and p. 95 to p. 104, in his "Essay on the Antiquity of Hindoo Medicine, London, 1838."

THE METEOROLOGY OF THE PLAINS AND MOUNTAINS OF N. W. INDIA.

THOUGH the Meteorology of a country is frequently omitted in Works treating of Natural History, there is no subject which is more interesting or more closely connected with its several branches, especially when it is desired to point out the connection between climate and the vegetable and animal forms which it supports. This is still more important, indeed essentially necessary, when we desire to make any Practical application to the Arts of Culture of the results of our investigations into the Natural History of a country.

India being so extended in territory and varied in surface, with lengthened coasts, washed by a tropical ocean, and the summits of its mountains, covered by eternal snows, necessarily presents every variety of climate. As it is intended in the present Work to notice the vegetation of its heated plains and vallies, and to compare this with that found on the slope of its mountains, it is desirable, therefore, for the sake of comparison, to notice the more striking characteristics of the climate of different parts of India. This can only be done very briefly; but the Author hopes to be able to return to the subject, and give the details of his observations made at Saharunpore, from the year 1826 to 1830, with the Barometer, and both the Dry and Wet Bulb Thermometer, with observations on Radiation, Temperature of Wells, Quantity of Rain, together with Horary Observations, with all the instruments, from 1 A.M. to midnight, or for one day (the 15th) in each month for one year; occasionally also at different elevations, and at the different seasons of the year, in the Himalayan Mountains.

The instruments were compared with those of Capt. Herbert and of Mons. Jacquemont, when these gentlemen passed through Saharunpore, and subsequently with those of my friend Mr. James Prinsep, on my arrival in Calcutta, and the differences between all were very slight.

As much of the vegetation of India is of a tropical nature, and as this is found extending into higher latitudes, or to considerable elevations, when local circumstances favour the production of a similar climate, we may therefore notice the characteristics of tropical climate, which consist in great uniformity of temperature, as well as of moisture, throughout the year. Various attempts have been made to ascertain by calculation the mean temperature of the Equator, assisted by the few observations which we possessed, of places in its vicinity. The illustrious Humboldt was induced to adopt 81° 5′ as the mean temperature of the Equator. Mr. Atkinson, on the contrary, inferred, that it was at least 84° 53′; but when it is considered that five-sixths of this line passes over the Ocean, the mean temperature of which between the limits of 3° N. and 3° S. varies, in general, between 80° 24′ and 82° 4′, and as the air which rests upon these waters is from 1° 8′ to 2° 7′ cooler, it is probable that 81° 5′ is not too low for the mean temperature of the Equator. Sir David Brewster, indeed, from observations since made in Ceylon, Penang, and at Singapore, is inclined to think that this may be too high.

The seasons in equatorial regions are well known to be characterized by great equability of temperature, and, in fact, they are not distinguished, as in high latitudes, into hot and cold, but into wet and dry seasons, and are greatly regulated by the periodical winds. In Java and Sumatra the thermometer seldom rises above 85° or 90° on the coast, falling as low as 70° at sunrise. The heaviest rains take place in December and January, the driest weather occurs in July and August, while the intermediate months afford variable weather. Singapore, from its insular nature, and being 1° 15′ North of the Equator, and near the S. extremity of the Malayan Peninsula, is well suited to give an idea of an Equatorial climate; there we have, fortunately, thermometric observations carried on for six years by Capt. C. E. Davis, three times a-day: at 6 A.M., 6 P.M., and at Noon (v. Journ. As. Soc. 2, p. 428), though the mean temperature deduced from them may probably be a little too high; but in the whole time the

Thermo-

Thermometer never rose above 89°, or sunk below 71°, and the mean temperature deduced from the means of the extremes is 80° 04′ in all the years.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Maximum	84·5	85	87	87	89	88	88	88	88	88	86	86
Minimum	70·5	73	72	74	75	74	74	75	75	75	74	74
	77·5	79·5	80	80·5	82	81	81.5	81·5	81·5	81·5	80	80=80.4

This degree of equability is found near the Equator only, but an approach is made to it during the rainy season of the year, both in higher latitudes and at considerable elevations, within the influence of the tropical rains, though the general characteristics of these situations is that of variableness of climate, or of a great range of the thermometer, both daily and annual. The result is the production, not only of great cold, but also of great heat, so that the thermometer is found to rise much higher at, and a little beyond the tropics, than in the neighbourhood of the Equator. This is accounted for, in some measure, by what has been observed by astronomers, that the sun, in his progress from the Equator towards the Tropic, advances in the first month 12°, and in the second 8°, so that at the end of the second month he is 20° from the Equator, and takes a month to advance the remaining 3½°, and an equal time to return, so that during the whole of this period the solar rays must fall nearly perpendicularly at noon on all places between 20° and 23½° of latitude, while a place situated under the Equator has the sun only during six days, as near the zenith, as the above places near the tropics have it for near two months; and, therefore, we may expect a greater degree of heat, which is moreover increased by the greater length of the days. The larger proportion of land near and beyond the tropic of Cancer, as well as the sandy barren nature of the soil, perhaps originally a consequence of, but now acting as a cause, in increasing the heat, together with the dryness of the air, all contribute, as causes, in increasing the absorption of, and the subsequent radiation of the heat imparted by, the nearly perpendicular solar rays. Thus Ritchie and Lyon state, that during whole months the thermometer stood at 117°, and at 128° in the Oasis of Mourzouk; Dr. Coulter mentions having observed it at 140° on the banks of the Rio Colorado, 32° 30′ N. lat., and we have it often stated as being 120°. Mr. Everest gives 111° as the highest at Ghazeepore; Mr. Prinsep as its being 114° at Benares. I have observed it at 107° at Saharunpore. The free radiation of the same open plains in the clear still nights of the winter months, causes a degree of cold which one is surprised to hear of as occurring in situations where the summer heat is so intense; hence the coldness experienced in some of the deserts of Africa, also by Lieut. Burnes, as well as in the plains of India.

The climate of many places in low latitudes has been ascertained, but of these we can only state the mean temperatures: as of places in Ceylon, from lat. 6° to 8½°; of Point de Galle, 81°10′; of Colombo, 80° 75′; and of Trincomalee, 80° 56′; while the temperature of Madras, in lat. 13° 5′, has been ascertained, by numerous observations, to be 80° 42′. Pondicherry, on the dry and hot part of the Coromandel Coast, and in N. lat. 11° 55′, has the highest observed mean temperature, this having been found to be 85° 28′. Seringapatam, in lat. 12° 45′ N. long. 76° 51′ E., and elevated about 2,412 feet above the level of the sea, has a mean temperature of 77° 06′; the mean at sunrise is 63° 17′; at 3 P.M., 90° 95′; of the day, 84°; of the night, 70° 11′; the highest temperature observed was 115°, and the lowest 48°. At Bangalore, the mean temperature is about 74° 39′.

My friend Mr. James Prinsep, whose lamented illness all friends of science and of literature equally deplore, published, in the year 1832, the results of my observations, and as he has united them with others, I give his tables for the sake of comparison.

"The whole presents a convenient epitome of meteorological phenomena between 12° and 30° of north latitude. Of the climate of Madras, the minutest details are recorded in the voluminous and careful reports of the late astronomer, Mr. Goldingham, whose results merely required to be reduced to the freezing point. The Ava tables are abstracted from Major Burney's Registers, published in the 'Gleanings;' the Benares tables are taken from the Oriental Magazine, 1820; for the Saharunpore results we are indebted to Dr. Royle, who allowed us to look through his copious registers for the pur-

 pose

pose. As the several barometers were never absolutely compared together, entire dependence cannot be placed upon the mean altitudes given; but with regard to Calcutta, Benares, and Saharunpore, as some opportunities occurred of comparison through the instruments of different travellers, the relative altitude of these places can be estimated tolerably well: thus, Saharunpore will be found to be almost exactly one thousand feet above the sea, as was before estimated by Captain Hodgson. Benares, in like manner, may be safely stated, in even numbers, to be three hundred feet above the sea.

MONTHLY DEVIATIONS of the BAROMETER and THERMOMETER from their annual mean height at Calcutta; and at several other places, introduced for the sake of comparison.

MONTH.	BAROMETER AT 32° FAHR.					THERMOMETER.				
	Madras, mean of 21 years from 1796 to 1821.	Ava, 1830.	Calcutta, for three years, 1829-30-31.	Benares, four years' observations, 1822 to 1826.	Saharunpore 1826-27.	Madras, mean of 21 years' observations, max.& min.	Ava, 1830, sun-riseand 4 P.M.	Calcutta, 3 years' observations, max.& min.	Benares, 4 years' observations, max.& min.	Saharunpore 1826-27.
	Inch.	Inch.	Inch.	Inch.	Inch.	Deg.	Deg.	Deg.	Deg.	Deg.
January	+·146	+·229	+·208	+·273	+·274	—6·5	—13·7	—11·6	—17·0	—21·8
February	+·131	+·115	+·172	+·175	+·219	—4·5	— 4·9	— 6·0	—11·5	—20·9
March	+·087	+·051	+·095	+·107	+·151	—1·8	— 2·8	+ 1·0	— 1·5	+ 0·1
April	—·006	—·028	—·030	—·043	+·061	+0·7	+ 7·8	+ 5·1	+ 9·5	+ 6·1
May	—·124	—·105	—·152	—·136	—·060	+5·2	+ 5·6	+ 7·5	+13·9	+11·6
June	—·117	—·156	—·248	—·289	—·217	+7·4	+ 7·1	+ 5·5	+13·1	+17·5
July	—·103	—·176	—·218	—·308	—·398	+3·9	+ 4·4	+ 4·6	+ 6·9	+12·8
August	—·088	—·126	—·194	—·203	—·278	+3·0	+ 4·1	+ 3·6	+ 6·4	+10·0
September	—·057	—·098	—·115	—·098	—·158	+2·1	+ 4·3	+ 3·7	+ 5·8	+ 9·5
October	—·018	—·010	+·020	+·074	—·047	+0·1	+ 2·2	+ 2·5	+ 1·3	— 0·8
November	+·006	+·102	+·161	+·181	+·209	—3·1	— 4·2	— 5·4	— 9·7	—10·8
December	+·124	+·201	+·258	+·279	+·245	—4·9	—10·1	—11·5	—17·6	—13·8
Ann. mean	29·810	29·573	29·764	29·464	28·766	81·69	78·39	78·13	77·81	73·5
Range	·270	·405	·506	·587	·672	13·9	21·5	19·1	31·5	39·3

"It will be remarked, that the range of variation in the weight of the atmosphere increases with the latitude, even up to the foot of the Himalaya Mountains, and that it is accompanied by a corresponding increase in the range of the thermometer.

"We now come to the *diurnal oscillation* of the barometer, for which the same sources have furnished me with materials for framing a comparative table for five localities considerably distant from one another; we could have added Moorshedabad to the list, but that the thermometric series for that place was incomplete. At Saharunpore the horary observations were confined to a single day, the fifteenth of each month; at Madras to three similar days; at Benares, perhaps, the hour of the minimum was not always exactly observed; thus a little irregularity must be expected, but on the whole the results are wonderfully equable.

DIURNAL OSCILLATIONS of the BAROMETER and THERMOMETER at Calcutta, with Comparative Observations at other places.

MONTH.	BAROMETER AT 32°.					THERMOMETER.				
	Madras, max.& min. every tenth day for 1823.	Ava, 10 A.M. and 4 P.M.	Calcutta, 9 40 A.M. and 4 0 P.M.	Benares, 9 to 10½ A.M. and 4 to 6 P.M.	Saharunpore, max. and min. of one day in month.	Madras, 4 A.M. and 2 P.M.	Ava, sun-rise and 4 P.M.	Calcutta, sun-rise and 2 50 P.M.	Benares, daily extremes by register thermom.	Saharunpore, extremes of one day in each month
	Inch.	Inch.	Inch.	Inch.	Inch.	Deg.	Deg.	Deg.	Deg.	Deg.
January	·072	·144	·123	·097	·103	11·0	9·4	20·7	17·8	24·5
February	·070	·126	·117	·103	·093	10·0	16·8	18·5	19·2	21·0
March	·076	·107	·125	·121	·146	7·0	20·8	14·0	20·7	26·0
April	·081	·110	·124	·125	·107	9·0	20·9	14·6	23·2	31·0
May	·081	·113	·115	·124	·160	9·0	20·4	13·7	21·9	38·0
June	·092	·136	·095	·113	·178	9·0	9·0	7·6	16·1	31·5
July	·097	·133	·090	·077	·103	7·0	6·6	6·1	9·0	15·3
August	·105	·109	·099	·088	·079	7·0	8·8	5·9	8·3	11·5
September	·094	·145	·101	·103	·123	6·0	7·8	6·2	10·3	13·0
October	·068	·144	·110	·100	·120	8·0	5·0	8·4	18·1	31·5
November	·071	·127	·107	·107	·147	8·0	6·7	13·4	16·8	29·3
December	·071	·126	·114	·098	·124	9·0	8·5	17·1	16·3	17·5
Mean tide	·081	·126	·110	·105	·120	8·5	10·6	12·2	16·6	24·2

"With due allowance for the difference of sensibility in the instruments, the above table shews that the average diurnal tide of the barometer between the Equator and 30° north latitude, exceeds one-tenth of an inch, and that it is progressively greater as the variation of temperature during the day is also greater. With regard to the *nocturnal tide* of the atmosphere, the Calcutta tables afford us no data, for want of an observation at 10 P.M., the hour of the supposed maximum at night; all that is indicated therein is, that the barometer is constantly *lower* at sunset than at sun-rise. At the Madras observatory, in 1823, a series of horary observations was made for three days in each month, which seems to establish the fact of a night-tide beyond a doubt to the extent of .04 inch; when, however, the corrections for the temperature of the mercury are applied, this amount is reduced to two-hundredths of an inch, which is one-fifth only of the *diurnal tide.*

"The same result is obtained from a month's horary observations, undertaken by Col. Balfour, at Calcutta, in the year 1784. At Saharunpore, also, the existence of a nocturnal tide is equivocal: the following table exhibits all that we can gather towards the elucidation of the point in India, expressing by minus signs the real tide, or fall of the barometer, from 10 P.M. to 5 A.M., and *vice versâ.*" Mr. Prinsep concludes by saying, "There is still sufficient ambiguity respecting this second tide, therefore, to render further inquiry necessary, and it would be desirable to employ a barometer for the purpose, which should not require to have any correction applied for the temperature of the mercury; this might be easily effected, by enclosing the barometer tube in an outer tube of the same length, also filled with mercury, upon the surface of which the scale might float."

NOCTURNAL OSCILLATION of the BAROMETER from 10 P.M. to 5 A.M. reduced to 32° Fahr.

MONTH.	Madras, three days in each month.	Berhampore, from Dr. Russel's tables.	Saharunpore, Dr. Royle's observations.	Vera Cruz, in Mexico, by Fray Juan.
January	—·004	+·034	—·043	+·018
February	—·029	+·026	—·009	+·009
March	—·026	+·069	—·008	—·002
April	—·027	+·008	—·007	+·008
May	—·014	+·020	—·020	+·005
June	—·026	+·012	+·039	+·003
July	—·009	·000	—·005	—·002
August	—·028	+·014	—·016	—·007
September	—·024	+·011	+·011	—·012
October	—·033	+·009	—·004	—·021
November	—·010	+·009	+·024	+·001
December	—·019	+·027	+·015	—·023
Means	—·021	+·020	—·001	—·002

Saharunpore, as we have seen, is situated nearly at the head of the great Gangetic valley, in N. lat. 29° 57′, long. 77° 32′ E., one thousand miles north-west of Calcutta, in the Doab, or space included between the Ganges and Jumna rivers, about twenty miles from the former, and nine from the latter, and about thirty miles from the Sewalik or Sub-Himalayan range of Mountains. It is celebrated as the station whence the Trigonometrical Survey of the Himalayas was commenced by Capts. Hodgson and Herbert (v. p. xii.) It was then calculated by Capt., now Col., Hodgson, to be elevated 1,013 feet above Calcutta. Mr. James Prinsep, from my observations, compared with his own, in Calcutta, calculated that my house, situated in the vicinity of the Botanic Garden, was as near as possible one thousand feet above the sea (Journ. As. Soc., vol. i. p. 29). The characteristics of the climate are mentioned at p. 7, in connection with the vegetation, which is described as being tropical at one season, and partially European at another, and as having, in consequence, an equally varied cultivation. To display this connection of climate with vegetation, it is desirable to give the temperature, so as to show the rise and fall of the thermometer; I have therefore thought it advisable to commence with the month of March, when increase of temperature takes place so rapidly. The thermometer was placed on the northern side of the house, but too near, for the extremes to be accurately observed, as, though the heat was probably

greater, yet the cold was probably less, from the more confined radiation, as the minimum outside of a tent and not far from the house, was 27°, when the other was 38° 5′.

	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
Maxima	89	96	105·5	105	95·5	92	91·5	90·5	84	69	64·5	81·5
Minima	47	62	67·5	73	76	78·5	64·5	57·5	45.5	44	38·5	45
Means	68	79	86·5	89	86·75	85·25	78	74	64·75	56·5	52·5	63·25

Mean temp. .... 73·58

In connection with the thermometric observations at Saharunpore in the open plains of Upper India, it is interesting to give that of the Deyra Valley, in the same latitude, and about forty-five miles to the east. The observations were made by my late friend, the Hon. F. Shore, while Assistant Commissioner in the Deyra Doon.

	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
Maxima ..	86	93	98	101	94	90	91	86	70	71	68	73
Minima ..	48	53	64	71	72	72	66	61	44	42	37·75	45
Diff. ..	38	40	34	30	22	18	25	25	26	29	30·25	28
Mean....	67	73	81	86	83	81	78·5	73·5	57	56·5	52·8	59·5=70·65

From the greater number of cloudy days, as well as from the greater moistness of the climate, it is found difficult to ripen some fruits which succeed in the plains, though others, as Bengal Plantain, Guavas, and several varieties of Limes, arrive at greater perfection. The greater degree of moisture must be ascribed to the surrounding mountains, and to the quantity of vegetation with which the uncleared parts of the valley are covered. Like other vallies, it is also more close, as the winds cannot blow so freely as in the open plains. The evenings and nights are, however, pleasant, as a cool breeze generally descends from the mountains, and at some seasons of the year the climate is delightful.

In the ascent of the Himalayas, in the course of the Geological section, Jurreepanee is a mid-way station, where I have occasionally taken observations, and of which the temperature feels cool to those who are ascending, but warm to those descending from, the mountains:

	Ther.	Moist Bulb.	Barom.	Merc.	Spring of water.
April 4, eight A.M.	64	49·5	24·84	71°	63·5
Oct. 2, half-past seven A.M.	62·5				
July 22, eight A.M.	68				65·5
„ four P.M.	79				

Mussooree and Landour are on the elevated range which rises immediately above the Deyra Doon, and where a Sanatarium for the recovery of the health of European soldiers has been established, as well as houses built by officers, and where I established a small Nursery-garden, which was abolished by Lord William Bentinck, but re-established by Lord Auckland. The range enjoys a delightful climate, presenting as great a degree of equability of temperature from summer to winter, and from day to night, as is desirable. In summer the temperature is low, and all accumulation of heat is prevented by the coolness of the breeze which ascends from the vallies. The transition to the rains, which commence about the 15th of June, makes but little difference in the temperature, and the climate is remarkably equable; and though moist and usually cloudy, it is not otherwise disagreeable or unhealthy. In the month of October, or at the conclusion of the rainy season, and throughout November, the sky is so clear and serene, the air so mild and still, that the climate is perfectly delightful. The approach of the cold is so gradual, and its degree so moderate, as to be well calculated to brace the system, when improved by a previous residence in the hills. The coldest months are December, January, and February; in the last the greatest cold, and sometimes snow-storms, occur; after this, the rise in temperature is very rapid. Though 5,500 and 6,000 feet more elevated, the minimum, however, is very little lower than at Saharunpore.

The Author has already said, "that the cold of winter in these mountains, at least on the Mussooree Range, is not in proportion to the coolness of summer. It may be said, that with a winter temperature of

of their own latitudes,—that is, of the plains at their base,—they have the summer temperature of European countries; so that, without exaggeration, it might be said:—

Gurmush nu gurm ust,—	Its warmth is not heat,—
Surdush nu surd.	Its coolness is not cold."

The mildness of the night, compared with the coolness of the day, appears to be owing to the descent of strata of the atmosphere, which the heat of the day had caused to ascend. These, in descending to a lower station, become more condensed, and thus having their capacity for heat diminished, give out a portion of their latent caloric, which necessarily prevents the sinking of the temperature to the degree it otherwise would, in consequence of the cooling effect of radiation from the surface of the soil. Favoured as this process is by the stillness and clearness of the night, its effects would be more perceptible, did not the breadth of the ridge bear but a small proportion to the mass of the air by which it is surrounded. This equability of temperature is observed, not only from day to night, but also from hour to hour, and from summer to winter.

One great anomaly presents itself in consequence of the still calmness of the mornings; for though the nights are pleasant and the mornings cool, yet, from the rapid rise of the sun, and the great power of the solar rays, the heat becomes considerable, and even insupportable in the open air, until a gentle breeze rises, and ascending up the valley, continues through the day, apparently following the course of the sun. The maximum of temperature frequently occurs at ten, or, at all events, the increase after that is so slight as not to be perceptible to the senses. In the plains we know the temperature of the air goes on increasing until 2 or 3 P.M. As the latitude is nearly the same as that of Saharunpore, the power of the solar rays and the quantity of heat communicated in a given time must be nearly the same; but in the plains it is allowed to accumulate: in the hills, on the contrary, the breeze which sets in daily from the plains towards the hills, and which commences about 10 A.M. (the very time after which so little increase takes place in temperature), passes over the top of the range, and prevents the accumulation of any heat. This breeze, though caused by the heat of the sun rarefying the dense air, at the surface of the earth, might be expected to arrive at the mountain top in the hot and parched state in which it rose from the heated plains; but the air as it ascends becomes still less dense, and in proportion to this diminution of density is its capacity for heat increased; so that it absorbs all the caloric which, in the plains, was sensible to the feelings, or was observed by a thermometer, and thus, on arriving at the top of the range, it feels cool and refreshing.* At night, a similar, but more gentle breeze, sets in from the hills towards the plains, and the two may, with the strictest justice, be compared to the land and sea breezes of the Coast and of Equatorial islands.

As instances of the very gradual rise and fall of the thermometer from hour to hour, as well as of the little diminution of heat during the night, the following observations are subjoined, which were all carefully made in the open air, and on clear sunny days, but in the shade:—

Time	5.	6.	7.	8.	9.	10.	11.	12.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
April 19	58	—	—	70·5	76·5	77	76	75	76	—	67*	69	—	—	—	—	—	—	—	60
„ 21	59	62	66.5	72	74·5	74·5	73·5	73·5	71·5	71·5	72	71·5	68	65	64	—	—	62·5	†	—
May 6	53·5	58·5	63	68	75	75	75·5	76	75·5	72	66*	70	69	—	64	—	—	58	—	—
Sept. 29	57	59	60	61	—	69	—	69	—	—	—	66	—	—	64	—	—	60	‡	—

* Cloudy. † 57·55 next morning. ‡ 56 next morning, at day-break.

The transition to the rainy season is not accompanied with so great a diminution of temperature as might be expected. In the year 1829, the rains came on on the 15th of June. The mean temperature of the two previous days was 67° and 68°, while that of the twenty-four hours subsequent to the rains was 62°, and that of the whole day of the 16th was 63·5.

A ther-

* These observations were first published by the Author in a Paper read before the Asiatic Society of Calcutta, and extracts published in the Journ. As. Soc., vol. i. p. 97.

A thermometer hung up in the sun, and freely exposed to its influence, as well as to that of the air, was usually from 5° to 10° higher; the maximum generally taking place about 12.

Atmospherical pressure is also very equable; but the observations have not all been made with a stationary instrument, nor all at the same place in the hills. At the top of the range, where the houses were first built, the barometer observed in September, October, December, and April, did not differ at these various times more than one-tenth of an inch, or from 23·60 to 23·50. Mr. S. Boulderson has published his observations in another part of the same range, called Caineville, from 15th May to 21st of November: he has 24·158 as the maximum mean of seventeen observations, from 1st to 21st Nov., at 10 A.M., while 23·815 is the minimum of twenty-two observations in June, at 4 P.M., giving a range of .343 inches.

The daily periodical fluctuation was observed to be as regular in the hills as in the plains. The maximum height to which the barometer rose was always about ten o'clock, and the lowest to which it fell, about 4 P.M.

From the equability of temperature as well as of pressure, we might also expect considerable equability of evaporation; but if it were not for the increased capacity of air for moisture, as well as for caloric, in proportion to its rarefaction, the climate would be a very moist one, as, indeed, is the case in the rainy season. From my observations, however, it appears that there is always a moderate degree of evaporation in the Mussooree climate; the greatest difference, or 20°, between the dry and moist Bulb Thermometer, occurred on the 6th May; on the same day, the difference at Saharunpore was 32° 5′. On the 5th April, in the morning, after rain, the difference was 7° 5′, while at Saharunpore, on the 7th, also after rain, the difference was only 3° 5′. Even when enveloped in a cloud on the Mussooree range, I have found 2° difference between the dry and moist thermometers, and on cloudy days the difference varied from 4° to 10°. Also at the conclusion of the rains, that is, on the 29th September, the mean of the differences on the Mussooree was observed to be 7° 7′, while at Saharunpore it was only 6° 7′.

The meteorological phenomena observed in the years 1827 and 1828, have been reduced to a tabular form, which will give a good general idea of the nature of the climate, as they nearly correspond with those observed in subsequent years; but the peculiarity of seasons, their greater dryness or moisture, later accession of the rainy seasons, or the total absence of a snow-storm, in some years, will, of course, here, as elsewhere, modify the temperature of particular months.

Results of Meteorological Observations at Mussooree.

Month.	Means of all the Observations.	Maximum during each Month.	Minimum during each Month.	Means of Maxima and Minima.	Increase and Decrease of each Month.
	°	°	°	°	°
January	42·45	51·5	34·5	43	—2·55
February	45·42	63	27	45	+2·97
March	53·63	69	37	53	+8·21
April	59·83	77	41	59	+6·2
May	66·01	78	41	59	+6·18
June	67·12	74	61	67·5	+1·11
July	67·35	71	63	67·5	—0·23
August	66·43	69	63	66	—0·92
September	64·04	69·5	57	63·25	—2·39
October	57·25	66·5	48	57·25	—6·79
November	50	57	48	52·5	—7·25
December	45	55	29	42	—5·
Mean Temperature of the Year..	57·04			56·5	Mean Temperature of the Year from the Monthly Maxima and Minima.

ON THE

ENTOMOLOGY OF THE HIMALAYAS AND OF INDIA.

By the Rev. F. W. Hope, F.R.S., F.L.S., &c., *President of the Entomological Society of London.**

It may by some be considered a proof of presumption, that any individual should undertake to describe the entomo-geographical character of a country which he has never visited; and bold, I am willing to allow, is the attempt to embrace, in my views, not only the distribution of Insects in the Himalayas, but those also of the whole Continent of India and its adjacent islands. Possessing, however, one of the richest Cabinets of Oriental Entomology to be found in this or any other country, the major part of the species collected at Calcutta, Madras, Poona, and Singapore, and in the islands of Java and Ceylon; and through the kindness of my friends, the late lamented General Hardwicke, Colonels Sykes and Whitehill, Captains Law, Smee, and Smith, having access to their rich and extensive collections from Nepal, Bombay, and the Deccan; I may be enabled, perhaps, from such a mass of materials, to offer some new facts respecting the geographical distribution of Insects, a subject apparently little studied, and certainly not sufficiently appreciated. It is, indeed, with diffidence that I undertake a task beset on all sides with difficulties; and before I enter on it, I claim the indulgence of my readers, and solicit them to regard the present attempt merely as an outline sketch, which can afterwards be filled up with greater accuracy, as our acquaintance with the nature of the soil, and the forms of animal and vegetable life belonging to the East, become better known. The entomological character of a country is particularly influenced by three things; first, by its temperature; secondly, by its vegetation; and, lastly, by its soil; and, perhaps, a few remarks on these subjects (relating chiefly to the Eastern world) may not here be deemed out of place, before entering more fully into the entomology of the Himalayas and of India.

INFLUENCE OF TEMPERATURE AND OF MOISTURE.

In those regions of the world where we find a multiplicity of genera of animals, united with a prolificness of species, we may naturally imagine that circumstances are admirably suited to their existence; and, on the contrary, where we find a small number of genera, and in many instances a diminutive form, and a paucity of individuals, we arrive at an opposite conclusion. Now, if we search for the cause of these discrepancies, we shall find it to depend in a great measure on the influence of temperature. Let us examine, then, in what portion of the globe a super-fecundity of organized life exists. Certainly not at the poles, or even in the temperate zones; to the tropical and equatorial regions we must next proceed, and it is there, in those warmer districts of the earth that we find the energies of life more early developed, and vigour and productiveness seem the characteristics of the clime. These remarks apply

* The Author has to apologize to the Rev. Mr. Hope and to his readers for the long delay which has occurred in the publishing of this valuable Paper, written for him in 1834, and which has been in type for a considerable time. The Insects of the Author's collection which Mr. Hope has described, were collected in the neighbourhood of Saharunpore, in the valleys of the Himalayas, and on the mountains in the neighbourhood of Mussooree, at 6,500 feet of an elevation in 30° of N. latitude. The reader will observe that many of the desiderata required by Mr H. on temperature and vegetation, are detailed throughout this work, and he cannot fail to be struck with the remarkable coincidence in opinion, respecting the distribution of Insects as given by Mr. Hope, with that of the Author on the geographical distribution of the Flora of the plains and mountains of India.—J. F. R.

apply not less to animal than to vegetable life, for no where do the Herbivora abound more than in warm regions, and no where do we meet with more luxuriance of foliage, or a greater exuberance of arboreous vegetation, than within the tropics. As we recede from the equator, and approximate to the poles, temperature gradually diminishes; and probably nearly in the same proportion as heat decreases, so shall we find the decrease of animal and vegetable species, till we arrive at that degree of cold where vegetation is stunted, circulation languid, animation becomes suspended, and existence is scarcely tenable, if not actually destroyed.

To obviate the effects occasioned by a low temperature, some animals burrow in the earth, and pass the winter in inactivity and torpor; others again, gifted with extraordinary locomotive powers, migrate into milder regions in quest of food, which the rigour of a brumal season and a northern climate has rendered precarious. It appears to me an observation worthy of attention, that at the very period the migratory birds visit us, Insects are already teeming into life, while vegetation has arrived at a state of forwardness sufficient to support, as it were, the expected increase of animal beings. We infer, then, that as vegetation is apparently regulated and influenced by temperature, so animalization is in a measure dependent on vegetation as a secondary cause. It may naturally be expected, in a gigantic country like India, whose superficial area is nearly one million and a half of miles in extent, that great diversities of climate will be found; and when we take into our consideration the altitude of its mountains, surpassing in grandeur the Andes of the American world, we may expect every gradation of temperature which can occur, from the intense cold of the eternally snow-capped height, to the baneful heat of the tropical valley. The elevation of the land above the ocean, the height and direction of its mountain ranges promoting or checking radiation, its mighty rivers and interminable jungles, its soil, strata, and arid deserts, absorbing and radiating heat, exert their varied influences, and modify the temperature of that extensive Continent; and yet, admitting thus much, I cannot help stating an opinion, that according to the extent of the country, no other portion of the globe enjoys a more general and equable uniformity of temperature than India. This may satisfactorily be proved, provided we take as the basis of our argument the wide range of region, over which not individual species, but whole genera of Insects extend, and the general uniformity of Oriental vegetation. Before dismissing the important subject of temperature, I wish to offer a few remarks on the variation of heat and cold throughout the summers and winters in the Himalayas and in India. In the former Dr. Royle states, in his admirable pages, that the Flora of the Himalayas in the spring and summer of the year resembles that of Europe, while in the rainy season it becomes intermixed with tropic-like vegetation; and hence there is a certain admixture of genera belonging to temperate and tropical climes. The change of temperature and of moisture producing a new vegetation, exercises a corresponding influence over the distribution of Insects throughout the same country; and consequently we have reason to expect, as will afterwards appear in my remarks, that its entomological character is also twofold, uniting in itself that of both zones. This intermingling of genera of tropical and temperate regions will ever probably be found more perceptible in the rainy season, in advancing from the valley to the mountain height; and perhaps we ought to know the results of the following researches, before we attempt to arrive at any conclusion respecting the distribution of animal groups in the Himalayas or in India. I would therefore suggest to future travellers in these magnificent regions, first, to endeavour to ascertain the differences of climate, and the causes which affect its temperature; secondly, to find out the average limit to which tropical forms extend, to state where they most abound, where begin to lessen, and finally terminate; thirdly, to note in what proportions the genera of tropical and temperate climes are intermingled; fourthly, at what altitude temperate forms predominate over tropical; and, lastly, to mention as nearly as it is possible the range of any group of animals in preference to that of any individual species: both objects, however, are desirable. In addition to the above desiderata, it will be necessary to note the seasons of

Insects

Insects and times of their appearance, the soil in which they are found, and the vegetation upon which they live; since the distribution of animals in general is greatly dependent on food, which food will abound, or be found deficient, according to the richness or poverty of the soil, or according as the degrees of heat and moisture influence the same. It appears to me, that it is chiefly in swamps, and in low and marshy lands acted on by the rays of the sun, where there is a union of heat and moisture, that the major part of Insects seem particularly to flourish. In such localities we find genera more abundant, a great increase of species, the number of individuals prodigiously augmented, and the energies of life more rapidly developed. Animals appear more than usually productive, either in the alluvium of mighty rivers, or in the tropical jungle. It was on the banks of the Nile, amid its slime, acted on by the influence of the sun, that the doctrine of spontaneous generation originated, and I am told also entertained by the ancient Brahmans on the banks of the Ganges, as seen in Susruta. It is in like situations, where heat and moisture predominate, that nature still exhibits her surpassing and inexhaustible fecundity.

If we next turn our attention to the tropical jungle, we meet there with nearly an equally teeming exuberance and productiveness of species. The heavy tropical rains saturating the accumulated mass of heated leaves, and vegetable matter, considerable vapour is produced peculiarly adapted to increase insect life; and it is not a little singular, that as soon as the first showers fall in these regions, all nature becomes reanimate; and as the rains increase, so do the Insects in proportion more and more, till the rainy season fairly sets in, at which period the jungle and the forest literally teem with myriads of insect population, more numerous than the stars of heaven, and as countless as the sands of the sea-shore. In concluding this part of my subject, I need only repeat shortly, that heat and moisture combined, exercise a powerful control over the geographical distribution of insect life, and that this distribution is also influenced in a greater or less degree by vegetation, as well as by the soil of a country; but these are subjects which require further elucidation.

INFLUENCE OF VEGETATION.

The entomologist who wishes for accurate information respecting the geographical distribution of Insects over the wide extent of our globe, must take into his consideration not only the influence of temperature, but that of vegetation; nor should he omit to note the varieties of soil which materially influence it. The dependence of this distribution of animals, although greatly swayed by temperature, is no less so by the supply of food and nourishment they can obtain. Insects are designated according to the kind of food they consume, as carnivorous or phytyvorous; and in proportion as food is ample or deficient, so probably they abound in numbers, or decrease and vary in magnitude and form. To its abundance we may in some measure attribute size, to its deficiency the frequency of dwarfishness of stature, immaturity, and many of the numerous crippled specimens, as also some of the monstrosities found in our collections. The great Latreille has justly observed, that where the empire of Flora ends, there also terminates that of Zoology; and I have little doubt, that where vegetation is richest, there animal groups also will be found most abundant in genera, species, and individuals, not only those which are herbivorous, but those also which are carnivorous.

It is not my intention here to enter into any details respecting the Himalayan or Indian Flora. If the reader requires information on these points, I refer him at once to the accurate and invaluable pages of Dr. Wallich and Dr. Royle; and as I at present look merely to the vegetation, as influencing in a great measure the character of the entomology of the country, a concise outline of the leading features of the Botany of those regions is all that is here requisite. Throughout India, according to the above authorities, there appears to be an uniformity of vegetation, tropical species greatly predominating over those of the temperate zones; there occurs also a considerable admixture of genera belonging to temperate climes, and at a high elevation plants abound, which are indicative of Alpine regions. Several

genera appear common to Europe, North America, and India; and in some instances identical species have been recognized as existing in Europe and in Asia, as well as in the New World. It still remains, however, with the botanist to determine the similarity of vegetation in Western India and Africa, a similarity which I anticipate will be eventually found to exist, if not at present actually known—a similarity I am led to suspect solely from observing a great resemblance in the character of the entomology of Western India and Eastern Africa.* In many instances cognate species of Insects appear both in Africa and Asia, which, by a careless observer, might be considered only as varieties; they are, however, on examination, sufficiently distinct, and I therefore think myself justified in esteeming them the representatives of their respective countries, as undoubtedly they fulfil the same offices and functions in both. In several cases we meet with identity of species in Asia and Africa; and there is an observation I have made, worthy of still further investigation, that most of the Insects which are identical in both countries, are either coprophagous or phytyphagous; in short, vegetable feeders, which circumstance would lead one to suppose a similarity of vegetation in the different regions.

It may here be expected, perhaps, that I should state the relative proportions of the carnivorous and phytyvorous Insects; and I cannot but regret that I have not as yet followed up my investigations sufficiently to enable me to draw a satisfactory conclusion. Messrs. Kirby and Spence, in their interesting work, speaking of our British Fauna, esteem these groups as nearly equal in number. I must confess my own observation induces me to believe, that the latter greatly exceed the former in our own country. With respect to the phytyvorous group in tropical climates, they certainly greatly outnumber the carnivorous; and were it not so, the air in those regions would scarcely be habitable, considering the nauseating effluvia arising from excrementous matter, which the Copridæ in particular tend to neutralise, by consuming, decomposing, and burying in the earth, all that is obnoxious and liable to putrify. In proof of this assertion, I will only here add, that five of the greatest groups with which we are acquainted, namely, the Lamellicornes, the Sternoxes, and the Longicornes, the Curculionidæ, and Chrysomelidæ, are almost entirely phytyvorous or xylobious; and it may also be naturally inferred from the superabundance of animal life of all classes within the tropics, particularly the Ruminantia, that there also vegetation will be found most luxuriant; yet, looking to Insects only, we find they are scarcely sufficient to keep in check its excessive exuberance. In addition to multiplied forms of genera, we have an extraordinary increase of species and of individuals. It is in these same prolific regions also, that the mighty Goliathi and gigantic Prionidæ abound, where they perforate the trunks of the proudest monarchs of the forest, and hasten them onward to decay; and, by means apparently inefficient, check vegetation. It is time, however, to add a remark on the carnivorous Insects, which, although inferior in numbers to the phytyvorous, are still an important group; and in northern regions, by removing the decomposing matter from the decaying and putrifying carcass, fulfil the functions assigned to them by Providence. In tropical regions they are certainly not always so abundant, as a dead body, from the natural dryness of the air, and intense heat of the sun, is frequently dried up before putridity has made much progress; at least, such is the case in the Pampas. I cannot help thinking, however, although our cabinets contain but few species from equinoctial and tropical latitudes, that eventually they will be found more numerous, and that in these regions we shall still find them more proportioned to the excess of animal life than appears to be the case at present. Religious prejudice, and the filthy and disgusting habits of these Insects, may be the causes why they have been neglected. In India, if the Necrophaga are not so numerous as elsewhere, yet the numbers of some particular species being excessive beyond measure, are sufficient, perhaps, to compensate for want of variety.

RANGE.

* Vide p. 159 of this work, where the similarity of vegetation in parts of India and in Western Africa is referred to, as originally remarked by Mr. Brown, and which has been confirmed by subsequent discoveries.—J. F. R.

RANGE.

In the consideration of the geographical distribution of Insects, especial notice should be taken of the range over which genera and families extend. From want of attention to this subject, entomologists have not sufficient data to form any just views respecting it. Every naturalist who has studied animals, must be aware that certain tribes, genera, and species, are peculiar to particular regions of the globe. On the contrary, in various countries of the earth the Botanist meets with genera of plants which are common to Europe, and the other quarters of the globe, to the Old World as well as to the New. In some instances, identity of species has been recognized in countries remotely situated, between which seas and oceans intervene. It becomes, then, a question of considerable importance to determine if any species of plants have an unlimited or universal range, as probably all those insect races which feed on vegetables are regulated in their distribution by the same laws which govern the distribution of the plants themselves. It must be evident even to the most careless observer, that where the climate is materially changed in temperature, that there vegetation will be proportionately altered, and I imagine that eventually the entomological character of a country will be found much more dependent upon vegetation than has hitherto been allowed. It is true, indeed, that although two countries may agree in temperature and botanical character, the Insects may be totally different in form and appearance; but, in looking to their functions, if we find them the same, or nearly the same, we at once acknowledge the resemblance, and imagine they take the place of other known and existing groups elsewhere; a resemblance of character, which Messrs. Kirby and Spence have very properly denominated representation, which representation will even be more perceptible as the soil and general characters of the countries accord.

INFLUENCE OF SOIL.

Having already seen that both temperature and vegetation exercise a powerful control over the geographical distribution of insect races, there still remains a third subject of inquiry, namely, the influence of soil over the same groups. If we find that in particular rich soils various genera of Insects abound, and that in others of an inferior quality scarcely a species can be met with, may we not naturally infer that there must be some peculiarity in it, and that the animal groups are influenced by their attachment to the same? The Botanist readily admits that vegetation is materially influenced by it, but as yet the Zoologist has made little inquiry respecting this subject, replete as it ever must be with high interest, and well worth most serious attention. Without entering deeply into the geology of India, I may state, on the authority of Colonel Sykes, that the character of the geology of great part of the Peninsula, like that of its vegetation, presents considerable uniformity: unacquainted with its leading features, I can derive my observations respecting it solely from the examination of the genera before me. I will, therefore, merely give concisely what groups attach themselves to particular soils in different countries, and hope that the attempt, imperfect as it is, may induce other naturalists to undertake an inquiry which must lead to very important results. As the mountain, the valley, and the plain, have their own peculiar temperature, vegetation, and soil, they have also particular groups of animals attached to them; and if we look more closely, we shall find that particular families and genera are always to be met with in certain strata and soils, evincing, as it were, a partiality and adaptation, by frequenting and thriving in them.

It may here be worth while to specify some of the genera of Insects attendant on the difference of soil. It is in the sandy districts of our own country that the few species of Cicindela, peculiar to our island, occur. Cicindela maritima, however, prefers the vicinity of the sea-shore, while several Oriental species, remarkable for their beauty and colouring, delight more in the alluvial soil of rivers. Frequenting the sandy heath are found the splendid Chlorion, the fetid Sphex, and restless Ammophilus, associated with

numerous

numerous species of Andrena and Nomada. In the sand, washed from the mountain height, at the sources of our European rivers, some species of Nebria and Psammodius are exceedingly abundant. If we visit the parched and burning sands of Africa, we there meet with the rapacious Anthia, the desert-loving Graphiptera, the burrowing Scarites, and countless species of Heteromera and Tetramera. In the same soil also, on the banks of rivers, the genera Epaphius and Trechus, Clivina and Dyschirius, are not unfrequent. On the sand of the sea-shore, Broschus, Bradytus, Pedinus, and Ægialia, occur in extraordinary numbers; and where it is habitually covered with salt water at the departure of the tide, we capture Cillenum, Pogonus, Hesperophilus, and Heterocerus, the singularly-formed Bledius, and wonderfully-abundant Ophonus pubescens, all of which I have reason to believe can live submerged beneath the sea a considerable period. Of all other soils, *clay*,* being naturally cold, attracts fewer Insects, excepting the widely-disseminated Harpali. In gravel, occur the genera Opatrum, Halictus, Cerceris, with numerous colonies of Ants. To a chalky soil are attached the Ophoni, Licini, Chœtophora, and various species of Polyommata, Osmia spinulosa, and Andrena hæmorrhoidalis. When collecting in the mud of the fresh-water marsh, we capture Blethisa, Chlænius, Omaseus, and Agonum, and several Carabidæ. In the slime of brackish waters, several Notaphi are exceedingly abundant, though rare elsewhere; and in company with them we find the subaquatics Elophorus, Parnus, and springing Salda. It has also been observed, that Pimelia is only to be met with where the plants of the genus Salsola abound. Catascopus and Elaphrus frequent the alluvium of rivers. In the mud of lakes and pools various genera of Eupodina, Nothiophilus, Bembidiadæ, and Trechidæ occur; and in vegetable mould, where the grass is luxuriant, numerous Diptera, and Larvæ of Lepidoptera, abound. Even in this short and imperfect account of different genera attached to varieties of soil, sufficient has already been stated to prove that it exerts an important control over the range and distribution of Insect races: however, to give the naturalist a better insight into Indian groups, I shall here add an analysis of the leading families and genera which have fallen under my observation, and then conclude with an abstract describing the leading characters of Himalayan and Indian Entomology.

From what has already been written, it will appear that Insects, in their geographical distribution, are influenced by various causes; by temperature, by excess or deficiency of moisture, by the influence of vegetation, and by soil. There is yet, however, another, which materially affects, in some instances, particular groups, namely, the peculiarity of the organization of the Insects themselves. Should any genera of Insects occur which are deficient in the organs of locomotion, they would naturally be restricted to certain localities. How many genera of the Coleoptera and other orders are apterous, and are only found in particular situations; and they have necessarily particular functions to perform in their restricted limits, and also particular organs adapted to the work assigned them by the Creator. It is to the study then of the differences of organization adapted to differences of situation, and other external circumstances wherever we find Insects, that the entomologist should direct his attention. Contemplating all these instances of adaptation, we reverence the wisdom of a creative and the beneficence of a superintending Providence, that prevents diminution and increase, both extremes of which would prove injurious; for without these "armies of the living God," to keep in check the fecundity of nature, plague and pestilence would walk abroad, and depopulate not a single country, or one quarter of the globe, but the whole earth itself.†

* Mr. Shuckhard informs me, that Andrena labialis seems peculiarly attached to the London clay.

† In concluding my observations on the geographical distribution of Insects, I think it may be stated, that naturalists on this subject have almost exclusively directed their attention to temperature. Where temperature fails, we may turn to vegetation; and if the latter is not sufficient, then to the soil and strata of a country, and even to the organization of the Insects themselves, as well as other causes. No one by itself is sufficient to unravel the difficulties which arise; by uniting all, however, we may in a great measure account for the various discrepancies that occur.

ANALYSIS

OF THE ENTOMOLOGY OF THE HIMALAYAS AND OF INDIA.

CICINDELIDÆ.

The following genera belonging to this family are not uncommon in India, *viz.* Therates, Tricondyla, and Colliuris: the two former are characteristic of a southern range, while the latter is abundant throughout the eastern continent. Of Indian Cicindelidæ, more than sixty species have fallen under my notice: the most splendid of the race abound in Nepal. Among various species, however, peculiar to the Himalayas, only one approaches the form of our European Germanica.

DRYPTIDÆ.

As I am only acquainted with a single species of Indian Casnonia, I pass on to Drypta, a Nepalese individual of this family belonging to the genus Desera, Leach, which is described in General Hardwicke's collection. Five others are also recorded as inhabiting India.

LEBIADÆ.

Cymindis has not yet been discovered in India; eventually it may occur in the Himalayas: it is difficult to imagine what genus takes its place. Lebia is of rare occurrence in the East; a non-descript, named unicolor, in my collection, is from the Himalayas. Aploa is found at Poona. Orthogonius is common to Africa and Asia: the gigantic species, however, predominate in the latter country.

BRACHINIDÆ.

The French writers appear unacquainted with the true type of Helluo, exclusively belonging to New Holland: the genus denominated Omphra by Dr. Leach, applies solely to the Indian Helluones. Ozæna and Pseudo-zæna inhabit Calcutta and Cayenne; while Trigonodactyla appears in Africa and Asia. The Graphipteræ of the sandy deserts have no representative in the East. This genus appears to unite Brachinus and Anthia: the latter is found throughout the continent of India. Some of the specimens from Nepal, however, are very diminutive. Aptinus is partly confined to Northern Europe and America; while true Brachinus enjoys the unlimited range of the world. Catascopus is found in Nepal, and resembles in its habits Elaphrus of Europe, and probably occupies its place. Dyscolus, Promecoptera, and Thyreopterus, prefer the southern tropical regions, and are not found to range as far north as the Himalayas.

SCRAITIDÆ.

Siagona atrata is met with in Nepal and various parts of India: a specimen lately received from Egypt, if not the self-same, is so exceedingly alike in size and sculpture, that it is very difficult to distinguish. The Scaritidæ abound in both hemispheres. Scapterus of India is represented by Oxystomus in the Brazils, and in Africa by Acanthoscelis. Morio and Clivina will, perhaps, be found in both the Old and New World; the latter, indeed, is common to all temperatures; the former may eventually occur in Europe, perhaps in Sicily.

HARPALIDÆ.

Harpali are found dispersed nearly in all the countries of the globe: they abound more in the arctic than antarctic regions. The following genera are recorded as belonging to India, *viz.* Harpalus, Platymetopus, Selenophorus, Cyclosomus, and many others. Some species of Ophonus from Bengal and Poona, closely resemble British species.

POGONIDÆ.

Some of the genera of this family are not confined to the temperate zones; the major part of them prefer the polar regions. Pogonus and Cardiaderus are met with in Asia and Africa; while Patrobus is apparently peculiar to Northern Europe and America.

CALATHIDÆ.

Dolichus has not yet been discovered in India: it is probable, however, that it will occur there. Pristonychus inhabits Nepal and Europe; while Calathus prefers a northern more than a southern climate.

FERONIADÆ.

Instead of finding Pœcilus in India, we meet with Trigonotoma, Catadromus, Lesticus, and Distrigus: most of them peculiar to that continent. Argutor antiqua occurs in the East; Omaseus and Platysma in Nepal; and Steropus in the vicinity of Poona. It is by mistake that Percus has been introduced among oriental genera. Cephalotes is found in Nepal and Australia: Stomis, Zabrus, and Pelorus prefer the temperature of Southern Europe. They may, however, be expected to appear in the Himalayas. Amara is captured in Japan; Antarctia and Masoreus are equally natives of Europe, Africa and Asia. Several nondescript species from the East, of the latter genus, are to be found in our English cabinets.

SPHODRIDÆ.

The genus Sphodrus occurs in Nepal, and the anomalous form of Mormolyce in Java and Singapore; which last has been ranged with this family, but appears to be sadly out of place, as it is most likely a subcortical feeder.

ANCHOMENIDÆ.

I am not aware that Platynus, Agonum, or Olistophus, have yet been discovered in India: the two former will no doubt be found in the Himalayas, when the Insects of that country are better known.

CALLISTIDÆ.

Epomis and Chlænius abound in the tropics: the maculated set appear common to Asia and Africa, each country possessing species almost exact representatives of each other. Chlænius nepalensis approaches in form to Licinus; and although Oodes is widely dispersed over India, no Nepalese examples have yet come under my notice. Callistus occurs in the Mysore.

DICŒLIDÆ.

Rembus is found on the Malabar and Coromandal coasts, at Calcutta, and in Nepal: its allied genus, Licinus, may be expected to occur, as some Asiatic species have already been described. Panagæus has its metropolis in India.

PROCERIDÆ.

Among the Insects collected by Dr. Wallich, there were four or five species of true Carabus, only one of which I was enabled to describe. Several may occur in the colder mountain temperature, and it is probable they will resemble Siberian forms. Wherever the oak grows, there Calosoma will be found. Seven eastern species are known to me. C. indicum inhabits Nepal. If caterpillars are necessary to keep in check the luxuriance of tropical vegetation, surely the Calosomata are equally necessary to keep within bounds these Insects, which sometimes destroy, in northern climes, nearly the foliage of the year.

NEBRIADÆ.

This family may be considered as belonging to a Northern and Alpine range. Should it occur in Nepal, it will be found at a considerable elevation, possibly amid the Himalayan snows. As to Elaphrus, I have already stated an opinion that Catascopus represents it in India.

BEMBIDIIDÆ AND TRECHIDÆ.

Of the former family, several genera will no doubt eventually be found in Nepal: a single species of Tachys is the only example I am able to record at present. Of the latter, Stenolophus, Acupalpus and Tetragonoderus have occurred: the last of which may take the place of Bembidium.

DYTICIDÆ.

Aquatic Coleoptera are apparently not much influenced by climate: the temperature of water not varying like that of the earth or air, is the reason we meet with the self-same species in the interior of India and the south of France. Dyticus appears confined to Northern Europe or America, while Cybister is dispersed throughout the world. Eunectes and Hydaitcus belong to Nepal and India, and to the latter country we may add also the following genera, *viz.* Colymbetes, Laccophilus, Noterus, Hyphydrus and Hydroporus.

GYRINIDÆ.

Many gigantic species of Gyrinidæ abound in India. Dineutus nepalensis, politus, and spinosus, have been found within the Himalayan districts.

HYDROPHILIDÆ.

Several genera of this family are as widely distributed as the Dyticidæ; and most of those found in India inhabit Nepal.

NECROPHAGA.

Differing with most entomologists, I am inclined to believe that the carrion feeders abound more in warm countries than is generally believed. The religious prejudices of the Indians not allowing them to touch a dead body, may account for the few species which have hitherto reached Europe from the East. Necrophorus, Necrodes, Silpha, and Oiceoptoma, are met with in India and Nepal. It is probable that Necrophorus is more peculiarly adapted to Northern climates, while the remaining genera affect those of tropical regions.

EROTYLIDÆ.

Passing Nitidulidæ, which have been captured in India, we arrive at Engidæ and Erotylidæ. In the former family, we find Triplax, Ips, and Dacne; in the latter, Erotylus; and next to this group, Languiria and Eumorphus should be placed; genera abounding in species in Nepal and India.

DERMESTIDÆ.

In General Hardwicke's Collection, there is a Nepalese specimen of Dermestes, similar in every respect to D. lardarius of Europe: a second species is closely allied to D. vulpinus of Africa. It is scarcely possible that either of them can have been imported into the Himalayas by commerce. This genus, and its congeners, is apparently a predominant group throughout the world.

BYRRHIDÆ.

The foreign Helocerata require attentive examination. Among the drawings of the Nepal Collection, made purposely for General Hardwicke, two species of Anthrenus are figured: they appear novel in form.

HISTERIDÆ.

This family abounds in India. I am acquainted with more than fifty species from the East: some of the Nepalese specimens are in too mutilated a state to describe.

LUCANIDÆ.

I formerly described six species from Nepal; two more from the Himalayas are undescribed in Dr. Royle's Collection. In no country is there a greater admixture of temperate and tropical forms than in India; some of the Lucanidæ resemble our British species very closely, while others are the same as those in Java and Singapore. Forty species have been submitted to my inspection. Passalidæ are not equally abundant in the Old as in the New World.

LAMELLICORNES.

The celebrated Ateuchus Ægyptiorum, or Sacred Beetle, has almost an exact representative in India. Gymnopleurus capicola Hope, and azureus, Jab. both of them African species, are replaced in the East by G. sinuatus, Jab. and splendens Hope. Sisyphus is met with in both hemispheres. Epirinus is an African, as well as an oriental form. Several Indian Copridæ resemble those of Egypt. Copris Midas of India and Nepal, exactly corresponds with C. Isidis of Africa. C. Sabæus and Pithecius appear common to both continents, and are equally abundant in Ceylon; and several smaller species of Copris, from the eastern part of Africa, if not the same, approach so closely to those of Western Asia, as to induce a belief that they are the same Insects, only modified by climate. Onitis and Oniticellus have also several representatives in both regions, if not in some instances the self-same species. Onthophagus abounds more in India than any other country; some of them unrivalled in size, splendour, and variety of form. More than 120 oriental species may be seen in European cabinets; five only now are described from Nepal; double that number, however, are in too mutilated a state to be characterized. Pactolus of Nepal and India, is represented in Senegal by Harpax, Jab. Aphodius, compared with Onthophagus, as an Indian group, is quite insignificant; scarcely twenty species are recorded, including those of Manilla and the Eastern Isles: a nondescript from Nepal will appear in the Appendix. As there is only a single specimen of Trox in General Hardwicke's collection, I pass on to

GEOTRUPIDÆ.

Geotrupes has been denied by Latreille to exist in India; the Baron de Jean also makes no mention of any Eastern species from that country in his last catalogue. Two species are in my recollection; one from Delhi, and a second from Japan; a third also, unique, is among Dr. Royle's Insects from the Himalayas. It is probable that this genus, when found in India, appears on mountains at a considerable elevation: the species also may be the common food of the Shrikes of that country, as they are in Europe, should those birds be found there. Orphnus, Athyreus, and Hybosorus, occur in India. Bolboceas appears in some measure to supply the place of Geotrupes, which last is not so important a group in the East, as in a northern region.

SCARABÆUS.

Under this term, the gigantic and most remarkable Insects of the Old World are ranged. Four species, allied to S. Atlas, Jab. are indigenous to Nepal, a convincing proof that equatorial forms extend beyond the tropics, and that they are found in much colder temperature than is generally believed. There are several genera of Scarabæidæ, besides Oryctes, found on the Himalayas, as yet uncharacterized; some of them approaching African types.

MELOLONTHIDÆ.

Some of the Melolonthæ of Nepal are closely allied to our British M. vulgaris; others again, with the margins of the thorax serrated, evince their affinity to tropical species. Geniates, Apogonia, &c. are common to the Himalayas, the whole continent of India, and the Southern Isles.

MIMELÆ

MIMELÆ AND EUCHLORA.

These genera appear peculiar to the East: in a monograph, read before the Entomological Society, there are thirteen Mimelæ described; several from Nepal. Euchlora appears wherever Mimela ranges, and is more abundant in species.

POPILLIA.

This genus appears nearly equally abundant in Asia and Africa, and is common to the Old and New World. Fourteen species have been collected in Nepal. The following genera of Melolonthidæ, also, *viz.* Anomala, Hoplia, Apogonia, and Adoretus, occur in the same territories.

TRICHIIDÆ.

Acanthurus, Trichius, and Dicronocephalus, inhabit the Himalayas. The first of these forms approaches our European type, the latter is the representative in India of what Goliathus is in Africa, and Incas in Southern America. Goliatidæ is a conspicuous family, and may justly be ranked among the most extraordinary forms of the Insect world.

CETONIADÆ.

Although I described seventeen species from Nepal, Dr. Royle's collection appears to contain at least six more, entirely new. Campsiura xanthorhina, Hope, is represented in Africa by Cetonia scutellata, Jab. C. cornuta, Jab. is found in Africa, as well as Asia. I am acquainted with more than 111 species from India, and from this surprising number still likely to be greatly increased, it is evident that the metropolis of Cetoniadæ is situated in the tropical regions.

BUPRESTIDÆ.

Of this superb and extensive family, comprising at present more than one thousand species, existing in the cabinets of Europe, the most magnificent inhabit India; the splendid Sternocera and giant Catoxantha range the Equator and the Tropics. Ninety species belong to the continent of India, many to Nepal, the isles of Java and Sumatra: among them are forms of temperate as well as of northern climes.

ELATERIDÆ.

This family presents us with types of form belonging both to the tropical and temperate regions: the former, however, are few in number, when compared with the latter. Several of the Nepalese Elateridæ resemble our British species, some so closely as to induce one to imagine that difference of climate is the cause of variety of the species. Elater murinus, Jab. of England, is well represented in Nepal by Elater cœnosus, Hope; and various species, which in Europe frequent the oak, alder, and willow, have Nepalese species nearly resembling them, and we have stated that there is a correspondence of vegetation between Europe and the Himalayas.

LAMPYRIDÆ.

Passing the Cebrionidæ, few examples of which occur in India, we arrive at the Lampyridæ; and justly may the East boast of its numerous and fine species, unsurpassed probably by those of South America. The warm damp of the jungle is peculiarly adapted to the habits of this family. Lycus and Omalysus, as well as Lampyris, abound in the Himalayan range.

MALACODERMATA.

By some writers, the families composing this group are considered rare within the Tropics, and they certainly are more abundant in Nepal than Central India; and yet they are not of rare occurrence. Anisotelus, Hope, appears to be peculiar to the East. Several species of Malachius and Melyris enjoy an Asiatic and African clime.

CLERIDÆ.

By the family Cleridæ abounding in the East, we arrive at the Ptinidæ; they, the latter probably, exist in Nepal; none, however, I believe, have yet been discovered in India, the nearest locality where they are found being the Mauritius. The Bostrichidæ are, however, abundant, and it is not unlikely that the Paussidæ commence where the Ptinidæ terminate.

CURCULIONIDÆ.

Without entering at large into the geographical range of the numerous genera of this family, I briefly state, that Nepal contains many tropical forms, as well as others, which are peculiar to temperate climes, some of them extending from the Himalayas, even to New Holland, particularly Sipalus.

PRIONIDÆ.

By the Cucujidæ (common to India and Nepal) we arrive at the Longicornes. Prionus loves the torrid and tropical zones; some of the Himalayan species indicate an alliance to European types.

LAMIADÆ.

The largest, as well as the most beautiful species of this family, are found in Nepal. Lamia Roylii, Hope, is unrivalled in size; and L. Wallichii surpasses all others in beauty and colouring; it is found in Nepal, Japan, at Singapore, and the Isle of Java. Cerambyx, Callidium, Clytus, and Saperda, are predominant groups, and are found in all countries and climates. Many Nepalese species exactly represent our European types.

SAGRIDÆ.

Omitting Lepturidæ, confined almost entirely to Northern Europe and America, we arrive at Sagridæ. Donacia occurs in Java, and we may expect to meet with it in Nepal, and other parts of India; if not, it is probable that Sagra takes the place which Donacia does in northern regions. Several species of this genus are found on the Nympheacæ. I am doubtful if Sagra attaches itself to peculiar water-plants, or frequents the same as the former genus. Megalopus is found in Nepal, in Africa, as well as South America. Crioceris also appears to be a predominant group, while Adorium is confined more to Asia than Africa.

GALLERUCIDÆ.

Galleruca and Auchenia abound in Nepal, Halticæ are found throughout the world, and are intended probably to keep in check particular vegetation. In Europe, the genera Brassica and Sinapis almost annually suffer from their depredations; they appear to abound more in light and sandy soils; and where lime is used instead of animal manure, the crops are less attacked.

CHRYSOMELIDÆ.

Many of the Nepalese species resemble those of Siberia; others approximate closely to our European forms, so much so, that in many instances they appear like one and the self-same Insect; and if not the same, they are certainly similar representatives of their respective countries, and probably fulfil the same offices and functions. Podontia and Phyllocharis seem peculiar to Asia and New Holland.

EUMOLPIDÆ.

The Eumolpidæ of India are not surpassed in beauty or splendour by those of South America: they seldom, however, equal the latter in size. Clythra and Cryptocephalus occur in the East, both of them abounding more in temperate than tropical countries; in Dr. Royle's collection there are found several undescribed species from the Himalayas.

CASSIDIDÆ.

About fifty species of Indian Cassida have come under my notice; some of the Nepalese species resemble our English specimens, and may be parasitic on the thistle, as they are with us.

COCCINELLIDÆ.

Although I described twenty new species from General Hardwicke's collection of Nepal Insects, I find five others undescribed in Dr. Royle's collection from the Himalayas. Coccinella 7-punctata, Fab., appears common to Europe and Asia; at least the specimens agree so exactly in every respect, that after a very accurate examination, no important difference can be found; and believing them to be the same, I still cannot imagine that they have been imported into India by commerce. Endomychus may eventually be expected to occur in Nepal.

HISPIDÆ.

Hispa erinacea is abundant in Nepal; and two undescribed species are in Dr. Royle's collection from the same country.

TENEBRIONIDÆ.

The transition from Hispidæ to the present family by means of Sarrotrium is rendered easy. Hegeter and Tagenia, common to India, appear to follow in successive order. Both Upis and Tenebris are found in the Himalayas, and are abundant in the Tropics.

PIMELIARIÆ.

Pimelia has not yet been described as existing in India; last year I received two species from the vicinity of Poona. Sepidium, Blaps, Eurynotus, and Opatrum, occur in the East; the first prefers the Southern Tropic; the two next appear at Bombay, Calcutta, and Nepal; and the last is widely dispersed throughout the East. Passing Diaperidæ and Cossyphus, both of them common to Asia and Africa, we next meet with Cistela and Lagria: the latter apparently a predominant group. Pyrochroa, also, has been discovered in Java.

HELOPIDÆ.

This family is the grand receptacle for the various forms of Heteromera. Among the Indian genera we find Amarygmus, Cnodulon, and Platycrepis, with several true Helopidæ, rivalling in splendour and magnitude those of the South American Continent.

MORDELLIDÆ.

Most of these Insects are parasites of the Hymenoptera, and abound in tropical climates. Their office is probably to keep in check, and prevent the too rapid increase of Vespidæ and Bombidæ: they are common to the Old and New World.

CANTHARIDÆ.

The geographical distribution of this family is particularly interesting, as it contains those Insects which are used in Medicine, and denominated Blister Flies. Lytta gigas, Fab., is found abundantly in India, and also in Senegal; and there is little doubt that several species of Mylabris will be found common to both continents. These vesicatory Insects of the Old World are replaced in the New by the genus Tetraonyx.

STAPHILINIDÆ.

By the families Notoxidæ and Scydmænidæ, we arrive at the Pselaphidæ, and afterwards at the Brachelytra, which terminate the Coleoptera. Anthilephila and Notoxus occur in Nepal, and Scydmænus in Java; while various other genera of Staphilinidæ are widely dispersed throughout the East.

ON

ON THE REMAINING ORDERS.

Having entered fully into the consideration of Eastern Coleoptera, it is not my intention at present to go into lengthened details of the remaining Orders. It is sufficient to state, that in all of them there will be found similar and corresponding characters as in the Coleoptera. With regard to identity of species, I cannot help remarking, that of Lepidoptera, there appear to be a much greater number of species, widely disseminated throughout the world, than of any other Order. In Asia and Europe we meet with Papilio Machaon, Gonepteryx Rhamni; with some species of Colias and Pontia, with Vanessa Atalanta, and Cynthia Cardui; and to these might be added, several identical Sphingidæ, particularly Acherontia, Atropos, Deilephila, Celerio, and Sphynx. Among the Noctuidæ, Geometridæ, Tortricidæ, and Tineidæ, many species will also be found inhabitants of both continents. In the Orthoptera, some Gryllidæ are common to countries remotely situated, which may partly be accounted for by the migratory habits of these Insects; and the same remarks may be applied to the Sphingidæ. Among the Blattidæ, several tropical species range widely; some of them have become naturalized even in a northern climate; and it is no uncommon occurrence to find Indian, Brazilian, and New Holland, species in a high state of perfection alive in the houses of London; and among the Eastern Neuroptera, there occur various Libellulinæ and Hemerobeidæ, closely resembling our English species.

Among the Hymenoptera, may be noticed the universal ranger, Evania appendigaster, ever attendant on Blatta; some Icheumonidæ, Crabronidæ, Apidæ, and Vespidæ, all of them presenting identical species with those of our own country. In referring to the Diptera, I need only mention the wide range of the Orange Fly, the same in England, India, and America; the Gnats and Mosquitoes, common to the four quarters of the globe, alike the pest of the Indian and Laplander; and, lastly, various species of Musca, as widely dispersed as the half-domesticated sparrow of Great Britain. Passing by the Aptera, and the various parasites of birds, quadrupeds, and of man himself, we shall find also among the Hemiptera, several identical species of Pentatoma, Reduvius, Tetyra, besides Cimex lectularius, the scourge of all countries and climates. It does appear, then, from the above Analysis, that Asia and Europe have many Insects in common, and probably other parts of the world will eventually be found to present not only similar genera and representatives, but also the same identical species, subject to the modifications of climate, and other external circumstances.

CHARACTER OF HIMALAYAN ENTOMOLOGY.

The character of Himalayan Entomology is twofold, Asiatic and European; and the intermingling of forms of temperate and tropical climes is one of its most distinguishing peculiarities. In its valleys (probably influenced by the heat and moisture of the jungle) southern forms predominate over northern; and it is not unlikely, that to the uninterrupted belts of jungle stretching along the mountain ranges, we may partly trace several tropical phytyvorous genera far beyond their apparent natural limits. Some carnivorous Insects are also found ranging far to the north in the Himalayas; an example of which is Anthia 6-guttata, a well-known native of the Tropics: the specimens, however, are mere dwarfs, compared with those of Peninsular India, a fact which may be regarded as a proof, that Anthia has here reached its extreme limits, and consequently will soon disappear (as is the case) and be represented by another type, fulfilling the same functions, only under a difference of form. The following genera of Himalayan Insects, selected from many others, will evince their tropical relationship. Among the Cicindelidæ, Colliuris appears; among the Carabidæ, we find Desera, Omphra, and Cyclosomus; among the Lamellicornes, Euchlora, Mimela, and Dicronocephalus; and to these may be added, Anisotelus belonging to Telephoridæ, and Podontia and Phyllocharis to the Chrysomelidæ: all of them

them attached to warm countries, and some, indeed, are seldom found but within the Torrid Zone. It is needless to state many genera from the Himalayas evincing an affinity to European types;* some few, however, are worth noticing, such as Broschus and true Carabus, Geotrupes and Pimelia: the two last have been declared by high authority never to be found in India. Regarding identity of Insects occurring in the Himalayas, as well as in Europe, there are several species of the following genera of Coleoptera, namely, Elater, Melolontha, Chrysomela, Cassida, and Coccinella, which I cannot help thinking are the same as those of England; particularly as the vegetation of the two countries greatly coincide, for in very many cases, genera, and in some instances the self-same species of plants have been recognized. Among the carnivorous Insects, I believe that Dermestes lardarius, and vulpinus, Corynetes violaceus, and rufipes, and some of the Staphilinidæ, are essentially the same in Europe and the Himalayas. Of Lepidoptera, I figure Papilio Machaon, because it is evidently the same as what we meet with in England; the same remark will apply to Vanessa Atalanta, and Cynthia Cardui. The French entomologists are inclined to regard the Insects of widely separated countries as distinct species; I wish to esteem them as varieties, and I cannot help thinking, that as identity of Plants has been satisfactorily proved by Dr. Royle, so also we may believe in the identity of Insects in regions widely removed from each other. At any rate, should these varieties eventually prove distinct (which may be ascertained, I think, in the Lepidoptera order, when we become better acquainted with the oval, larval, and chrysalidous stages), yet the differences will ever be so slight, that we cannot separate or distinguish them in the imago state with any degree of certainty. But whether they be accounted species, or only varieties, we see the grand object of their creation, in their fitness for performing certain functions which are assigned them; one of these is, to keep in check the luxuriance of vegetation and to restrain it within due limits; another may be, that these puny agents may fecundate the flowers, by carrying the fertilizing pollen from tree to tree, and thus be the means, in one case, of promoting vegetation, as in another they are the agents of its destruction.

ENTOMOLOGICAL CHARACTER OF INDIA.

From the foregoing Analysis, I have no hesitation in asserting that the pervading character of Indian Entomology is uniformity. It is true that we meet with numerous genera, both of tropical and temperate climes, associated together; the former more abundant, the latter less frequent (as we might naturally expect) than in the Himayalas. There is, however, a greater intermingling of forms than at first sight would be readily imagined; but when we take into our consideration, that many of the species resembling those of Europe may have been captured on the mountain ranges, at a considerable elevation, we may partly account for it. This attempted explanation, however, is not always available or satisfactory; for in the heated valleys of the East, we find many European types and species, in numbers sufficient to excite our astonishment. It will appear, then, that many species taken in temperate and northern climes, are not confined to them, and that the range they enjoy is very considerable, extending not only over the Old World, but also to the New. As we advance from the Poles to the Equator, vegetation is more luxuriant, in proportion as heat increases, and the quantity of work assigned to Insect races is proportionately increased. Is it not natural to imagine that the functions performed by them in a colder climate, would in a warmer one require increased exertion and capabilities? It does not follow, because we find new types of form in tropical countries, and new genera of superior bulk and power, and more abundant in individuals, that therefore they necessarily replace the old ones, and are to perform the duties

* I may here add, that various Himalayan genera closely approximate Siberian forms, and that some of the species described by Dr. Gebler from the Altaic chain of mountains, particularly some Chrysomelidæ, I believe to be indigenous in both regions.

MISSOURI BOTANICAL GARDEN.

duties peculiar to both regions; both may live and thrive together, and abound in the same countries, and will eventually be found to do so. When the genera of temperate climes appear within the Tropics, I see no reason why they may not have the same functions assigned them there, as in colder latitudes; but when we find new types of form, and a more powerful organization, with the size of the Insects greatly increased (as is the case in tropical regions), does it not almost naturally follow that they are intended solely for those regions, and for the increase of work they are there destined to perform? To return, however, to the subject of uniformity of entomological character throughout the Peninsula and the East, I think it probable that it is in a great measure to be accounted for by the general uniformity of its temperature, vegetation, and soil; there may, indeed, be other causes, which particularly influence it, but these may be esteemed the most essential. When we look to the range which genera here enjoy, it is very considerable: in part of the Himalayas, at the extreme southern points of India, in the West, and even in its Eastern Isles, there is one pervading character, evincing every where the prevalence of tropical genera. To speak more specifically, in Nepal and the southernmost extremity of the Mysore, and in Ceylon, at Bombay, and at Madras, at Calcutta and Singapore, in Japan and Java, with the rest of the Polynesian Isles, the majority of the same types abound; and what is of more consequence, a great majority of the same species also occur in most of the above-mentioned regions. Having noticed the intermingling of genera belonging to Europe and Asia, we may probably find a slight accordance elsewhere. Now, if we turn our eyes to Africa, we shall there find a considerable similarity in the entomology of this quarter of the globe with that of Asia; and this resemblance between the two countries will be readily seen by the short annexed list of some of the more particular genera, which are common to both of them. Among the Carabidæ occur Anthia, Orthogonius, Trigonodactyla, and Siagona. Among the Lamellicornes, Epirinus and Popillia, the conical Buprestidæ and the extraordinary Paussidæ, which last are chiefly found only in these regions; and to these may be added, as well as many more, the genera Melyris, Megalopus, Sagra, and Adorium; Dorylus, among the Hymenoptera, and Diopsis among the Diptera. Passing from genera to species, we shall find that precisely the same occur in both continents; among the most conspicuous, I shall mention but a few, namely, Copris Midas, Sabæus, and Pithecius, Cetonia cornuta, and Lytta gigas. Even supposing that no identical species occurred, which were common to Asia and Africa, yet we could not help observing the very remarkable similarity in the representatives of each; one example of which is, Ateuchus sanctus, which very closely resembles the celebrated Sacred Beetle of the Egyptians, the object of their worship, by some regarded as an emblem of fertility, but I think more probably that of eternity. Before concluding my remarks on the similarity of Insects found in Asia and Africa, I cannot help expressing a wish that some individual may be induced to develope the character of the entomology of these gigantic regions more thoroughly than has yet been attempted; or there is an ample field for research and speculation. We shall feel much indebted to him, if he will explain how the Copridæ were transported from one country to another, and how they reached the island of Ceylon; how also Cetonia cornuta, which is taken on the banks of the Gambia, became an inhabitant of India. Lytta gigas may have travelled by land, and perhaps the Copridæ following the track and droppings of the camel, may have pursued the same route. Let him describe the sands of the desert and those in the vicinity of the Indus, give us a comparative Fauna of the Ganges and the Nile, record the varieties of temperature, the character of vegetation, and the genera peculiar to the different soils. Let him do this, following the steps of the celebrated Forskal, and he indeed will advance the objects of science, deserve the thanks of the present generation, and command the respect of posterity.*

* By pursuing the course recommended by Mr. Hope, a naturalist would be enabled, not only to display the connection between soil, temperature, and vegetation, as well as the animal forms which the latter supports, but also prove the advantages of studying the natural sciences in connection with each other, and be enabled to explain something of the laws which influence the geographical distribution of plants and animals.—J. F. R.

DESCRIPTIONS OF INSECTS FIGURED IN PLATES 9 AND 10.

By J. O. WESTWOOD, Esq., F.L.S.

ORDER DERMAPTERA LEACH.

Family Forficulidæ.

Forficula Macropyga, Westw.

Forficula micropyga (errore sculptoris) in Tab. 9, fig. 12.

Piceo-nigra, punctata, abdomine æneo submicante, marginibus thoracis, tegminibusque rufescentibus, forcipe (♂) longissimo valde curvato, et gracili; (♀) fere recto tenuissimo.

Long. Corp. (forcipe excluso) ♂ lin. 6 ♀ lin. 5.

Ad genus Forficulam (stricte sic dictum Servilleo) appertinet, statura fere Forficulæ auriculariæ et paullo robustior, caput nigrum punctatum, impressionibus duabus anticis inter oculos. Antennæ ♀ (♂ mutilatæ) 13-articulatæ graciles rufescentes, articulis basalibus obscurioribus.—*Prothorax* planus antice vix emarginatus, lateribus antice rectis, postice rotundatis, niger punctatus, margine tenui rufescenti; foveolis duabus rotundatis, antice impressus.—*Tegmina* piceo-refescentia, punctata, portio alarum detecta concolor. *Abdomen* nigro-picum punctatum æneo submicans; segmento penultimo lateraliter et angulariter producto (♂) aut simplici (♀). Forceps (♂) niger valde elongatus, gracilis ad basin, valde externè curvatus, in medio, dentibus duobus parvis internis instructus, apice sursum et exterius producto, acuto (♀) elongatus multo gracilior, rufescens fere rectus et inermis.

ORDER LEPIDOPTERA LINN.

DIURNA. Family Papilionidæ.

Papilio Machaon, Linn., Tab. 10, fig. 4.

This handsome butterfly, like Vanessæ Antiopa, and Atalanta, Cynthia Cardui, and some others, affords an instance of wide geographical range,* rather than of representative structure, since the individual figured cannot be regarded as specifically distinct from the European specimens, which differ amongst themselves in various slight particulars, as the size of the dark bars, and spots, &c. It may, however, be noticed, that the specimen figured has the small oval black spot near the extremity of the anterior wings almost entirely isolated, the large basal black portion of the same wings is very strongly covered with yellow powder, whilst the black lunules of the posterior wings are not nearly so much powdered with blue bloom, as in the ordinary English specimens.

Fam. Nymphalidæ.

Paphia Parakekta, Horsfield. Lepidopt. Javanica. No. 2, plate 6, fig. 4. Sine descript. Tab. 10, fig. 3.

Paph. alis anticis ad apicem acutis, posticis subcaudatis; anticis supra ad basin cæruleis, fascia obliqua lata fulva in medio, apiceque nigro; maculisque duabus parvis albis (una discoidali, altera apicali) ornatis; posticis cæruleis.

The preceding characters, drawn from the upper surface of the wings of this remarkable butterfly, will suffice for its determination until the publication of Dr. Horsfield's description. The under surface of the wings are, however, much more remarkable, bearing a most striking resemblance to a pale dried leaf; the deception being much increased by the form of the wings, when brought in contact by the Insect, whilst sitting upon a flower in the sun-shine, the short caudal appendages giving rise to the idea of the stalk of the leaf, thus completing the delusion.

DIVISION? ——— ? Fam. Zygænidæ?

Genus Campylotes, Westw.

Genus anomalum, Heleonæ et Anthonoyzæ *Sw.* Gymnanto ceræque *Guér*, affine, alæ oblongæ, subovales, integræ, nervis apicalibus valde curvatis, anticæ cellula discoidali clausa nervos duos postice emittens, quorum exterior trifurcatis, posticæ etiam cellula discoidali clausâ, nervo recurrente intermedio bifurcato. Corpus parvum abdomine gracili, pone alas haud protenso. Caput parvum. Ocelli 2. Antennæ graciles biramosæ. Palpi brevissimi supra haud discernendi, maxillæ elongatæ spirales.

Campylotes histrionicus, Westw. Æneus, alis ad costam rufo—, interne flavo-lineatis, maculisque apicalibus albis.

Tab. 10, fig. 1. Long. Corp. lin. 11. Expans. alar. unc. 3.

Habitat in Nepalia. Hardwicke; in Montibus Himalayanis, Royle.

Corpus nigro-æneum, palagris maculisque abdominalibus lateralibus flavis. Alæ anticæ æneæ, costa, fasciisque duabus discoidalibus rufis, fasciiisque tribus internis per totam longitudinem alarum currentibus flavis; maculis 8 vel 9 (spatium inter nervos apicales occupantibus) albis. Alæ posticæ similiter coloratæ, at maculæ terminales flavo ornantur.

This remarkable Insect appears to be the extreme type of a very numerous Indian group of Lepidoptera, to which belong the species named Capys pectinicornis, Thallo, and

* Messrs. Godart and Latreille, in the Encyclopédie Méthodique (vol. IX., Art. Papillon) state, that Pap. Machaon is found in Syria and Egypt.

Rhodope. It is impossible to decide upon their real affinities, until we obtain a knowledge of the metamorphoses of some of the species.

ORDER ORTHOPTERA. FAM. MANTIDÆ.

MANTIS Roylii. Hope, MSS. Tab. 10, fig. 5.

ORDER HYMENOPTERA. Section PUPIVORA.

FAM. CHALCIDIDÆ.

DIRHINUS HIMALAYANUS, Westw.

Niger, pedibus 4 anterioribus, tarsisque posticis rufescentibus.

Capite obtuse bicornuto.

Habitat in Himalaya. Tab. 10, fig. 8.

Long. corp. lin. 2. Exp. alar. lin. 3.

Caput nigrum punctatum, anticé obtusé bicornutum antennarum articulo primo nigro (articulis reliquis deteritis). Thorax fortiter punctatus; metathorace 4 lineato et ad latera, angulariter producto. Abdomen breve depressum thoracis latitudine. Pedes 4 anteriores rufescentes, 2 postici nigri, tarsis solummodo rufescentibus.

Obs. In hac specie partes oris valde elongatæ, labro oblongo-ovali ciliato, mandibulis inter se similibus, gracilibus, sub apice dente interno unico armatis.

ORDER HETEROPTERA. Section LONGILABRES.

FAM. SCUTELLERIDÆ.

SCUTELLERA PULCHELLA, Hope, MSS.

Cæruleo-nigra vel-æneo, nitida prothoracis disco anticé, et margine postico æneo vel cupreo tincto, scutello aureo viridique intenti, fascia transversa basali, alteraque centrali obliqua, (in medio interrupta) et maculis tribus rotundatis (postice et in triangulum positis) cæruleo-nigris.

Statura fere Scutelleræ mauræ at paullo minor, scutelloque abdomen omnino obtegenti. Scutelleræ Stockeri affinis at robustior. Antennæ articulis duobus basalibus brevibus equalibus. 3tio. 2do. fere duplo longiori, ultimo omnium longissimo.

Long. corp. lin. 5. lat. lin. 3. Tab. 10, fig. 6.

FAM. PENTATOMIDÆ.

MEGARHYNCHUS TRANSVERSALIS, Westw.

Fusco-niger, capite acuté bicornuto, angulisque anticis thoracis acuté antice productis, prothorace et scutello transverse striatis, parte coriacea hemelytrorum nigrâ, tenuissime punctata, membranâ apicali albida, antennæ et pedes nigri.

Long. corp. lin. 7½. lat. lin. 3½. Tab. 10, fig. 7.

ORDER HOMOPTERA. Section SALTATORIA.

FAM. ACADIDÆ.

CICADA SULPHUREA, HOPE, MSS.

Nigra, capite thoraceque sulphureo maculatis, alarum dimidio basali sulphureo, parte anticarum sulphurea, fascia obliqua nigricanti divisa, apicibusque fuscescentibus.

Long. corp. unc. 1½. Expans. alar. unc. 3¾. C. pulchella in Tab. 10, fig. 2.

Affinis Cicadæ maculatæ. Caput nigrum orbitu interno oculorum sulphureo; thorax niger maculis 8 sulphureis abdomen nigrum segmentorum marginibus pallidis. Alæ anticæ costâ sulphureâ, maculâque ovali maximâ (plus quam dimidium basale alarum occupante) sulphureâ fasciâ obliqua tenui nigrâ interné dentatâ divisâ; apice fusco nervis nigris Alæ posticæ ad basin sulphureæ, ad apicem fuscæ nervis nigris; pedes nigri.

ORDER DIPTERA. Section PUPIPARA.

FAM. HIPPOBOSCIDÆ.

HIPPOBOSCA MACULATA.

Thorace fusco, flavo variegato, scutello nigricanti, maculis tribus flavis, mediâ majori, femoribus tibiisque posticis ad apicem fuscis.

Hippobosca equina; "ex Indiâ orientali paullo major, thoraceque magis albo variegato, at vix distincta." Fab. Syst. Antl. p. 338.

Hippobosca maculata, Leach, "On the genera and species of Eproboscideous Insects." Wernerian Trans. vol. ii. p. 549.

Long. corp. lin. 4. Expans. alar. lin. 8¾. Tab. 10, fig. 10.

Caput flavum, oculis fulvis, lineâ longitudinali inter oculos fuscâ. Proboscis nigra. Thorax fuscus, maculâ magnâ ad angulos anticos flavescenti in medio fuscâ; fascia parva centrali lunulisque duabus in medio conjunctis posticis flavescentibus, scutello nigricante maculis tribus flavis media majori. Abdomen fuscum, punctatum, marginibus rufescentibus. Pedes fulvescentes tarsis omnibus femoribus tibiisque posticis ad apicem fuscis.

FAM. NYCTERIBIDÆ.

NYCTERIBIA ROYLII.

Obscure nigra pedibus fuscescentibus elongatis, vix compressis, coxis anticis brevibus, abdomine ovalo, conico, depresso, 5-articulato, apice subtruncato, stylis duobus incurvis subtus armato, capite compresso.

Long. corp. lin. 1⅓.

Habitat in Indiâ Orientali. Tab. 10, fig. 9.

Nyct. Roylii. Westw. in Trans. Zool. Soc. 1. p. 290-5.

ORDER COLEOPTERA.

CETONIA ROYLII, Hope.

Long. lin. 12. lat. lin. 6. Tab. 9, fig. 1.

Nigro-viridis thorace flavo marginato elytrisque quatuor maculis flavis notatis. Clypeus quadratus. Antennæ nigræ. Caput quadratum punctatum. Thorax cupreis marginibus externis elevatis, lineaque flava utrinque externa, disco fortissime punctato. Scutellum magnum postice decitum. Elytra nigro-virescentia maculis quatuor flavis notata, binæ fere rotundatæ ad basin positæ, binæ aliæ reniformes ante apicem locatæ. Corpus infra nigro-æneum segmentis abdominis utrinque aurantiis capillis obsitis pedibusque concoloribus.

In Mus. Dom. Royle; in montibus Himalayæ captus ceria.

GEOTRUPES ORIENTALIS.

Long. lin. 10. lat. lin. 6½. Tab. 9, fig. 2.

Violaceus thorace sparsim punctulato, elytris striato-punctatis, pedibus supra nigris, infra violaceis nitidis. Antennæ piceæ capitulo fuscanti, thorax violaceus longitudinali serie punctorum in medio posita, variis aliis sparsim dispositis. Elytra striato-punctata striis quasi vermibus erosis. Corpus infra violaceum nitidum, femoribus posticis uni-spinosis, tibiis pilosis, tarsis chelisque piceis.

This singular species approaches very closely to some of our British species, and is probably from a high elevation of the Himalayan mountains.

In Mus. Dom. Royle.

ONTHOPHAGUS PHANŒOIDES.

Long. lin. 4½. lat. lin. 2¼. Tab. 9, fig. 3.

Niger obscurus, clypeo cornu reflexo abrupte truncato, thorace phanæoformi, postice lateribus in spinam obtusam productis, femoribus luteis. Antennæ piceæ capitulo fuscanti: clypeus hexagonus cornu reverso abrupte truncato, thorax fere quadratus; punctatissimus, punctulis erosis tuberculo antice, fossulaque postice in medio marginis impressa, angulis posticis in spinas productis. Scutellum parvum nitidum. Elytra striata. Corpus subtus atrum nitidum punctatum. Pedes femoribus luteis, tibiis tarsisque nigropiceis.

This singular Insect will, at some future period, form the type of a new genus: in form it unites the South American Phanæus, and the widely-disseminated genus Onthophagus.

LUCANUS LUNIFER.

Long. lin. 37. lat. lin. 10. Tab. 9, fig. 4.

Æneo-piceus, areolo tomento aspersus, mandibulis exsertis unidentatis, denticulisque minoribus instructis, apice bifurcatis. Clypeo deflexo lunifero, femoribus castaneis.

Hab. in Montibus Himalayæ; in Mus. Dom. Royle.

This Insect appears to unite in itself the characters of the Asiatic and European species, the latter rather predominating over the former: it is one of the finest forms of the Himalayan Fauna.

LAMIA WALLICHII.

Long. lin. 16. lat. lin. 5. Tab. 9, figs. 5 and 6.

Viridisericeus, Antennis penicillatis, elytris tribus fasciis nigris, binisque penicillis dorsalibus ornatis. Antennæ corpore longiores et nigro-virides, primo articulo subpenicillato, tribus sequentibus atris, penicillis magnis pilorum barbatis, et reliquis pubescentibus, ultimo tamen pubescentia densiori tecto. Thorax viridis, spinosus. Elytra ornata tribus fasciis vix suturam attingentibus, una in medio elytrorum, secunda inter mediam et apicem, tertiaque binis penicillis dorsalibus interrupta. Corpus subtus nigro-virens, sanguinea pubescentia aspersum. Segmenta quatuor abdominis sanguineo colore fucata, ultimum omne autem viride et nitidum. Pedes viridi-pubescentes, femoribus maculâ rufâ notatis, tarsisque infra flavis.

It is impossible to describe accurately the beauty of this Insect; the sericeous covering, in different lights, imitating the various tints of opal, while the dark fasciæ flash with the iridescence of Labrador felspar.

PORUS, Hope.

{ STENIDÆ, M.L.
{ LONGIPALPI, Lat.

Corpus oblongum fere parallelum subdepressum. Caput mediocre oculis magnis lateralibus. Antennæ crassæ articulis transversis. Mandibulæ acutæ dente interiori armatæ. Labrum transversum integrum ciliatum. Maxillæ elongatæ bilobatæ. Palpi maxillares longitudine mediocres articulo 3tio. longo clavato, ultimo minimo. Labium elongatum apice lanceolato, paraglossis lateralibus. Palpi labiales breves, articulo ultimo parvo conico. Thorax fere circularis. Abdomen elongatum marginatum. Pedes simplices. Tibiæ calcaribus binis armatæ. Tarsis articulis simplicibus.

PORUS OCHRACEUS. Long. lin. 4. lat. lin. ¾. Tab. 9, fig. 7.

Elytris punctatis antennis fuscis, mandibulisque ad apicem nigris.

Hab. in Montibus Himalayæ; in Mus. Dom. Royle.

This genus somewhat approaches our European Evæsthetus.

APHODIUS.

APHODIUS IRREGULARIS, Hope.

Long. lin. 4. lat. lin. 2. Tab. 9, fig. 8.

Flavus thorace nigro, elytris subaurantiis, fascia media maculis quatuor nigris, pedibusque piceis. Antennæ piceo capitulo fusco. Caput angulis anticis oblique truncatis. Thorax niger nitidus punctatus, angulis anterioribus flavis. Elytra flava, seu subaurantia, fasciâ mediâ irregulari nigrâ, binis maculis humeralibus, binisque aliis fere ad apicem locatis concoloribus.

Hab. in Montibus Himalayæ; in Mus. Dom. Royle.

ANISOTELUS, Hope.

TELEPHORIDÆ.

Antennæ articulo 1mo. crasso, reliquis multo crassiori, 9-10 obconices magnitudine paululum crescentibus ultimo majori ovato apice acuto. Mandibulæ valde acutæ. Maxillæ membranaceæ lobo unico intus tomentoso. Palpi articulo 1mo. minimo, 2do. et quarto æqualibus, ultimo subsecuriforme. Mentum transversum. Labrum membranaceum fere rotundatum. Palpi labiales breves, articulo ultimo majori securiformi. Caput transversum oculis prominulis. Thorax transversus lateribus rotundatis, angulis posticis acutis elevatis. Elytra sicut in Telephoris, in medio nonnihil dilatata. Tarsi 5-articulati, articulo penultimo bilobato.

ANISOTELUS BIMACULATUS, Hope.

Long. lin. 4½., lat. lin. 2. Tab. 9, fig. 9.

Lividus, elytris 2-maculatis. Antennæ articulo primo testaceo, reliquis fuscis. Thorax rufo-testaceus nitidus, elytris pallidioribus macula ovali nigra in singulo fere ad apicem posita. Corpus infra testaceum.

Hab. in Montibus Himalayæ; in Mus. Dom. Royle.

ELATER CYANOPTERUS, Hope.

Long. lin. 4½., lat. lin. 1¼. Tab. 9, fig. 10.

Cyaneus, antennis fuscis, marginibus thoracis pedibusque rubris. Caput nigrum antennis fuscis. Thorax in medio nigro-cyaneus, marginibus lateralibus rubris. Elytra striato-punctata subpubescentia. Pedes rubri.

Hab. in Montibus Himalayæ; in Mus. Dom. Royle.

RIPIPHORUS APICALIS.

Long. lin. 3., lat. lin. 1. Tab. 9. fig. 11.

Rufus, thorace pedibusque nigris, elytris flavo-rufis quatuor maculis notatis. Caput atrum ramo antennarum piceo, foliisque nigris. Thorax concolor. Elytra flavo-rufa, basi nigrofasciata, maculis binis fere mediis, apicibusque corporeque infra nigris.

Hab. in Montibus Himalayæ; in Mus. Dom. Royle.

MEMOIR ON THE MAMMALOGY OF THE HIMALAYAS.

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In the early part of the year 1833, Professor Royle put into my hands an extensive Collection of Zoological Specimens, made during his excursions through the Western parts of the Himalayan Mountains, of which the rich Botanical results are now in course of publication, with a request that I would furnish him with a Catalogue *Raisonnée* of the different species of which it contained the spoils, to be added as an Appendix to his work. Whilst occupied in this easy and unostentatious task, various observations presented themselves, which induced me to propose to my friend a slight alteration of his original plan, so as to embrace a general outline of the Mammalogy of the Mountain Regions of Northern India, for the purpose of exhibiting, at one view, the intimate relations which I soon perceived to subsist between the animal productions of this elevated and extensive mountain chain and those of Northern Europe, Asia, and America. It soon became obvious, in fact, that the Zoology, like the Botany of the Hills, differed essentially from that of the sultry plains of India, which skirt their southern base; that, though occasionally mixed with tropical forms, it was, upon the whole, of a character closely resembling that of the more temperate and northern latitudes; and that the insulated position of these remarkable mountains, exhibiting, as they do, the rare and interesting phenomenon of a temperate and even a boreal climate on the very confines of the tropic, where the summer heat is necessarily greater than even under the equator itself, gave an importance to the inquiry, as connected with the geographical distribution of Animal Life, which promised the most important results. The nature of the problem, indeed, and the very different conditions of Animal Life, as compared with that of Vegetables, forbade me to anticipate the discovery of laws of distribution in the Animal Kingdom, so definite and circumscribed as those which Baron Humboldt has established with regard to Plants; the principle of animality, if I may be allowed the expression, possesses an innate power of adaptation which renders Animals in some measure independent of climate, particularly as compared with Vegetables, and which increases in proportion as we ascend in the scale of life; but I felt that if any such laws of geographical distribution prevailed in Zoology, they might naturally be expected to be exhibited most clearly and unequivocally on a theatre like this, and therefore that the opportunity should not be neglected of investigating the circumstances of a problem which appeared to promise so much scientific interest.

From the observation just made, *viz.* that the power which all animals possess, in a greater or less degree, of adapting themselves to different varieties of climate, and of withstanding, uninjured, the effects of temperatures foreign to their natural habits, increases in proportion as we ascend from the lower to the higher tribes, it will be seen that the Mammalia—the class which I had undertaken to review—form one of the most unfavourable groups for the discussion of this important question. Indeed, were it not from their limited powers of locomotion, they would be the very worst of all, because their high position in the scale of life, and the superior intelligence and resources with which

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it endows them, necessarily protect them against changes and casualties, which would prove fatal to more simply organized beings; but, deprived of the powers of flight, ordinary Mammals have not the means of traversing the wide deserts and oceans, which separate the habitable portions of the earth: the nature of their locomotive powers consequently confines them to particular regions; and, in spite of the more favourable circumstances of their physical organization, their more varied resources and superior intelligence, they afford better materials for studying the problem of geographical distribution, than the kindred class of Birds, whose faculty of rapid flight enables them to set oceans and deserts equally at defiance, in passing to the most distant quarters of the globe, and, as it were, to choose their own temperature and climate in the boundless fields of air. Hence it is that the circumstances of the important problem of geographical distribution are less favourably presented in Ornithology than in Mammalogy; but, with this exception, the observation above made holds good throughout all other classes of animals, and the simplest tribes will always be found to present the most certain results. Insulated families also occasionally occur, which possess peculiar advantages for the prosecution of this inquiry; as, for instance, in the case of fresh-water Fishes, than which I am acquainted with no other group of animals so well calculated to illustrate the laws of geographical distribution, or so likely to repay a careful study under this point of view; and I am only surprised that no competent Ichthyologist has hitherto occupied himself with so promising an inquiry.

The only other principle which can well be regarded as influencing the geographical distribution of Animals, *viz.* the dispersion of Plants, upon which all Animals live, either mediately or immediately, is obviously subordinate to that of climate, with which it has been shown to be most intimately connected. On a limited scale the distribution of particular species may be seriously affected by the influence which civilization and cultivation produce upon the face of particular countries; wild animals necessarily disappear with the woods and forests which afforded them food and shelter; the Wolf, the Bear, and the Beaver, have thus disappeared from our own country; the Capercalzie, exterminated about a century ago, is once more spreading rapidly over the pine forests of Scotland; but these are partial cases, which do not bear upon the general problem of geographical distribution; and it is obvious, that upon the great theatre of nature, climate and temperature are the only laws which regulate it, limited, indeed, by the physical structure of the animals, as has been already observed, and by their powers of transporting themselves to distant regions. Hence it is that terrestrial and fresh-water tribes are more favourable for this study than marine or pelagic; though even among the latter, the comparative simplicity of their structure, and their consequent susceptibility of changes in temperature, render the habitats of different genera and species more definite and confined than might otherwise be expected. Of the former, again, land and fresh-water Mollusks being among the most simply organized, are consequently most limited in point of range; the species of Insects are almost equally confined, unless in the case of certain tribes, which are susceptible of being transported to distant countries in wood and other extraneous substances; next follow Reptiles and fresh-water Fishes; and, last of all, Birds and Mammals; the former, as already observed, having an almost unlimited range of habitat, from the facilities which they derive from their powers of flight, of passing to the most distant quarters of the globe. The common Sparrow, the Snipe, and the Woodcock, for instance, are found in the Himalayas and in Japan, as well as in the North of Europe; nature has endowed these birds with means of traversing the arid climes and extensive deserts which intervene between these localities, which she has denied to Quadrupeds; and hence we must not expect to find the Badger and the Fox so widely distributed as the Owl and the wild Goose. But if the same species of Mammals are confined to particular regions, the great question still remains, whether similar regions, wherever situated, or however separated from one another by intervening seas and deserts, produce kindred or analogous species of Mammals? and it

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is the general solution of this question in the affirmative, as far at least as the great continents of the globe are concerned, which renders the Mammalogy of the Himalayas so interesting in this point of view. We have here an insulated territory on the confines of the tropic, with a climate varying from the most intense heats of the Equator to the greatest rigours of the Pole; and we shall find, in discussing its animal inhabitants, that it presents, as it were, an epitome of the Mammalogy of the world; an intermixture, or rather a succession of species and genera similar to that which we meet in travelling from India to Kamtschatka, or from Brazil to Labrador.

Having thus fully explained the objects, it now only remains for me to acknowledge the sources from whence I have derived the materials of the following Memoir. The principal of these has been, of course, the Collection of Professor Royle himself, and the few notes, rendered particularly valuable, however, by containing the native names and localities, made by that gentleman during his tours. Besides which, the extensive Collections of the British Museum, of the Museums of the Zoological Society, the East-India Company, and various private collections of less note, which are occasionally made by Officers, and sent to their friends in this country, many of which I have had the good fortune to examine, have furnished me with valuable materials; whilst the different Notices and Memoirs on Indian Zoology, dispersed through the pages of the Asiatic Researches, the Journal of the Asiatic Society of Bengal, the Zoological Proceedings, and other similar publications, have been consulted with the greatest advantage. By carefully quoting my authorities, I have invariably taken care to distinguish what I have seen or know myself, from what is merely given on the faith of others. Yet with all these resources at my command, I have found my materials much too limited to give any thing beyond a mere outline of the Mammalogy of the Himalayas; but if this Memoir should prove to be the means of inducing future travellers, or residents, in those interesting regions, to fill up the sketch thus imperfectly traced, or assist them to distinguish what is already well known, from what still continue to be desiderata, in these inquiries, it will not have been without its use. The present time, indeed, is peculiarly favourable for such pursuits. India now contains many able and zealous naturalists; and what is not less fortunate, has a Nobleman for its Supreme Governor who both understands and can appreciate the value of their pursuits. Drs. Cantor, M'Clelland, and Falconer, are skilful and practised observers; and Mr. Hodgson appears only to want access to European libraries and museums, an advantage unfortunately beyond the reach of the Indian Naturalist, to illustrate the Mammalogy of Nepal in the most ample and satisfactory manner.

Before leaving this part of the subject, I shall take the opportunity of offering a few remarks, which may be useful to that numerous class of intelligent and educated gentlemen, who are dispersed over every part of India; and who, from their taste for field sports and the facilities afforded by their situations, have the means of making the most valuable observations in various departments of Natural History; but which are too often neglected, not from any deficiency of zeal or inclination on the part of the observers, but from a want of practical experience in observing, from the difficulty of naming and describing the animals which fall under their notice, and from not knowing exactly what points to attend to. An accurate knowledge of specific differences, however, is by no means indispensable for this purpose; generally speaking, it is sufficient to indicate the affinity of the animal to the most approximate European species, and to ascertain its native name, in order to enable the more practised Zoologist to recognize it with sufficient accuracy, especially if the forms of the feet, teeth, ears, &c. be carefully noted: but the main points to be attended to, and those, unfortunately, which the generality of observers most neglect, are the habits and economy of the animals which fall under their notice; their manners, whether aquatic, arborial or terrestrial; whether they inhabit burrows, or reside among thick jungle, or on the naked open plain; whether they live in society or solitary; the number of young which they produce at a birth; their period of gestation; the duration of life; their instincts,

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and the stratagems which they employ to capture their prey or to escape from their enemies; the nature of their food; whether they hibernate or migrate from place to place, according to the season; whether they are turned to any account by the natives, or are capable of yielding any products applicable to the purposes of commerce or domestic economy. These, and other similar inquiries, of the utmost importance to the philosophical Zoologist, are within the ordinary range of daily observation to most gentlemen in India, with respect to many rare and interesting animals; whilst they are, generally speaking, attended with so little trouble, and at the same time productive of so much mental recreation and instruction, that it is only surprising how much they have been heretofore neglected. One principal cause of the apathy which our countrymen in India have shown, if not in making, at least in recording, their observations on various branches of Natural History, may, indeed, have arisen from the want of some common central institution, where they could be properly arranged and published; but the establishment of the Zoological Society of London, and the unrivalled resources which it possesses, offer facilities for this purpose, which it is hoped will hereafter be made extensively available by Englishmen in all parts of the world. It is scarcely necessary to add, that any interesting details relative to the habits and manners of foreign animals, observed in their native climates, will be gladly received from any quarter, and published in the Proceedings of the Society; especially if accompanied by the skins of the animals (the skulls, legs, and tail, being carefully preserved), for the purpose of identification. The Journal of the Asiatic Society contains numerous articles on Natural History, but its contributions in this department are fewer than could be wished: whilst the Bengal Sporting Magazine, hitherto in a great measure confined to mere journals of shooting excursions, might likewise be made a ready and appropriate medium for the publication of such observations; and the contributions of its various correspondents prove them abundantly qualified for this higher and more important object.

These introductory observations being premised, I shall now proceed to enumerate such Mammals as I know to inhabit the great Himalayan Chain; and without following any formal arrangement, shall throw them into such natural groups or families, as appear best suited to illustrate their geographical distribution with respect to climate and temperature, the principal object of the present Memoir.

QUADRUMANA.

Throughout Bengal and the northern provinces of British India, there appear to be only two species of *Simiæ*, the Hoonuman (*Semnopithecus Entellus*), and the Bhunder (*Papio Rhesus*); both of which ascend the hills to a very considerable elevation during the summer heats, and return again to the plains at the commencement of the cold season. This migration is a very interesting fact in the history of these *Simiæ;* it is the only instance of a similar phenomenon, which has been recorded of this family of Mammals, and may become of great value in its application to geological reasoning on the climate and temperature of Europe during the tertiary epochs, in the deposits of which periods the bones of Apes and Monkeys have lately been found, associated with the remains of Pachydermata, and other inhabitants of more tropical latitudes. The Hoonuman, called *Lungoor* by the Hill tribes, is not unfrequently found at an elevation of from 9,000 to 11,000 feet, as among the Pine forests in the neighbourhood of Choor, and sometimes even at the verge of the snow-line. Nay, it even appears to have succeeded in crossing the mountains; Turner* mentions having seen a large troop of these monkeys in Bootan, where they are held in the same veneration as in Hindustan; and that it has found its way, and is capable of subsisting in a state of nature, at a considerable elevation, and a comparatively low temperature, is sufficiently evinced by these facts, as well as by the testimony of Fraser,† Traill,‡ and

* Journey to Thibet, p. 147. † Journey in the Himalayas, p. 351. ‡ Asiat. Res. xvi. 153.

and other intelligent travellers. Dr. Royle found it common enough in the neighbourhood of Hurdwar in April, and on Tuen and Manma at 9,000 feet of elevation in the latter end of May and in June.

The Bhunder, Bender, or Bandar, the Common Monkey of Bengal and Upper India (*Papio Rhesus*), though said by Mr. Hodgson to exist in the central regions of Nepal, only in the vicinity of the temples, and in a semi-domestic state, whence he conjectures it to have been introduced from religious motives, is also reported to abound in Kumaon; and it is highly probable, that the nearly allied species (*Papio Assamensis*) lately discovered by Mr. M'Clelland in Assam, ascends the more eastern hills, as its congener does the central and western ranges. Of this, however, we have no positive knowledge, though the close affinity of the animals gives a strong degree of probability to the fact; but the various species of Monkeys which Mr. Fraser thinks may be found along the upper courses of the Jumna and Ganges, rest on more questionable authority; and it is not unlikely that this intelligent traveller, as indeed he has himself conjectured, was deceived by distance, variety of size, and other circumstances, which give a very different appearance to individuals of the same species. Mr. Hodgson* gives the Bonnet Monkey (*Cercopithecus radiatus*) as a native of Nepal; but this species is confined, as far as at present known, to the Peninsula and western coast of India, and seems to have been confounded by Mr. H. with the *Papio Rhesus*, or Bhunder of Hindustan. The same gentleman, in a letter to the Zoological Society, written some years ago, mentions that his shooters were once alarmed in the Kachar, or Alpine regions of Nepal, by the appearance of a wild man, which walked erect, was covered with long dark hair, and had no tail. The improbability of finding a real Ape in such a situation led him to question the truth of the report; but it is well known that the woods of the lower ranges to the east of Nepal contain at least one species of Gibbon, *Hylobates Scyritus*, called *Hooloo* or *Hooloc* by the Assamese; and it is not improbable that individuals may occasionally wander to the higher and more remote forests of the Central Hills.

CHEIROPTERA.

When it is recollected that of the sixteen species of Bats, now known to inhabit the British islands, no fewer than ten have been discovered within the last few years, it will not appear surprising that we should be so imperfectly acquainted with this department of Himalayan Mammalogy. Mr. Hodgson, indeed, is the only author who has furnished us with any details on the subject: his "Synopsis of the Vespertilionidæ of Nepal," published in the Journal of the Asiatic Society of Bengal, vol. iv. p. 699, contains an enumeration of seven species of *Cheiroptera:* but, as he himself very candidly observes, his specific identifications must be received with considerable caution, from his want of access to extensive libraries and museums, for the purpose of comparison. Of the two species of *Pteropus*, for instance, which he has there briefly described under the names of *P. leucocephalus* and *P. pyrivorus*, the former does not appear to differ from the *P. medius* or *Edwardsii* of the Plains; and the probability of its identity with that species is increased by the fact, which Mr. Hodgson mentions, of its only visiting the temperate regions of Nepal during the autumn, returning of course to the more sultry plains of India on the approach of the cold season. The *Pteropus rubicollis* of Mr. M'Clelland's "list of objects of Natural History collected in Assam," is likewise identical with the *P. Edwardsii*. The only other species of tailless *Pteropus* known to inhabit the continent of India, *Pteropus Dussumieri*, is very different in its characters from *Pteropus medius;* and as Dr. Royle brought undoubted specimens of this latter species from the lower hills a little farther west, it is but reasonable to suppose that it is equally common in Nepal, and consequently identical with Mr. Hodg-

* Proc. Zool. Soc. II. 96.

Hodgson's animal. The *Pteropus pyrivorus*, to judge from the short description given by Mr. Hodgson, appears to be less questionably a new species: it belongs to the second section of the genus, having a short tail, partly free, and partly enveloped in the membrane, and derives its specific name from the depredations which it commits among the ripe pears in the central regions of Nepal. The migratory habits ascribed to these *Pteropi* are common to the *Pteropus poliocephalus* of New South Wales, and many other species of the same genus; for these large frugivorous *Cheiroptera* are essentially tropical in their habitats, and only visit more temperate climates during the summer and autumn heats, when the ripe fruits tempt them to wander from their native regions. They are consequently but occasional visitors to the higher elevations and latitudes of the globe; and the *Pteropus dasymallus* and *Pteropus pselaphon*, which have been hitherto observed only in Japan, comparatively a high latitude for these animals, do not probably form an exception to the general law.

Of the *Insectivorous Cheiroptera*, a family far more abundantly and extensively dispersed over the surface of the globe, Mr. Hodgson indicates only five species as natives of Nepal. Three of these are described as *Vespertiliones*, by the specific names of *formosa*, *fuliginosa*, and *labiata*, and two as *Rhinolophi*, by the names of *armiger* and *tragatus* respectively; but without a more careful examination and comparison with other species than Mr. Hodgson had it in his power to make, it is impossible to say how far these Bats may be distinct from, or identical with, species already described. One thing at least is certain, that the temperate and more elevated regions of the Himalayas must contain many species of *Insectivorous Cheiroptera*, still unknown or undistinguished, besides those enumerated by Mr. Hodgson; it has been already observed, that this section of the family is very widely and generally distributed in temperate climates; and the rich harvest which has attended the researches of British naturalists, within the last few years, in their own country, ought to stimulate our Indian brethren to a pursuit which cannot fail to be rewarded by still more extensive discoveries. It would be extremely interesting, for example, to procure a complete series of Himalayan Bats, with the seasons, temperatures, and elevations at which they were captured carefully noted down, so as to compare them with analogous species of higher latitudes, and thus ascertain what law of succession the different forms may follow, or within what limits they may be confined in respect to temperature, in their geographical distribution over the surface of the earth. Speaking of these *Insectivorous Bats*, Mr. Hodgson observes, that "they are neither migratory nor subject to hibernation;" two properties which in more northern climates would be considered incompatible with one another, and which even in the central regions of the Himalayas require a very careful revision before they can be admitted as established facts. I am not aware that these animals ever migrate in any climate; hibernation is the resource which nature has provided to preserve them during the season when their natural food disappears; and it is the general opinion, that even within the tropics, the Insect-feeding Bats go to sleep at certain seasons, as they do throughout the winter in more northern latitudes: should the fact be otherwise, it would prove a highly interesting addition to our knowledge of their habits; but it is possible that Mr. Hodgson may have been led into error, by the casual appearance of a few individuals during an occasional fine evening, as sometimes occurs in Britain even in the depth of winter. The subject is well worth the attention of Indian Zoologists.

INSECTIVORA.

Ascending gradually from the *frugivorous Cheiroptera* of the Plains of India, which visit the hills only during the summer heats, through the insectivorous genera of the same family, which remain throughout the whole year, we next come to the *Insectivora*, properly so called; a family which belongs almost exclusively to the temperate regions of the earth; and of which it is therefore extremely

interesting to find the common forms of Europe and Northern Asia occurring in the analogous climates of the Himalayas. No fewer than three distinct species of Hedgehogs, for instance, have been described from the Western Hills:

Erinaceus spatangus, a small dark-coloured species, not more than twice the size of a large mouse;

Erinaceus Grayii, of a grizzled black and yellow, from the spines being annulated with these two colours, rather smaller than the common European species; and

Erinaceus collaris, by some supposed to be identical with *E. Grayii*, but easily distinguished by a white collar half surrounding the neck. All these species, however, require a careful revision; they are founded on single specimens, those of the two former deposited in the Zoological Society's Collection, that of the last in the British Museum, and of which a figure is published in the Indian Zoology of Messrs. Hardwick and Gray. It is possible that more extensive and accurate observation may prove the whole three to be identical: at all events, it is certain that one, either of these, or a different species (*Erinaceus indicus* of Royle's Illustrations, &c. p. 6), inhabits the neighbourhood of Delhi, where it would be interesting to observe the phenomena attending its hibernation, such as the temperature of its body, the nature of its respiration, &c. during the period of repose. Mr. Hodgson, in the letter to the Zoological Society, already referred to, denies that there are any Hedgehogs in Nepal, but mentions a small dull slaty-blue variety of the common Indian Shrew or Musk Rat (*Sorex indicus*), as common in the lower and central regions, to which he speaks of it as being confined. Other species no doubt exist in the more temperate parts of the mountains, though their small size and shy habits screen them from observation. The same gentleman mentions the Mole (*Talpa*), as abounding in the Kâchar, or northern region of Nepal, and Traill* says it is common in Kemaon; but no one appears to have described, or even examined it, and we are ignorant of every thing relating to it, except the name. It will probably prove to be a distinct species from its European congener, if it exist at all; but the question is involved in great doubt, and is well worthy of a careful examination.

CARNIVORA PLANTIGRADA.

Of this family, the majority of which likewise belong to the temperate regions of the earth, various forms and species occur among the Himalayas. First, of the genus *Ursus*, we have the *Bhaloo*, or Common Bear of India (*Ursus labiatus*), and, according to Mr. Hodgson,† the Malay Bear (*Ursus Malayanus*), inhabiting the Turaï, or sultry regions, at the base of the mountains, to which localities he appears to intimate that they are confined. But the habitat here assigned to the Malay Bear is extremely doubtful. It rests solely on the authority of Mr. Hodgson, who, from the want of proper means of comparison, is often mistaken in the identification of species; moreover, we have never received this animal from any part of Continental India, but only from the great islands of the Indian Archipelago; and it is therefore not improbable that it may have been in this instance confounded with the *Ursus Thibetanus*, which, from the general similarity of the two species, may have readily happened. Mr. Hodgson, indeed, expressly mentions this latter species as an inhabitant of the Central and Northern regions of Nepal; and Dr. Royle informs me, that it is confined among the more western hills, to the Doon and warm valleys, where it is called Reech by the natives. Lieut. T. Smith, of the 15th regiment N. I., however, an officer well acquainted with the Mammals of the Himalayas, and a keen sportsman, assures me that the Common Sloth Bear (*Ursus labiatus*) does not ascend above the lower spurs of the great Mountain Chain of Northern India; that it is there replaced by the *Reech* or *Reek*, which occupies the whole of the more elevated hills, as far up as the snow line, where it is succeeded in its turn by the *Barji* or Yellow Bear (*Ursus isabellinus*), a species hitherto very imperfectly

* Asiatic Researches, vol. xvi. 153. † Proc. Zool. Soc., ii. 96.

fectly described, though mentioned by every tourist as extremely abundant in the higher regions of the Himalayas. Capt. Skinner* met with it in the neighbourhood of Bhaïro Ghati; Traill † found it in Kemaon, though he says it is peculiar to Bhot; and it is probably the Brown Bear mentioned by Mr. Fraser: ‡ so that upon the whole it appears, that whilst the Common Sloth Bear (*Ursus labiatus*) is on all hands admitted to be confined to the sultry plains of India, the Reech (*Ursus thibetanus*) succeeds it, as the legitimate representative of the European Bear (*Ursus Arctos*), and of its American analogue (*Ursus americanus*), in the middle or temperate regions of the hills, to be itself replaced among the frozen peaks of the higher mountains, by the *Barji*, or Yellow Bear of the Himalayas (*Ursus isabellinus*), a species in all respects analogous, in its colour and habitat, as well as in its decidedly carnivorous appetite, to its congener, the Polar or Sea Bear of the North (*Ursus maritimus*).

Various animals, either belonging or closely allied to the Gluttons and Badgers (*Gulo* and *Meles*), pre-eminently northern forms, likewise inhabit the elevated ranges of the Himalayas. Among the lower terraces we have the Ratel (*Rattelus mellivorus*), called *Peejoo* by the Hindoos, which is common over all the plains of Northern India, and differs from the same animal, as found at the Cape of Good Hope, only in being of a lighter colour on the back. This wide distribution of the *Carnivora*, and the common occurrence of the same species in India, and the most remote parts of Africa, will be more particularly mentioned in the following article: Mr. Hodgson,§ under the erroneous impression that the Peejoo, which the Nepalese call *Bharsiah*, was an unknown animal, and evidently misled by some imperfect or faulty account of its dentition, has recently described it as a new genus under the name of *Ursitaxus inauritus;* but the species has long been well known in Europe. M. F. Cuvier figured, and accurately described its teeth in the "Dents des Mammiferes," so long ago as the year 1825; and the late Mr. Bennett described and figured the animal itself in 1830, from an Indian specimen then living in the menagerie of the Zoological Society.‖ The *Balloo-soor*, (perhaps more properly *Bhalloo-soor?*), *Meles collaris*,¶ which M. F. Cuvier likewise elevated to the rank of a generic form, under the name of *Arctonyx*, upon the faith of a distorted native drawing sent to him by M. Duvaucel, is a real *Badger*, and was described and figured by the celebrated Bewick, at least thirty years before M. Duvaucel's visit to India. It inhabits the northern plains of Hindostan, and probably ascends the hills, but of this fact I have no certain information. Of the Gluttons, properly so called, the *Gulo nepalensis* of Mr. Hodgson, which does not differ specifically from the *Gulo orientalis* of Dr. Horsfield, the only distinction being in a lighter shade of ground colour, inhabits the lower terraces of the hills; whilst the *Wah*, or *Chitwah* (*Ailurus fulgens*) and the *Benturong* (*Arctitis albifrons*)** are said to be confined to the Kachar, and regions bordering on the snow-line. As regards the *Wah*, there is no doubt about the truth of the habitat here assigned to it; but the *Benturong* is a native of the Indian Archipelago, and of the Peninsula of Malacca; and I strongly suspect, that it has been confounded with some other animal, perhaps with *Paradoxurus bondar*, or some closely allied species. The habitat of *Bootan*, assigned to it in the *Regne Animal*, is altogether erroneous. Messrs. Gray and Isidore Geoffroy have proposed to consider the *Gulo nepalensis* as the type of a new genus, the former under the name of *Helictis moschata*, the latter under that of *Melogale personata*.

CARNIVORA DIGITIGRADA.

It was mentioned incidentally in the preceding article, that many species of *Carnivora* were common to India, and the Continent of Africa; and it is not a little singular, that this migration appears to have proceeded exclusively from west to east, and never in the opposite direction; or, in other words, that whilst

* Excursions, &c. ii. 72. † Asiat. Res., xvii. 16.
‡ Journey, &c. p. 351. § Res. Asiat. Soc. xix., and Journal of Asiat. Soc., v. 671.
‖ Gard. and Menag., &c. i. 13. ¶ Penny Cyclopædia, iii. 264. ** Mr. Hodgson, in Zool. Proc., ii. 96.

whilst the *Carnivora* of Africa have found their way freely into the neighbouring Continent, those of India have never passed the Arabian desert. I do not pretend to account for this. Perhaps it may depend upon the physical character of the two Continents, and the influence which this circumstance exerts in modifying the nature and habits of their respective inhabitants. The Lion of the burning Sahara, for instance, like the wild Taurick or Bedoween of the same regions, would find the parched deserts of Syria and Persia no barrier to his progress towards the East; whilst, on the other hand, the Tiger of the moist jungles of Bengal could no more pass the arid plains of Arabia than the puny and luxurious Hindoo, accustomed to the same humid soil and atmosphere. But whatever may be its cause, the fact itself is as undoubted as it is interesting. The common distribution of the *Ratel* over both Continents has been already mentioned. This animal is spread over the whole of Africa; it is common in every part of the Cape colony, and Denham and Clapperton brought it from Bornou; and though its geographical limits have not been accurately ascertained in Asia, we know that it abounds on the plains of Northern India, which do not differ much in their physical structure from the Karroos of South Africa. So likewise the Lion (*Felis Leo*), the Leopard or Panther, for they are both the same species (*Felis Pardus* and *Leopardus*), the Cheetah (*Felis jubata*), the Persian and Red-eared Lynxes (*Felis Caracal* and *Felis Chaus*), the striped Hyæna (*Hyæna virgata*), and the Jackall (*Canis aureus*), all pre-eminently African species, are found in most parts of India, without offering any striking variety either in form or colour; whilst the Tigers, Wolves, Paradoxures, &c. of the latter country have never passed far to the west of the Indus, and some of these are even without generic representation on the Continent of Africa: nor is it less singular that, as far at least as at present known, this migration should have been confined to the Carnivora. There is not a single authenticated instance of any of the numerous Antelopes in which Africa abounds above all other parts of the world, and which nature has peculiarly adapted to inhabit the most parched and arid deserts, having crossed the Isthmus of Suez, any more than of the various species of Deer so common throughout the whole extent of Asia having migrated in an opposite direction. If the various indications which Mr. Hodgson has given of the occurrence of species known to inhabit the great islands of the Indian Archipelago, and the southern extremity of the Malay Peninsula, such as the Benturong (*Arctitis albifrons*), the Malay Bear (*Ursus malayanus*), and the Javanese Ichneumon (*Herpestes javanica*), in the forests of the Turaï, which skirt the southern foot of the Himalayas, should turn out to be correct, (and it is certain that *Felis minuta* and *Gulo orientalis* are common to both these localities), it would appear that India Proper, besides its own appropriate Mammals, is a kind of neutral ground upon which the species of the most distant countries to the east and west of it meet and mingle together.* One fact, abundantly singular, but which I have never seen accounted for, is the alleged total absence of every species of the genus *Canis*, so numerous and so common throughout all parts of India, in Burma, Siam, and those other countries east of the Brahmapootra, which compose the great Malay Peninsula. This is a phenomenon well worth the attention of Indian Naturalists.

As far as regards the occurrence of the *Digitigrade Carnivora* among the Himalayan Mountains, it is certain that the Lion, called *Baug* by the Indians, ascends the western hills to a very considerable elevation. Mr. Frazer often heard of it during his journey to the sources of the Ganges and Jumna,† and Bernier, whilst travelling to Cashmere, in the train of Aurungzebe, had frequent opportunities of witnessing the chace of this animal: the amusement was reserved for the Emperor alone, and the success of

* See the observations on the distribution of Plants of different countries in India, p. 158. J.F.R.

† I beg to observe here, that I frequently made inquiries on this subject, and could never learn anything positive on the subject; nor had any of the numerous sportsmen to whom I spoke on the subject, ever seen a Lion or its skin, obtained from within the Himalayas. At present, the Lion is I believe only found to the west of the Jumna, especially on the edge of the desert, near Hansi. J.F.R.

of a day's sport was recorded by the Imperial Historiographer in the annals of the empire. The same indifference to climate characterises the Lion in Africa; in the time of Herodotus and Aristotle, he was common among the coldest mountains of Macedon; at the present day he is as often found among the snowy peaks of the Atlas, or on the chilly slopes of the Snueuberg, as in the desert of Barca, or on the banks of the Gareip. Travellers should look for him to the east of the Brahmapootra, as though not known to inhabit any part of Eastern India, the Burmese are said to have figures which can be intended for no other animal, and which can only have been drawn from the living model. The Tiger and Leopard are well known to inhabit every part of the Himalayas, even to the line of perpetual congelation: they exist equally in Japan, in the Caucasus, and in the Altai Mountains in Southern Siberia.* The Tiger of Bockhara is less than the Bengal variety, and chiefly confined to the Valley of the Oxus;† whilst in Japan he is covered with a thick coat of long soft fur, to protect him from the rigours of that northern climate. The *Cheetah* is said by Mr. Hodgson‡ to occur chiefly among the lower valleys of the Himalayas, but Pallas found it as far north as the Caspian Sea and the deserts of the Khirgis Tartars, so that it may possibly ascend the Hills to a greater height than has yet been suspected. Lieut. Smith mentions a small dark coloured variety of the Leopard, called *Luckur-backer*, extremely fierce, and common in every part of the Hills.

Among the smaller species of the genus *Felis*, the Moormi Cat (*Felis moormansis*) first described by Mr. Hodgson, and hitherto observed only by that gentleman, as likewise the *Felis bengalensis* or *nepalensis*, are stated to inhabit the middle terraces of Nepal.‡ The *Felis Viverrinus*, first described by Mr. Bennett§ in 1833, and three years afterwards by Mr. Hodgson, under the nearly identical name of *Felis Viverriceps*,‖ inhabits the lower terraces and valleys of the Turaï. *Felis Chaus*, (called Biraloo in Nepal), of which I have compared numerous African and Indian specimens, extends over every part of the Hills: it is the *Felis erythrotus* of Mr. Hodgson;‖ and there is a specimen of a Himalayan Cat in the Museum of the Zoological Society, so closely resembling the common Wild Cat of Europe, that it differs only in the absence of the dark transverse and longitudinal stripes which mark that species, and which may not improbably be a mere effect of locality.

Mr. Hodgson¶ has described three species of Paradoxuri as inhabitants of the Southern, Central, and Northern regions of Nepal respectively, two of which at least I have seen from the more Western Hills; *P. Bondar* (P. hirsutus, Hodg.) is confined to the Turaï; *P. nepalensis*, Hodg. frequents the middle ranges of the mountains, and *P. larvatus*, (P. lanigerus? Hodg.) is only found in the higher regions. Two species of Mungoos (*Herpestes*) likewise inhabit the lower terraces; *H. griseus*, called Nyool in Nepal, does not extend beyond the Turaï, but *H. Edwardsii* (H. auropunctata, Hodg.)§ ascends the central hills; whilst *Viverra Rasse* and *indica*, and *Viverra Zibetta*, are said to frequent the same localities respectively.

The true Mustelæ, a genus proper to more northern latitudes, abound in the Himalayas, where there appear to be many different species, some of which, according to Mr. Hodgson, differ but little from those of Northern Europe and Asia. It is to be remarked, however, that they have never been properly compared; but it is interesting to find this additional instance of the relation between generic forms and climate. In the central region, besides *Mustela flavigula*, Mr. Hodgson mentions two closely allied species, one larger and of a fuller habit of body, (query, Paradoxurus larvatus?); the other, which he has described under the name of *Mustela Kathiah*, is much smaller, and often domesticated by the Nepalese for the purpose of destroying vermin, and sometimes even large animals.** This appears to be the *Kukar* of Kemaon, where it likewise frequents the villages, burrows in the walls of houses, and is similarly

* Pallas Zoog. Ros., i. 16. † Burnes' Travels, ii. 178. ‡ Zool. Proc., ii. 97. § Zool. Proc., i. 68.
‖ Journ. Asiat. Soc., v. 232. ¶ Asiat. Res., xix. I. 72. ** Journ. As. Soc., iv. 703.

similarly protected by the inhabitants.* The *Mustela lanigera* of Mr. Hodgson resembles the common Weasel of Europe, but differs in its spirally twisted hair; and the same gentleman mentioned another species so nearly approaching our common Pole-cat, that he is unable to perceive any specific difference; however it will probably turn out to be distinct. Both these latter species abound in the northern and central regions. No fewer than seven species of Otters are said by Mr. Hodgson to inhabit the Himalayas; but they require to be carefully studied and compared, before we can venture to pronounce definitely upon their specific distinction. It is certain, indeed, that several species do actually exist in these Hills; Mr. Hodgson has himself given brief characters of four which he regards as new,† besides the two common species of the plains, (*Lutrae Nair* and *Leptonyx*), and seems to intimate that the seventh may be no more than a variety of the common European Otter.‡ The following is the substance of Mr. Hodgson's observations in the letter already referred to, and I give them at length in the hope that they may induce other observers to co-operate with that gentleman in filling up the sketch of which he has given an outline. "Of Lutræ we have seven species, five differing from the two usually found in the plains, as well as from all described species, except the common Otter (*L. vulgaris*), of which the largest Nepal species seems to be only a variety. It is five feet long, including the tail, and is the largest, though not the longest of our species. It is peculiar to the lower region, where also three other species inhabit: two more belong to the central, and one to the Kachar. One species is yellowish brown all over; the others brown, more or less dark, some having the chin and throat much paler than the rest of the body, and approaching nearly to white or yellow. They differ in length from five feet to one and a half feet; some being quite vermiform, and others as bulky as the Badger. Detailed descriptions, skulls, and skins of these animals, are much wanted."

Of the genus *Canis*, different species are found everywhere. The common Pariah Dog is universally dispersed through the mountains, but the Thibet Mastiff is confined to the Kachar, into which it is imported from its native country. There are many distinct varieties of this noble animal. That called *Sassa*, a large black kind, with dew claws on the hind feet, is esteemed the finest: another called *Mustang* is of a bright red colour. The common Wild Dog, called simply *Junglee Coota* in the Plains and *Buansu* in Nepal (*Canis Duckunensis* of Sykes, and *C. primævas* of Hodgson) is only found in the lower regions, but is replaced farther up by two other wild species, likewise called *Junglee Coota* by English sportsmen. Lieut. Smith informs me that one of these is larger and the other smaller than the *Junglee Coota* of the Plains, from which they both differ in having shorter tails and a lighter or more ashy colour: both species ascend the Hills even to the snow line; they hunt in packs, and inhabit ravines and rocky dells; but, being excessively shy, are not very often seen. The *Junglee Coota* of the Plains, in other respects, does not appear to me to differ from the *Canis Sumatrensis* of Genera Hardwicke. The *Kokree*, or small Indian fox (*Canis Corsac, Indicus, Bengalensis, Kokree, &c.*); and the *Berria*, or Wolf of India (*Canis pallipes*, Sykes), never ascend the Hills. The Jackal (*Canis aureus*), is however occasionally said to be found in the central regions; but the higher mountains are inhabited by a very beautiful species of Fox, which Dr. Royle first noticed as the Hill Fox,§ and of which he brought home the first skin ever seen in England, and which was described at the time in the present memoir, and afterwards in the Proceedings of the Zoological Society, Part iv. p. 103, by the name of *Canis Himalaicus*. Mr. Pearson, then Curator of the Museum of the Asiatic Society at Calcutta, likewise described it about the same time as the latter;‖ and as he had a few months priority in point of publication, his name of *Canis montana* must have the preference.

The Hyæna of India (*H. virgata*), a native of the Plains, sometimes ascends even to Simla.

RODENTIA

* Asiat. Res., xvii. 16. † Journ. As. Soc., viii. 319. ‡ Letter to Zool. Soc.
§ Journ. As. Soc., i, p. 99. 1832. ‖ Journ. As. Soc., v. 113.

RODENTIA.

The remark which was formerly made to account for our limited knowledge of the *Cheiroptera* and *Insectivora* of these mountains, may be applied with equal force to the present family; *viz.* that the comparatively diminutive size and timid habits of the animals which compose it screen them from general observation. Still we have much more detailed accounts of the Himalayan *Rodentia* than of either of the two former families, though even these are far from being so complete as could be wished.

The striped Squirrel of the Plains (*S. palmarum*) is, according to Mr. Hodgson,* abundant in the lower hills of Nepal; and I have seen a second species (*Sciurus Lokriah*, Hodg.) of the same size, but of a uniform earthy brown colour, tipped with golden yellow, which is said to be an inhabitant of the central regions. Mr. Hodgson mentions a third (*S. Lokroides*) similar to the latter, and perhaps not specifically distinct.† Two beautiful species of flying Squirrel‡ (*Pteromys magnificus* and *P. alboniger*, Hodg.) are found both in the northern and central regions, but do not extend to the very elevated parts of the mountains.§ Here, however, are found a small brown kind of Marmot, called *Bhia*‖ by the natives, hitherto undescribed; and an equally undescribed species of Rat,¶ with a tail not more than half an inch in length, most probably a Lemming (*Georychus*, Illiger), if it be not rather a *Lagomys*, of which rare and essentially arctic genus Dr. Royle has brought a beautiful specimen from the Choor Mountain. Capt. Herbert, in his tour up the Valley of the Sutlej,‖ met with this tailless rat at an elevation of 12,000 feet, and observes that the ground was every where cut up into groves by it in search of food. He conjectures the animal to be a species of Spalax, but Dr. Royle is rather disposed to think that it was no other than the Lagomys, as he observed the ground similarly cut up in the vicinity of the spot where he obtained his specimen. The circumstance of the tail, however, which, short as it is, is expressly mentioned by both Capt. Herbert and Mr. Traill, appears to me to preclude Dr. Royle's supposition, since the Lagomys of the Himalayas, like the rest of its congeners, is absolutely without any rudiment of this organ. It is not improbable, indeed, that species of all the three genera here mentioned may be found among the more elevated ridges of the Himalayas, of which the climate is perfectly adapted to their habits: and it is to be hoped that future observers will direct their attention to the elucidation of this, as well as the numerous other unsettled points of Himalayan Mammalogy, to which I have already been so frequently obliged to refer.

Dr. Falconer, in the report of his recent journey to Cashmere and Little Thibet, mentions a Rodent under the name of the Thibet Marmot, which he says was first found in a bleak and rocky tract of country, immediately after passing to the northern slope of the great Himalayan range; but we have no farther knowledge of its characters: however, this is precisely the locality in which Mammals of this description might naturally be expected to abound. Rats and Mice, differing little, if at all, from our common European species, are abundant in all the houses. Mr. Hodgson,‖ indeed, expressly states that both our black and brown, or Norway rats, (*Mus Rattus* and *M. decumanus*), are the common species of Nepal, and Mr. Traill mentions them incidentally as inhabitants of the province of Kemaon. This is another interesting and important point of similarity between the Zoology of the Himalayas and that of the more northern parts of Europe and Asia; nor can we attribute the presence of these animals, in this part of the globe, to the introduction of European conquerors, as is well ascertained to have been the case in America¶ and Australia, since they are confined to the mountains, and altogether unknown in the Plains of India, except perhaps in some of the larger seaports. They must consequently have travelled south to reach their present habitat; and, no doubt, exist in Thibet, Tartary, and other intermediate countries, where the climate is suitable, as far as Northern Asia, from which at least one of the species

* Proc. Zool. Soc., ii. 98. † Asiat. Res., xvi. 153. ‡ Asiat. Res., xvii. 16.
§ Journ. As. Soc., v. 232. ‖ Asiat. Res., xv. 5. ¶ Proc. Zool. Soc., ii. 98.

species (*M. decumanus*) is said to have been originally introduced into Europe. Besides these, Mr. Hodgson describes two other species (*Mus niviventur* and *M. nemorivagus*) as peculiar to the Himalayas; and I have received a Rat from Dr. Royle, which in the dried state of the specimen I cannot distinguish from the common European Campagnol (*Arvicola vulgaris*), a fact the more interesting from this genus being confined to the temperate and colder regions of the Old World. The *Bandicoot*, or great Rat of the Plains (*M. giganteus*) does not exist in Nepal;* but various kinds of Field Mice, of what precise species is not mentioned, are stated to be sufficiently common.† The Porcupine (*Hystrix cristata var. leucarus*, Sykes) is found in Kemaon,‡ and the lower and central regions of Nepal.§

Mr. Hodgson ‖ mentions two species of Hares as inhabiting Nepal. One he calls the common small species, (probably the black-necked Hare of F. Cuvier, '*Lepus nigricollis*'), which, he says, is confined to the Turaï; the other, which he considers a new species, as large as the common English Hare and nearly resembling it, inhabits the higher and colder parts of the mountains. This is *probably* the red-tailed Hare of M. Isidore Geoffroy St. Hilaire,¶ (*L. ruficaudatus*), of which Dr. Royle obtained a specimen at Hurdwar (?), and which, he informs me, is very common in the Doon and in the neighbourhood of Delhi. As M. Is. Geoffroy's short description of this species is necessarily imperfect, from the mutilated state of the only skin which he had an opportunity of examining, the following more detailed account will not be unacceptable to the scientific Zoologist:—

The skin obtained by Dr. Royle is that of a full-grown female; it is in perfect condition, and measures one foot ten inches from the nose to the origin of the tail: the ears are about five inches in length, and the tail fourinches. The face, back and sides are regularly brindled, or variegated with alternate wavy lines of black and light sandy brown, arising from the hairs on those parts being annulated with these two colours. The whole coat is short, smooth and glossy; it consists of a short fine internal fur, of a cottony texture, and pale bluish white colour, and of a long, coarse, external hair, which, as just observed, is annulated with black and light sandy brown, and gives the general colour to the upper parts of the body. In the distribution of these colours, each hair is divided into three equal parts, the top and bottom being black, and the centre light reddish brown. The dark colour predominates most on the face, hips, and along the median line of the back, but becomes gradually fainter upon the shoulders and flanks, and is separated from the pure white of the belly by a narrow band of pale rufous. The cheeks are grey, pointed or intermixed with black; a light grey spot occupies the space in front of each eye; the chin is also grey, and the moustaches long and stiff, black at the roots and grey at the points. The ears *appear* to be reddish brown tipped with black, but the hair has been partly rubbed off in the specimen described, which prevents me from speaking with certainty. The whole upper part of the neck is pure unmixed sandy red, the fur being of the same quality as the internal fur upon other parts of the body, and without any intermixture of the long external silky hairs. The outer face of the arms, the whole of the fore legs, and the outer face of the hind, are also red; the tail red, or rather reddish brown above, and pure white beneath; and the belly and under parts of the body unmixed white. The animal had probably been killed whilst suckling her young, as the skin exhibited four very large teats, one pair on the breast and the other on the abdomen. These were all I could observe, but there may have been more, as the skin had been a good deal rubbed about these parts.

But by far the most interesting and unexpected acquisition, which Dr. Royle's discoveries among the Himalayas has produced to the Zoologist, is a new and beautiful species of *Lagomys*, a genus heretofore only found in Northern Asia and among the rocky mountains in North America. This discovery, of the

*Asiat. Res., xvi. 153. † Richardson Faun. Bor. Amer., i. 140-1. ‡ Journ. As. Soc., v. 234.
§ Proc. Zool. Soc., ii. 97, 98. ‖ Traill in Asiat. Res., xvi. 153. ¶ Dict. Class., ix. 381.

the greatest importance to our inquiries into the principles which regulate the geographical distribution of animals, is entirely due to Dr. Royle, and furnishes another, and a most glaring instance of the paramount influence of climate upon the dispersion of animals, as well as of vegetables. Unfortunately, the only skin which Dr. Royle has brought to England, is too imperfect to admit of so detailed a description as would be desirable. The skull has been taken out, (it is now in the Museum of University College, and, Professor Grant informs me, exhibits the same form of dentition as the other species of Lagomys described by Drs. Pallas and Richardson), and the hind legs cut off, but in other respects it is in a sufficiently good state of preservation to enable me to assign its specific characters. I propose, under the specific denomination of *Lagomys Roylii*, to dedicate it to my friend Dr. Royle, in commemoration of the important service which that distinguished Botanist has rendered by its discovery to the kindred science of Zoology, v. Tab. 4, where the animal and its dentition are figured.

The *L. Roylii* more nearly resembles the *Sulgan* (*L. pusillus*, Pallas), and the American species (*L. princeps*, Richardson), than either the *Pica* or *Ogotona* (*L. alpinus* and *Ogotona* of Pallas). With the exception of the *Pica*, however, it is considerably larger than any other species of *Lagomys:* the skin here described, notwithstanding its imperfect state—for the hinder parts have been partially mutilated, measuring eight and a half inches in length, which is more than one-third as large again as the *Ogotona*, *Sulgan* or American species. From the *Ogotona*, however, it is easily distinguished by its colours, which, in that species, are light grey above and pure white beneath, as well as by its naked soles. The triangular form of the ears in *L. pusillus*, prevents that animal from being confounded with any other species, and the *Pica* (*L. alpinus*), which alone approaches the size of *L. Roylii*, is at once distinguished by the sandy red colour of its fur. The *L. princeps* of Dr. Richardson is the only remaining species of the genus at present known; it is very similar to our animal in the colour and quality of the fur, but may be readily distinguished by its inferior size, and by the deep black hair which covers the external surface of its ears, and which is replaced in *L. Roylii* by long fur of a pure white colour.

The fur of this species is of two kinds, a very soft and fine internal one of a beautiful blue black over every part of the head and body, as well above as below, and a coarser external kind, of the same colour at the base, but afterwards marked with a broad ring of a greyish yellow colour, and finally tipped with dark brown. These two kinds of fur, however, are not produced by an actual difference in the individual hairs; on the contrary, the same hairs exhibit both the appearances here described, being extremely soft and fine at the root, and assuming a harsh and rigid structure towards the extremity. These harsh tips, being the only parts of the fur seen from without, give their general colour to the whole body. On the upper parts of the body, the head, back and sides, this is uniform brown, slightly mixed with yellowish grey, very dark on the back, much more so, for instance, than in the common Rat (*M. Decumanus*), but rather paler on the sides, and yellowish white on the belly; the hairs on this part wanting the harsh brown point, though in other respects perfectly similar to those of the back. The fur on the body is about an inch in length, and nearly as long on the head, which gives the face a rough shaggy appearance. The nose is entirely covered with short harsh hair of a uniform brown colour; the upper lip is bilobed as in the Hare; the ears are of an elliptical form with regularly rounded tops, covered internally with very short brown hair, and on the outside with long white hair at the base, and short brown at the top, the posterior edges having a scarcely perceptible narrow white border. They are about half an inch broad and three quarters of an inch in length, with a small internal lobe about a quarter of an inch long, and have the folding inwards of the anterior margin, and, consequently, the resulting funnel shape of their basal portions, which Pallas noticed in the species of Northern Asia. Dr. Richardson could observe nothing of this appearance in his *L. princeps*, but I presume this must have arisen from the imperfect state of his specimens in a part so liable to be injured, since an individual

in the British Museum exhibits the structure too obviously to have otherwise escaped the notice of that accurate Zoologist. The vibrissæ of *L. Roylii* are nearly as long as the head and ears together, and of a uniform brown colour. The arms and fore-arms, and, I presume, the thighs and legs, for, as I have already observed, the posterior members are wanting in the specimen, are covered with fur of the same colour and quality as that on the body, only shorter; but the whole upper face of the carpus, and probably also of the tarsus, is covered with short adpressed hair of a bright reddish yellow colour. The soles of the fore feet present four naked tubercles, corresponding to the extremities of the toes, and a fifth, considerably farther back, which represents the heel, and is separated from the others by a space covered with very short brown hair. The thumb is situated behind the other toes, and, like them, has a small sharp claw of a dusky horn colour.

Dr. Royle obtained his specimen on the Choor Mountain. I take it to be this animal which Captain Mundy* met with during his interesting tour recently published, and which he describes as something between a hare and a guinea-pig; and it is probably, also, the tailless rat which Turner† observed in Thibet, where the banks of a lake were everywhere perforated by its burrows.‡

EDENTATA.

Of this family, the only species known to inhabit the Continent of Asia, the short-tailed Manis, or Scaly Anteater of authors (*Manis pentadactyla* of Linnæus, *M. macroura* of Desmarest) is found in the lower and less elevated parts of the central regions: but all the *Edentata* are essentially inhabitants of the warmer parts of the earth, more especially of tropical America, and we cannot therefore expect to find their forms reproduced in the Himalayas. Mr. Hodgson has described the Manis of Nepal as a new species, under the name of *M. auritus*,§ on the supposition of its being distinct from the common species of the plains of Upper India, the *Badjarkita* of the Bengalese (*M. macroura*), which has been known ever since the expedition of Alexander the Great, and is mentioned by Ælian under the name of Φατταγης; but Mr. Hodgson in this, as in many other instances, has been misled by Griffith's Translation of the *Regne Animal*, a compilation which has obtained a much greater authority in India than its merits entitle it to, or than it enjoys at home.

PACHYDERMATA.

The great Saul Forest, which extends for many hundred miles along the bases of the Himalayan Mountains, affords shelter to vast multitudes of animals, of which it is probable that many species still remain undescribed. Among other genera, the large *Pachydermata* abound in these situations; the Elepnant and Rhinoceros (*Elephas indicus* and *Rhinoceros unicornis*), are extremely numerous; and in the rainy season, or in times of scarcity, make frequent inroads into the lower hills, and commit great depredations among the crops of the natives. The Indian Rhinoceros affords a remarkable instance of the obstructions which the progress of knowledge may suffer, and the gross absurdities which not unfrequently result from the wrong application of a name. This animal, to whose horn the superstition of the Persians and Arabs has in all ages attributed peculiar virtues, became known to the Greeks through the description of Ctesias, a credulous physician of that nation, who appears to have resided at the court of Persia in the time of the younger Cyrus, about 400 years before the birth of Christ. His account, though mixed up with great deal of credulous absurdity, contains a very tolerable and perfectly recognizable description of the Rhinoceros, under the ridiculous name, however, of the *Indian Ass*;

* Tour in India, II., 196.

† Journey to Thibet, 211.

‡ I have since seen perfect specimens of this animal, but have nothing to add to the description here given.

§ Journ. As. Soc. V. 234.

Ass; and as he attributed to it a whole hoof, like the horse, and a single horn in the forehead, speculation required but one step further to produce the fabulous Unicorn, such as it appears in the royal arms of England, and such as it has retained its hold on popular credulity for the last two thousand years. The works of Ctesias have perished, but this curious passage is preserved by Phocius;* Aristotle† adopted his statements regarding the *Indian Ass*, from Ctesias; and no other passage of his writings has given rise to a tenth part of the commentaries, discussions, and speculations which have originated in this. Religion was, as usual, pressed into the discussion, and as the Septuagint had used the word *Monoceros*, it was at one time next to rank heresy to doubt the existence of the Unicorn, and might have brought the imprudent sceptic to the stake. But it is not my intention to renew this fruitless and childish discussion; my only wish is to point out the perfect applicability of Ctesias's description to the Indian Rhinoceros, as it is now well known to naturalists; those who wish to pursue a subject of considerable interest in the history of human knowledge, will find many curious details in the writings of the learned Bochart,‡ in Scaliger, Hardouin, Sivry, and others of the older commentators on Aristotle and Pliny.

Wild Hogs, but of a smaller variety than those of Bengal, are extremely numerous in all the wooded parts of the mountains; they do not appear to be specifically different from the common wild boar of Europe. Horses do not breed on the southern face of the mountains, but are imported from Thibet.§ A valuable and sure-footed variety, called Tangun, is described by Turner.‖ The Ass does not appear to have been introduced into any part of the mountains, at least neither Dr. Hamilton nor Mr. Hodgson makes any allusion to its being found in Nepal,¶ and Mr. Traill expressly states that it does not exist in Kemaon.** The Dziggetai, however, (*Equus hemionus*), is found on the plains of Thibet and Tartary, and is called *Kiang* by the natives.

RUMINANTIA.

The Ruminantia of the Himalayas, as composed of the larger four-footed game most commonly followed by sportsmen, are probably better known than any other department of Hill Mammalogy. Yet even here much still remains to be done to make us thoroughly acquainted with all the different species or varieties which have been mentioned by Mr. Hodgson†† and other writers; the nomenclature, in particular, is extremely confused, and there is strong reason to believe that the number of species, particularly among the deer tribe, has been greatly increased by the variety of names given to the same animal in the ever varying dialects of the hill tribes. I have, however, only mentioned those of which the existence is known with some degree of certainty.

The Musk (*Moschus moschiferus*), called Kastooree, is not uncommon in the higher hills. It is said to derive its peculiar odoriferous secretion from feeding on the Kastooree plant, a kind of ground nut, which is strongly impregnated with the same pungent scent, and which the animal digs up with its long tusk. Mr. Hodgson, in a recent number of the Journal of the Asiatic Society,‡‡ expresses his belief in the existence of three different species of this animal among the Himalayas, and even assigns them distinct names; but the characters are founded entirely on the difference of colour, which is too variable to be depended on for the purpose of specific distinction; and, in fact, Lieut. Smith assures me that the colours vary with the age of the animal; a remark on which I am disposed to place the greater reliance from its agreeing with my own observations, made on many individuals preserved in the museums of this country and the Continent. Whether the "Second species of Musk," mentioned by Dr. Falconer as having been discovered during his recent journey into Cashmere and Little Thibet, be founded on more important

* Photii Biblioth. cod., 72, p. 91.
† Hist., lib. ii., c. 1.
‡ Hierozoï, lib. iii., c. 26.
§ Mundy's Tour, ii., 75.
‖ Fraser's Journey, p. 351.
¶ Hamilton's Nepaul, 79.
** Journey, 21.
†† Asiat. Res., xvi., 351.
‡‡ New Series, I., 202.

important characters, we have no means of ascertaining, that Naturalist not having yet published his observations.

Of the genus Cervus, the Chittra or Spotted Axis (*C. axis*), and the Laguna or Pâra and Sûgoriah, called also *Jhou Laghuna* and *Khar Laguna*, or spotted and brown varieties of the Hog-deer (*C. porcinus*) are common in the lower hills and forests, but do not ascend the mountains. The specific distinction or identity of the two latter animals has long been a subject of dispute among naturalists; Lieut. Smith believes that the spotted variety is only the young; but I have myself seen animals at least three or four years old, with a row of spots on each side of the spine, though, at the same time, I do not believe them to be distinct from the plain coloured or common brown variety, with which they perfectly agreed in every other respect. The subject is worth the attention of those who have an opportunity of settling the question. Three other species of the Axine group of deer are mentioned by Mr. Hodgson, under the collective name of Jaraï, but individually distinguished by the Nepalese as the Phûsro, Râto, and Kâlo, or hoary, red, and black Jaraïs respectively. The two former have been identified with the *Cervus Hippelaphus* and *Cervus equinus* of Cuvier, the latter certainly without foundation, and the former at least very doubtful; the third, said to be undescribed, is probably the *C. Aristotelis* of Cuvier; but the truth is, that we know very little about them, nor are these different species mentioned by any other author besides Mr. Hodgson. The *Cervus Hippelaphus*, indeed, called *Saumer* or *Sambre* in the Plains, is well known in this country, where he has long existed in our menageries, and is probably the *C. Aristotelis*, which is familiarly called *Elk* in the Hills, and of which the native name in the British hill provinces is *Jerow* for the male, and *Maha* for the female, names which have been not unfrequently applied to different species; of the Phûsro, or Hoary Jarai of Mr. Hodgson, which, whatever else it may be, is certainly not the *C. equinus*, since that species does not inhabit Continental India, nothing is known but the name, if, indeed, it be not a mere variety of sex or age. Lieut. Smith describes the Jerow of the Hills as a larger and heavier animal, and with finer horns, than the Saumer of the Plains: the tan and black colours of these two species appears to identify them with the Râto and Kâlo Jaraïs of Mr. Hodgson.

No fewer than three species of deer, with characters approaching to those of the common stag (*C. Elaphus*) of Europe, have been mentioned as inhabitants of Nepal. Two of these, the *Cervus Wallichii* and *Cervus Duvaucellii* of Cuvier, are known, though not so perfectly as could be wished; the third, which has been identified with the common stag, appears to be founded upon error. Mr. Hodgson has briefly described the *Cervus Duvaucellii* under the name of *C. Elaphoïdes*, and I have seen a full-grown male in the Zoological Gardens; the comparison of the skull figured by Mr. Hodgson* with the horns in the *Ossemens Fossiles* leaves no doubt as to the identity of the species. It is called in Nepal *Baraïya*, and, according to Mr. Hodgson, *Maha* in the Western Hills, a name which, as observed above, Lieut. Smith applies to the female Jerow. *Cervus Wallichii*, called *Bârah Singha*, is mentioned by Mr. Walter† as an inhabitant of the mountains of Silhet, and by Mr. Hodgson,‡ who confounds it with the common stag, as found in the Saul Forest, which skirts the foot of the Nepal Mountains, whence it was originally sent to Calcutta by Dr. Wallich. There is no grounds for supposing the existence of a third species of this group in the Himalayas, identical with the Red Deer of Europe (*C. Elaphus*), though the fact is distinctly stated both by Duvaucel and Mr. Hodgson:§ these authors appear to have mistaken the *C. Wallichii* for that animal, though the specific distinction was afterwards well known to Duvaucel, who sent to Baron Cuvier the description published in the "Ossemens Fossiles." Dr. Falconer mentions the discovery of a new species of deer in the Report of his recent Journey to Cashmere and Little Thibet,‖ and

* Journ. Roy. As. Soc., IV., 648.

† Asiat. Res., xvii, 499.

‡ Loc. Cit.

§ Asiat. Reg., xv., 120.

‖ Journ. Asiat. Soc., iv., 710.

and Dr. Royle has figured (tab. 5, fig. 1) a female under the name of *C. Dodur*, by which it is known about Saharunpore. He describes it as being about the size of the female Hirn (*Antilope cervicapra*), lighter and more graceful than the Hog-deer, and of an ashy brown colour; but this is all I know of the animal, nor do I find it even mentioned by any other writer. It appears to be unquestionably a new species, and is well worth the attention of Indian naturalists.

Of the *Muntjac* tribe of deer, I am acquainted with three distinct species inhabiting the Indian continent: one entirely black (*C. melas*), one of a light sandy fawn colour, probably the *Ratwa* of the Nepalese (*C. ratwa*, Hodg.), and the third the common Muntjac, called Kacker by the natives, and Barking Deer by the Europeans (*C. Muntjac*, Lin.), of a deeper bay and much smaller size than the *Ratwa:* the former is scarcely the size of the Roe-buck (*C. Capreolus*); the latter nearly equals the Fallow Deer (*C. Dama*, Lin.) Dr. Royle has figured the "Barking Deer" of the North Western Himalayas, v. tab. 5, fig. 2, under the name of *Cervus Rutwa*, conceiving it to be identical with Mr. Hodgson's species. All these animals may be readily distinguished from the other species of Deer, by their long projecting tusks, horns mounted upon long bony pedicles, and the glandular folds of skin on the forehead. They require, however, to be more attentively examined, and compared with one another.

Of *Hollow-horned* Ruminants, the *Ghoral* and *Thar* (*Antilope Ghoral* and *A. Thar*), are now pretty well known from the researches of Mr. Hodgson, who has set a praiseworthy example to our Indian countrymen, by the laudable zeal with which he perseveres in illustrating the Zoology of Nepal. Both these species are proper to the middle and northern regions of the Hills. The Thar of Mr. Hodgson is universally called *Surow* and *Imoo* in the more western parts of the Mountains, the latter name predominating in the higher, and the former in the lower hills: the name of Thar, according to Lieut. Smith, is there applied exclusively to the species of goat which Mr. Hodgson calls the *Jharal.* That beautiful and stately antelope, the *Chiru* (*A. Hodgsonii*), of which our knowledge is entirely due to Mr. Hodgson's researches, is confined to Bhot, Thibet, and the surrounding countries; it appears to be altogether unknown on the southern face of the Mountains, except from an occasional specimen imported by the traders, either for presents or barter. The common Indian antelope, called *Hirn*, and the *Chickarra*, or four-horned species (*A. cervicapra* and *quadricornis*), are confined to the lower hills and forests, and the *Neel-ghau* (*A. picta*) principally to the plains and jungles of the north-western districts. Mr. Colebrooke says that, in the opinion of the Hindoos, the resort of the Antelope sanctifies the countries graced by his presence, while his absence degrades the regions which he avoids. This seems more connected with physical observation than with popular prejudice. The wide and open range in which the Antelope delights is equally denied by the forests of the mountain and by the inundation of the fens.* These are the only antelopes of which we have any precise knowledge, as inhabitants of this part of India; but it is probable that others still remain undescribed. Capt. Herbert,† in his "Tour to the Sutlej," mentions two animals by the names of *Skin* and *War*, the accounts of which do not agree with any known species, and which are therefore well worth the attention of future observers. The *War*, according to Capt. Herbert, is somewhat like the *Musk Deer* (*Moschus Moschiferus*), but with a face more like that of a sheep, divided hoofs, and horns more nearly resembling those of a buffalo than of any other animal; a description which, in spite of the similarity of names, is inapplicable either to the Thar or Jharal, though indeed, little dependence is to be placed in the descriptions of unscientific observers.

The *Neel-ghau* deserves a more particular notice, for the purpose of clearing up a point in its history, equally interesting to the Classical Scholar and to the Zoologist. It has been already observed that Modern Naturalists, after the example of Baron Cuvier, have identified the great *Saumer Deer* of India with the animal which Aristotle describes by the name of *Hippelaphus.* "The *Hippelaphus*," says the Greek

* Colebrooke on Bengal Husbandry.

† Asiat. Res., xv., 397.

Greek philosopher,* "has also a mane, (he is talking of the mane of the Horse), above the shoulders, but from this to the head along the top of the neck *it is very thin;* it has a likewise a *beard on the larynx;* .....it is about the size of the Stag.....the female has no horns.....those of the male resemble the horns of the *Dorcas,* (*A. Gazelle*).....it inhabits Arachosia." Any one acquainted with the *Neel-ghau* will readily perceive the applicability of this passage to its most obvious characters: in fact Aristotle's description of this animal, under the name of *Hippelaphus,* is more exact and minute than the description of any other animal mentioned in his history; it is evidently taken from personal observation, and it is surprising that the application should have hitherto escaped the penetration both of critics and Zoologists. The older naturalists, such as Gesner and Aldrovandus may be excused for misapplying the passage in question, sometimes to the Elk, sometimes to the common Stag in his winter-dress, when the hair of the neck becomes longer than ordinary, since they were unacquainted with the form and characters of the *Neel-ghau;* but the continuation of the mistake by their successors, to whom the animal has been long familiar, is altogether unpardonable. This identification, indeed, was absurd enough from the beginning: the habitat of Arachosia, and the assigned form of the horns, were alone sufficient to distinguish the Hippelaphus from either the Elk or common Stag, independently of the critical absurdity of supposing Aristotle to describe such well-known animals at such length and under a new name: but the truth is, that all modern commentators have been misled by a wrong translation of the term Δορκας, employed by Aristotle, as the name of an animal, to the horns of which he compares those of the Hippelaphus. Now, it is to be observed that the Dorcas of the Greeks and Romans is universally admitted to be the Gazelle of Egypt and Northern Africa, as may be easily proved from many passages in Herodotus and other ancient writers. Theodore Gaza, himself a Greek, and the first translator of Aristotle, very properly renders the word by *capra,* but Buffon† having criticised Gaza's *ignorance,* and affirmed that the word should really be translated *caprea,* every body has since followed the translation of Buffon, and the *Dorcas* of Aristotle has been accordingly considered identical with the *Roe-buck,* whilst the *Dorcas* of all other ancient writers is acknowledged to be the *Gazelle.*

This seems to have been one of the principal sources of error which misled Baron Cuvier, after the example of his predecessors, to identify the Hippelaphus of Aristotle with a species of Deer. The head and skin of the large Indian *Saumer* had been sent to Paris by Diard and Duvaucel; the hair of the neck was observed to be considerably longer and coarser than that on the rest of the body, the horns had only two antlers, *like those of the Roe-buck,* and it came from India. Baron Cuvier immediately concluded that he had discovered the real Hippelaphus of Aristotle, and takes considerable pains to prove it.‡ Against this opinion of the most distinguished of modern naturalists, however, I have to urge objections as grave as those which lay against the ancient error which identified the *Hippelaphus* with the Stag and Elk. In the first place, as I have just shown, the fancied similarity of the horns of the *Hippelaphus* to those of the Roe-buck, arises from a false translation of the word *Dorcas;* when this term is properly translated, *Gazelle,* the horns of the *Hippelaphus,* to be similar to those of the *Dorcas,* should be small, round, and *without branches;*—such are the horns of *Neel-ghau,* and such are not the horns of the Saumer. In the second place, the *Saumer* Deer has certainly longer and stiffer hair on the neck than elsewhere, but it is equally long and rough *over the whole neck, as well on the sides as above and below,* and has no resemblance whatever to the mane of the Horse and Mule to which Aristotle compares it. In fact the description of Aristotle does not apply to it in any particular. *The Saumer* does not show the least appearance of the *thin mane along the top of the neck, longest and thickest on the shoulders;* neither has it anything that can be called a beard, distinct, at least from the general roughness of the neck which Baron Cuvier calls its mane. But even allowing the rough hair on the

* Hist. lib. II. c. 5. † Hist. Nat. XI. 402. ‡ Oss. Foss. IV. 42.

the under surface to be called a beard, still Aristotle's description does not apply, for this rough hair covers the *whole throat* in the Saumer from the head to the chest, whilst the Greek philosopher restricts the beard of the *Hippelaphus* to the *larynx*, and this is precisely the situation in which the long bunch of coarse hair, nearly a foot in length, is found on the throat of the *Neel-ghau*. In fact there is not a single point, even to the most minute particular, the habitat of Arachosia, for instance, the modern Punjab, where the Neel-ghau is extremely abundant, and where the Saumer does not exist, at least we have no evidence of the fact,—in which Aristotle's description of the Hippelaphus does not perfectly agree with this now well-known animal; and we may therefore safely conclude that we have at length finally settled a question which has long puzzled both critics and Zoologists. The *Neel-ghau* should consequently assume in future the specific appellation of *Antilope Hippelaphus*, whilst the Saumer Deer, to which that name has been erroneously applied, may be more appropriately called *Cervus Saumer*.

Two distinct species of the genus Capra occur in the Himalayas: *Capra jemblaïca* of Hamilton Smith, called *Jharal* in Nepal, and *Thar* in the British provinces, is by far the more common of the two, and is stated by Mr. Hodgson* to differ from other goats by having four teats. The second species has never been described, but its existence is placed beyond a doubt; Major Kennedy, while resident at Simla, had two stuffed specimens, procured in the neighbouring mountains, and the animal is mentioned by various tourists under the name of the Ibex, which it appears to resemble in the form of the horns and other characters. Dr. Falconer, in the Report of his late Journey to Cashmere and Little Thibet, mentions the discovery of two new species of goats; but as he does not enter into any detail on the subject, we have no means of ascertaining how far they may prove to be identical with, or different from, the two species here mentioned. Different varieties of the domestic goat, the most valuable of which are the *Changra*, or shawl goats, of two breeds, distinguished as the larger and the smaller Changra, are found in the more alpine regions; their wool forms an article of extensive traffic, but we are much in want of detailed comparative descriptions and good figures of these, as of all the different breeds of cattle and other domestic animals in India; a subject of great interest, which has been extensively illustrated at home, but which has met with little or no attention out of Europe.

Of sheep there are likewise two wild species, and numerous domestic varieties, found in these mountains. The *Burrhal*, called *Nahoor* by the Nepalese (*Ovis Nahoor* of Mr. Hodgson), is intermediate in character between the Mouflon (*O. Musmon*) of Corsica, the supposed parent of our domestic sheep, and the Aoudad (*O. tragelaphus*) of Northern Africa, which latter species it resembles in the form of the horns and the absence of the crumens, or tear-pits, which distinguish the rest of the genus. The second species, called *Banbhera* in Nepal, is less known, but appears to approach very nearly to the Argali of Siberia (*O. Ammon*), if, indeed, it be not identical with that animal. I have seen the skull and horns in the Museum of the Royal Asiatic Society, to which it was presented by Sir Alexander Burnes; but as there is no specimen of the Argali in this country with which to compare it, I can offer no opinion as to its specific difference. The animal seems to be more properly a native of Thibet and Chinese Tartary, and seldom appears on the southern part of the Himalayas; at least none of my sporting acquaintances ever met with it, and Mr. Hodgson was long doubtful of its existence. Of the domestic sheep of the Hills, besides the Dûmba, or common variety of Upper India, Mr. Hodgson mentions a breed called *Barwal* as occurring in the Kachar, and another called *Hoaniah*, peculiar to Thibet: these are used as beasts of burden for carrying grain and other products across the mountains, but we know little of their peculiar forms or qualities.

Of the genus *Bos*, the buffalo (*B. Bubalus*), and its representative, the *Arnee*, or *Urnee Bhinse*, are confined to the sultry forests at the foot of the mountains. The latter is a very distinct variety, if not a different

* Journ. Asiat. Soc., iv. 710.

different species, from the *Junglee Bhinse* of Bengal and Assam, so well known for the great length of its horns; the *Arnee* of the Saul forest is the short thick horned variety, of which there are many skulls, preserved in our Museums, and is said to be a much lighter made animal, though with a thicker skin than the *Junglee Bhinse.* The Zebu (*Bos indicus*) is common in every part of the Hills; but the peculiar and appropriate species of the Himalayas is the Changree, or Yak (*Bos pœphagus*, Pallas), which composes the domestic cattle of Tartary, and is not uncommon on the southern slopes of the higher Mountains, where a cross between it and the Zebu, or common Indian Ox, is much used in agriculture, and preferred to either of the pure races. This hybrid is not uncommon at Simla, and it is to be hoped that some intelligent observer will take advantage of this circumstance to ascertain from actual experiments whether the sexes be productive *inter se*, or when united with one of the pure races; or whether, like the common mule, they be absolutely barren. Lieut. Smith informs me that he has seen the Yak wild on the confines of Chinese Tartary.

LIST OF BIRDS

IN THE

AUTHOR'S COLLECTION MADE AT SAHARUNPORE AND IN THE HIMALAYAS.

RAPTORES.

Vulturidæ.

Vultur leuconotus—*gid.* Saharunpore and Kheree Pass.

Gypaetus barbatus—Simla.

Neophron Percnopterus—*Cheel*—Saharunpore.

Falconidæ.

Haliæetus—Saharunpore.

— Pondicerianus — *Choohmar* — Saharunpore.

Astur Hyder—Saharunpore—migratory.

Accipiter Nisus—Hills.

— Dussumieri—Saharunpore.

Hæmatornis undulatus — *Foorjbaj* — Saharunpore.

Falco peregrinus—Hills.

— Chicquera—*Shikra*—Hills, visits plains.

— pallidus, mas. fem. — Saharunpore, killed in S. B. G.

— cinereus ?—*buchree*—Hills.

Circus variegatus—Saharunpore.

— Teesa—*tesa*—Saharunpore.

Pernis apivorus—Saharunpore.

Elanus melanopterus —*Dhobun* — Saharunpore, banks of rivulets.

Milvus Govinda—Saharunpore.

Strigidæ.

Otus bengalensis—*oolloo*—Saharunpore.

— brachyotos — *oolloo* — Saharunpore district.

Strix passerina—*putohree*, H. *chogud*—Saharunpore.

Noctua—Saharunpore district.

INSESSORES.

FISSIROSTRES.

Meropidæ.

Nyctiornis Amherstiana—Deyra Doon.

Merops javanicus—*hurriul*—Saharunpore.

— viridis—*hurriul*—Saharunpore.

Hirundinidæ.

Cypselus affinis—*Huwa bilbill. kunchya*—Plains.

Hirundo filifera—*Ababeel*—Plains.

— erythropygia—*Ababeel*—Plains.

Hirundo —

Caprimulgidæ.

Caprimulgus indicus—*Chupka*—Plains.

Todidæ.

*Eurylaimus Dalhousiæ—Mussooree—in Rains Tab. vii. fig. 2, Jameson, Edinb. Phil. Journ.

Halcyonidæ.

Alcedo rudis—*goree macherunga*—Plains.

— Bengalensis — *golee macherunga*—Plains and within hills.

Halcyon Smyrnensis—*muchee mar ; macherunga* —Plains.

DENTIROSTRES.

Muscicapidæ.

Muscicapa.

— several species—Plains.

Muscipeta Melanops.

— Paradisii—*Sa-boolbool*—Foot of hills.

Muscipeta indica—*boolbool*—Foot of hills.

Rhipidura albifrontata—*Chukdeel*—Plains.

— fuscoventris—*Chukdeel*—Plains.

Cryptolopha poiocephala.

Phœnicornis princeps—*Sahelee*—Hills.

— peregina—*Sahelee*—Hills.

Laniadæ.

Dicrurus Balicassius—*Jhamp*—Plains.

Hypsipetes Psaroides—Hills.

Lanius muscicapoides—*lutora*—Plains.

—

Collurio Lahtora—*lutora*—Plains.

— erythronotus—*lutora*—Plains.

— Hardwickii—*lutora*—Plains.

— undetermined.

Ceblepyris—Hills.

Merulidæ.

Myophonus Temminckii—*Custoora*—Hills.

— Nepalensis.

* Pitta Brachyura, v. Tab. vii. fig. 3—Hills.

Turdus saularis—*dhier*—Plains.

— — *dhier*—Plains.

— atrogularis—Hills.

— pæcilopterus—Hills.

— erythrogaster.

— albocinctus, Royle—Hills.

* — *albicollis*, Royle, v. Tab. viii. fig. 3.

Cinclosoma leucolophum—Lower hills.

— melanocephalum—Hills.

— striatum—Kheree Pass.

Oriolus aureus—*peeluk*—Plains and Kheree Pass.

— melanocephalus—*peluk, zurduk*—Plains and Kheree Pass.

Timalia Somervillii—*Doomnee, Chutrea, Sutbuya* —Plains.

— chataræa—*Cheelchel*—Plains.

Petrocincla cinclorhyncha—Hills.

Ixos melanocephalus—Hills.

— cafer—*boolbool*—Plains. *kandoo boolbool* —Hills.

Iöra Tiphia.

Sylviadæ.

Sylvia sibilatrix.

— rufa—Plains.

— Trochilus.

— several species—undetermined.

— *kalcheera*—Plains.

Motacilla alba—*meemla* — Saharunpore, in cold weather.

— Dukhunensis—*meemla*—Saharunpore, in cold weather.

Phœnicura atrata—*thurthur kumpa*—Plains.

— frontalis—*thurthur kumpa*—Plains.

— leucocephala—*kaleepholia*—Mohun Ghat.

— cæruliocephala.

Budytes melanocephala — Saharunpore — Near water.

Enicurus maculatus—*khunjun*—Hills.

Anthus agilis—Plains.

Zosterops.

Saxicola rubicola.

— bicolor—Plains.

Pipridæ.

Parus melanophus.

— erythrocephalus.

— xanthogenys.

— monticolus.

CONIROSTRES.

Fringillidæ.

Emberiza—*Cheerya*—Hills.

— Cia—Hills.

— cristata—Hills.

Alauda—Plains.

— Plains.

— Plains.

* Carduelis caniceps—*Saira*—Cashmere, v. Tab. viii. fig. 2.

— spinoides—*Saira*—Cashmere.

Ploceus—*Denarbuya*—Plains.

— Phillipensis—*Phool buya, Chichur buya*—Plains.

Fringilla rodochroa—*Cheerya*, Plains. Hills.

Lonchura nisoria — *Nuggernul muena* — Deyra Doon.

— melanocephala—Deyra Doon.

— Cheet—*Churchura*—Plains.

Passer domestica—*Cheerya*—Plains.

Pyrrhula erythrocephala—Hills.

Sturnidæ.

Sturnus vulgaris—*tilliur*—Plains, in spring.

Pastor tristis—*bel salik*—Plains.

— roseus—*goolabee muena*—Plains.

— pagodarum—*kumooa paoee*—Plains.

— Mahrattensis—*dhudhee*—Plains.

— — *ubluk*—Plains.

Corvidæ.

Pica erythrorhynca—Hills.

Dendrocitta vagabunda—*lat.*—Kheree Pass, visits plains.

Garrulus lanceolatus—Mussooree.

* — bispecularis—Mussooree, v. Tab. viii. fig. 1.

— leucocephalus—Hills.

Corvus Corax—*puharee kag*—Hills, visits plains.

— splendens—*desee kag*—Plains.

Coracias Bengalensis — *gurrar, neel tas, neel kunth*—Plains.

Buceridæ.

Buceros gingianus — *Dhuner*, — Kheree Pass, visits S. B. G.

— Cavatus—Hurdwar, Kheree Pass.

SCANSORES.

Psittacidæ.

Palæornis torquatus—*tota* H.—Plains.

— flaviclolaris—*tooyan*, H.—Plains.

— Alexandri—*gullur tota*—Hills.

— schisticeps—Mussooree.

Picidæ.

Bucco grandis—*Busunt kulan*—Mussooree.

— Philippensis, mas. and fem.—*Busunt*—S. B. G.

— caniceps—Mussooree.

Picus Bengalensis—Deyra Doon and Kheree Pass.

Picus Malaccensis.
— Mahrattensis.
— Squamatus, fem.—Mussooree.
— — young male.—Mussooree.
— Strennus — *lukkur kut (wood-cutter)* — Kheree Pass. Deyra Doon.
— Himalayanus—Mussooree.
— Hyperythrus.
— Nepalensis.
— brunnifrons.
Yunx Torquilla—S. B. G—migratory.

Cuculidæ.
Antropus phillipensis—*joolaha, Makooha*, H.
Coccyzus chrysogaster—Saharunpore district.
Leptosomus afer — *papeea* — S.B.G. — Rains, note *peeo-peeo.*
CuculusCanorus—*Kookoo*—Hills, warm weather —Saharunpore, in rains.
— fugax—S.B.G.—migratory, March.
— sparverioides—*Chip Cheep*, H.—S.B.G. —migratory, March.
— Himalayanus.
Eudynamys orientalis — *koel*— S.B.G.— April, till end of rains. fem. *khohal*—S.B.G.

Certhiadeæ.
Certhia Goalpariensis, v. Tab. vii. fig. 1—Deyra Doon.
Upupa Epops—*hood hood, thok budhya*—Plains.

Tenuirostres.
Cynniridæ.
Cynniris Mahrattensis.

Meliphagidæ.
Chloropsis—Hills.
Pomatorhinus.
— erythrogenys—Hills.
Prinia—Hills.

Rasores.
Columbidæ.
Vinago sphenura—*huryul*—Mussooree.
Columba Meenah—*punduk*—Plains and hills.
— tigrina—*chitla*—Plains.
— humilis—Manukmow.
— Cambayensis—S.B.G.
— leuconota.
— javanica—Deyra Doon.

Phasianidæ.
Gallus Bankiva—*junglee mor*—Hurdwar, Kheree Pass, Deyra Doon.
Gallus Sonnerati.
Lopophorus Impeyanus—*Monal, Moorg zureen* —Dhunoultee, Mussooree, Choor.
Pavo cristatus, (mas. and fem).—*mor* — Hurdwar.
Tragopan Hastingii (*Satyrus melanocephalus*)— —*jeenar*—Hills, near snow.
Phasianus Pucrasia—*koklas*—Mussooree.
— albo-cristatus—*Kalij*—Kheree Pass.
— Wallichii (*P. Staceyi*)—*Cher*—Tuen Tibba, &c.

Tetraonidæ.
Coturnix textilis—*butter*—Plains.
— Pentah—Plains.
Perdix Chukor—*Chukor*—Hills, passim.
— olivacea—*teetur*—Mussooree—Hill partridge.
— Ponticeriana — *teetur* — Saharunpore — Grey partridge.
Pterocles exustus, fem.—Kheree.
Francolinus vulgaris, mas. and fem.—*kala teetur*— Plains and hills—Black partridge.
Hemipodius nigricollis—*luwe*—Plains.

Struthionidæ.
Otis aurita—*leek*—Foot of hills.
— deliciosa (Bengalensis)—*churg*—Kheree Pass.

Grallatores.
Ardeadæ.
Ardea cinerea—Saharunpore.
— vulgaris—*kang*—Saharunpore.
— Antigone—*Sarus*—Saharunpore district.
— Egretta—*Suffed boogla*—Saharunpore.
— Malaccensis—*kanee bug*—Saharunpore
— russata—*Suffed boogla*—Saharunpore district.
— Grayii—*Goroo bug*—Saharunpore district.
Botaurus stellaris—Saharunpore district.
Ciconia Australis.
— leucocephala—*Manuk jor*—Saharunpore district.
Mycteria—*loa jung*—Saharunpore district.

Tantalidæ.
Anastomus Typus—*Siam khol*—Saharunpore.
Tantalus leucocephalus—*Jhangeer*—Saharunpore district—Rains.
Ibis religiosa—*kuechea chora, keethee chora*—Saharunpore district.—October.

Scolopacidæ.
Numenius, black — Saharunpore, common in April.
Totanus fuscus—Saharunpore.
— glottoides—*Choghul*—Saharunpore.
— glareola—Saharunpore.
— —
Limosa melanura—Saharunpore.
Scolopax rusticola—Nalapanee, Mussooree.
— Gallinago—*Chaha*—Saharunpore.
Rynchæa capensis—*Chaha*—Saharunpore.
Tringa ochropus.
Two or three undetermined species.

Charadridæ.
Cursorius asiaticus—Saharunpore.
Vanellus goensis—*tuteree*—Saharunpore.

Rallidæ.
Parra Sinenis—*Jul peea*—Saharunpore, and Manukmow, in rains.
Glareola orientalis—Saharunpore.
Rallus aquaticus—Doulutpore jheel.
Crex pusilla—Saharunpore in Demola nuddee.
Gallinula javanica—*Jul Moorg*—Saharunpore.
— undetermined—*kora*—Saharunpore.
Porphyrio hyacinthinus—*kan*—Dadoopore.
Fulica atra.

Natatores.
Anatidæ.
Anser indica—Saharunpore.
Plectropterus melanotus—*Nukta*—Saharunpore.
Anas leucophthalmos—Saharunpore.
— pæcilorhyncos—Saharunpore.
— cristata—Saharunpore.
— Crecca—Saharunpore.
— clypeata—Saharunpore.
— Girra—Saharunpore.
— Penelope—Saharunpore.
— Querquedula — Saharunpore — Native name *buttuk* and *moorghabbee*, of most of the species.
Mareca Awsuree—Saharunpore.
— fistularis—Saharunpore.

Pelicanidæ.
Pelecanus Onocrotalus-*gugun bher*-Manukmow.
Phalacrocorax Javanicus—*Jul kag*—Mozuffer nuggur.

Laridæ.
Sterna Seena—*Gang cheel*—Saharunpore.

In publishing the foregoing List of Birds, the Author hoped it would have been accompanied by observations on their Geographical distribution by a distinguished Ornithologist. This, it is hoped, will still be done, with a more complete List than it is now possible to publish. Though the specimens have not been subjected to a minute comparison with the species indicated, yet, as Mr. Vigors, Mr. Gould, Col. Sykes, aud Dr. Horsefield, have seen and named the Birds, there can be little doubt respecting the correctness of the names published.

Mr. Ogilby has justly observed, p. lvii, that as the faculty of rapid flight enables birds to set oceans and deserts at defiance, so it enables them to choose their own temperature and climate, and therefore renders them not so well adapted as Mammals and fresh-water fishes for studying all the laws of Geographical distribution. But as they transport themselves from one country to another, as the seasons vary and become favourable for affording them food and a suitable climate, so are they better adapted than any other class of animals for appreciating the changes which take place in the climate of a place at different seasons of the year; so much so, indeed, is this the case, that in some places many of the operations of husbandry have been regulated by the appearance and disappearance of birds. Knowing the changes which take place in the climate, vegetation, and cultivation, both of the plains and mountains of India, as shown in the Meteorological Observations, p. xxxvii*, and at pp. 7, 9, 13, 14, 16, 20, &c. and that the animal forms varied also according to seasons as well as elevations, two plates of birds are figured, while a few of the animals of different elevations are enumerated at pp. 6, 11, 12, 19, 24, 37, and 41. Birds (Plate 8) characteristic of the Himalayas, being in form allied to those of European climates, are *Carduelis caniceps, Garrulus bispecularis*, and *Turdus albicollis*, Nob., of which the specific name should be changed to *T. albocinctus*, as the former name is pre-occupied. Tropical forms, as exhibited in *Certhia Goalpariensis, Pitta brachyura*, and *Eurylaimus Dalhousiæ*, are represented in Plate 7, as these, though common to the S.E., occur so far North as 30° of latitude, in small numbers, and only during the rainy season, of which the peculiarities of climate and vegetation are indicated in the above-cited passages. The specimen of *Eurylaimus Dalhousiæ* figured was shot at Mussooree, at 6,500 feet of elevation. This species was first described by Professor Jameson, in the Edinburgh Journal of Science, and not by Mr. Wilson, as indicated in the Plate, and as I had been erroneously informed.

CORRIGENDA ET ADDENDA.

Page. Line.

viii — 4 from bottom, for lat. 28° *read* lat. 23°.
ix — 9, for Eastern *read* Western.
x — 12 from bottom, for N.E. and S.W. *read* N.W. to S.E.
x — 10 from bottom, for to 24° of latitude *read* 27° of latitude.
x — 10 from bottom, for long. 75° *read* 74°.
x — 10 from bottom, for long. 90° E. read 95° E.
xi — 7, for Patna 5° *read* Patna 4°.
xii — 5, for N.E. *read* N.W.
6 — 13, for Fagonia Mysoriensis *read* Mysorensis.
6 — 14 from bottom, for Xanthochymus dulcis *read* pictorius.
7 — 14, for khadir *read* bangur land.
7 — 15, for bangur *read* khadir.
8 — 14 from bottom, for ocymum *read* ocimum.
9 — 21, for Lolium temulentun *read* temulentum.
9 — 6 from bottom, for Forskaol *read* Forskal.
12 — 2, from bottom, for Boa constrictor *read* Python.
13 — 20, for Bauhinia corymbosa *read* racemosa.
17 — 3, for Apocyenæ *read* Apocyneæ.
20 — 25, for Geoneptrix *read* Goneptrix.
22 — 4 from bottom, for stawberries *read* strawberries.
22 — 19, for Napalensis *read* Nepalensis.
26 — 29, for Saussurea religiosa *read* Dolomiæa macrocephala.
26 — 6 from bottom, for Gualtheria *read* Gaultheria.
27 — 5, and page 30 lowest line, for Trophis *read* Trapa.
28 — 10, for Cucubalus baccifer *read* bacciferus.
28 — 29, for southward *read* south-east.
29 — 12 from bottom, for C. Sasanquha *read* Sasanqua.
32 — 6, for Abies excelsa *read* Pinus excelsa.
32 — 13, for Carduus macrocephalus *read* Dolomiæa macrocephala.
33 — 19, for Squarrosa *read* Squamosa.
35 — 18 and 37, also page 40 line 14, for Genista *read* Caragana.
36 — 26, for Lophophurus *read* Lophophorus.
45 — 7 from bottom, for Delpia *read* Delphia.
45 — 9 from bottom, for Aconitia *read* Aconitina.
54 — 11, for accidens *read* accedens.
54 — 28, for p. 48 *read* p. 44.
71 — 15, before Brassica Napus *insert* Rape.
71 — 16, before Myagrum *insert* Colsa.
84 — 14, for Sida abutilon *read* Sida tiliæfolia.
105 — 4 from bottom, for Dipterocarpeæ *read* Dipterocarpus.
118 — 17, and p. 122 line 4 from bottom, for Elæococcus verrucosus *read* Elæococca verrucosa.
119 — 9 from bottom, and p. 168 line 5, for Evonymus *read* Euonymus.
121 — 4, for Evonymus micranthus *read* Euonymus micrantha.
127 — 27, for Tab. 25 *read* 24.
132 — lowest, for Siam *read* China.
133 — 14, for Mæsua *read* Mesua.
137 — 11 from bottom, for Dodonæa *read* Dodonæaæ.
146 — 24, for quantas *read* quintas.
155 — 12 from bottom, for *μολη read μωλυ*.
157 — and elsewhere, for Zanthoxylum *read* Xanthoxylum.
161 — lowest, for Elais *read* Elæis.

Page. Line.

164 — 3, for Venice turpentine *read* Chian.
164 — 4, for laudanum *read* ladanum.
167 — 21, for C. Royleanus *read* Royleana.
167 — 22, for C. spinosus *read* spinosa.
168 — 17, for M. Brongniart *read* Adolphe Brongniart.
170 — 2 from bottom, for 4,038 & 7,443 *read* 4038 & 7443.
171 — 21, for Excæcaria Agallochum *read* Agallocha.
181 — 4, for Cesalpineæ *read* Cæsalpineæ.
182 — 6, and page 183 line 17, for A. leucophæa *read* leucophlæa.
185 — 25, after Cassia auriculata *add* turwar.
188 — 9, for ou *read* on.
189 — 25, for Crotalaria *read* Crotolaria.
195 — 4 from bottom, for yield Dragon's blood *read* yield a kind of Dragon's blood.
196 — 24, for Tab. 34 *read* 32.
196 — 32, for Tab. 34 *read* 32.
196 — 41, *dele* such and as.
197 — 12 from bottom, for Hb. Hm. *read* Hb. Ham.
233 — 6, in Osmorrhiza *dele* r.
239 — 9, for 10° of N. & S. *read* 10° of N. & 20° of S.
240 — 12, for of 20° *read* of 30°.
246 — 10 from bottom, for E. nivea *read* niveus.
246 — 9 from bottom, for cornigera *read* cornigerus.
250 — 11 from bottom, for *χαμαιδρις read χαμαιδρυς*.
253 — 14 from bottom, for thalactrifolia *read* thalictrifolia.
256 — 2, for symplicifolia *read* symplocifolia.
256 — 10, for macrocarpum *read* macrocarpus.
259 — 22, for chrysanthemum *read* chrysanthum.
268 — 8, for J. fruticosum *read* Jasminum fruticosum.
270 — 10 from bottom, for idnebted *read* indebted.
273 — 8 from bottom, for sylvestris *read* sylvestre.
274 — 12 from bottom, for ashmatica *read* asthmatica.
274 — 7 from bottom, for curassivica *read* curassavica.
295 — 14, for Tab. 70 *read* 72.
298 — 6, for boerhaviæfolia *read* boerhaavifolia.
309 — 18, insert Tab. 69, fig. 1.
309 — 20, insert Tab. 69, fig. 2.
323 — 27, for India *read* Asia.
324 — 21, for Beilschmeidea *read* Beilschmiedia.
329 — 26, for fig. 2 *read* fig. 3.
329 — 33, for fig. 3 *read* fig. 2.
344 — 23, for Dundar *read* Durdar.
360 — 27, for Mandrogora *read* Mandragora.
364 — 6, for Pleurothallideæ *read* Pleurothalleæ.
370 — 15, for compestris *read* campestris.
388 — 15, insert Tab. 92, fig. 1.
388 — 27, insert F. verticillata, Tab. 92, fig. 2.
388 — 4 from bottom, for fig. 1 *read* fig. 2.
413 — 6 from bottom, for S. maritima *read* Scirpus maritimus.
416 — 14 from bottom, *dele* stop between Saccharum and Sara.
420 — 18 from bottom, for P. miliare *read* Panicum miliare.
421 — 26, for Jonas *read* Janus.
440 — 14, for c. 73 *read* c. 83.

As the dates of publication of the several Numbers of this Work have been spread over many years, they are here adduced for the sake of reference.

No. 1	...	Pages 1 to 40	appeared in	September	1833.
2	...	... 41 to 72	...	... March	1834.
3	...	... 73 to 104	...	... June	1834.
4	...	... 105 to 136	...	... September	1834.
5	...	... 137 to 176	...	... January	1835.
6	...	... 177 to 216	...	... April	1835.
No. 7	...	Pages 217 to 248	...	... August	1835.
8	...	... 249 to 288	...	... December	1835.
9	...	... 289 to 336	...	... May	1836.
10	...	... 337 to 384	...	... February	1839.
Supp. No.	...	... 385 to 472, and Introduction, from p. xxi. to lxxviii. with Table of Contents and Indexes	...		1840.

ILLUSTRATIONS

OF THE

BOTANY OF THE HIMALAYAN MOUNTAINS.

THE introductory observations having enabled us to appreciate the extent and general nature of the territories comprised within the boundaries of India, and shown the general uniformity, or rather almost insensible gradation of temperature, on which so greatly depends the natural distribution of animal and vegetable forms, as well as those which are the product of art, we now proceed to the more immediate object of this work; that of illustrating the Flora of the Himalaya Mountains. Here we shall find the changes in climate more rapid at successive elevations, and the modifications in plants correspondingly great, whether we ascend the great mountain ranges near the Southern extremity of India or those towards its most Northern limits. It is necessary only to enumerate the sources whence our information has been drawn, to show that these have been sufficiently extended to allow some reliance being placed on the inferences which are deduced.

The situation of the Honourable Company's Botanic Garden at Saharunpore in 30° of Northern latitude, one thousand miles to the north-west of Calcutta, elevated as many feet above the level of the sea, and placed nearly at the head of the extensive plain which forms the great Gangetic valley, was admirably adapted for enabling an observer to obtain a knowledge of the Flora of the plains of Northern India, as well as of the Himalayan Mountains, it being within thirty miles of the commencement of the successive ranges which form that great barrier between the dominions of the British and the territories of the Chinese.

The herbarium consists of at least 3,500 species; collected, 1st, in the plains which form some of the north-western provinces of India, from 28° to 31° of N. lat. or from about Delhi to the banks of the Sutledge; 2d, of plants growing in the mountainous tract included between the latter river and the Ganges, or between 30° and 31½° of

N. lat. from the level of the plains up to the Snowy Passes; with these may be enumerated the plants of Cashmere, which can only be considered a valley of the Himalaya; the third portion consists of plants from Kunawur, a country which being beyond the influence of the periodical rains, has its climate, and consequently many of its animal and vegetable productions, sufficiently modified to entitle them to a separate consideration.

The researches both in the hills and the plains having been carried on at all seasons for a series of years, the collection may be considered as giving (with the exception of the lower tribes of *Cryptogamic* plants) a very fair idea of the Flora of that part of India.

The plants from Cashmere were obtained in 1828, 1829, and 1831, by means of native plant collectors sent with the northern merchants, on their return to that valley after disposing of their annual investments of fruit and shawls in the plains of India. Along with dried specimens, seeds and living plants were also brought down, and grown either in the Saharunpore Botanic Garden or in the Experimental Nursery in the Hills. This collection can only be considered as giving a general idea of the nature of the Flora of that far-famed valley.

The collection from Kunawur, consisting of several hundred species from a cold and arid country, made in two years during the seasons of vegetation, will give a very good idea of the nature of the Flora of that tract. The first collection was made for me in 1825, by the late Lieutenant Maxwell, of his Majesty's 11th Dragoons, and the second by my plant collectors in 1831. With these, through the kindness of the distinguished Mr. Brown, I have had an opportunity of comparing a collection in his possession, made by R. Inglis, Esq. of Canton, in the year 1830, as well as a small collection in the British Museum made by that adventurous traveller the late Mr. Moorcroft, in his journey beyond the Himalaya; a few specimens from the same tract of country sent to Dr. Wallich by Messrs. Webb, Moorcroft, and Gerard, may be seen in the East-India Herbarium.

That attention may not appear to have been confined to too limited a portion of the Himalaya, the magnificent herbarium formed by Dr. Wallich, and presented by the Honourable the Court of Directors of the East-India Company to the Linnean Society, has been constantly consulted, for the purpose of showing either analogy or difference in the vegetation of different portions of the Himalayas. The plants of these mountains in the above collection consist of specimens from Dr. Wallich's plant collectors in Kemaon, a portion of the Himalaya extending from the Ganges to the Gogra, together with many sent by Drs. Govan and Gerard, from Garhwal and Sirmore. The great proportion, however, consists of plants collected by Dr. Wallich himself in Nepal and its mountains, together with some from the same country collected by Dr. Buchanan Hamilton. The most southern and also most western point from which any considerable collection has been obtained by Dr. Wallich's plant collectors is from the mountains above Silhet and Pundooa,—so that

that the space whence the several collections have been formed extends over ten degrees of latitude and nearly twenty of longitude.

Though there is no intention, in the present work, of treating of the Botany of India in general, yet as it is proposed particularly to note, not only the difference in the vegetation of the Hills and of the Plains and the distribution of particular families, but also for what other plants, chiefly the useful products of similarly constituted countries, India is peculiarly adapted, it may not be improper to remark, that the observations respecting the distribution of different tribes will be deduced from the collections and works of Drs. Roxburgh and Buchanan, Wallich and Wight, as well as from the author's own collections made in the most northern provinces of India.

It is hardly necessary, after the liberality with which Dr. Wallich placed his treasures in the hands of the Botanical World, to mention, that previous to his departure for India he expressed his most anxious desire that every possible use should be made of that portion of his collection which he had not himself had an opportunity of publishing, and joined in an application to the Honourable the Court of Directors, that his unpublished drawings should be placed at the disposal of the author for the purpose of selections being made for the present work. Major-General Hardwicke has also most kindly placed in the author's hands ten volumes of drawings made in the plains of Northern India, and also while travelling nearly thirty years ago in the Himalayas. These, when so used, will be duly acknowledged, but the greater portion of the illustrations will be from drawings made under the author's own direction. These were executed by the Honourable Company's painters, who during Dr. Wallich's absence in England were by the orders of the then Governor-General of India, the Earl of Amherst, sent from the Botanic Garden at Calcutta to that of Saharunpore.

Some explanation may perhaps be expected upon the preference given to the publication of the illustrations according to the natural families, as well as upon the particular series which has been adopted. For the latter no better reason than that of convenience can be assigned, as the celebrated De Candolle is the only botanist who has attempted an arrangement of all plants according to their natural families. For the adoption of the natural method of classification, no apology is in the present day necessary, as the advantages have been so frequently displayed ever since the illustrious Mr. Brown proved them in his Prodromus of the Plants of New Holland, and has so often illustrated them by his luminous observations on the Flora of different countries; a course which has been followed by the great Humboldt and other celebrated botanists. For whether we consider the structure, classification, geographical distribution, properties, or uses of plants, in every way does the natural method afford numerous advantages, particularly as our observations, instead of being confined to species and genera, may in general be made applicable to whole tribes of plants.

This we shall see to be more particularly the case in noticing the geographical

 distribution

distribution and uses of different families of plants, and in making the application to India of the result of our observations; for no where is the field more extended, and at the same time more favourable for acclimating the useful productions of different countries. In the peninsula of India, and in the neighbouring island of Ceylon, we have a climate capable of producing cinnamon, cassia, pepper, and cardamoms. The coffee grown on the Malabar Coast is of so superior a quality as to be taken to Arabia and re-exported as Mocha coffee; the Tinnevelly senna brings the highest price in the London market; and there is little doubt that many other valuable products of tropical countries may be acclimated, particularly as several are already in a flourishing condition in the Botanic Garden at Calcutta, such as the cocoa and nutmeg, as well as the camphor, pimento, cajeput, and cashew-nut trees. In the Neelgherries a favourable site might without doubt be found for the cinchona, as well as the different kinds of ipecacuanha; and as the potatoe has been introduced into almost every part of India, equal success and considerable benefit would probably result from introducing the different kinds of arracacha, so much prized for their roots as food for the natives of South America.

Along the coasts of the Bay of Bengal the cocoa and areca-nut palms flourish and abound, and the continent every where produces indigo, cotton, tobacco, sugar, and opium. The first, hardly of any note as an Indian product thirty years ago, is now imported in the largest quantities into England. The cotton, though indigenous to India, has not been in any way improved, though many provinces seem peculiarly well adapted for the culture, particularly Malwa, and those to the north-west. The tobacco brought home by Dr. Wallich from Martaban was pronounced by competent judges in England to be equal to the best from America; while the Persian tobacco, the produce of a peculiar species, the *Nicotiana persica* of Dr. Lindley, is celebrated, and commands a high price both in India and Europe. This, there is every probability in considering, would succeed well in the N.W. provinces which are nearest its native country. The opium of Patna is preferred in China, and that of Malwa bids fair to rival Turkey opium in the European market. The sugar-cane is cultivated in every part of India, but very inferior sugar has hitherto been produced; lately, however, a manufactory has been established near Calna, a new mine opened in the Burdwan coal formation, and very superior specimens of sugar sent home. Here the occurrence of sugar at the surface of the soil, and coal only a few feet below it, in a country where labour is so cheap, ought to be attended with decidedly favourable results. If from these we turn our attention to other products, we shall still see that there are great capabilities even where we should least expect them: for though India is generally looked upon chiefly as a rice country, wheat has been imported into and sold at a profit in England from the northern provinces, and flour for making starch is now one of the annual exports from Calcutta. Of dyes, medicinal drugs, resins, and gums, there are great varieties, and more might be successfully introduced. Timber of every kind is every where abundant, the coasts producing

ducing teak, ebony, and many others; the interior, saul, sissoo, bamboos, and rattans, while a great variety of plants, though but little known, yield excellent material for cordage.

The northern provinces and the hills forming the more immediate object of this work, will be more fully considered in the sequel; it is sufficient at present to observe, that at one season they grow European grains and at another those which are peculiar to the tropics: and that many perennials of both these two climates seem to succeed equally well in the northern provinces of India; here, therefore, many of the useful products of Persia, Arabia, and Barbary, might be grown.

The hill provinces enjoy nearly similar advantages; the forests are formed of oaks and pines, and the hill-men make their strongest ropes for crossing rivers with hemp, which every where abounds and is of the finest quality; opium, rhubarb, and turpentine, form articles of commerce, as well as musk, Thibet wool, and borax from the other kingdoms of Nature.

Somewhere in the valleys at the foot of these hills, or at moderate elevations, the more generally useful productions of European countries might be successfully introduced, as the olive and the hop; the latter would be particularly beneficial, as a brewery has been established in the hills, where the climate is excellent.

Here also, as I have recommended in a report to Government, there is considerable prospect of success in the cultivation of the tea plant, for the different elevations allow of every variety of climate being selected, and "the geographical distribution of this plant is sufficiently extended to warrant its being beneficially cultivated."

The above few examples will be sufficient to show that in the climates where these varied productions grow, others from different countries may be successfully introduced. It is not to be expected that equal success will attend every attempt, but where so many circumstances are favourable there is little probability of failure in many, if the proper means are adopted for ensuring success; and these consist chiefly in applying to one country our knowledge of the climate and productions of another, where any similarity of circumstances occur; and I entertain sanguine expectations that, with moderate attention and proper encouragement, the products of India may be still more varied, almost indefinitely increased in quantity, and very much improved in quality. Hitherto, instead of endeavouring to call forth the resources of the country, it seems rather to have been wished to repress its energies, by charging upon articles of well-known inferior quality a higher duty if imported from the East-Indies than from other parts of the world.

Having mentioned that considerable uniformity of temperature and of vegetable productions occurs over a very great expanse of Indian territory, we proceed to adduce specimens from some of the most northern parts as an indication of the truth of the observation. Delhi, the capital of Northern India, situated on the western bank of the Jumna, nearly at the upper part of the inclined slope which forms the plains of India, is elevated about eight hundred feet above the level of the sea. The soil is barren and

remarkable

remarkable for its saline efflorescence, and the wells for the brackishness of their water. The rocky soil, always exposed to the solar rays, absorbs much heat, and a high temperature with considerable dryness is produced in the hot weather; but from the openness of the country, and exposure to winds which pass over extensive lakes in the vicinity, a greater degree of cold is produced in winter than we should otherwise expect. We do not therefore find in the Flora round Delhi such plants as *Guttiferæ*, *Anonaceæ*, and *Strychneæ*, which requiring moisture with heat, flourish in the southern provinces of India. But the climate in general being favourable, and the minimum of cold not long continued, we find many of the plants which are common in warmer parts of India, but which are not found at Saharunpore. Among these may be enumerated *Ailantus excelsa*, *Prosopis spicigera*, and *Salvadora persica*, with *Capparis aphylla*, and species of *Hibiscus*, *Grewia*, and *Flacourtia*, as shrubs, together with such herbaceous plants as *Anisochilus carnosus*, *Ærua Javanica*, *Elytraria crenata*, *Fagonia Mysoriensis*, *Lepidagathis cristata*, *Acanthus Madraspatensis*, *Echinops echinatus*, *Cenchrus echinoides*, also species of *Cocculus*, *Leucas*, *Aristolochia*, *Polygala*, and *Ionidium*. *Cochlearia flava* spreads along the banks of the Jumna, nearly up to Delhi. A species of *Farsetia* and *Linaria ramosissima* are found; the latter only enumerated in the Flora of more southern parts of India; while a *Salsola*, which is common, indicates the saline nature of the soil. *Balanites Ægyptiaca*, *Alhagi maurorum*, *Salvadora persica*, and species of *Ethulia*, *Heliotropium*, &c. are remarkable as occurring all over the Northern provinces of Hindostan, and being equally common in Egypt, while the presence of a species of *Picnomon* and one of *Kentrophyllum* is interesting, as forming a point of resemblance to the Flora of the South of Europe.

Most of the plants which have been enumerated, I also found on the hills near Lohargaon and Mirzapore; several were recognized by Dr. Wight as occurring in the most southern parts of the peninsula, and nearly all have been described by Dr. Roxburgh as occurring in the neighbourhood of Samulcottah.

To show the effects of protection and culture, *Xanthochymus dulcis* may be adduced as a remarkable instance; this tree, which is found only in the southern parts of India, and which would not live in the more exposed climate of Saharunpore, exists as a large tree in the garden of the King of Delhi; but here, surrounded by the numerous buildings within the lofty palace wall, in the midst of almost a forest of trees, with perpetual irrigation from a branch of the canal which flows through the garden; an artificial climate is produced which enables a plant even so sensitive of cold as one of the *Guttiferæ* to flourish in the open air at Delhi, where it is highly prized, and reported to have milk thrown over its roots, as well as its fruit protected from plunder by a guard of soldiers.

The animal kingdom does not present many peculiarities to distinguish this district from that of India in general. The Lion is however almost peculiar, being found beyond Hansi on the edge of the desert. The Neel-gae is common in the plains, and the Porcupine and a species of Hedgehog which I have called *Erinaceus Indicus*, and the short-tailed Manis, are common about Delhi.

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In crossing the Jumna in the latitude of Delhi, and entering the Doab or flat country between that river and the Ganges, a considerable difference is observed in the vegetation, the arid-looking thorny shrubs having disappeared, and the trees become more luxuriant; this is consequent chiefly upon a change of soil, and is more observable as we approach Meerut and Saharunpore;—if we take the latter as an example, we shall obtain a fair specimen of the Flora of the plains of northern India.

The district is flat with but slight inequalities, intersected by several rivulets and watered by the Doab canal. The soil is generally clayey with a proportion of sand, having a substratum in many places of hard and retentive brick clay, and in some situations *kunkur*, imbedded in masses sometimes large enough to be used in the erection of tombs, but is generally employed only for making a coarse kind of lime. Below this, small gravel is brought up in digging wells. A part of the district is rather more elevated than the rest, therefore drier; and water being more distant from the surface, the wells are deeper; this tract is called *khadir*, while towards the hills and beyond Kheree, the ground being low, moist, and frequently overflowed, is called *bangur* land.

The climate has been described as being that of India in general; but modified by the more northern position of Saharunpore, as the cold commences earlier, continues later, and is succeeded by a short spring in February and March, when the deciduous trees come into leaf, and the greater number into flower; the heat in May and June is considerable, and the rains plentiful. The periods of occurrence of the maximum and minimum temperature (105° and 37° in June and January) being remote, the rise and fall very gradual and divided between several months, a degree and continuance of cold weather is produced, which allows of the growth of many annuals apparently incompatible with the Flora of the country; while the great rise of temperature in the hot months, and the influence of the periodical rains, permit the successful cultivation of tropical plants, which appear equally at variance with the European-like cultivation of the cold-weather months; as the great heat, however, is never very long continued, nor the cold excessive, many perennials both of tropical and temperate climates thrive here in the open air, and this latitude may be considered as being nearly the northern limit of the Flora of India, as well as the southern boundary of that which is called the Oriental or Persian region.

Tropical plants cannot easily extend beyond this, for though they can resist a moderate degree of cold in a dry atmosphere, in the north-western provinces there is always a good deal of rain about Christmas, when the cold, much increased in consequence of the freer radiation which ensues on the clearance of the atmosphere, combined with the moisture, is injurious to many plants, which have besides to undergo great vicissitudes of temperature instead of the equality of the tropics. Hence in valleys and in the midst of thick forests, where the climate is moister, the radiation less free, and the range of the thermometer less extensive, we find the same plants reaching a much higher latitude than in the open plains. This we shall see strikingly exemplified as we pass through the belt of jungle in ascending

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the Himalayas from the plains. With respect to perennials of more temperate climates, though many thrive, others, as well as most from alpine situations, suffer, not so much from the great heat, which when shaded from the direct rays of the sun they resist, nor from the equable moisture of the rains, but from the clear weather which succeeds, when there is always a good deal of moisture, with great heat during the day and considerable cold at night: a state of the atmosphere which is not only hurtful to plants, but injurious to the human frame; we cannot therefore expect to find, either in a wild or cultivated state, such plants as the *Guttiferæ*, impatient of the least degree of cold; for even the mangoe, though flourishing as a tree and producing fine fruit, requires when young to be defended from the cold by a covering of grass; the same may be said of the custard apple (*Anona squamosa*), of which indeed old plants are frequently killed by the cold of winter. The plantain, covered by sheathing petioles, is enabled to resist a greater degree of cold, and survive through the winter, while the more delicate *Papaya* is generally killed. The pine apple does not flourish, but the *Agave* is as vigorous as in more southern latitudes, and *Pandanus odoratissimus* is only kept alive in the shade of trees. The arboreous vegetation is the same as generally found in the plains of upper India, consisting almost entirely of Dicotyledonous trees, which lose their leaves in the cold weather as completely as trees in more northern climates. The Monocotylenous trees consist only of *Phœnix sylvestris*, and of the almost stemless *Phœnix humilis*. The most common trees are *Dalbergia sissoo*, *Acacia Serissa*, *Arabica*, and *Farnesiana*, *Cedrela Toona*, *Butea frondosa*, *Ægle marmelos*, *Feronia elephantum*, *Nageia Putranjiva*, and species of *Melia*, *Ficus*, *Morus*, *Trophis*, *Bauhinia*, *Cordia*, *Gmelina*, and *Premna*. Of shrubs, species of *Zizyphus*, *Capparis*, *Carissa*, *Vitis*, *Vitex negundo*, *Buddleia Neemda*, *Guilandina Bonduc*, and *Cratæva religiosa*. The smaller herbaceous plants consist chiefly of species of *Cassia*, *Hedysareæ*, *Justicia*, *Barleria*, several *Cucurbitaceæ*, *Euphorbiaceæ*, *Sida*, *Carduus*, *Cirsium*, *Chondrilla*, *Cæsulia*, *Cotula sternutatoria*, *Ocymum*, *Leucas*, *Cissampelos*, *Vallaris pergulana*, *Cardiospermum Halicacabum*, *Plumbago Zeylanica*, *Gisekia pharnacioides*; also of *Corchorus*, *Achyranthes*, *Portulacca*, *Trianthema*, *Celsia*, *Trichodesma*, *Heliotropium*, *Boerhaavia*, *Aneilema*, *Aloe*, *Anthericum*, *Gloriosa superba*; *Costus Nepalensis* is the only one of the *Scitamineæ*, which escapes to any distance from the hills, and *Zeuxina sulcata* the only *orchideous* plant found in the arid plains, and this is spread all over India, from Ceylon to Saharunpore. The bamboo is only found in a cultivated state; the other *gramina* consist of *Sporobolus*, *Polypogon*, *Eragrostis*, *Rottboellia*, *Saccharum*, *Andropogon*, and *Anthistiria*, with species of *Panicum*, *Paspalum* and *Elytrophorus*.

In the vicinity of water and in moist situations, many of the same plants, that are common in other parts of India in similar situations, are found here. *Herpestis monniera*, *Gratiola juncea*, *Hydrolea Zeylanica*, *Sphenoclea Zeylanica*, *Limnophila gratioloides*, *Jussiæa repens*, *Marsilea quadrifolia*, together with species of *Coix*,

Leersia,

Leersia, Sagittaria, Pontedera and *Butomus;* and with these along the edges of streams we generally find species of *Polygonum, Rumex* and *Tamarix,* and as aquatics *Nelumbium speciosum, Euryale ferox, Damasonium Indicum, Trapa bispinosa,* several species of *Nymphæa, Utricularia, Potamogeton, Lemna,* one *Typha* and *Vallisneria;* along with these *Ranunculus sceleratus* and *aquatilis* are found; the former in every part of India, but the latter I have only met with in the Northern provinces. Here we have a good instance of the equalizing effects of water in producing uniformity of temperature, for we have in one situation many of the same kind of plants which occur in more northern latitudes, as well as in the most southern parts of India.

The plants hitherto enumerated are either those which, from being perennial, give the character to the Flora, or occurring in the rainy season, assimilate it more to that of tropical countries. But in the cold weather, or from November to March, when the temperature becomes low, and the ground as well as the atmosphere dry, species, generally only single ones, of colder latitudes, elevated sites, or of European genera, make their appearance, as of *Potentilla, Campanula, Arenaria, Spergula, Lithospermum, Tradescantia* and *Poa.* The following plants appear to be identified with those found in northern latitudes; some have no doubt been spread with the *Cerealia,* others have crept down from the hills, or spread themselves from more northern latitudes: *Malva rotundifolia, Veronica hederifolia, Fumaria Vaillantii, Anagallis cærulea, Sonchus oleraceus, Antirrhinum Orontium, Silene conoidea, Saponaria vaccaria, Avena fatua* and *Lolium temulentun; Verbena officinalis* and *Zapania nodiflora,* more extensively diffused, are also found here; *Peganum Harmala* is found a little to the north of the district near the Sutledge, and also in the vicinity of Agra, but it has probably been introduced into the latter, as its seeds still continue to be used in medicine by the natives of India.

From the foregoing enumeration it is evident that, with the trifling exceptions mentioned, there is great uniformity in the vegetation of different parts of the widely extended plains of India, as several of the plants found in the northern parts of the Continent are equally so in the southern parts of the Peninsula, as well as in the island of Ceylon, and some even, as enumerated by Mr. Brown, on the eastern coast of New Holland. *Aloe perfoliata, Guilandina Bonduc,* and *Gisekia pharnacioides,* occur in Africa, as well as in every part of India; while species of *Cratæva* are found in both, as well as in America. *Lantana* is generally considered an American genus; but there is no doubt that one, if not more species, are indigenous to India, as I have found it common in the north-western provinces, and Dr. Wallich in Rohilcund. He had also a species sent him from the Neelgherries; and *L. nivea* of Ventenat was also most likely obtained from the Peninsula, while Forskaol met with *L. viburnoides* in Arabia. *Cactus Indicus, Roxb.,* another plant common about Saharunpore, and indeed over all India, is the only species, not only of the genus, but of the family found out of the New World; though Dr. Roxburgh has also a *Cactus Chinensis,* but it is doubtful whether the former may not have been introduced into India.

Having seen that both the climate and vegetation partake at different seasons of the year of the nature of both temperate and tropical parts of the world, we shall be less surprised at finding the cultivation likewise participating in this double nature, and the northern enjoying, like the southern parts of India, two crops during the year: the one called the *khureef* or rain crop, sown in May and June and reaped in October; the other sown in October and reaped in March and April, called the *rubbee* crop.

The latter, embracing the months which approximate in temperature to that of the seasons of cultivation in colder countries, corresponds with them also in the nature of the grains cultivated; as, for instance, of *gramina*, wheat, barley, oats, and millet; of leguminous plants, peas, beans, vetch, tares, chick, and pigeon peas; of *cruciferæ*, species of *Sinapis* and allied genera cultivated for oil seeds; and of the *umbelliferæ*, the carrot, coriander, cummin, species of *Ptychotis* and *Fœniculum panmorium;* as well as of other tribes, tobacco, flax, safflower, and succory. Hemp exists in abundance in a wild state, but is only used for making an intoxicating drug. Almost all the esculent vegetables of European countries succeed remarkably well in the cold weather in India.

In the rainy season a totally different set of plants engages the agriculturist's attention, as rice, cotton, indigo, maize; *Holcus Sorghum*, species of *Panicum*, *Paspalum*, and *Eleusine;* of leguminous plants, species of *Phaseolus* and *Dolichos;* many of the *Cucurbitaceæ*, as well as *Sesamum*, and the species of *Solanum* for their esculent fruit. Ginger, turmeric, and *pan*, or betel leaf, do not extend quite so far to the northward. The *Crotalaria juncea* and *Hibiscus cannabinus* are every where cultivated for the purpose of yielding fibre for rope-making.

As we have seen with perennials of other kinds, so it is with those yielding fruit of an edible nature; many, both of tropical and temperate climates, succeed nearly equally well in the northern parts of India; so that, taking the Saharunpore garden as an example, we have collected in one place, and naturalized in the open air, the various fruit-trees of very different countries, as of India and China, Caubul, Europe, and America.

Of those belonging to hot countries, we have the plantain, custard-apple, shaddock, orange, lemon, and guava, with the mangoe, tamarind, and others, which are common in every part of India. Of Chinese fruits, the *Leechee*, *Loquat*, *Longan*, *Wampee*, flat peach, and digitated citron, are perfectly naturalized. Of fruit-trees from more northern countries, as Caubul and Cashmere, and from the Hills or Europe, there are the almond, peach, nectarine, apricot, plum, pomegranate, grape vine, apple, pear, quince, mulberry, fig, and walnut. Of useful trees of cold countries, which thrive in what is at some seasons so hot a climate, pines, oak, maple, dog-wood, service-tree, holly, juniper, and box. Of American trees, besides those first enumerated, the logwood, mahogany, *Parkinsonia aculeata* and *Acer negundo* may be instanced as perfectly naturalized.

That to hope for success in the cultivation of a still greater number of the useful plants of other countries is not chimerical, is evident from the result which has already

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attended the attempts which have been made, particularly when we take into consideration that countries which have many valuable productions of their own, have already possessed themselves of those which were originally peculiar to India. It is of some parts of China and Japan, as well as of America, New Holland, and the Cape, parts of Persia, Arabia, and the north of Africa, corresponding in latitude and a good deal in climate, particularly in having hot summers and rather cold winters, that it would be the most desirable to acquire the productions, whether these be the gift of Nature, or the result of the successful application of Art.

The distribution of the animal kingdom does not present any thing requiring particular notice, except in those which are migratory, for the others being always subject to the influence of temperature, partake of the uniformity in distribution all over India, which we have seen to characterize the climate and vegetation.

The camel, buffalo, and bullock form the beasts of burden; the latter alone used for agricultural purposes; though the climate and soil being dry, and the pasturage good, the district is favourable to horses, and the breed has been of late years much improved by means of the Company's stud. Tigers were formerly common in the very centre of the district, but the increase of cultivation has removed the jungles, with its inmates, to the outskirts: now the antelope roams over the plains, and the peacock is found near most villages where there are groves of trees. The other *Mammalia* are those common in almost every part of India. The otters, which are very abundant near all the rivulets, are perhaps less common in the southern provinces. The *rattel* is considered only a variety of that found at the Cape, while the *caracal* is identical with that found in Persia and the north of Africa. With regard to the feathered creation the variety is greater, as they have the power of changing their habitation according to the seasons. In the rains numerous *Grallæ* and *Anseres* make their appearance; among the latter the pelican, with many, towards the close of the season and in the cold weather, which are well known as English ducks and teal. The Chinese *jacana* and purple gallinule are also seen, as well as coots and rails; together with the ibis, curlew, bittern, and egret. The different kinds of game, as black and grey partridge, quail and snipe, and among the latter, *Scolopax capensis*. The starling, oriole, and cuckoo, make their appearance chiefly in the spring. The insects met with are those common in every part of India, and several have been recognized in my collection by Mr. Wilson Saunders as also found by him at Calcutta and Madras. Of these may be instanced the fire-fly, which attracts every one's attention, as well as several of the Coleoptera, as the *Copris Molossus, Lamia rubus;* and of butterflies, *Papilio Epius, Vanessa Almana, Pieris hyparote, Terias Hecabe, Eublæa Plerippus,* and *Phalanta antica,* are among others which are common in the northern, as in the most southern parts of India.*

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* These, together with some hill specimens, have been examined and named by Mr. Samouelle, of the British Museum, to whom I feel much indebted for his kindness.

It is generally well known that the bases of the mountains in India are every where covered with a thick, and often impenetrable jungle, and that a broad strip of this nature extends along the whole foot of the Himalaya from Chittagong to the Sutledge. This gradually diminishes in breadth and density the further we proceed to the northward, until in the country beyond the Jumna it is scarcely perceptible.

The greater portion of the land occupied by this tract of jungle is low, and being inundated during the rainy season, as well as by the hill streams frequently overflowing their banks, is generally in a moist state, and has hence been called the *Turrai,* or moist land. The powerful rays of a nearly vertical sun beating upon this, and a dense mass of vegetation, where there is little circulation of air, produce a heated and moist atmosphere highly favourable to the production of tropical plants. From the southern and eastern parts of this tract, on the confines of Silhet and Chittagong, Drs. Roxburgh and Wallich obtained their splendid specimens of tree-ferns, and numerous species of *Scitamineæ,* of *Epiphytal Orchideæ,* of *Piperaceæ, Ebenaceæ, Bignoniaceæ, Myrtaceæ, Byttneriaceæ, Malvaceæ, Guttiferæ, Dipterocarpeæ, Anonaceæ* and *Dilleniaceæ.*

According, however, as we approach the north-western limits of this tract, so do we find that, as the same causes operate in a less degree, so does the jungle diminish in breadth and density, the country becomes drier, and the atmosphere less moist. In consequence, however, of the increased cold of the winter months, the more strikingly tropical forms disappear, and some of a European type by degrees make their appearance; but as there is still considerable heat combined with moisture, so do we find many of the plants which are common in Bengal and Silhet, in the Peninsula, and even in Java, creeping to a much higher northern latitude along this favourable tract, than they can do in the open plains.

In the most northern parts, the jungle consists generally of large trees and long grass; the latter is annually burnt down for the purpose of allowing cattle to feed upon the young blade, which immediately shoots up on the removal of the old grass. The low range of hills is covered with trees and herbaceous vegetation, and the valley of Deyra, in the uncleared parts, with dense and almost impenetrable forests. It is unnecessary at present to take separate notice of the distinctions in the Flora of these low hills and of the valley, as there is between them a general uniformity, adapting each for the support of many of the animals and plants which occur in perfection in more southern latitudes. For though the rhinoceros and wild buffalo are not found to the northward of the Ganges, the elephant here reaches his most northern limit. Tigers, leopards, hyenas, lynxes, and bears are common, as well as *Simia rhesus* and *Entellus,* together with the stag, the spotted and hog deers, with the four-horned antelope. The jungle fowl, *florikin* and *leek* (*Otis Bengalensis* and *auritus*), horn-bill, and a green pigeon (*Columba Javanica*), with *Picus Bengalensis,* are common as birds; and the *Papilio parakekte* is remarkable as a butterfly found also by Dr. Horsfield in Java. A species of Boa constrictor is found in the lower hills as well as in those of Central India. As indicating the vicinity of a cooler climate, a species of pheasant

(*P. leuconotus*)

(*P. leuconotus*) may be noticed as existing with the jungle fowl in these hills, and the woodcock is occasionally shot in the Doon in winter.

According as we have seen to be the case in the plains of Upper India, so do the valleys at the foot of the Himalaya enjoy a climate and vegetation partaking at different seasons of both the temperate and torrid zones. At Deyra, elevated about two thousand feet, with a maximum and minimum temperature of 101° and 37°, where snow occasionally falls, we find many of the plants of Lower India more flourishing than in the neighbouring plains. As, for instance, *Artocarpus integrifolia, Psidium pyriferum,* and different kinds of limes and plantains. Rice, with many of the smaller grains, forms the chief cultivation, though wheat and barley are not neglected, but very little *gram* (*Cicer arietinum*) is cultivated. This difference in a cooler climate can only be ascribed to the greater moisture, as well as to the less free radiation which takes place during night in these valleys than in the open plains.

As arboreous vegetation is characteristic of tropical countries, so we find in the doons or valleys at the foot of the Himalaya a profusion of trees, many of which are common in more southern parts of India; and arborescent species of genera, of which herbaceous ones are found in colder parts of the world, as of *Terebinthaceæ, Semecarpus anacardium, Buchanania latifolia, Spondias mangifera, Boswellia glabra, Garuga pinnata, Odina Wodier;* of *Leguminosæ,* arborescent species of *Cassia, Bauhinia, Dalbergia, Pongamia; Bauhinia corymbosa* and *Robinia macrophylla* exist as immense climbers, and the *Acacia Catechu* in great abundance, affording its extract as one of the articles of commerce; while *Cathartocarpus fistula, Butea frondosa,* and a species of *Erythrina* when in flower, form the great ornaments of the forest. Of *Malvaceæ* and *Tiliaceæ,* several species of *Hibiscus* and *Grewia; Byttneriaceæ,* species of *Sterculia* and *Kydia; Aurantiaceæ, Murraya, Glycosmis* and *Citrus; Bombax heptaphyllum,* with its trunk supported by great buttresses. *Myrtaceæ, Eugenia* and *Careya; Combretaceæ,* species of *Terminalia, Conocarpus* and *Pentaptera;* species of *Nauclea* and *Hymenodictyon, Rondeletia,* with *Coffea Bengalensis,* and others exist as species of *Rubiaceæ;* of arborescent *Boragineæ,* species of *Ehretia;* and of *Euphorbiaceæ, Phyllanthus Emblica,* species of *Rottlera, Briedelia,* and frutescent species of *Euphorbia;* of *Urticeæ, Artocarpus lacucha,* numerous species of *Ficus* and of *Trophis.* Among the other trees worthy of notice *Diospyros Embryopteris* and *Moringa pterygosperma* may be mentioned, as well as the *Saul* or *Shorea robusta,* with its durable resinous wood, shining leaves, and showy clusters of flowers, forming in many places a forest extending for many miles without the interposition of any other tree. *Marlea begonifolia, Pogostemon plectranthoides, Panax odora, Psoralea corylifolia, Biophytum sensitivum,* and *Smithia sensitiva* may be instanced as plants found in the most southern parts of India, and some even in Java. Of herbaceous plants the forms are also very tropical, consisting of species of *Curcuma, Zingiber* and *Globba,* as well as of *Pothos, Piper* and *Begonia; Platanthera gigantea,* and *Saccolabium guttatum* may be taken as specimens of the *Orchideæ. Cyrtopera obtusa* and *flava,* with *Eulophia*

herbacea

herbacea occurring in the valley within the hills, and the last also in the Kheree Pass. Bamboos are common at the foot of the hills, and the plantain seems to be wild in some places. It is not the least interesting feature in the Flora of the northern portion of this tract that the palms here attain their highest limits, a species of *Calamus* being found in the valley itself; and a *Phœnix*, which I have called *humilis*, from its never attaining above a few feet of elevation, exists alongside of the *Pinus longifolia*, which is the only one of the Indian *Coniferæ* found at so low an elevation as two thousand feet. The existence of European and tropical forms in juxtaposition is an interesting fact for the Geologist, particularly when it is considered that the vicinity of lofty hills affords a still greater number of the former, while the valley is filled with the latter.

That it is not, however, devoid of other characteristics of a more temperate climate, we observe, from finding species, generally only single ones, of the following genera: *Pinus, Ulmus, Salix, Gentiana, Campanula, Geranium, Rosa, Rubus, Clematis, Viola,* and *Galium.*

That similar vegetation characterises the forests further to the eastward may be seen in the accounts, by General Hardwicke and Mr. Traill, of that passed through in entering Kemaon, which is described by the latter as consisting of *Saul, Sissoo,* and bamboos, and called in Bishop Heber's Journal "the belt of death." If we proceed still further in the same direction, the low land lying between Nipal and the plains of India will be found of the same nature, both with regard to climate and vegetation. Dr. Buchanan describes it as hot and unhealthy, the vegetation the same as in other parts of India, and similar to what we have already seen characterizing the tract between the Ganges and Jumna. Bounding this on the north is a region of nearly the same breadth, consisting of small hills covered with numerous trees, which, according to Dr. B., resemble those of Goalpara; and from the instances given, likewise those found in the hills near Hurdwar, as we find among them *Saul, Sissoo, Toon, Catechu,* and *Pinus longifolia.* The nature of the vegetation in the most southern part of this tract has already been indicated as occurring in the districts of Silhet and Chittagong, where the several Palms are found with the Tree-fern.

As in ascending mountains, the same decrease of temperature is observed as in receding from the equator, so do we observe a similar change in vegetation; and it has been remarked, that the same families and genera which approach nearest to the poles, are those which attain the highest elevations in mountainous regions. This is no where better exemplified than when we depart from the tropical vegetation of the plains of India, and passing through the intermediate changes which may be observed in proceeding from the equator to either pole, we attain a moderate elevation, and find a mild temperature, with the climate and many of the productions, both of the animal and vegetable kingdoms, of the temperate zone. At a still greater elevation, where from the late melting of the snow in summer, and its early fall in autumn, the season of vegetation is as short as in polar regions, we have in place of either an Indian or

a European

a European one, a perfectly Alpine Flora. But as the decrease of temperature is gradual, so is the disappearance of Indian forms, and we continue for some time to meet plants with which we are familiar in every part of the plains, many of which indeed must originally have been derived from the bases of these mountains. Among these may be mentioned *Butea frondosa, Carissa sepiaria, Justicia Adhatoda, Nyctanthes arbor tristis, Grislea tomentosa, Sterculia villosa, Kydia calycina,* and *Leea aspera. Nerium Oleander* is found at the base of these mountains; and as in Syria and Barbary, along the banks of streams; *Bassia butyracea,* to which the *shea* tree of Bruce is probably allied, is indigenous in the neighbourhood of Almora, while the other species are found in warmer parts of India. The mangoe, though its fruit does not ripen, is found as high as four thousand feet, near Deyra, as well as at Nahn: and *Gloriosa superba* attains an equal elevation, but it only exposes its annual shoots during summer, while the subterranean situation of its tubers protects them from the great vicissitudes of temperature.

An European, on his first arrival in a tropical country, is struck by the magnificent peculiarities of its vegetation; but to one who has long resided in such a clime these become familiar, and his attention is more quickly excited by the re-appearance of forms with which he was familiar in his youth, and which characterize the more humble and verdant, but not less beautiful Flora of temperate climates. In proportion as we ascend these mountains, the plants of India disappear, and we are delighted at finding the increase in number and variety of those belonging to European genera. At first we see only a few straggling towards the plains, which in a more temperate climate would be their favourite resort; and it is not until we have attained a considerable elevation that, having apparently lost all traces of tropical vegetation, we enter a forest of pines or oaks, and lofty rhododendrons, where none but European forms are recognizable. The genera of which species descend to the lowest levels, are chiefly *Clematis, Berberis, Viburnum, Hypericum, Rhus, Euonymus, Rubia, Geranium,* and *Viola.*

This disappearance of tropical forms is not so complete as would appear at first, on visiting the mountains in the spring or summer months; for the southern slope of the Himalaya being within the full influence of the tropical rains, a peculiarity of atmospherical phenomena is induced, which favours the existence of a series of forms not otherwise to be expected in a climate of which the mean temperature is so low.

For the attainment of greater precision in our ideas respecting the peculiarities of vegetation as connected with the climate of successive elevations, it is proposed to divide the slope of the Himalaya into three several belts, and take separate notice of each. The first has been already considered, and may be supposed to extend to between four and five thousand feet of elevation, as several tropical perennials extend to the latter, and snow does not usually fall below the former. The second belt may be conceived to embrace the space between five and nine thousand feet of elevation, as the winter's snow is always melted from such elevations before the accession of the rainy season, and the

upper

upper is nearly the limit to which the herbaceous plants of tropical genera extend. The third belt may be taken from this elevation up to the highest limits from which snow melts away on the southern face of the Himalayan Mountains. The bounds are in a great measure arbitrary to which each of these belts have been restricted, for the changes, both in temperature and vegetation, are so gradual, that it is impossible to draw any line where the peculiarities of one can be so clearly defined as not to interfere with those which are considered characteristic of another; and this difficulty is further increased by the change which is continually taking place in the climate and productions of similar elevations the further we penetrate into the Himalayas, for even where the mean temperature is the same, the range of the thermometer is greater, and the line of perpetual congelation higher in the internal than in the external ranges of these mountains. A further difficulty is also produced by the great difference in the vegetation of the northern and southern faces of the very same range or mountain, so that frequently a straight line running along the summit of the ridge may be seen dividing the luxuriant arboreous and shrubby vegetation of the northern face from the brown, barren, and grassy covering of the southern slope. This difference has been observed by all travellers, and may be ascribed in part to the greater depth of the soil on the northern face; but chiefly, I conceive, to the less direct influence of the solar rays on this than on the southern side.

The stations of Simla, Mussooree, and Lundour having been much resorted to for health, their climate and vegetation attentively observed, and offering an altitude of seven thousand five hundred feet, will afford a good illustration of the peculiarities of the central belt. The details of meteorological phenomena being confined to the introductory chapter, it is sufficient here to remark, that with a range of the thermometer of 53°, from 27° to 80°, and a mean temperature of about 55° observed at this elevation in 30° of N. lat., we could not expect the existence of any plants either belonging or allied to tropical genera; and certainly we do not meet with them in the clear dry months of the autumn, spring, or summer, but only in the rainy season, when a moderate and uniform degree of evaporation, in a moist, mild, and equable atmosphere, is favourable to the growth of plants usually considered indicative of a tropical climate. These generally consist of only a few species of genera belonging to such tribes as have perennial roots and annual stems or their tuber-like stems secure in the earth from the cold of winter.

The families and genera of which the species come into flower when the mild temperature and moist atmosphere are so congenial, consist of *Scitamineæ*, *Canna*, *Hedychium*, *Roscoea*, and *Globba*; *Orchideæ*, *Habenaria intermedia*, *pectinata*, and *marginata*, species of *Platanthera*, *Pleione*, *Herminium*, and *Satyrium Nepalense*; *Commelineæ*, species of *Commelina* and *Tradescantia*; and of *Graminæ* a few species of *Panicum*, *Eragrostis*, and *Andropogon*; of other tribes *Begonia*, *Osbeckia*, *Drosera*. Almost every rock is covered with species of *Cyrtandraceæ* and *Platystemma Violoides*, and the ground with *Balsamineæ*; of *Acanthaceæ*, a few species of *Justicia* and *Ruellia* are found; the

Leguminosæ

Leguminosæ consist of a few shrubby *Indigoferæ*, *Acaciæ*, and *Desmodia*, as well as of small species of *Cassia* and *Crotalaria*. Species of *Vitis* are found in the valleys and at moderate elevations; of *Tiliaceæ*, *Corchorus* and *Grewia*; of *Apocyenæ*, *Alstonia*; of *Asclepiadeæ*, a few species of *Cynanchum*, *Oxystelma*, *Marsdenia*, and *Hoya*; and of *Myrsineæ*, two or three shrubby species of *Myrsine* and *Bæobotrys*.

That the arboreous vegetation corresponds almost entirely with that of temperate climates, will be evident from a mere enumeration of the plants which constitute the forests at elevations of from seven to eight thousand feet. These consist almost entirely of *Rhododendron arboreum*, and species of *Quercus*, *Acer*, *Ulmus*, *Carpinus*, with, more frequently on the northern aspect, the different Himalayan Pines. Of smaller trees, there are species of *Cornus*, *Benthamia*, *Euonymus*, *Rhamnus*, *Rhus*, *Ilex*, *Andromeda*; and of shrubs, *Berberis*, *Buxus*, *Daphne*, *Cratægus*, and *Coriaria*, with others of the *Rosaceæ*, *Caprifoliaceæ*, and *Smilaceæ*. Among the trees which produce edible fruits, now cultivated in almost every part of the world (here growing apparently wild, but some may have been introduced from the mountains of Caubul and the hilly regions further to the north-westward), we have *Juglans regia*, *Armeniaca vulgaris*, *Persica vulgaris*, and *Punica Granatum*, with species of *Pyrus*, *Cerasus*, *Rubus*, and *Morus*. Species of *Abelia* and *Stauntonia* are interesting, as the only other species are found in China; and species of *Deutzia*, *Kadsura*, and *Hovenia* are found here, in Nipal, and Japan, as well as *Boehmeria frutescens*, *Daphne cannabina*, *Cleyera ochnacea*, and *Lonicera japonica*. *Senacia nepalensis* is remarkable as belonging to a genus of which the other species are found in Mauritius, and the rest of the family scattered from New Zealand in the southern to Madeira in the northern hemisphere, nearly in the same latitude, to which the Himalayan species of *Senacia* extends. Many of the trees and shrubs belong to the same genera as those of the northern parts of America, but the genus *Triosteum* is peculiar in being confined to North America and to parts of the Himalaya. So also *Onoseris nepalensis* and *Leucomeris spectabilis* belong to genera of which the rest of the tribe are South American.

But as the climate has been shewn to correspond in so many respects with that of the temperate zone, so do we find the distinguishing characteristic of this mid region of the Himalaya to be that which is the most pleasing feature of climes where man, as De Candolle observes, attains the greatest perfection. Here, in a rich thick sward, numerous delicate annuals are found, of which the congeners are so abundant in European countries, and which to enumerate at present would be tedious and out of place: but they may be described in general terms as belonging to the great European families of *Ranunculaceæ*, *Umbelliferæ*, *Saxifrageæ*, *Crassulaceæ*, *Caryophylleæ*, *Hypericineæ*, *Geraniaceæ*, *Violaceæ*, and a few *Cruciferæ*. Among the monopetalous tribes, *Campanulaceæ*, *Plantagineæ*, *Dipsaceæ*, *Valerianeæ*; and of *Compositæ*, species of *Carduus*, *Echinops*, *Lactuca*, *Hieracium*, and *Mulgedium*, as well as of *Solidago*, *Diplopappus*, *Aster*, *Achillea*, *Artemisia*, *Gnaphalium*, *Carpesium*, and *Senecio*; together with species of *Stellatæ*, *Gentianeæ*, *Primulaceæ*, *Pediculares*, and *Labiatæ*. The monocotyledons consist

of *Irideæ, Junceæ,* herbaceous *Asphodeleæ, Liliaceæ, Aroideæ.* The *Gramineæ* consist of species of *Agrostis, Polypogon, Trisetum, Poa, Festuca, Brachypodium, Kæleria,* and *Vilfa;* with of *Cyperaceæ* several species of *Carex.* Of *Rutaceæ,* a single species, *Ruta Albiflora* is extremely abundant. *Oxalis Corniculata* and *Centranthera hispida,* as well as other plants, are found both in the hills and the plains. This is accounted for by observing that the cold weather of the latter and the warm weather of the former approximate much nearer the same degree of temperature than would at first be supposed, and these are the respective seasons of vegetation of many of these plants.

It is not necessary to be more minute on the present occasion, but some plants may be more particularly alluded to, as they are remarkable on account of their geographical distribution; as for instance, we have among the herbaceous, as among the shrubby vegetation, an affinity to the Flora of China and Japan, in *Ophiopogon spicatus* and *Japonicus, Pardanthus Chinensis,* and *Houttuynia cordata* being found here as well as in those countries. With reference to the Flora of North America, analogous species of *Podophyllum, Monotropa, Phytolacca, Ampelopsis,* and other genera have been found, and the specific identity of American and Himalayan specimens of *Panax quinquefolium, Phryma leptostachya,* and *Datura Stramonium* has been ascertained; while *Chaptalia gossypina* is a Himalayan species of a South American genus and tribe. But what is still more remarkable, a species of *Sclerocarpus,* which does not seem to differ from *S. africanus,** has been found at Mussoree and at Simla as well as in Africa, while a species of *Melianthus,* a genus belonging to the Cape of Good Hope, exists also in Kemaon. With respect to the Flora of Europe, the number of identical species already ascertained is more numerous, and others I have no doubt will be determined to be so in the families which remain to be examined. Of those already ascertained, it will be sufficient to mention *Ranunculus arvensis, Thlaspi arvense, Capsella Bursa Pastoris, Hedera Helix, Galium Aparine, Leontodon Taraxacum, Acorus Calamus, Alisma Plantago, Prunella vulgaris, Carduus nutans, Phleum alpinum, Alopecurus geniculatus, Phalaris canariensis, Cynodon Dactylon, Poa annua, Lolium temulentum. Samolus Valerandi* is a remarkable instance of a plant found in many parts of the world, but in no part of India except at moderate elevations in moist situations in the interior of the Himalaya.

In the same way that we have seen the plains, from their northern latitude, and from being also within the influence of the periodical rains, enjoying the benefits both of an European and a tropical climate, with respect to the seasons and the nature of their cultivation; so do we find the hilly regions, with their cool summits and heated valleys equally deluged by the same rains, partaking of the same advantages; and we may sometimes, at the same time, see wheat being cut on the top of a mountain and rice sown in the valley at its base: or immediately that the former is removed, the ground prepared

* This plant was recognised in my collection by Mr. David Don, who informs me that he had also seen a specimen in a collection formed by the Countess of Dalhousie at Simla.

prepared for the reception of the latter. On account both of the climate and the facilities for irrigation, rice is generally cultivated in the valleys, though not restricted to them; particularly the variety which does not require irrigation, as this is sown at elevations of five thousand feet on the terraced flats of the mountain side, where, as soon as the wheat is ripe, the ears are merely picked off, the straw burnt on the ground for manure, and the rice sown immediately after the first shower of rain, of which there are generally some falls in the months of April and May. Maize, millet, *Eleusine coracana*, and many of the other small grains, constitute, as in the plains, the rain crop; together with species of *Amaranthus*, *Polygonum*, and an *Arum*, of which the root is much in use as the ordinary food of the hill people. Capsicum, turmeric, and ginger, the last as high as four thousand feet, are also cultivated, and form articles of export to the plains. Mr. Traill describes the little cotton that is produced in Kemaon, as "superior to that of the plains in softness of texture, gloss of colour, and length of fibre." Hemp is also cultivated, of excellent quality for the manufacture of both cloth and cordage. The cold weather cultivation of moderate, and the only one of higher elevations, consists chiefly of wheat, barley, buckwheat, peas, opium, and a little tobacco: the last only in small quantities, but the opium of very superior quality. As few of the villages extend above this central belt, so is there little cultivation to be found beyond it. I have not myself seen wheat and barley at a greater elevation than eight thousand feet on the sides of Urukta, and higher on this than on Choor, a more exterior mountain; but no where have I seen finer crops than at seven thousand feet on the shoulders of the latter. Mr. Gerard has seen wheat at ten thousand feet, and Captain Webb at twelve thousand feet of elevation, still on the southern slope of the Himalaya; but these being included within the limits of a higher belt, will be afterwards considered. The mustard tribe is also cultivated as oil seeds, which is also afforded in large quantities, of a very fine quality, by the kernels of the apricot at the highest villages. It may not be uninteresting to remark, that at some of these, where fodder is with difficulty or not at all to be procured in the winter months, the cattle are fed upon the leaves of trees which have been stacked for that purpose in the autumn. The kinds preferred are species of *Grewia*, *Ulmus*, and *Quercus*; but those of the *Coniferæ* are also employed: first, as bedding for their cattle, and afterwards as manure for their fields. Since the introduction of the potatoe its cultivation has been much increased, and the quality, which had deteriorated, much improved by renewing the stock from seed. It is fortunate, both for growers and consumers, that the Hill potatoes are not ready until those cultivated in the plains are either spoilt or expended.

The animal forms which are associated with the foregoing vegetation display alike the powerful influence of climate and the admixture of European with Tropical forms. Of the monkeys, the *Entellus* alone ascends in the summer months as high as nine thousand feet, where may also be seen one of the *Scitamineæ*, which, though not entirely agreeing with the generic character, I have called *Roscoea alpina*: but this makes its appearance only with the first showers, while its tubers, as well by the depth to

which they are sunk as by the layer of snow, have been well protected from the excess of cold, at a season when the *Entellus* had retired to the neighbouring plains. The Tiger, Leopard, and others of the feline tribe, travel upwards to a considerable height in search of prey. The *Mustela Hardwickii* is common, and the Himalayan Fox is distinguished from that of the plains both by size and colour, and in both approximates to the English variety. The Porcupine of the hills does not seem to differ from that in the plains, but as it lives under ground, where greater equability of temperature is preserved, a more extended diffusion of the species takes place. The Wild Dog is, like the Hog, found at every elevation. The Flying Squirrel supplies the place of the so-called Flying Fox or Fox Bat of the plains. The *Jurao* or great Stag is the largest and most common of the tribe, and the *Muntjac* (*Cervus Rutwa. Hodgs.*) the smallest, and always recognised by the peculiar noise he makes, from which he has by English travellers been called "the Barking Deer." The Antelope *Hodgsonii, A. ghoral,* and the Musk, though inhabitants of a higher and colder region, are at particular seasons seen within this limit. The Eagle and Bearded Vulture are here, as elsewhere in the mountains, seen soaring aloft. The Pheasants peculiar and most common to these heights are *Phasianus leuconotus* and *pokras;* others may be seen when the season is inclement in loftier regions. *Corvus erythorhynchus* is common to these hills and to China, while *Garrulus bispecularis* and *lanceolatus* nearly approach to European forms of Jay; and *Pica vagabunda* is identical. The Cuckoo is most common, and heard every where; and like many others, indicates the temperate nature of the climate. Among insects, the Glow-worm strikes every one with the brilliancy of its light, and the *Cicadas* with the incessant noise they make; while the existence of the Stag Beetle, and of the following Butterflies, proves the analogy with European forms; *Colias edura, Geoneptrix rhamni, Vanessa cardui et urticæ, Pontia brassicæ, Argynnis tephniæ.*

We shall now proceed to take a general view of the higher belt, where we shall find the affinities both in the animal and vegetable kingdoms, as well as in the meteorological phenomena, to be considerable with those of cold and Alpine regions of the globe. As lofty summits in the interior of the Himalaya are covered with snow until May and June, perennial roots are always protected from excessive cold, while annuals and the herbaceous parts of perennials are destroyed. The snow not melting until the sun has nearly reached his most northern limit, the increase of temperature is great and sudden, and the vegetation proportionally rapid, exactly as we know to be the case in polar regions. To give the reader a clearer idea of the appearances which present themselves while ascending these lofty peaks, a few abridged extracts from the author's journal are subjoined.

"In ascending the Choor mountain on the 9th of May, at first the ordinary Himalayan trees, such as *Rhododendron arboreum* and *Quercus lanata,* were met with; the pines then made their appearance. Every thing looked like the revival of spring, some of the trees and shrubs were putting forth new leaves, others, as *Viburnum, Acer,* and *Ribes,*

were

were in full flower. The ground was covered with a profusion of beautiful flowers, among which *Primula denticulata* and *petiolaris*, *Potentilla atrosanguinea* and *splendens*, with species of *Trillium*, *Anemone*, *Ranunculus*, *Viola*, *Convallaria*, *Corydalis*, *Caltha*, and *Morina* were chiefly conspicuous. Higher up, patches of snow were seen, and the Himalayan bamboo, which had been levelled with the ground. The barometer stood at 21·324. Beyond this every thing had a wintry aspect: the snow lay in masses though detached, having melted away from round the trunks of many trees and the blocks of gneiss rock. Few plants were even in leaf, but the Yew was in flower, and the Juniper seen straggling over the rocks, and *Primulas* peeping up in the warmer situations. At first the *Coniferæ* and other trees were intermixed with oaks, but latterly the oak alone (*Quercus semecarpifolia*) formed the forest. On emerging from this there is only a short ascent to the peak which formed the principal station in Captains Hodgson and Herbert's survey."

"The highest of the two peaks of Choor (12,149 feet) was covered with snow and inaccessible. The second, composed of great granitic blocks, was like the other bare of trees, but the snow had melted from the more open places. The Juniper and Currant were the only shrubs; the sward looked perfectly brown and dried up. The withered ferns and other plants, such as Rhubarb, which had been levelled with the ground by the snow, were just putting forth new leaves, and some few were in flower, as *Primula denticulata*, a Saxifrage and Gentian. The Bearded Vulture, Raven, and Siberian Pika were seen. The atmosphere was clear and cold, the wind west. The thermometer ranged from 42° to 60°; and with a blackened bulb, rose to 120° when placed near the ground. The barometers in the twenty-four hours ranged from 19·7 to 19·8, indicating, when compared with simultaneous observations made at Calcutta, an elevation varying from 11,550 to 11,850, according to the hours selected for comparison, but not more than 11,460 when deduced from observations made at Saharunpore. The height assigned in the survey is 11,689 feet. Nothing could be more magnificent than the view from this culminating point, having the plains of India indefinitely extended to the southward, and on the north the snowy peaks of the Himalaya towering even above this great height. On the northern face, the snow was observed to be lying in continuous beds. At its lowest limit on the ridge, in descending, an observation was taken (Bar. 21.08, Ther. attd. 65°, Ther. detd. 56°), but in sheltered places it extended much lower."

"The most northern mountain ascended was a branch of that called Changshel, in lat. 31° 5′, and no where were the trees more magnificent, consisting of Pine, Walnut, Birch, and Elm, with, as usual, Oaks and Pines. As plants were the principal objects of the excursion, the highest ridge of this mountain, at this time covered with snow, was not attempted to be ascended." But as it was passed over by Capt. Herbert and Lieut. Gerard in the month of September, it will be interesting to give the result of their observations. Capt. H. describes Changshel "as a ramification from the snowy range of great height, separating the waters of the Pabur and Roopin. Their path lay

along

along the summit, and their camp on the 24th September attained an elevation of 11,280 feet. Here the Juniper, with Black and Red Currants, were found. The thermometer in the sun rose at noon to 79°, and in the shade to 67·5°. The following morning it was 41° at daybreak. In proceeding along this ridge they attained an elevation of thirteen thousand feet. This part of the mountain was of course far above the limit of forest: it was however clothed with luxuriant pasturage, richly enamelled with a thousand flowers, many of which were familiar to them as the production of Europe."

"The highest mountain ascended, though a little to the southward of this, was Kedarkanta. Crossing the Tonse, where the thermometer rose to 102°, though the point of junction of this river with the Roopin is elevated nearly five thousand feet, we ascend a pretty gradual slope, and pass through a very splendid forest, composed of the same trees as seen elsewhere at similar heights. The encampment was in an open glade, surrounded with magnificent trees of *Pinus Webbiana* and *Quercus Semecarpifolia*, among which *Rhododendron campanulatum* formed a large straggling shrub, in full flower even in the midst of the melting snow. An excellent view was obtained of the snowy mountains: many of the peaks were completely covered with snow, others in many places displayed the bare rock. The thermometer was in the evening at 61°, and sunk in the morning to 46°. The road continued through the forest, where the Birch and Hazel were seen in flower. On emerging from this, the ground was found level, extended, covered with a thick coating of grass, and much furrowed by an *Alpine Arvicola;* a little stream produced by the melting snow flowed across; its temperature was 42°, and its sides were lined with a species of *Sphagnum*. *Primula Stuartii* and *denticulata*, with a deep blue *Gentian* and *Caltha Napalensis*, formed a bright contrast of colours. Barometer 20.25, thermometer attached 70°. From this the highest peak, elevated twelve thousand six hundred and eighty-nine feet, was found covered with deep beds of snow, which had in many places melted away from the lower one. On ascending the latter, a beautiful purple *Primula*, nearly allied to *P. Stuartii*, and *Ranunculus polypetalus*, were alone found in flower; a little below these, a *Phalangium*, a *Fritillaria* and *Bistorta*, were found; with *Rhododendron lepidotum* and *anthopogon*, as well as *Salix Lindleyana*, forming diminutive shrubs. From the higher peak, at a late season of the year, I have also received many of the same plants, with *Ranunculus hirtellus*, and species of *Draba*, *Agrostis*, and *Festuca*. The barometer at noon stood at 19·55, thermometer attached 70°. Thermometer detached 63°."

Further to the eastward, in the province of Kemaon, the same appearances present themselves. Captain Webb, on the 21st June 1818, at eleven thousand six hundred and eighty feet of elevation, to the southward of Josheemuth, found woods of oak, long-leaved pine (*P. excelsa*?), and *Rhododrendron*, and the surface covered with rich vegetation as high as the knee, with beds of stawberries and currant bushes in full flower all around. On the following day he ascended the pass of Pilgointi or Pilkonta, and found its elevation to be more than twelve thousand seven hundred feet above the sea; no snow was seen contiguous to the spot. The surface was

covered

covered with strawberry plants, buttercups, dandelions, and a profusion of other flowers.—(*Quarterly Review*, No. 44.)

These brief notices will give some idea of the vegetation at ten and twelve thousand feet of elevation on the southern face of the Himalaya, as Choor, Kedarkanta, and Changshel are some of the loftiest mountains not included in the snowy range itself, from which the snow annually melts in June, July, and August.

Though but small shrubs are found in the vicinity of the highest peaks, no where are more splendid pines to be seen than at eleven and eleven thousand five hundred feet of elevation. The species most common are, *Pinus Webbiana, Deodara, excelsa,* and *Morinda*. *Quercus Semecarpifolia* generally forms the forests, at their highest limits. Below, other species of *Quercus* are found, with *Taxus, Betula, Acer, Cerasus,* and *Populus*. The smaller trees and shrubs which are found as high as at twelve thousand feet of elevation, are species of *Juniperus, Salix* and *Ribes*. *Viburnum, Euonymus, Xylosteum, Pyrus lanata,* and *P. crenata* do not reach so great a height; but the most ornamental certainly are *Rhododendron campanulatum, Anagyris nepalensis, Rosa tetrapetala,* and *Clematis nepalensis,* all found at considerable heights, with species of *Gualtheria, Sibbaldia, Staphylea, Sambucus,* and *Syringa*. The more diminutive shrubs, found at still greater elevations, are the smaller species of *Rhododendron* (*R. lepidotum* and *anthopogon*), with *Andromeda fastigiata* (the heather of Mr. Fraser), and *Salix Lindleyana*.

In addition to the small herbaceous and showy flowering plants enumerated in the Journal, and also to other more Alpine species of European genera, of which species are also found at lower elevations, the following may be enumerated as being chiefly found at higher elevations:—*Pæonia, Actæa, Podophyllum, Monotropa, Circæa, Fragaria, Chrysosplenium, Onosma, Euphrasia, Caragana, Conopodium, Nasturtium, Turritis, Arabis,* and *Erysimum;* with species of *Lappa, Saussurea, Diplurandra, Hieracium,* and *Mulgedium*. The genera of monocotyledons, which furnish species growing at the highest elevations, are *Phalangium, Fritillaria, Gagea, Trillium, Iris, Allium, Tulipa,* and *Cypripedium*. The grasses belong chiefly to *Agrostis, Poa, Festuca, Bromus,* and *Phleum;* while of *Cyperaceæ* many *Carices* are found. Ferns are less common, but mosses and lichens abound, both on rocks and the trunks of trees.

As the long-continued covering of snow, and its removal in the hottest months of the year during the partial prevalence of the rains, presents some of the same meteorological phenomena as observed at lower elevations, so we may meet with some plants which we would not otherwise expect, or be able to account for. The *Roscoea* has been already mentioned as being common at nine thousand feet of elevation. What is more remarkable, one of the Bamboo tribe, and which in the hills is used for the same purposes as the bamboo in the plains, is found commonly at elevations of from seven thousand five hundred to ten thousand feet, but its annual stems are yearly beaten down by the falls of snow, which protect its perennial roots from excessive frost. This does not, however, belong to the genus *Bambusa*, but is nearly allied to the *Chusquea* of Humboldt and Kunth, found by the former, the most accomplished

of

of travellers, in the cold mountains of Quito and Santa Fé de Bogota. An *Euphorbia* also is found at great elevations, but its great tuberous root sunk in the ground sends up long peduncles bearing flowers only in the warmest month of the year.

Investigations have not yet been sufficiently extended to enable us to detail all the instances of identity in species found in this belt with that of the Flora of other countries, but the following may be mentioned, in addition to those enumerated, with the vegetation of the central belt: *Pyrus baccata, Spiræa kamtschatica, Fritillaria verticillata, Thymus serpyllum, Lamium amplexicaule, Arenaria serpyllifolia.*

Within this belt there is but little cultivation, though Mr. Gerard has seen it as high as ten thousand feet, and a village at nine thousand five hundred feet; but there the crops are frequently cut green. Capt. Webb saw extensive fields of buckwheat and Tartarian barley, between the village and temple of Milem, at the respective elevations of eleven thousand four hundred and five and eleven thousand six hundred and eighty-two feet above Calcutta; but these, though not beyond the snowy passes, partake more of the climate and peculiarities of the northern than of the southern face of the Himalaya, and in the former, as has been well ascertained, both by the Messrs. Gerard and by Captain Herbert, both habitations and cultivation extend to a much greater height than on the latter.

The animal kingdom affords many of the same indications of the Alpine nature of the country, as we have seen presented by the vegetable kingdom. The *Thibetan musk* is found on the mountains in the vicinity of the snow. The Antelope *ghoral, A. thar,* and *A. Hodgsonii,* peculiar to these mountains, are generally found on the most inaccessible places in the warm weather; but in the colder, like most other animals, they come down to lower elevations for the benefit of a milder climate and better pasturage. The *Pika* does not appear to differ from that found in Siberia by Pallas, and like the *Arvicola,* lays up a winter store, and continues to thrive in a climate apparently incompatible with animal existence, being, like others of its tribe, so admirably adapted for fulfilling the functions of the link which they form in the animal creation, that of converting vegetable into animal matter, as Dr. Grant so beautifully shows in his interesting and most philosophical course of lectures. *Gypaetos barbatus* is found, as in the Alps, soaring above the highest peaks; and the Raven, frequently seen in the plains in winter, is here found in the neighbourhood of the snow in the month of May. The different species of Himalayan Pheasant, so celebrated for the beauty and splendour of their plumage, *Satyra Melanocephala, Lophophorus Impeyanus,* and *Phasianus Wallichii,* may, like the Antelopes, be found according to the seasons at different elevations, but lower and nearer to the plains, according as the weather in the interior becomes more inclement.

Having obtained a general idea of the vegetation at successive elevations in the tract of the Himalaya included between the Ganges and Jumna rivers, it remains only to show that the observations respecting these will apply generally to similar elevations in other parts of the range. Between the vegetation of the mountains of Gurhwal

and

and Kemaon, a general uniformity is observed; if we compare with these the plants obtained by Dr. Wallich from Gossaingthan, a lofty mountain and place of religious resort, in 28° of N. latitude, and about seven days' journey N. by W. from Katmandoo, in Nepal, we shall find that many of the same families and genera prevail in each, as well as a great many of the same species. In the more northern mountains we find an excess in the families of *Ranunculaceæ, Cruciferæ, Caryophylleæ, Umbelliferæ, Gentianeæ, Boragineæ, Pediculares,* and *Primulaceæ,* and in some sections of *Leguminosæ, Compositæ, Labiatæ,* and *Gramineæ;* but that the same botanical features mark both parts of this extended range will be evident, if we observe that almost all the new genera discovered in the mountains of Nepal are also to be found in those of Gurhwal. Of these may be enumerated *Cyananthus, Codonopsis, Crawfurdia, Hemiphragma, Parochetus, Argostemma, Platystemma, Leycesteria, Astilbe, Leucostemma, Acosmia, Cyclostegia, Roylea, Colquhounia.* Of species, it will be sufficient to mention that many of the *Coniferæ, Amentaceæ, Rosaceæ, Campanulaceæ, Caprifoliaceæ, Saxifrageæ, Valerianeæ, Dipsaceæ,* and *Compositæ* are the same in both, and that we equally find in each such plants as *Rhododendron campanulatum, lepidotum,* and *anthopogon, Andromeda fastigiata, Sambucus adnata, Nardostachys Jatamansi, Salvia nubicola, Primula Stuartii* and *denticulata,* with many others. To these it may be added, that the same species of the following genera, of which only single ones have yet been found in the Himalaya, are met with along the whole extent investigated; *viz.* of *Actæa, Cimicifuga, Podophyllum, Sambucus, Monotropa, Philadelphus, &c.* Among *Cryptogamic* plants there is here, as elsewhere, a much greater uniformity over a great extent of space.

Though there is this great similarity in the botanical features, it is not to be supposed that it is universal, for several genera belonging to the mountains of Nepal have not yet been discovered in those to the northward: as *Triosteum, Tricyrtis, Neillia, Sanguisorba, Glossocomia, Dactylicapnos, Eriophytum, &c.* So also there are some in the latter which are not enumerated as forming a portion of the Flora of the former: as *Isopyrum, Dictamnus, Turritis, Melianthus, Orobus, Polemonium, Abelia, Echium, Onosma, Moltkia, Syringa, Oxyria, Euphrasia, Hippophae, Datisca,* and *Ephedra.*

If instead of the eastward and southward we proceed to the westward and north, we shall find, though with considerable modifications, that many of the same appearances present themselves; for though changes take place, yet every thing indicates as in ascending from the plains, or in proceeding from the equator to the poles, so from eastward to westward, that all changes are gradual whenever no great natural obstacles intervene to prevent plants diffusing themselves by degrees all around; and this we would see to be more strikingly the case if we could examine the spaces intervening between Nepal and Cashmere, or between the latter and Caucasus.

The most northern point of the Himalaya accessible to my plant collectors was the mountain barrier which encircles the valley of Cashmere: to reach this by the commencement of the rains, when from the melting of the snow the passes become accessible,

sible, they left the plains of India by the commencement of May. At different times they crossed both the pass of Bunal, entered by Forster, and that of Peerpunjal, described by Bernier when he accompanied the Emperor Aurungzebe into Cashmere. The latter I had always concluded, from the plants brought me, and allowing for its more northern position, to be at least ten thousand feet in elevation; by M. Jacquemont the pass he entered is said to be the lowest, and elevated only eight thousand two hundred feet, equal only to one-half of the medium height of the Himalayan passes.

Bernier was surprised, on the first night that he left Bember and entered these mountains, to find himself transported as if from the torrid into a temperate zone, and from the vegetation would have concluded that, instead of being in India, he was on one of the mountains of Auvergne; and seems to have been particularly struck by observing that, though both sides of the mountain were covered with plants, there was this great difference, that on the side which was exposed to the south, towards India, there was a mixture of Indian and European plants, but on that exposed to the north, he only saw European ones. In crossing Peerpunjal, he remarks that three things particularly attracted his notice: first, that in one hour he experienced both summer and winter; secondly, that within the space of two hundred paces he encountered two directly contrary winds; and thirdly, being informed that every noise made in these mountains excites storms and furious tempests; an opinion which is also entertained by the mountaineers to the eastward.

Among the plants brought me by my plant collectors from this very mountain are many of those which must be alluded to by Bernier, as reminding him of the Flora of Europe. In the following enumeration I have only mentioned those which show the analogy existing between the vegetation of Peerpunjal and that of Kedarkanta and other lofty mountains within the limits of the British territories. Among the most conspicuous of these plants I may mention *Delphinium vestitum, Aconitum heterophyllum, Actæa frigida, Meconopsis aculeata, Lappa himalayana, Picris hispida, Gentiana cærulea, Onosma bracteatum, Salvia nubicola* and *Moorcroftiana, Primula denticulata* and *Stuartii, Acosmia rupestris, Saussurea religiosa, Rheum Emodi,* some of the Himalayan species of *Fritillaria* and *Allium,* with many others. Besides these, new species make their appearance, chiefly of *Boragineæ, Ranunculaceæ, Labiatæ,* and of the genera *Potentilla, Saxifraga, Gentiana,* and *Pedicularis,* and also some new genera, as *Trollius, Moltkia, Anchusa,* but these in general are the same as found in more eastern parts of the Himalaya. Among the trees and shrubs may be mentioned some of the *Coniferæ,* as *Pinus Gerardiana,* and species of *Taxus* and *Juniperus,* as well as of *Quercus, Betula, Acer, Pavia, Corylus, Rhododendron,* and *Gualtheria,* with *Fraxinus Xanthoxyloides, Staphylea Emodi,* and *Sambucus adnata.* As showing the analogy with other parts of the world, it is interesting to observe that *Senecio asplenifolius* is found here, and is identical, as I am informed by Mr. Don, with specimens in the Herbarium of Pallas from Caucasus. This analogy with the Flora of Caucasus is observed in several other plants, as will appear in the sequel. *Elsholtzia cristata* is found here, as in other parts of the

Himalaya,

Himalaya, and in Siberia. The European species which have been identified are *Thymus Serpyllum, Origanum vulgare, Prunella vulgaris, Polemonium cœruleum.*

If, instead of keeping on mountain tops, we descend into the vallies on their northern face, we shall observe that, with many of the phenomena peculiar to such localities, there is considerable modification in the vegetation of each, according to elevation and latitude. The valley of Cashmere, situated between the thirty-fourth and thirty-fifth parallels of latitude, in the most northern part of the Himalaya, and to which we descend from the snow-clad summit of Peerpunjal, is described as being of an oval form, encircled by mountains clothed with vegetation, which are themselves girded by a higher range covered with snow. The level of the valley is of considerable extent, being about sixty miles in length, and about forty in breadth in the widest part; its elevation is estimated by the late lamented traveller M. Jacquemont to be from five thousand two hundred and forty-eight to five thousand five hundred and seventy-six feet; he however states that the beauty of this valley has been much exaggerated, both by his countryman Bernier and by Mr. Forster. But there is no doubt that, in consequence of its being copiously watered by numerous streams, lakes, and canals, there is considerable moisture both of soil and climate, and almost constant verdure; while the numerous gardens, and the great variety of fruit-trees and of beautiful flowers, must always strike visitors from the arid plains of India, whether Europeans, as Bernier and Forster, or Asiatics, as Abul Fuzl. From the mixed nature of the cultivation the climate must evidently be mild and temperate, for even in the warmest months of summer the breezes which descend at night from the mountains are always cool and pleasant; the periodical rains consist of gentle showers, and the snows which fall in winter cannot remain long upon the ground. Abul Fuzl says that it rains and snows here at the same season as in Tartary and Persia; and that during the periodical rains in Hindoostan light showers only fall here, though with great violence on the mountains which form the barrier to the south-east.

From the northern latitude and great elevation of the valley of Cashmere, we are not surprised at finding in its flora a great resemblance to that of European countries; but the moisture of the climate, and its mild temperature in the season of vegetation, causes so great an extension of the herbaceous parts, as well as of the flowers of plants, that many of them rival in luxuriance those of tropical countries. The mildness and moisture of the climate is indicated by the extensive cultivation of rice, as well as by the successful cultivation of the *Cucurbitaceæ*, as no where are there finer and larger melons, water-melons, gourds, and cucumbers. The kidney bean, though not common in the gardens of the north-western provinces, thrives remarkably well in Cashmere, as well as the egg-plant and the capsicum. The lakes abound with *Trophis bispinosa*, and species of *Nymphæa* and *Menyanthes*. The existence of hemp and of species of balsam, of marsh-, tree-, and common mallow, all indicate a temperate climate, as do the cultivation of wheat, barley, and saffron, together with the culture in their gardens of such European vegetables as turnip, radish, beet-root, and cabbage; and the usage of clover as fodder

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for cattle; all proving the approximation in vegetation to that of European countries, as has been already indicated with regard to the climate by the testimony of so many travellers. The other genera of which species have been brought down by the plant collectors are chiefly European, as *Viola*, *Trollius*, *Dianthus*, *Mathiola*, *Cheiranthus*, *Draba*, *Capsella*, *Hypericum*, *Lythrum*, *Spiræa*, *Rubus*, *Geum*, *Myricaria*, *Eryngium*, *Euphrasia*, *Salvia*, *Nepeta*, *Phlomis*, *Trifolium*, *Vicia*, *Orobus*, *Ononis*, *Medicago*, *Lactuca*, *Sonchus*, *Iris*, *Narcissus*, and *Crocus*. The species which have been already identified with those of Europe are the following: *Mentha viridis*, *Mentha arvensis*, *Mentha sylvestris*, *Hibiscus Trionum*, *Centaurea moschata*, *Hieracium sabaudum*, *Dianthus barbatus*, *Lychnis coronaria*, *Myosotis palustris*, *Dactylis glomerata*, *Cucubalus baccifer*.

In the arboreous vegetation the same resemblance exists to the Flora of Europe: the Walnut, Aspen, Poplar, and Willow are, with the Oriental Plane, the most common trees. The fruit trees are so abundant as to be described by natives from India as constituting a jungle: they consist of the Apple, Pear, Peach, Quince, Cherry, Apricot, Pomegranate, Plum, Mulberry, Hazle, and Vine; while the drying of raisins, and the conversion of the grape into wine, would of themselves be sufficient to determine the temperate nature of the climate. With their fruit and saffron the northern merchants also bring down rhubarb and musk, which they procure from Tibet. The Salep is produced in the hills between Jumboo and Cashmere; specimens of the plant, with the root, leaves, and seed-vessel, but without flowers, were brought down, and appear to Dr. Lindley to belong to *Eulophia*; and as I have no doubt of its being the plant which yields the salep of Indian commerce, I have ventured to call it *Eulophia vera*. Of animals we have few notices, but they may be supposed, from the specimens procured, to approximate to those of Europe and cold climates. The shawl-wool it is well known is procured from Tibet; but the merchants bring down the Chowry ox (*Bos grunniens*), large dogs, the Persian cat, broad-tailed sheep, and rams for fighting; as well as the blackbird, thrush, goldfinch (*Carduelis caniceps*), and *Carduelis spinoides*.

If we proceed to the southward, and take the valley of Nepal as an example, we shall have, with a great proportion of European forms, a greater mixture of tropical ones, and the prevalence of genera of which the greater number of species are found in more southern latitudes.

The low hills which separate Nepal from the plains of India are themselves separated from the high mountains by vallies of considerable length, varying in elevation from three to six thousand feet; so that we may expect considerable difference in their respective temperatures and productions. The valley of Nepal proper is an oval of about sixteen miles in length, elevated about four thousand five hundred feet. That of Noakote, though more to the northward, is far less elevated, and therefore hotter in summer and milder in winter; its vegetable productions correspond, according to Dr. Wallich, with the lower parts of Nepal. The temperature of the latter is described by Mr. Hodgson as being generally from ten to fifteen degrees lower than that of India.

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From Dr. Buchanan's observations, the thermometer has a range of 55°, the maximum and minimum, 86° and 31°, occurring in July and January. The winters are described as never being very severe; but Nepal being within the influence of the tropical rains, there is at that season of the year considerable moisture of climate, and the mean temperature of eight months in the year being above 60°, even in the open country about Catmandoo, and must be higher in some of the lower and more close vallies, we shall not be surprised at finding so many of the natural productions approximating to those both of the temperate and tropical zones. The general nature of the European-like Flora may be appreciated by a reference to that which has been enumerated as characterizing the central belt of the Himalayan slope. The greater prevalence of tropical forms is indicated in the existence of species of *Semecarpus, Hiræa, Hiptage, Triumfetta, Grewia, Utricularia, Dysophylla, Premna, Callicarpa, Anisochilus*, and still more by the genera *Podocarpus, Schæpfia, Æschynanthus, Leucosceptrum, Gomphostemma, Geniosporum, Oxyspora, Sarcopyramis, Turpinia*, and *Apostasia* being found here, while their remaining species are found in Sylhet, and still further to the southward and eastward.

That considerable diversity of climate is met with in the several valleys which are comprehended under the general term Nepal might be inferred from their several elevations, and is proved by some of them abounding in bamboos and ratans, where the pine-apple thrives and ripens its fruit, while in others oaks, walnuts, hornbeams and pines abound. We cease, therefore, to be surprised at finding a lofty palm, the *Chamærops Martiana* of Dr. Wallich, in this valley, as well as a species of *Balanophora*, the rest of the genus being found both in the Indian and Malayan peninsula, as well as in the island of Java. *Passiflora* and *Melastoma* have each a species in Nepal, the former distributed chiefly over South America and the West-Indies, and the latter confined almost entirely within the Tropics; but species of the nearly allied *Osbeckia* found here, extend also as far as 31° of N. latitude along these mountains. The affinity to the Flora of China may be observed in the several plants being found here previously mentioned as being common to that country and the Himalayas. To these may be added, *Hovenia dulcis, Lonicera confusa, longifolia*, and *chinensis*. *Camellia Kissi*, closely allied to both *C. Sasanquha* and *oleifera*, according to Dr. Wallich; is a plant of Nepal, where the tea shrub succeeds so well, that a young plant introduced from China had in 1818 attained a height of nine or ten feet. The *Magnoliaceæ*, of which several species are found in Nepal, form a link connecting its Flora with that of China and North America.

Being within the influence of the tropical rains, we find rice, particularly when transplanted, forming the chief cultivation in Nepal, with maize and the other grains cultivated in India during that season, together with cotton, sugar-cane, ginger, a large kind of cardamom, the produce of a species of *Amomum*, and the Indian Madder or *Rubia Munjista*. Wheat and barley are cultivated in the winter months, which are however so mild as to ripen the orange in the open air; though European fruits do not succeed so well, from the shortness of the spring. The influence of the rains may

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also be seen in the presence during that season of numerous species of *Grallæ* and *Anseres*, as illustrated by Mr. Hodgson, who observes, that many of these generally make a mere stage of the valley in their migrations to and from the vast plains of India and Tibet. The migration southwards of snipes, teal, ducks, herons, storks, cranes, and woodcocks, respectively follows in succession from August to November, and their return takes place in the same order, beginning with the commencement of March and continuing till the middle of May.*

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* In connection with this notice of the vegetation of the Himalayas, it will be interesting to ascertain if the same phenomena result from elevation in a still more southern mass. The Neelgherries, in 11° of N. latitude, have their highest peak, Dodapet, elevated eight thousand seven hundred feet. The general elevation of the level ground around Ootacamund is about eight thousand, and at Dimhutty about six thousand feet above the level of the sea. The mass is considerable, being in length thirty-five miles, and fifteen in breadth, containing four hundred and seventy square miles of undulating country. The temperature is described as being generally 30° below that of the neigbouring plains. At their base these mountains are surrounded by a dense jungle, in which elephants, bisons,and tigers abound, where formerly rice, sugar-cane, betle, cocoa-nut, and plantain were cultivated. The acclivities are likewise covered with a gigantic forest of teak, tamarind, mangoe, ebony and bamboos; among which, in favourable situations, *Borassus flabelliformis* and *Phœnix sylvestris* occur as palms. The *Mimosas, Cassias* and *Pongamia glabra* afford specimens of arborescent *Leguminosæ,* while *Thespesia populnea* is a malvaceous tree. *Hopea* supplies the place of *Shorea* as one of the *Dipterocarpeæ*; *Xanthochymus* and *Garcinia* exist as *Guttiferæ;* and species of *Strychnos* are found here, though not occurring in the jungles of the Northern provinces, while *Myrsineæ, Laurinæ* and arborescent *Euphorbiaceæ* are common to both. This belt of jungle extends from three thousand five hundred to five thousand feet of elevation, is very unhealthy, and the distinctly marked region of fever. Above this the country is open, the wood in clumps and patches, the climate delightful and healthy. The range of the thermometer is about 43°, from 31° the minimum in winter, to 74° the maximum in summer: but this, from the mode in which the observations are recorded, I have not been able to ascertain so exactly as I could wish. During the cold season Mr. Young gives the utmost range of the thermometer as 28°, between 31° and 59°, but as not more than 10° during the rest of the year. The maximum he states in the sun to be 85°, and the minimum 56°, but in the shade 20° to 25° lower; and that the average in the rainy season is about 64°, from which the thermometer hardly ever varies above two or three degrees. The Neelgherries experience the influence of both the S.W. and N.E. monsoons. The elasticity of the air is proved by the distance to which sounds are conveyed, and by its effects on the animal spirits.

Though materials do not exist in such abundance for giving a view of the vegetation of the Neelgherries, yet there are sufficient to shew that a similarity in vegetation is produced by a correspondence with the Himalayas in meteorological phenomena. Many of the plants of the Neelgherries are enumerated in Dr. Wallich's catalogue of the East-Indian Herbarium; a list of genera was published by M. Leschenault de la Tour, and Dr. Wight has furnished me with several additional names, so that the materials are sufficient for giving a general idea of the nature of the vegetation; but a difficulty occurs in the exact localities of the plants not being given, nor the seasons of vegetation indicated; but as no snow falls, and the cold weather is of shorter continuance, we may expect the Flora to be less completely European, particularly as the long-continued equability of the rest of the year, and the rainy season, will be favourable to many genera of tropical families. Thus, though none of the pines or other *Coniferæ* are found, the scarlet flowers of the *Rhododendron arboreum,* with a white rose climbing to the tops of the highest trees, form the ornament of these as of the northern hills. The other European genera are *Andromeda, Gualtheria, Vaccinium Ranunculus, Thalictrum, Clematis,*

Anemone,

In addition to the vallies of Cashmere and Nepal, we may notice the peculiarities of vegetation in another set of vallies—those which constitute river beds. These forming inclined slopes, of which the lower end rests on the plains of India and the upper at the sources of rivers touching the limits of perpetual congelation, will present every variety of temperature and organic life to be met with in ascending the mountains themselves. Hence, according to the part of these vallies which we examine, we may meet with either the plants of tropical or of alpine regions; and this will explain the anomaly which frequently presents itself in finding so many plants requiring quite different climates enumerated as occurring in the same locality.

Thus, if we notice the vegetation on the banks of either the Ganges or Jumna, where they emerge from the mountains into the plains, we shall find it perfectly tropical, and jungly; consisting of bamboos, ratans, and such trees as saul, toon, sissoo, and ebony, with many others enumerated as forming the tract of jungle which runs along the foot of the hills. Thirty miles higher up we have the banks of both rivers covered with Alders and *Pinus longifolia;* still further up we have species of *Olea, Elæagnus, Hippophae* and *Fraxinus Xanthoxyloides;* but if we ascend to the sources themselves of the two rivers near Gangotri and Jumnotri, we shall see only the plants

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Anemone, Adonis, Rosa, Rubus, Fragaria, Berberis, Geranium, Viola, Parnassia, Lonicera, Euonymus, Viburnum, Salix, Salvia, Wulfenia, Scutellaria, Lysimachia, Daphne, Plantago, and *Lobelia.* The gigantic *L. excelsa* attains there an elevation of twelve feet.

The plants allied to tropical genera are both herbaceous and perennial; the former we may suppose occur in the rainy season, while the exact localities of the latter not being given, we are unable to form any inferences respecting the climate; but the greatest cold, if not long continued, will not be fatal to many, as several of the same genera exist in the northern provinces of India. The herbaceous genera alluded to are *Canna, Costus, Hedychium, Curcuma, Begonia, Piper, Melastoma, Osbeckia, Sonerila, Impatiens,* together with species of *Sida, Crotalaria, Callicarpa, Convolvulus, Thunbergia, Solanum,* and *Ardisia,* as small shrubs; while species of *Grewia, Sterculia, Kydia, Strychnos,* and *Syzygium* exist as trees; but these are probably not found in the highest parts. Species of *Pittosporum* and *Lantana* are also found here; and *Myrtus tomentosa* affords an edible berry.

The grains cultivated are nearly the same as those of Northern India, consisting of wheat, barley, millet, mustard, peas, in the cold weather, and the smaller grains during the monsoons, though rice does not at all succeed. The soil and climate are most favourable for gardening, as all kinds of European vegetables are described as attaining an enormous size, and some as living for two or three years. The climate is equally favourable for European fruit-trees, but the early accession of the rainy season prevents the proper ripening of the fruit of many, though some requiring a shorter season produce very fine fruit. Orange-trees live, but do not thrive in the Neelgherries.

The animal kingdom displays the same mixture of European and tropical forms as we have seen existing among vegetables. Many of the common Indian mammalia are found on the Neelgherries, as well as the elk, the wild sheep and wild dog, and with these a black monkey (an *Simia* (*Macacus*) *Silenus,* the *Ouanderou?*) with the peacock and jungle fowl; the raven, blackbird, thrush, lark, and woodcock are also seen.—*Hough on the Neelgherries; Young on the Topography of the Neelgherries; Transactions of the Medical and Physical Society of Calcutta,* vol. iv.

plants found on the highest mountains, as Choor and Kedarkanta. The elevation is certainly great, being at least ten thousand feet; but the trees, which are elsewhere found looking down upon vallies, are here themselves situated in them, having mountains towering above them covered with snow, which, on melting below the line of perpetual congelation, gives place to a lowly but rich vegetation.

The trees consist of *Abies excelsa* and *Betula Bhojputra;* with them are found species of juniper, hazle, and a new *Quercus.* Walnut and apricot trees exist in the vicinity of the nearest villages. Wheat and buckwheat are cultivated, but are green even in July, when the water of the river is cold, but the sun's rays very powerful. A kind of gooseberry, rhubarb, and currant are also found; and among the most remarkable flowers are species of *Dictamnus, Isopyrum, Phalangium,* and *Aconitum; Hemiphragma* is one of the new forms produced in this somewhat peculiar situation. *Andromeda fastigiata, Saussurea gossypina, Carduus macrocephalus,* and *Nardostachys Jatamansi,* are with many others found in the mountains in the vicinity.

From the frozen sources of rivers, the transition is easy to the snowy passes of the Himalaya. These always lead over the lowest parts of the snowy range, are generally from fifteen to sixteen thousand feet high, though some to the eastward are more elevated, and mostly flanked by peaks which are three or four thousand feet higher. Being for the greater part if not for the whole year covered with snow, their vegetation is only interesting as affording examples of the plants which attain the highest limits, but they afford the most favourable sites for observing the elevation of the line of perpetual congelation. These passes have been explored and described by Captains Hodgson, Webb, Herbert, and the Messrs. Gerard. By the first, the air within the mountains has been described as clear, light, and very dry, in which evaporation is very rapid; the sky of a deep blue colour; and the stars of great brilliancy, appearing and disappearing instantaneously, without any apparent augmentation of their size. The country leading to these passes is generally very rugged and barren below the limit of snow. Above the pine forests, or from eleven thousand to eleven thousand eight hundred feet of elevation, a few dwarf oaks, junipers, and stunted birches are met with, as well as *Rhododendron lepidotum,* and a species of *Allium* and wild rose above twelve thousand feet. The raven and Alpine hare are also seen. The genera, of which species have been brought me from the highest extent of vegetation in these passes, are *Ranunculus, Aconitum, Geranium, Potentilla, Epilobium, Carduus, Senecio, Inula, Cineraria, Cynoglossum, Myosotis, Primula, Pedicularis, Salvia, Lamium, Origanum,* and *Polygonum;* of the last there are several species from such localities. On descending the northern face, a peculiarity is observed in finding a pine, which is not met with on the southern face, owing most likely to the influence of the rains. This is the *Pinus Neoza* of Dr. Govan, *P. Gerardiana* of Dr. Wallich, and most probably the *Chilghoza* of Mr. Elphinstone. *Rhododendron lepidotum* is found as high as fourteen thousand two hundred feet, villages and cultivation at ten thousand five hundred and eleven thousand five hundred feet. Snow was found at thirteen thousand four hundred feet in June by the Messrs. Gerard

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on the southern face, but they mention that it would be melted at this height a month later. Capt. Herbert gives thirteen thousand feet as the limit of snow on the northern face in the beginning of October.

To the eastward the general elevation of the country must be raised, as it is nearer the sources of the great rivers and the passes are higher. The Beans Pass was estimated by Capt. Webb, who found snow at the end of May, at seventeen thousand five hundred and ninety-eight feet, and more recently, by the Editor of the *Gleanings in Science,* at sixteen thousand eight hundred and forty-four feet, from the observations of a traveller in October 1828, who had only some new snow, but no old beds to cross. The Neetee Pass, elevated sixteen thousand eight hundred and fourteen feet, had no snow on it when visited by Capt. Webb, nor any on a ridge three hundred feet above, whence the lower point of congelation was estimated at not less than seventeen thousand feet on the northern side of the Himalayan Mountains.

In the neighbourhood of these passes the snow does not entirely disappear until July, which, with half of August, constitutes the summer, a season when, on the southern face, rain frequently falls; autumn extends to the end of September, and winter commences with October. Above the limit of forest, which is composed of the same oaks, pines, yew, birch, and poplar as found to the westward, Cypress and Junipers are found (*Cupressus torulosa, Juniperus communis* and *squarrosa*), with Rhubarb, Gooseberry, Rose-bushes, and a species of *Astragalus,* the furze of travellers. The grains cultivated in the nearest villages are the same as have been elsewhere enumerated as those peculiar to such heights. Cultivation was found by Capt. Webb in this direction above eleven thousand five hundred feet of elevation, though not above ten thousand by Capt. Gerard near the Western Passes; but here the occurrence of loftier mountains to the southward produces some of the same effects as are witnessed on the northern face of the Himalayas,—a confinement of all the solar rays imparted, and their reverberation from two sides, instead of one of a mountain, by which, and by the general raising of the vallies, the lower limit of congelation becomes considerably elevated, and with it the limit of vegetation, as well as of villages and cultivation. This is still better exemplified if we notice the highest cultivation in the mountains which intervene between the snowy range and the plains of India, where we shall see that the height of cultivation diminishes as we proceed to the outer range of mountains. Thus: in the line of the geological section, we have wheat near Rol at ten thousand, at Bumpta on Urukta at eight thousand, and above Chowras on Choor not much above seven thousand feet of elevation, while on Mussooree, the most external range, I have seen it but little above six thousand feet, though parts of the range are fifteen hundred and two thousand feet higher. This must in some measure be ascribed to the diminished height of mountains lowering the sources of irrigation, but principally I conceive to the effects of the breeze, which always blows up the mountains from the plains, and which, besides being very drying, has its capacity for heat increased as its density is diminished, and thus prevents the accumulation of heat on the mountain sides over which it passes.

On descending the western passes of the Himalaya, we enter the district of Kunawur, which has been described by Captain Herbert as comprehending the valley of the Sutlej and its principal feeders, from lat. 31° 33′, long. 77° 47′, to lat. 31° 51′, long. 78° 42′. It is bounded on the north-east and west by Tartar provinces, under the influence of China, and may be said to be contained within the Himalayas; for on the south it has the Indian snowy range, and on the north the Parkyul ridge, the highest peak of which is twenty-two thousand feet. There is no table land, or undulating plain; the mountains are tipped with snow, and the villages of Kunawur are situated in the valley of the Sutlej itself, or in glens watered by its principal feeders: their general elevation is from eight to nine thousand feet; though some are below, others are much above this height, being at least twelve thousand feet in the interior.

Lower Kunawur commences near Seran, of which the climate is fine, though Rampore, the capital of Bissehir, not far distant, elevated three thousand three hundred feet, but situated in a valley, has sultry days (the thermometer as high sometimes as 100°, and even 110°) and chilly nights, with hot summers and cold winters. Some of the lower villages are subject to the periodical rains, which make their way up the valley of the Sutlej and across the lower part of the Himalaya. Near these, grapes do not thrive, but long rank grass, a species of *Saccharum*, eight or ten feet in length, with *Aneilema*, and other tropical genera, are found; higher up the river, the villages are more elevated, and the rains less regular and heavy. Here there are luxuriant vineyards, where the delicious grapes are dried as raisins, and converted into a kind of wine; orchards of apricot, apple, walnut, and in some places of peaches are seen, with pear-trees, of which also the fruit is dried. The forest-trees consist of *Pinus Deodara* and *Gerardiana*, with yew, holly, oaks, and horse-chesnuts.

Upper Kunawur is still higher up the stream, and completely beyond the influence of the periodical rains, the height of the outer chain of the Himalaya being sufficient to exclude them from this, as well as from a part of Lower Kunawur; the climate is therefore dry and cold, the country covered with snow in winter, but in summer enjoying a few months of powerful sun. The nights become frosty in the middle of September, and the thermometer sinks below the freezing point in the mornings in October, and snow falls towards the end of that month, or in the beginning of November, and covers the ground until March or April. The climate being so dry, the falls of snow are not heavy, but the winters are extremely rigorous. In July and August, there are alternately light clouds and sunshine, the air is somewhat humid, and there is occasionally a little rain. In some villages, surrounded by high mountains, the sun is not seen for more than nine hours, but in others the temperature is high, as the thermometer ranges in July and August from 55° to 58° in the morning, to 80° and even 85° at noon, in villages elevated ten thousand feet.

In comparison of the Tartar districts more to the northward, Kunawur exhibits a green and lively picture of vegetation, as there are forests of pines, poplars, willows, junipers, and cypresses. "The pasture zones occupy a belt between the limit of trees

and

and the confines of perpetual snow." Some of the villages, as Kanum and Soongnum, are populous and wealthy, with luxuriant vineyards, and orchards of apples, apricots, and walnuts, of most of which the fruit is ripe in September. Gooseberries are also met with, and wheat and Siberian barley thrive at great elevations. Captain Herbert describes the two crops in the year, as consisting of wheat, ooa, barley, cheena (*Panicum miliaceum*), phapur, ogla (two species of *Polygonum*), and turnips; the three last following barley, but wheat and cheena exhaust the soil. To these may be added peas and beans, mentioned by the Messrs. Gerard. Kunawur is every where intersected by very elevated ranges, which are crossed by passes varying in elevation from twelve to eighteen thousand feet; on some of these to the eastward, even at the latter height, little snow is seen, and that only in streaks. Vegetation extends to sixteen thousand six hundred feet, junipers are found at fourteen thousand five hundred, birches as high as fourteen thousand, and *Rhododendron lepidotum* above them; pines do not appear to extend beyond twelve thousand three hundred feet. The highest cultivation seen was to the eastward of Dabling, where, at thirteen thousand six hundred feet, crops of barley, buckwheat, and turnips were seen by the Messrs. Gerard; and a little lower the ground was covered with thyme, sage, and many other aromatic plants, besides juniper, Tartaric furze (*Genista versicolor*), sweet briar, and gooseberries. Even at this great height the sun was at times found very powerful, and the thermometer rose to 68° on the 23d July, at fourteen thousand seven hundred feet of elevation. Near the Charang Pass, continuous snow-beds commenced about the height of sixteen thousand three hundred feet. Upon the left bank of the Tagla, no snow appears at sixteen thousand feet; on the right bank, at eighteen thousand feet, there is only a little in streaks.

If we proceed to the northward of Kunawur, we shall see how much the intervention of even a single range can alter the face of a country, for crossing the Hungarung pass, at an elevation of fourteen thousand eight hundred feet, coinciding here with the limit of snow, we enter the Tartar pergunnah of Hungarung, which, besides being destitute of trees, differs from Kunawur considerably in the nature of its climate, and in having but one crop in the year. The mountains, instead of the pointed pinnacles of the Himalaya, present only a rounded outline, with gentle declivities, covered at top with a little snow, but bare of forests, and every where presenting the traveller a picture of arid barrenness. The stunted trees, consisting of apricots, willows, walnut, are only found in the neighbourhood of villages, with the dog-rose, gooseberry, and currant; and two kinds of fruit not familiar to Captain Herbert, the one yellow and acid, about the size of a currant (an *Hippophae?*), the other red and mawkishly sweet (an *Eleagnus?*). The Whin and Furze of travellers are now known to be species of *Genista* and *Astragalus*. The elevation of the villages is from ten to twelve thousand feet, and cultivation is carried on at a still greater height. Nako, on the western face of Parkyul, and on the eastern bank of the Spiti, is at least twelve thousand feet above the level of the sea; yet there are produced most luxuriant crops of wheat, barley, buckwheat, and turnips,

 rising

rising by steps to near seven hundred feet higher, in fields enclosed by hedges of gooseberry and barberry, with Juniper and Tartaric furze, extending above thirteen thousand feet. The seasons are similar to those of northern latitudes, grain being sown in March and April, and reaped in August and September. Snow generally falls towards the end of October: it seldom exceeds two feet in depth, but does not leave the ground for near six months. Want of moisture in the air must prevent its earlier descent, as the temperature at sunrise in October is seldom above 20°; in August it was 75° at noon, and never below 52°. At Chango, elevated ten thousand feet, the temperature rises to 80° in the same month; the seasons are a month earlier, and more rain falls in April and May. The crops, besides those noticed at Nako, consist of ogal (*Polygonum emarginatum*), millet, peas, and beans. At Shalkur, the most northern part of Hungarung, as well as at Lari and Dunkur in the adjoining province of Ludak, houses are built of unburnt brick, these being sufficient to resist the weather, as very little rain falls, and that only in May and June. From this position, all the mountains to the northward have a rounded outline, with but little snow resting on them in the summer months; while the irregular and snowy peaks of the Himalaya are all seen to the southward.

On the eastern boundaries of Kunawur lies that part of Chinese Tartary which is under the authority of the Grand Lama of Lahasa; Shipkee is the first village, elevated ten thousand five hundred feet. The mountains still further to the eastward are of a rounded form, with a gentle slope, of inferior elevation, and said to be of a gravelly structure. On the southern bank of the Sutlej they rise from the water's-edge up to eighteen or nineteen thousand feet, without forests or even a bush, clothed with a withered and russet vegetation, and bare of snow; a hedge of gooseberry and a row of willows are noticed as remarkable. *Chukors* and *Monals* (*Perdix Chukor* and *Lophophurus Impeyanus*) were seen while the thermometer in October stood at 33°. Shirang Mountain, beyond Shipkee, on the road to Garoo, exceeds eighteen thousand three hundred feet in elevation, yet only one strip of snow could be seen. In a late journey through the north-eastern parts of Kunawur, Dr. Gerard writes that he "came upon a village at a height of fourteen thousand seven hundred feet. It was the middle of October, and the thermometer on two mornings was 17°, yet the sun's rays were oppressive, and all the streams and lakes, which were sheeted with ice during the night, were free and running by two o'clock. The finest crops of barley are reared here, and to irrigation and solar heat are the people indebted for a crop. The barometer gave for the highest field fourteen thousand nine hundred feet of elevation; "and this," Dr. Gerard adds, "verifies the inferences on the limit of cultivation in the upper course of the Sutlej, and I think it quite probable that crops may vegetate at sixteen and seventeen thousand feet. The Yaks and Shawl goats seemed finer than at any other spot within my observation." Further on he continues: "On the north-eastern frontier of Kunawur, close to the stone bridge (near Changrezing), I attained a height of more than twenty thousand feet, without crossing snow, the barometer shewing 14·320,

14·320, thermometer 27°, at one P.M.* Notwithstanding this elevation, I felt oppressed by the sun's rays, though the air in the shade was freezing."

A little to the southward, and more to the eastward of Shipkee, the Keubrung Pass forms the boundary between Kunawur and Chinese Tartary; though elevated eighteen thousand three hundred and thirteen feet, snow was only found by the Messrs. Gerard in sheltered places contiguous to the pass, and mountains leading to it about fifteen hundred feet more elevated were just tipped with snow. The Tama or Tartaric furze extended as high as seventeen thousand feet; beyond this, every thing was barren and desolate.

At Zamsiri, Zinchin, and Bekhur, the same appearances were observed, as well as by Mr. Moorcroft still further to the eastward, in crossing from Neetee Ghat to Ghartope, the elevated plain which separates the Himalayan and Cailas ranges, which he describes as a dreary waste with a few furze bushes (species of *Genista* and *Astragalus*), but without a tree or shrub, "the woolly plant, like everlasting, is probably one in Mr. M.'s collection, having the external appearance of a *Leontopodium*, with much-divided hairy leaves; besides these, Mr. M. only enumerates tufts of silky grass, and a species of moss; but in his collection there is also a diminutive *Primula* and a *Pedicularis* from near Daba. Beyond this, he notices goldfinches in poplars, and several flowering shrubs of Tamarisk, a new species of *Myricaria* which I have also received from other parts of the hills. The rhubarb is probably *R. spiciforme*, or a new species distinct from *R. Emodi*. The animals enumerated as having been seen, are eagles, ravens, blue pigeons, partridges, larks, and linnets. The plains are also filled with the bural, yak, and shawl-wool goat; herds of wild horses and wild asses were seen, as also hares and marmots; he describes the latter as being like a young hare, they are therefore most probably the *Pika*.

In crossing the Cailas range, he saw numerous hares, and a bird resembling grouse, probably the *Tetraogallus* of General Hardwicke and Mr. Gray; also, Brahminee geese, *Anas Casarca*. At Ghartope, he notices the Gurkur or wild ass, and mentions that with frosty nights the thermometer frequently exceeded 80° in the day-time in July. Still further to the eastward, Messrs. Turner and Saunders, in their journey to Teshoo Loomboo, likewise describe the elevated plains as bare of vegetation, the atmosphere dry and clear, the cold excessive, with little snow, but the sun's rays as very powerful.

If

* The date is not mentioned. Using the mean results for October observed in Calcutta, this gives twenty thousand four hundred and nineteen feet as the elevation.—(*Note by the Editor of the Gleanings in Science*, vol. i. p. 107.) This valuable periodical, established in Calcutta under this modest title by Capt. Herbert, has, from its great success, been permitted by the Society to assume the title of "The Journal of the Asiatic Society." The first volume, completed under the editorship of my talented friend Mr. James Prinsep, shews that it is not unworthy of the name, being filled with abstracts of papers presented to the Asiatic Society of Calcutta, and with scientific communications respecting the country from correspondents in India.—(Vide *Philosophical Magazine*, May 1833, p. 371.)

If we turn our attention to the westward of Kunawur, we witness a repetition of the same appearances: a road leads from Soongnum up the bed of the Dabrung to Penoo and Dunkur, over very elevated passes. Dwarf pines are noticed at ten thousand feet, fields of beans, and orchards of apricots are passed through at a considerable elevation, and towards Pamacheen a belt of birches at fourteen thousand. Here a juniper, called *Pama*, is used as fuel. On this road the Manerang Pass is elevated eighteen thousand six hundred and twelve feet, the last half mile covered with perpetual snow; and some stunted vegetation is observed at the base of the mountains. At sunrise the thermometer stood at 31°, and must have been lower during night, as the blankets of the Messrs. Gerard were tough as leather. In proceeding towards Manes, they found bushes and wild leeks at fifteen thousand feet, and passed over gravelly hills covered with tama bushes, and found cultivation of wheat, barley, and ooa at twelve thousand feet above the sea. The grain was almost ripe, and there were a few poplars, and some barberry and other bushes in the vicinity. At Manes, elevated eleven thousand nine hundred feet, the temperature ranged, on 1st September, from 52° in the morning, to 81° at the hottest time of the day. One of the Surveyors, in a letter published in the Asiatic Journal for May 1825, p. 629, gives a most animated account of the excessive rigour of the climate at the commencement of winter in these regions, and of the fierceness with which the sun's rays dart through the rarefied air of great elevations, so as to produce a feeling of scorching in the midst of almost unbearable cold; of this may be adduced as instances, that, at the fort of Dunkur, elevated thirteen thousand feet, while the temperature of the air was 32°, a thermometer in the sun rose to 126°, and the inhabitants were thus enabled to keep themselves comfortable on the roofs of their houses even in winter. At Rangreek, elevated twelve thousand five hundred feet, the thermometer fell to 6° during the night, and rose, at eleven in the forenoon, only to 20°; and yet the greatest inconvenience was experienced, as well from the dazzling reflection from the snow as from the great power of the sun's rays; the latter made more sensible by the sharp chill of the air, which was never heated beyond 25°. Towards evening, a sudden gust of piercingly cold wind destroyed several of their followers, the breath of the travellers congealed upon their beards, and their clothes grew stiff on their backs. In fording a stream, the water froze as fast as it touched them, until their feet and legs became stiff as wicker-work. After a fresh and heavy fall of snow, the weather became settled and serene, but the cold increased so much that the thermometer fell 2° below zero; and yet, in such regions as the valley of the Peenoo, there are villages and cultivation at not less than thirteen thousand five hundred feet of elevation, and, not far distant, poplar trees twelve feet in girth. The most western regions of which we have any accounts are those traversed by Mr. Moorcroft and Dr. Gerard on the road to Leh or Ludak, through the district of Kooloo. In this direction the highest habitation seen by the latter was at eleven thousand feet, the thermometer 84° in the shade. On the plateau of Tartary, elevated sixteen thousand feet, he saw before him a black ridge, having the uniform height of three thousand feet

above

above the camp, and yet there was no snow on its summit. On mountains on the N. E. shores of lake Chimororel, which is elevated fifteen thousand feet, the region of snow had an uniform margin of nineteen thousand feet.

The above extended notices will serve to give a good idea of the nature of the country and climate to be found to the northward of the Indian Himalayas, and enable us to appreciate the causes which favour vegetation at such great elevations: the same facts have occasionally been repeated, at the danger even of being considered prolix, in consequence of the disposition some time prevalent to doubt the accuracy of observations, because they were considered incompatible with theories which were themselves deduced from facts, but occurring in regions where all the circumstances are not similar.

From the details which have been given, it seems abundantly clear that the elevation of the Indian snowy range is sufficient to prevent the passage across of the cloudy masses which deluge the plains of Northern India with rain, both in the cold and in the warm season. The atmosphere, therefore, on the northern face of the Himalayas preserves unimpaired the dryness, which is the characteristic of the rarefied air of lofty situations: hence the little deposition of snow which takes place in winter in proportion to the lowness of the temperature. The returning warmth of spring rapidly dissolves this thin layer of snow from level places, in consequence, it appears, of the undiminished power of the solar rays in passing through so rare and transparent a medium; a fact tending to confirm Mr. Daniels' views respecting the superior energy of the solar rays in the higher regions of the air; and as this seems already to have been done with respect to his opinions of their great power in polar regions, the fact is interesting as giving an additional cause for the analogy between alpine and polar vegetation. When the snow is once melted, these elevated tracts, surrounded and confined by towering mountains, absorb heat as readily during the presence of the sun, as they radiate it freely while he is absent, and becoming, like the surface of the earth at ordinary levels, the source whence the heat received from the sun is diffused to surrounding objects, they cause the line of perpetual congelation to recede higher and higher in proportion to their own elevation. Peaks and pinnacles, on the contrary, projected into the air like promontories into the ocean, partake rather of the equability of temperature of the media into which they intrude, than impress on them, like plains and table-lands, their own extremes of heat and cold.

The plants obtained from the most elevated regions of Ludak are few in number, and the localities not sufficiently defined to enable us to draw any inferences respecting the climate. All were sent by Mr. Moorcroft to Dr. Wallich, and are enumerated in his catalogue. The genera are all European, but the species new: the former being *Gentiana, Aquilegia, Iris, Salsola, Axyris, Potentilla, Campanula, Corydalis,* and *Salvia.* The shrubs are *Astragalus, Fraxinus,* and *Elæagnus,* all with the specific name of the discoverer. From the fruit of the last, a spirituous liquor is said to be distilled. Some of the finest rhubarb that I have ever seen was sent by Mr. Moorcroft from Ludak. In the same regions he discovered the celebrated Prangos Hay Plant (*Prangos pabularia, Lindley*),

Lindley), the seed of which is brought down by the northern merchants, and sold in the bazars of Northern India under the name of فطراساليون *fiturusaliyoon,* to which in the Persian works on *Materia Medica,* is attached a translation of the description of *Petroselinum,* πετροσελινον of Dioscorides, lib. iii. c. 77.

The fruit-trees and cultivated grains of Kunawur having been enumerated, with their localities, it is only necessary here to mention, that the former belong to the genera *Pyrus, Persica, Armeniaca,* and *Vitis,* and the latter to *Triticum, Hordeum, Polygonum,* while *Juglans, Corylus,* and *Pinus Gerardiana,* afford edible nuts; the other species of the latter genus are *P. Deodara* and *Webbiana; Juniperus excelsa* and *recurva* with *Cupressus torulosa* and *Ephedra Gerardiana,* forming the other *Coniferæ;* species of *Quercus, Acer, Betula, Populus, Salix, Fraxinus,* and *Pavia,* the remaining trees. The shrubs consist of species of *Elæagnus, Rhododendron, Lonicera, Berberis, Capparis, Cratægus, Rosa, Ribes,* and *Rubus;* with, of *Leguminosæ, Colutea, Caragana, Genista,* and *Astragalus: G. Versicolor,* and *A. Moorcroftianus, spinosissimus, Webbianus* and *Gerardianus,* forming the different kinds of Tartaric furze so frequently mentioned by travellers. The remaining *Leguminosæ* belong to the genera *Medicago, Lotus, Vicia,* and *Orobus.* The other herbaceous families and genera are, of *Ranunculaceæ, Thalictrum, Anemone, Isopyrum, Adonis, Ranunculus, Aquilegia, Aconitum;* of *Cruciferæ, Cardamine, Arabis, Dentaria, Draba, Hesperis, Sisymbrium, Erysimum, Tauscheria, Crambe;* of *Caryophylleæ, Gypsophila, Dianthus, Silene, Arenaria, Stellaria, Cerastium;* of *Umbelliferæ, Ptychotis, Bupleurum, Heracleum, Cuminum, Thapsia, Chærophyllum, Myrrhis, Hymenolæna;* of *Compositæ, Saussurea, Serratula, Lappa, Cirsium, Carduus, Eriocoryne, Diplurandra, Scorzonera, Crepis, Mulgedium, Lactuca, Gnaphalium, Aster, Erigeron, Tanacetum, Artemisia, Tussilago;* of *Boragineæ, Onosma, Moltkia, Anchusa, Cynoglossum, Echium, Lithospermum;* of *Scrophularineæ, Veronica, Scrophularia, Euphrasia, Pedicularis;* of *Labiatæ, Salvia, Scutellaria, Marmoritis, Dracocephalum, Erianthera, Leonurus, Phlomis;* of *Primulaceæ, Lysimachia, Androsace, Primula;* of *Chenopodeæ, Chenopodium, Blitum, Salsola;* of *Polygoneæ, Rumex, Rheum, Polygonum, Oxyria.* The other genera, generally only single ones of other families are, *Corydalis, Viola, Polygala, Linum, Malva, Vitis, Impatiens, Potentilla, Epilobium, Circæa, Myricaria, Illecebrum, Herniaria, Sedum, Saxifraga, Chrysosplenium, Galium, Rubia, Valeriana, Scabiosa, Macrostemma,* a new genus of *Asclepiadeæ, Gentiana, Atropa, Orobanche, Euphorbia.* The monocotyledons consist of *Iris, Alisma, Allium, Gagea, Convallaria, Juncus,* the *Orchideæ* of *Epipactis* and *Gymnadenia,* and the grasses of species of *Phleum, Pennisetum, Poa, Festuca, Bromus, Brachypodium, Melica, Hordeum, Alopecurus.* Among the ferns is the only *Acrostichum* in my collection, and a few species of *Pteris, Osmunda,* and a *Lycopodium.*

The most cursory comparison of this enumeration with the list of genera and species given in Ledebour's *Flora Altaica,* will show the great analogy which exists between the Flora of those mountains and of the south of Siberia with that of Tibet, or of the northern face of the Himalayan mountains, which, consisting entirely of the elevated land included

between

between the latter mountains and the Kuen-lun, makes up by elevation for its more southern latitude. It is sufficient at present to mention *Tauscheria desertorum*, *Biebersteinia odora*, *Isopyrum grandiflorum*, and *Dracocephalum Sibiricum*, as species common to these two countries; and that among other European plants found on the northern slope of the Himalayas, we have *Hyoscyamus niger*, *Lithospermum arvense*, *Myosotis palustris*, *Lamium amplexicaule*, *Prunella vulgaris*, *Samolus Valerandi*; with *Datisca cannabina*, *Cuminum Cyminum*, and *Scutellaria orientalis*, found in more southern latitudes. Several also of the new species of Himalayan plants, especially those found on such sites as Kedarkanta and Peerpunjal, are also found along this tract, though the vegetation resembles the Siberian rather than the Himalayan Flora; and this most probably is also the case along the whole extent of Tibet, as many of the phenomena of climate, general appearance, and productions, are the same in the account of Messrs. Turner and Saunders' visit to Teshoo-lomboo.

The plants of Kunawur have generally a dry sombre aspect, few leaves, and those small, frequently inserted in a cluster round the root, from the centre of which rises the scape of generally large and showy flowers. The petioles not undergoing decomposition, from the dryness of the climate, remain attached round the plant, and as they become pushed outwards by the growth of internal parts, the cellular parts are destroyed, while the fibrous remain, and protect the root, as with a covering of hair, from the severity of the weather. One peculiarity is remarkable, and that is, the resemblance externally between the plants of this cold region and those of the desert-like country near Delhi; but this is observable only in the parts of vegetation, and not in those of fructification, for in the cold climate the flowers are large and showy, and in the hot, small and inconspicuous: in both the shrubs are stunted, thorny, and frequently hairy; the wood scanty, hard, and compact; while the surface of each is dry, and of an ash grey or pale green colour. The only similarity in climate is, that in each there is great dryness of the atmosphere; the resemblance therefore is probably dependent on peculiarity of the transpiratory surface. *Capparis* and *Salsola* are almost the only genera common to both situations; the latter evidently owing to the soil of each being covered with saline efflorescence.

Among the animals which inhabit this cold and arid region, the herbivorous tribes are particularly conspicuous, for number, variety, and flourishing condition, notwithstanding that the country appears barren of vegetation; but the grasses belong to the genera which furnish the best pasturage grasses of Europe, and the *Astragali* afford legumes, which must be as nourishing as peas and beans. The Tiger is mentioned by Mr. Hodgson as extending his wanderings to the neighbourhood of the snow, and by Mr. Moorcroft has been traced as far as Khoten, nearly as far north as by Ehrenberg. The Tibetan Dog is remarkable for his size and fierceness. Hares are common, and most likely also the *Pika*, as Moorcroft compares his Marmots to young Hares; and Captain Turner mentions seeing Rats without tails. The Tibetan Musk is of course a native; *Antelope Hodgsonii* and *A. thar.*, the latter allied to the *Chamois*, are also found,

 while

while the Shawl Wool Goat thrives only in these regions. The Sheep, unrivalled for size and beauty, as well as for fineness of wool, are, like the Goat, used for carriage, and both, as also the Dog, are furnished with a fine wool under the rough upper covering of shaggy hair. The *Bhural,* Asiatic Argali, or *Ovis Ammon,* is also found here, with the shaggy-tailed *Yak* or *Bos grunniens.* The Wild Horse, the Guckur or Wild Ass, and the Dziggtai or *Equus Hemionus* of Pallas, (the Mule of travellers) complete the list of *Mammalia* on the N. face of the Himalaya. The Birds enumerated as having been seen, are Eagles, Ravens, Grouse, Linnets, and Goldfinches, and the lakes are described as being covered in summer with Geese, Ducks, and numerous Grallæ ; *Vultur barbatus, Perdix Chukor, Satyrus melanocephalus, Lophophorus Impeyanus, Phasianus Wallichii,* and a bird, with red beak and legs, like *Fragilis gracula,* have also been seen in Kunawur, which in the distribution of the animal, as in that of the vegetable kingdom, approximates to the Altai mountains.

In the foregoing general view of the climate and productions of the tract of country whence the collections have been formed, it was impossible to be more minute regarding species; but the details respecting such as it will be requisite to notice, will be introduced after the general observations on the natural orders to which they respectively belong. At the same time also will be noticed the particular plants of other countries, which it would be advisable to introduce into India ; and there is no doubt that, with the warm climate of the Plains, moist in the lower and dry in the upper provinces, and the temperate one of the Hill provinces, the facilities are great, and the field most extended for increasing the resources and improving the comforts of an immense population. The results which have already attended the introduction into India of such foreign products as Tobacco, Capsicum, the Guava, Pine, and Custard-apples, which are so completely acclimated as to appear indigenous, are our best guarantees for further success; particularly as the most valuable products of the plains of India, as Rice, Sugar-cane, Ginger, now form a part of the principal resources of the warmer parts of the New World, which possess many valuable products peculiar to themselves. Many also of the useful and ornamental productions of the Hill provinces, may no doubt be introduced into England and the rest of Europe; the principal of these will be pointed out; and here, again, there is every reason to hope for considerable success, as many of the trees and shrubs of Northern India are now flourishing in the open air of England, especially in the gardens of the Horticultural Society of London, and of the Messrs. Loddige, where may be seen: *Pinus Deodara, Webbiana, excelsa, Gerardiana* and *Morinda; Rhododendron arboreum, aristatum, campanulatum* and *lepidotum; Pyrus vestita* and *variolosa; Cratægus glauca; Cotoneaster microphylla, rotundifolia,* and several other species; *Benthamia fragifera; Rosa sericea, macrophylla,* and *Brunonis; Berberis Asiatica, aristata* and *Wallichiana; Potentilla atrosanguinea* and *Nepalensis, Salvia nubicola,* with many others.

ILLUSTRATIONS

OF THE

BOTANY OF THE HIMALAYAN MOUNTAINS.

RANUNCULACEÆ.

THE *Ranunculaceæ*, named from their principal genus, and well known from containing many most ornamental garden flowers, as well as affording several very energetic medicines, form a family well suited to commence the series, and display the advantages of the natural method of classification, from presenting so many points of affinity in organic structure, geographical distribution, and in the possession of similar sensible and medical properties. They are extensively diffused throughout the cold and temperate parts of the globe, with only a few chiefly aquatic species existing in warmer regions. They are found every where in mountainous regions, from the bleak and exposed summits in the neighbourhood of melting snow, to the rich, shady, and moist valleys everywhere occurring in hilly regions where the elevation is sufficient to ensure moderation of temperature. As nearly one hundred species of *Ranunculaceæ* have been discovered in the Himalayas, their preponderance over many other natural orders which are properly considered characteristic of warm regions, displays at the first step how different must be the climate and Flora of the Himalayan mountains from that of India in general. But as several of these species have been ascertained to be identical with, while others which are new, have been found to be closely allied to those indigenous to other countries, considerable resemblance in climate may be inferred from the similarity in vegetable productions. In the plains of India but few of this family are found. *Ranunculus aquatilis* and *sceleratus*, from their existence in or vicinity to water, experiencing greater equability both of temperature and moisture than if more exposed to atmospherical changes, are found in most parts of the world. So the former is found in the north-western provinces, and the latter exists in every

part of India. The tribe of *Clematideæ*, distinguished from the other *Ranunculaceæ* by their valvular æstivation, opposite leaves, and generally scandent habit, may therefore be considered the least *ranunculaceous* of the family, have also a few species in the plains of India. *Naravelia Zeylanica*, belonging to a genus peculiar to India, is common in Ceylon, and everywhere in the Peninsula, but not found above the province of Bengal; *Clematis Gouriana*, common in hedges and in the jungle at the foot of hills, extends from the Neelgherries and from Dindygul, near the extremity of the Peninsula, up to the Deyra Doon, in 30° of N. latitude, along the foot of the Himalaya: but it is worthy of remark, that this species, as well as *C. grata*, flowers only in the autumn, or at the commencement of the cold season of the plains, while the Himalayan species flower in the spring, or at the commencement of the warm weather of the mountains, that is, according to elevation, either in April or May; and it is remarkable, that April and October are the two months in which the mean temperature of the year is found to occur in most places; and though the temperature of October and November in the plains is above that of May and April in the hills, yet the approximation is greater than if the respective species flowered in the same months in the different places. *Nigella sativa*, found in the south of Europe, Asia Minor, and Syria, exists only in the gardens of India, but where, from its numerous Indian names and uses, it must, as well as *Delphinium Ajacis*, have been long acclimated, and formed a part of the ornamental flower-garden of the cold weather months.

The genera of *Ranunculaceæ* of which species are found in the Himalayas, are *Clematis*, *Thalictrum*, *Anemone*, *Ranunculus*, and *Caltha*, distributed also throughout the cold and temperate parts of both the northern and southern hemispheres, and with these we have also species of *Adonis*, *Trollius*, *Aquilegia*, *Delphinium*, *Aconitum*, *Cimicifuga*, *Actæa*, and *Pæonia*, which the Himalayas share in common with Siberia, Europe, and America. No genus of this family has yet been discovered peculiar to these mountains, as *Knowltonia* to the Cape of Good Hope, *Hamadryas* to South, and *Hepatica*, *Hydrastis*, and *Zanthorhiza* to North America. It is interesting to observe, that the genera, of which only species are found in the highest latitudes, are those also which are alone found on the highest peaks of the Himalaya: thus *Ranunculus affinis* and *Caltha arctica* were found in Melville Island, so I found only *R. polypetalus* and *C. Himalayanus* on the top of Kedarkanta, with *Anemone discolor* a little lower down; of this genus species extend as far as 68° of N. latitude. Species of *Thalictrum* are found in the same situations later in the year, but as the Himalayas are within the influence of the periodical rains, a degree of moisture and equability of temperature is produced during that season, which allows of the existence of genera and species at elevations where they could not otherwise exist. The Himalayan genera of *Ranunculaceæ*, with the exception of *Cerotocephalus*, are exactly those enumerated by Ledebour, as those of which species are found in the Altai mountains; and also, with the exception of *Helleborus* and *Nigella*, which do not extend either eastward to the Altai or southward to the Himalaya, the same genera as those enumerated by Meyer and Bieberstein, as

being

being indigenous to the ranges of Taurus and Caucasus. Many of the species are identical with those found in more northern latitudes, as *Ranunculus arvensis, bulbosus, Flammula* and *salsuginosus, Isopyrum grandiflorum, Delphinium pubescens* and *Adonis æstivalis,* while of those which are new, many are in like manner allied to those described by Ledebour, Bieberstein, and Meyer, in the *Floras Altaica* and *Taurico Caucasica,* as *Thalictrum Maxwellii* to *T. flavum* and *appendiculatum. Anemone Wallichiana* to *A. albana* and *Bungeana. Trollius pumilus* to *T. patulus. Aquilegia Moorcroftiana* to *A. Sibirica. Aconitum læve* to *A. septentrionale,* and *A. multifidum* to *A. anthora. Ranunculus polypetalus* must be allied to *Ficaria? glacialis* of Fischer, this being described as having the habit of *Caltha appendiculata,* a six sepaled calyx and a corolla with thirteen petals; while *R. pimpinelloides* being nearly allied to *R. rutæfolius* must be so to the new genus *Callianthemum* of Ledebour, formed of this species. Some of these Himalayan species assist, though in a small degree, in shewing the analogy of *Ranunculaceæ* with the other families which have long been pointed out. Thus the broad filaments of many of the species show the mode of formation of the petals of *Nymphæaceæ;* and *Anemone tetrasepala* with its umbel and partial umbels, supported by an involucrum and involucels, points out the relation of this family with the *Umbelliferæ.* The plants of this family figured in Dr. Wallich's *Plantæ Asiaticæ Rariores,* as well as those in the present Illustrations, will give a very good idea of the highly ornamental nature of the Himalayan species of this family; and there is no doubt, from the nature of the climate where they are indigenous, that many of them would be perfectly at home in England, where already so many of their European and Siberian congeners flourish; but perhaps *Clematis grata* from its fragrance, and *C. montana* from the showy nature of its garlands of numerous white rose-like flowers, are the most desirable as ornamental flowers, and *Aconitum ferox* and *heterophyllum* as medicinal plants. To mention the rest in detail would be tedious, but there are many others highly ornamental, as may be judged of from the drawings and descriptions.

The *Ranunculaceæ* form a very natural family, not only with respect to structure and geographical distribution, but also in possessing the same sensible properties and modes of action on the human frame. This is owing to their containing in all parts an acrid principle, which Krapf ascertained to be neither acid nor alkaline, but of so volatile a nature, that in most cases simple drying in the air, or infusion, or decoction in water, is sufficient to destroy it; that its activity is increased by acids, sugar, honey, wine, and spirits, and is only effectually destroyed by water and vegetable acids. (*Fée, Cours. d'Hist. Nat. Pharm.* v. i. p. 373.) Two vegetable alkalies, *Delpia* and *Aconitia,* the latter little known, are produced by the plants of this family; if the acrid principle be always of the volatile nature that it is represented, the powerful effects attendant on the administration of the root of *Aconitum ferox* even after it had been preserved ten years, must be ascribed to the presence of some principle of a more permanent nature. According apparently to the proportion of the acrid principle to the rest of the vegetable substance, or perhaps owing to the peculiar nature of the acrid

acrid principle in each species, it is found that they act either on the system generally, or in different degrees on particular organs. Thus several species of *Ranunculus* are used as rubefacients and vesicatories; while the roots of *Zanthorhiza, Coptis,* and *Hydrastis,* as tonics; and those of *Thalictrum majus* as a substitute for rhubarb. *Hellebore* has long been known as a powerful cathartic, and *Aconite* as a no less powerful narcotic and poison; while some from the destructibleness of their noxious property by water have been used as food. The Mahomedan physicians in India having derived their knowledge of drugs chiefly from Arabian authors, who translated from the Greek, it is not surprising to find such articles as *Hellebore, Pœony, Lycoctonum,* and *Stavesacre,* all of which as well as others might be grown in the Himalayas, prescribed in every part of India, though the druggists, calculating upon the ignorance of both practitioners and patients respecting the true drug, generally substitute some which they consider an equivalent. Yet it is interesting to observe, that independent observation has introduced into Indian practice several drugs from this family, to which the same properties are ascribed as in Europe. Thus *Ranunculus sceleratus* is used as a vesicatory. The roots of *Thalictrum foliolosum* as a bitter in the cure of fevers—those of *Aconitum heterophyllum* as a tonic, and of *Aconitum ferox,* though a poison, as a narcotic in rheumatism. *Nigella sativa* is alone cultivated in India, as in most Eastern countries, and continues in the present day, as in the most ancient times, to be used both as a condiment and a medicine.

The celebrated Indian poison called *Bish* or *Bikh,* being referred by all authorities to *Ranunculaceæ,* requires to be noticed, though it would not be easy, even in the present state of confusion of Indian Materia Medica, to find an article of which it is more difficult to give a satisfactory account, and of which, at the same time, it is so necessary that we should have a clear idea. The subject to be entered into, with the detail which it requires, would claim a much greater space than can be allotted to it here: little more therefore can be done than to state the little that is known, and to urge observers, who may be favourably situated, to prosecute the inquiry.

Dr. Buchanan first acquainted the European world with the existence of four kinds of *Bikh.* 1. *Singya Bikh.* 2. *Bish* or *Bikh,* the poison. 3. *Bikhma,* a powerful bitter. 4. *Nirbisi;* also without deleterious properties. The first Dr. B. referred to a species of *Smilax;* the author has had two species of *Convallaria,* called *meetha-doodhya,* and *mohura-doodhya,* represented to him as being of a poisonous nature. The three other kinds of *Bikh* Dr. B. refers to the genus *Caltha,* but for what reason it is difficult to discover, as the flower of the species he describes are without the characteristics of the genus; and the plant, he allows, differs much in habit from *Caltha palustris.* It may be supposed, therefore, that he had only an opportunity of examining the flowers in a young state, and it is known that when he published his description, he was without his specimens. These are now in the East-Indian Herbarium, and have been all referred by Dr. Wallich to the genus *Aconitum.* The specimens of *Caltha? Nirbisi* and *C.? Codoa* of Dr. Buchanan, appear to be Dr. Wallich's *Aconitum ferox,* while those of *C.? Bishma,*

Bishma, his *Aconitum palmatum*, all evidently in a young state, and without flowers or fructification. That the virulent poison, emphatically called *Bish*, *i.e.* the poison, is the root of *Aconitum ferox*, admits, I think, of no doubt. The root is brought down to the plains of India from the mountains where this plant is indigenous; that it was produced by it was first learnt by Dr. Wallich in Nepal; the fact was confirmed by Dr. Govan in Sirmore, and the information communicated to the author on the same mountains was, that *Bikh* is the name applied to *Aconitum ferox* and *Meetha tellia* to the root, which, though a violent poison, is occasionally used in medicine. It may further be stated, that the specimens of *Aconitum ferox* in the author's Herbarium, have the fusiform roots attached side by side, black and wrinkled externally, and of a brownish colour internally; they impress upon the tongue and fauces a peculiar burning sensation, and increase the flow of saliva, as is described to be the case with the *Bikh*. They moreover exactly resemble the specimens bought in the Indian bazars, of *Meetha tellia*, in the author's collection of Materia Medica.

Both Drs. Buchanan and Wallich have mentioned the uncertainty and confusion existing in the names of the several articles of the Indian Materia Medica. This is no doubt true, and it therefore becomes more necessary to elucidate the subject when such powerful drugs are sold and administered as remedies for disease. Considerable assistance will be derived in this labour, if, when consulting native works on the subject, we at the same time procure as many as possible of the drugs which are described. Without this, no satisfactory progress can be made, as we have no means of ascertaining when the same drug is given in different parts of the country, under different names, nor when, which is sometimes the case, different articles are given under the same name.

Dr. Buchanan (*Brewst. Journal*, i. p. 250) gives *Bish*, *Bikh*, and *Kodoya bish* or *bikh*, as the synonymes, to these *Meetha* ought to be added, instead of being referred to *bikhma*. Professor H. Wilson (*Cal. Med. Trans.* Vol. ii. p. 280) referring to this article, says, that *Bish*, *Bikh*, or *Vish*, means poison simply, and that it has several Sanscrit synonymes, as *Amritam*, *Vatsanabhu*, *Visham*, &c. Dr. Carey, in his Bengalee Dictionary, refers *Bish* to *Aconitum ferox*, and quotes as synonymes with *Vatsanabhu*, *Mitha*, or *Mitha zuher* (sweet poison). Dr. W. Hunter (*Cal. Med. Trans.* Vol. ii. p. 410) has *Meetha zuhur*, *Meetha bikh*, and simply *Mitha* as synonymes. Dr. Wallich (*Plantæ Asiat. Rar.* i. p. 41) mentions that Dr. Govan found the root called *Meetha-doodya* and *Meetha-telya*, and gives as synonymes, *Visha*, *i.e. Venenum, et Ati visha, summum venenum;* Hindee, *Vish* or *Bikh;* Newar, *Bikh* and *Bikma*. In the *Mukhzun-ool-Adwieh*, probably the best Persian work on Materia Medica in use in India, several kinds of *Bish* are enumerated; as—1. *Seengheea*, so called from its resemblance to the horn of a Deer. 2. *Buchnag*, like *judwar*. 4. *Teezuk*. 5. *Kuroon-ool-soombul*. 6. *Buhrasoorut*. 7. *Burhmunee*. 8. *Muhoodah*. 9. *Huldeh*. 10. *Kala koot*. 11. *Sutwa*. 12. *Tellia*. But as it is doubtful whether these are varieties or species, or whether more than those already mentioned, can be referred to the genus *Aconitum*, they are only

only enumerated as subjects for further inquiry. In the *Taleef-Shereef*, an Indian work on Materia Medica, lately translated by Mr. Playfair, *Singia* and *Bechnak* are given as two names of a most deadly poisonous root from Nepal, no doubt the Aconite.

In all the native works, the *Bikh* is represented as being a deadly poison, even in the smallest doses. The Hindoo works quoted by Dr. Hunter, describe it as being at first sweetish (hence the affix *meetha*, sweet), and then followed by a roughness on the tongue, or as it is expressed in one work, "seizing the throat." Dr. Buchanan has informed us, that it is equally fatal when taken into the stomach, and when applied to wounds: hence used for poisoning arrows and killing wild animals. The futility of the Gorkhas attempting to poison the springs of water was shown in the last campaign, and Dr. Govan has proved the improbability of deleterious exhalations from this plant being the cause of the unpleasant sensations experienced at great elevations, inasmuch as it is only found much below where these are experienced. But as it is a root of such virulent powers, it has no doubt been frequently employed as a poison, and its sale was therefore prohibited by the native powers in India. Notwithstanding this, the Hindoo physicians, noted for the employment of powerful drugs, such as arsenic, nux vomica, and croton, do not hesitate to employ this also in medicine. In the *Taleef-Shereef* it is directed never to be given alone; but mixed with several other drugs, it is recommended in a variety of diseases, as cholera, intermittent fever, rheumatism, tooth-ache, and bites of snakes. It is also used as an external application in rheumatism in the north-western provinces. Mr. Pereira's experiments have shown that this root, either in the form of powder, watery extract, or spirituous extract, is a most virulent poison: but of these forms the last is by far the most powerful. "The effects were tried by introducing this extract into the "jugular vein, by placing it in the cavity of the peritoneum, by applying it to the "cellular tissue of the back, and by introducing it into the stomach. In all these cases, "except the last, the effects were very similar; namely, difficulty of breathing, weak-"ness, and subsequently paralysis, which generally commenced in the posterior "extremities, vertigoes, convulsions, dilatation of the pupil, and death, apparently from "asphyxia." (*v. Wall. Pl. Asiat. Rar. loc. cit.*)

With respect to the *Bikhma*, or the second kind of *Bish*, the difficulties are greater, as the specimens of *Caltha*? *Bikhma*, which Dr. Buchanan was informed produced the febrifuge root, belong to Dr. Wallich's *Aconitum palmatum*, Cat. No. 4723; this may therefore produce a root possessed of the properties ascribed to the *Bikhma* by Dr. Buchanan's informants. Though we have no further information respecting it than its name, properties, and the short description of *Radix tuberosa* to guide us, it is interesting to endeavour if it can be traced in other parts of India, though names, especially provincial ones, we have seen vary in different districts, and the properties ascribed to a drug is rather an uncertain guide in the present state of the Indian Materia Medica; but it appears to be more than an accidental coincidence, that the author, in his inquiries, has met with a *tuberous root* produced by a species of *Aconite*, which is extensively used in India as a tonic medicine. In the native works on Materia Medica,

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as well as in the common Persian and Hindoostanee and English Dictionaries, *Atees* is described as being the root of an Indian plant used in medicine. This the author learnt was the produce of the Himalayas: he therefore sent to one of the commercial entrepots situated at the foot of the hills, and procured some of the root, making inquiries respecting the part of the mountains whence it was procured. The plant-collectors in their next excursion were directed to bring the plant, with the root attached to it, as the only evidence which would be admitted as satisfactory. The first specimens thus procured are represented in Plate 13, and the root *Atees* having been thus ascertained to be the produce of a new species of Aconite, it was named *Aconitum atees* (*Journ. Asiat. Soc.* i. p. 459), but which has since been ascertained to be the *Aconitum heterophyllum* of Dr. Wallich. The roots obtained in different parts of the country resemble one another, as well as those attached to the plant. They are about an inch in length, of an oblong oval-pointed form, light greyish colour externally, white in the inside, and of a pure bitter taste. That its substance is not so injurious as the *Bish*, I conclude from its being attacked by insects, while the other remains sound and untouched. The natives describe it as being of two kinds, one black, the other white, and both as bitter, astringent, pungent, and heating, aiding digestion, useful as a tonic and aphrodisiac. By inquiries in Nepal it might easily be ascertained whether this has any resemblance to the *Bikhma* of Dr. Buchanan.

Respecting the third kind of *Bish, Nirbisi, Nirbishi*, or *Nirbikhi*, the uncertainties are also considerable; as we have only the information that it is a tuberous root without deleterious properties; while Dr. B.'s specimens of *Caltha*? *Nirbisia* are not to be distinguished from those of his *Caltha*? *Codoa*, which have been shown to be those of *Aconitum ferox* in a young state. It is evident, therefore, that the people employed did not take the necessary precautions, and, perhaps, brought the leaves of the latter plant, because they thought it was like the true one, and it may therefore be supposed to be one of the *Ranunculaceæ*, particularly as the author, in the mountains of Sirmore and Gurhwal, found the name *Nirbisa* applied to *Delphinium pauciflorum;* and the roots brought down from these mountains with that name have the closest resemblance to the roots of some species of this genus, though he did not succeed in tracing it to the particular one; but that which is reckoned the best kind of *Nirbisi* in the Indian bazars is of a very different nature, and brought down from Bissehur and from Umritseer, the commercial capital of Lahore. This kind is fusiform, somewhat flattened and wrinkled, of a black colour externally, and in some respects resembling the *Bikh* itself; when cut, the substance is found to be compact, and of a brownish colour, with a slight degree of bitterness and acrimony.

The name *Nirbisi*, with its Persian and Arabic synonymes, *judwar* and *zudwar*, has been already applied by Mr. Colebrooke to the roots of *Curcuma Zedoaria*, because they agree pretty well with the round zedoary (*zedoaria rotunda*) of the shops; but that distinguished scholar, with a caution dictated by his extensive knowledge of the subject, observes, that if the drug be not the true zedoary, the synonymes must be transferred to

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some other plant. The term *Nirbisi,* as observed by Mr. Colebrooke, implies that the drug is used as an antidote to poison, being composed of the privative preposition *nir* and *bis,* poison; and in the *Mukhzun ool Adwieh,* it is further explained, as repelling from and purifying the body from deadly poisons. It may therefore be considered as a medicine of considerable importance in Eastern countries, and that it is not only so at present, but has been reckoned such from very ancient records, will appear from the following quotations. The Arabic synonyme *Zudwar,* leads us at once to the accounts of the *Zedoaria* of old authors, and the *Geiduar* of Avicenna. Thus, Mathiolus (*Commentaries on Dioscorides,* lib. ii. c. 154), tells us, "Zedoaria (ut cap. clxxii. testis est Serapio) convehitur e Sinarum regione ultra extremas Indiæ oras;" adding, after giving the medical properties, "et in antidotis additur. Ideoque dixit Avicenna nihil esse ea præstantius ad ebibitum Napellum." Garcias ab Orta, who was for so many years one of the physicians at Goa, writes: "Quod nos hîc Zedoariam appellamus, *Avicennæ,* lib. ii. cap. 734, *Geiduar* dicitur; aliud nomen ignoro, quia nascitur regionibus Sinensium provinciæ vicinis. Magno vero emitur *Geidwar;* nec facile invenias, nisi apud circumforaneos quosdam et circulatores, quos Indi *jogues,* Mauretani *Calandares* appellent, hominum genus quod peregrinationibus et stipem amendicando vitam sustentat. Ab his enim et reges et magnates Geiduar emunt." "Utile est autem istud Geiduar ad plurima, sed præsertim adversus venena, et virulentorum animalium ictus morsusque." Clusius, at p. 378 of the same work, "Exoticorum libri decem" having obtained some specimens, "Gedwar veri nomine inscriptas," gives a figure, and compares them with the roots of Anthora, which was at one time thought to be the Zedoary; they resemble a good deal those of *atees,* as represented in pl. 13. The Persian authors, after giving the synonymes, mention that there are five kinds of *Judwar.* The best, called *Khutai,* or Chinese, procured from the mountains of that country. The two next kinds are the produce of the mountains of Tibet, of Nepal, of Morung, and Rungpore; the fourth kind is from the hills of the Dukhun; and the fifth, called *Antuleh,* is the produce of Andaloosee, or Spain. A long account follows of the properties and uses of *Judwar,* of which it is needless to adduce more than that it is considered a powerful antidote to poison, particularly of the *bish*; more so, indeed, than the *tiryak farook,* the ingredients of which are given by Prosper Alpinus De Medicin. Ægypt. lib. iv. c. 9. It is therefore probable, that the *Nirbisi* is the true *Zedoary* or *Geiduar* of Avicenna, whatever may be the plant which produces it; that it is not likely to have been what is now so called, the produce of a species of *Curcuma,* is evident from the difficulty which Garcias ab Orta had in procuring it even in India, Further, if the descriptions in the Persian works on Materia Medica be compared with those of the old Arabian authors, they will be found to refer to the same article, of which in India the name is *Nirbisi.* It may therefore be recommended as an interesting subject of inquiry for travellers in the Himalayas from Silhet to Cashmere, to ascertain the plant or plants which furnish the different kinds of *Nirbisi, Judwar, Zudwar,* or *Antuleh.* *Cissampelos convolvulacea* is called *dukh nirbisee* in the N.W. provinces.

SYNOPSIS

Of the GENERA and SPECIES of RANUNCULACEÆ found in the Himalayan Mountains, in the Tract between the Ganges and Indus Rivers, or from N. Lat. 30° to N. lat. 35°.

TRIB. I. CLEMATIDEÆ.

I. CLEMATIS.

1. *C. Gouriana.*—Roxb. Fl. Ind. ii. 670. D.C. Prod. 1. 3. Wall. Cat. Herb. Ind. No. 4673.

HAB. Deyra Doon, N. Lat. 30° flowering in October.

Var. β. subovata, foliolis brevioribus, ovato-acuminatis.

HAB. Sahunsadhara, near Deyra Doon; flowering in November.

2. *C. cordata;* caule scandente, foliis pinnatisectis, segmentis submembranaceis cordato-oblongis acuminatis dentato-serratis 5-nerviis.

HAB. Jumboo, Lat. 33° between Lahore and Cashmere.

3. *C. grata.*—Wall. Pl. Asiat. Rar. 1. 83. tab. 98. Cat. 4668.

HAB. Suen range in Sirmore; flowering in October and November in the Botanic Garden at Saharunpore.

4. *C. Buchananiana.*—D.C. Pr. 1. 4. Don Prod. Fl. Nep. 191. Wall. Cat. 4677.

HAB. Mussooree and Suen range; flowering in October.

5. *C. nutans;* caule scandente, foliis pinnatisectis foliolis tripartitis, segmentis ovato-lanceolatis trinerviis, lateralibus sæpe irregulariter lobatis terminali integro; petiolis brachiatis, pedunculis folii longitudine trifloris, floribus nutantibus, sepalis apice revolutis.

HAB. Suen range, and on the banks of the Giree; flowering in May.

6. *C. venosa:* caule scandente, foliis pinnatisectis, foliolis cordatis acuminatis argute serratis glabris membranaceis reticulato-venosis, pedunculis trifloris folio brevioribus, sepalis acutiusculis apice revolutis.

HAB. Mountains between Lahore and Cashmere; flowers in September, and ripens its fruit in October. Simla, Nagkanda.—*R. Inglis, Esq.*

7. *C. globosa;* caule scandente, foliis biternatim sectis, segmentis oblongis lobato-dentatis integerrimisve, petiolulis cirrhosis, pedunculis 3-v. 5-floris, alabastris subglobosis, sepalis ovatis patentibus.

HAB. Soongnum lat. 31½°. Elevation 9,000 feet.

8. *C. tenuifolia;* foliis biternatim sectis, segmentis lineari-lanceolatis subdentatis, pedunculis inferioribus unifloris, superioribus trifidis trifloris medio bi-bracteatis, sepalis lanceolatis ciliatis patulis staminibus longioribus.

HAB. Jumboo.

9. *C. montana.*—D.C. Prod. 1. 9. Wall. Cat. 4681. *C. anemoniflora.* Don Prod. Fl. Nep. 192.

HAB. Mussooree, and every where in the Himalayan Mountains between 5,000 and 7,000 feet of elevation; a highly ornamental plant flowering in April.

10. *C. Nepalensis.*—D.C. Prod. 1. 9. Wall. Cat. 4680. *C. montana.* Don Prod. 192.

HAB. Choor, Urukta, and other mountains, at elevations of from 9,000 to 10,000 feet; flowering in May.

II. NARAVELIA.

11. *N. Zeylanica.*—D.C. Prod. 1. 10. Wall. Cat. 4687. *Atragene Zeylanica,* Roxb. Corom. 2. 47. t. 188.

HAB. Bengal.

TRIB. II. ANEMONEÆ.

III. THALICTRUM.

12. *T. elegans*—(Wall. Cat. 4728)—floribus dioicis? caule angulato, foliis quadriternatim sectis exstipellatis, segmentis cuneato-rotundatis subtrilobis, carpellis longe stipitatis umbellatim patentibus obovatis inflatis apice obliquis.

HAB. Choor Mountain; in fruit in August.

13. *T. foliolosum.*—D.C. Prod. 1. 12. Don Prod. 192. Wall. Cat. 3711.

HAB. Mussooree and every where in the Himalayas at 7,000 feet of elevation, flowering in April. Root used as a cure for agues, and called in the Hills *pelijurree* and *shuprak.*—All my specimens present male flowers only.

14. *T. neurocarpum;* pericarpiis stipitatis dolabriformibus compressis aristatis 3-costatis marginatis, foliis quadriternatim decompositis, foliolis cordatis obtusis inciso-crenatis membranaceis.—An. *T. foliolosi* fæmina?

HAB. Choor. Seed ripe in August.

15. *T. microphyllum;* scapo nudo, foliis subbipinnatis, foliolis petiolulatis ternatis dum sessilibus cuneiformibus apice tridentatis, racemo spiciformi, bracteis trilobatis lobo medio elongato, carpellis stipitatis costatis nutantibus apice obliquis.—*T. alpino* omnino simile; scapus palmaris.

HAB. Lofty mountains, as Kedarkanta, at an elevation of between 12,000 and 13,000 feet; flowers in June.

16. *T. marginatum;* scapo nudo, foliis bipinnatis, jugis inferioribus ternatis superioribus simplicibus, foliolis rotundatis subbilobis coriaceis, racemo spiciforme paucifloro, bracteis

bracteis oblongis membranaceis subdentatis.—*Scapus* palmaris.

HAB. Chango in Kunawur.

17. *T. vaginatum;* caule tereti striato subflexuoso, foliis semiamplexicaulibus tripinnatis petiolulis articulatis, foliolis ovato-cuneatis trifidis subtus glaucis, lobis acutis dentatis, floribus paniculatis cernuis, stigmatibus dilatatis, carpellis ovato-acuminatis.—Planta bipedalis, *T. minori* et *Sibirico* affinis; *T. cultrato* Wall. Cat. 3715 quoque affinis sed folia obtusiora.

HAB. Rogee in Kunawur.

18. *T. Maxwellii;** foliis decrescente tripinnatis petiolulis angulatis, foliolis latis oblongis basi cordatis v. ovatis, apice grosse 3 v. 5-dentatis, subtus glaucescentibus venosis, paniculis axillaribus terminalibusque ramosissimis, floribus erectis, stigmatibus dilatatis.—Planta tripedalis. *T. appendiculato* et *flavo* affinis, a priori quo flores erecti, filamenta longissima, anthera brevia.—Ledeb. Ic. pl. Fl. Ross. alt. t. 164, differt floribus nutantibus, filamentis brevibus, antheris longis.

19. *T. radiatum;* foliis longe petiolatis triternatis: foliolis rotundatis obtuse lobatis membranaceis subtus glaucis, pedunculis dichotomis radiatis, stylis arcuatis apice circinatis, carpellis substipitatis.

HAB. This plant I have only found at an elevation of 6,500 feet at Mussooree, in flower in the rainy season, where it is found growing luxuriantly with such *Orchideæ* as *Mycrostylis Wallichii* and *Empusa paradoxa*, on the branches of trees in the thick coating of mosses and ferns with which these are covered during the moisture of the rainy months.

20. *T. pauciflorum;* caule folioso, foliis triternatis subsessilibus, foliolis cuneato-rotundatis trilobis glaucis venosis, pedunculis longis axillaribus unifloris.—*Caulis* spithamæus.

HAB. Kioonthul in Cashmere.

IV. ANEMONE.

21. *A. Wallichiana;* foliis pinnatis scapo dimidio brevioribus, foliolis 3 v. 5-sectis segmentis cuneatis apice tridentatis, petiolis foliolis involucrisque villosis, pedunculis involucro duplo longioribus, flore subnutante, sepalis 6 patentibus elliptico-oblongis extus sericeis intus glabris. Affinis *A. Bungeanæ* et *Albanæ*.

HAB. Chango in Kunawur.

22. *A. discolor;* scapo unifloro maculato foliis 3 v. 5-partitis sericeo-villosissimis, lobis obtuse inciso-serratis cuneato-ovatis, involucris triphyllis sessilibus, foliolis cuneatis lobatis dentatis, sepalis 7 ovalibus extus pilosis, intus glabris, ovariis ovatis hirsutis. (Tab. 11. fig. 1.)

HAB. This species of Anemone, is that chiefly found on the tops of lofty mountains in the Himalaya, along with *A. obtusiloba*, of which it may possibly be a variety, though distinguished by a sufficient number of positive characters. I have found it in flower in April and May on the top of Choor, Urukta, and Kedarkanta, at elevations of about 10,000 feet, where it is highly ornamental, from the variety of its colours, and from making its appearance shortly after the melting of the snow.

The *root* is fusiform, and appears thicker than it actually is, in consequence of being surrounded by the sheathing bases of the petioles of former years, which as happens in many other plants of the Himalayas and of Kunawur, remaining undecomposed, protect the root from the inclemencies of the seasons. The *radical leaves* form a spreading tuft, the *petioles* are broad, sheathing, membranous at the base, and parallel-veined; the *leaf*, auriculate, acuminate, 3 or 5-lobed, lobes frequently subtrifid oblong-cuneate, coarsely serrate, villose, soft and velvetty. The *involucrum* composed of 3 sessile leaflets, which are entire and dentate, or 3-lobed, with the lobes oblong linear 3-dentate. The *scape* is erect or ascending, round, striated, frequently spotted, hairy. *Pedicels* either single or double, in the former case equal in length to the involucrum during æstivation, afterwards twice or thrice as long; where there are two flowers, one is nearly sessile, the other long pedicelled, with frequently a two-leafed involucel. The flowers are erect. The *sepals* generally seven in number, imbricate, obovate, three times as long as the stamens, varying in colour from white on the upper, and blue on the lower surface, to entire blue, and even to a livid hue. The *stamens*, with broad filaments tapering towards the apex. The *ovary* ovate, oblong, and very hairy.

23. *A. obtusiloba;* Don Prod. Fl. Nep. 174. *A. Govaniana*, Wall. Cat. 4688.

HAB. Choor Mountain, at elevations of from 10,000 to 12,000 feet; flowering in May.

24. *A. vitifolia;* D.C. Pr. 1. 21. Don Prod. 193. Wall. Cat. 4695, Ic. ined. 428. Royle, Ic. ined. 4.

HAB. Mussooree, and every where in the Himalayas, at elevations of from 5,000 to 7,000 feet; flowering in June and July.

25. *A. rivularis;* D.C. Pr. 1. 21. Don Prod. Fl. Nep. 193. Wall. Ic. ined. 973. Cat. 4694. sub nomine *A. hispidæ.*

HAB. Common at Mussooree and in the Himalayas, in the vicinity of water; found also in Kunawur.

26. *A. villosa;* foliis radicalibus villosis cordato-rotundatis 5-lobis, lobis cuneatis inciso-dentatis, involucris sessilibus cuneiformibus trilobis, lobis tridentatis, floribus umbellatis, pedicellis involucro longioribus nudis v. involucella

1 v.

* I have named this species in honour of the late Lieut. E. Maxwell, of H.M's. 11th Dragoons, who was a zealous prosecutor of the physical sciences, but found time to collect specimens of the plants of Kunawur, while travelling in that interesting region in the year 1825. This is one of the many species Lieut. Maxwell first brought me, and which I have since procured from Rogee, in Kunawur, as well as from Cashmere.

1 v. bifolia gerentibus, sepalis 5 obovatis super glabris, ovariis ovatis glabris. *A. narcissifloræ* affinis.

HAB. Lippa and Cheenee in Kunawur.

27. *A. tetrasepala;* foliis radicalibus longe petiolatis triangulari-cordatis 3 v. 5-lobatis, lobis cuneatis dentatis super glabris subalveolatis, infra pallidis pilosis, involucris 4-foliis, duobus externis laté cuneatis 3-lobis, internis externis alternantibus cuneatis serratis, umbellis 5-radiatis, umbellulis 3 ad 5-floris, involucellis 3-phyllis, sepalis 4 obovato-rotundatis patentibus.

HAB. Jumboo.

28. *Adonis æstivalis;* Lin. D.C. Prod. 1. 24.

A. Inglesii; MSS. calyce basi soluto glabro. sepalis 5 patentibus striatis submembranaceis, petalis 5—8 concavo-conniventibus calyce ⅓ majoribus sanguineis striatis basi nigrescentibus, carpellis subreticulatis stylo recto vel subarcuato acuminatis in capitulum ovato-oblongum aggregatis, caule ramoso.

This plant brought me from Hango I first saw in the collection, now in the possession of Mr. Brown, made in Kunawur by R. Inglis, Esq., which that gentleman allowed me to look through on his arrival at Saharunpore. I was at first inclined to consider it a new species, and named it after the discoverer, but it appears to be a variety of *A. æstivalis*, and therefore closely allied to *A. parviflora* of Fischer, found by him in the south of Siberia.

TRIB. III. RANUNCULEÆ.

RANUNCULOS HERBARII ROYLEANI IN ORDINEM DIGESSIT DAVID DON.

V. RANUNCULUS.

29. *R. bulbosus. L.*—A plantâ Europæâ nullo modo differt, nisi pilis copiosiùs ornata.

HAB. Kunawur.

30. *R. glabellus* (Royle), caudice elongato, caule villoso unifloro, foliis tripartitis lobatis glabris, bracteâ tripartitâ, carpellorum rostro recurvato.—*R. polyrhizo* affinis, sed diversus caudice distincto, caule villoso, carpellorum rostro filamentisque longioribus.

HAB. Shalkur in Kunawur.

31. *R. distans* (Royle), adpressè pilosus; foliis trifidis lobato-dentatis, carpellis ovatis acutis glabris margine callosis, caule multifloro.—An a sequente satis distinctus?

HAB. Mountains towards Cashmere, and at Joonug near Simla.

32. *R. lætus* (Wall.), adpressè pilosus; foliis palmatis acutè inciso-dentatis, calyce patulo hirsuto, carpellis ovatis muticis compressis glabris.

Ranunculus lætus. Wall. Cat. n. 4702. *ex-parte.*—*R. acri* nimis affinis, et vix ac ne vix diversus videtur; staturâ tamen robustiore, et foliis radicalibus maximis discrepat.

HAB. Mussooree, and every where in the Himalayas.

33. *R. hirtellus* (Royle), pubescens; foliis tripartitis lobatis dentatisque; superioribus subsessilibus digitatis, carpellis pubescentibus: rostro revoluto.—*R. villoso* et *caucasico* affinis, sed pilis brevibus vestito, floribus minoribus, carpellis pubescentibus, rostro triplò breviori revoluto distinguitur.

HAB. Deobun and Kedarkanta, also at Lippa in Kunawur.

34. *R. attenuatus* (Royle), villosus; foliis radicalibus tripartitis inciso-lobatis; caulinis digitatis: segmentis lineari-lanceolatis basi attenuatis, carpellis gibbosis pubescentibus.

HAB. Lippa in Kunawur.

35. *R. nervosus* (Royle), glabriusculus; foliis caulinis pedatis: segmentis lineari-lanceolatis basi dilatatis, carpellis ventricosis pubescentibus.—A præcedente tantùm differt foliorum caulinorum segmentis basi dilatatis, nec attenuatis.

HAB. Mussooree.

36. *R. Choorensis* (Royle), subcanescens; foliis radicalibus trilobatis inciso-dentatis; caulinis palmatis, calyce hirsutissimo, carpellis tomentosis: rostro elongato recto.

HAB. Choor Mountain, and Kedarkanta.

37. *R. vitifolius* (Royle), decumbens, hirsutus; foliis trilobatis: lobis ovatis inciso-serratis, petalis ovalibus, carpellis angulatis punctatis: rostro brevissimo adunco.

HAB. Mussooree.

38. *R. mollis* (Wall.), procumbens, hirsutus; foliis subrotundo-cordatis trifidis: segmentis obtusè lobato-dentatis, pedunculis oppositifoliis, carpellis lanceolatis acutis compressis lævissimis.

Ranunculus mollis. Wall. Cat. n. 4704. *R. hydrocotyloides.* Ejusd. n. 4703.—*R. parvifloro* affinis, diversus tamen foliis latioribus, carpellisque lanceolatis lævibus.

39. *R. arvensis. L.*—Planta patriâ dubia, semper arvicola.

HAB. Suen range.

40. *R. sceleratus. L.*

Ranunculus carnosus. Wall. Cat. 4699.—*R. indicus.* Roxb. Fl. Ind. ii. 671.—Planta Linnæi omninò.

HAB. Found everywhere near water, and used as a vesicatory in the north-western provinces of India.

41. *R. pimpinelloides;* caulibus procumbentibus unifloris, foliis subtripinnati-sectis glaucis: segmentis incisis, carpellis ventricosis scrobiculatis! muticis.—*Planta* perennis, depressa, cæspitosa, glaberrima, caudice rudimentis foliorum fibrosis undique vestito, facie ferè *Nardostachyos. Caules* plures, procumbentes, simplices, uniflori, 2-3-unciales. *Folia* subtripinnati-secta, glauca; *caulina* petiolata, plerumque solitaria: *lobis* cuneatis, incisis, obtusis, coriaceis. *Petioli* bipollicares, basi valdè dilatati, membranacei. *Pedunculi* pollicares. *Calycis foliola* ovalia, coriacea, glabra. *Petala* nondùm vidi. *Torus* globosus. *Carpella* subrotunda, ovata, ventricosa, obtusa, scrobiculata! glabra.

HAB. Soongnum in Kunawur.

42. *R. membranaceus* (Royle), foliis radicalibus ovato-lanceolatis dentatis subtùs lanatis; caulinis trifidis, carpellis lanceolatis muticis.

HAB. Lippa in Kunawur.

43. *R. salsuginosus. Pall.*—Cum plantâ Pallasianâ omninò convenit, folia tamen rotundiora.

HAB. Soongnum in Kunawur.

44. *R. Flammula. L.*

Ranunculus salsuginosus et Moorcroftianus.—Wall. Cat. 4708.

4708. In paludosis per totius ferè orbis regiones temperatas et frigidas provenit.

HAB. Soongnum in Kunawur.

45. *R. aquatilis* β. *capillaceus*. Dec. Prod. 1. 26.—Planta polymorpha, in aquosis per Europam, Asiam, et Americam communissima. *Flores* minores, albi. *Carpella* scabra.

HAB. Small streams in the vicinity of Saharunpore.

46. *R. polypetalus* (Royle), scapo unifloro, foliis reniformibus crenatis calyceque glabris, petalis oblongis numerosis. (Tab. 11. fig. 2.)—Species distinctissima, ad Ficariam accidens. *Herba* perennis, cæspitosa, rudimentis foliorum emarcidorum suprà tecta. *Radix* fibrosa, fusca. *Scapi* erecti, filiformes, glabri, uniflori, semi v. pollicares. *Folia* petiolata, reniformi-cordata, crenata, glabra, 3 v. 4-lineas lata: *dentibus* 7-10, magnis, obtusissimis. *Petioli* glabri, semiunciales. *Calycis foliola* 5, elliptica, obtusa, subcoriacea, glabra, persistentia. *Petala* 10 v. 15, spathulato-oblonga, obtusa, flava, calyce longiora, 3 v. 5-nervia, basi angustata, poro tubuloso esquamato aucta. *Stamina* duplici ordine numerosa: *filamenta* dilatata: *antheræ* subrotundæ! *Torus* sphæricus. *Carpella* compressa, glabra: *rostro* subulato, recto, elongato.

HAB. This new and very distinct species has been hitherto found only on the peak of Kedarkanta, enamelling the ground with its rich yellow flowers immediately on the melting of the snow. It appears to be nearly allied to *Ficaria? glacialis* of Fischer, D.C. Prod. 1. p. 48, found also on the top of a mountain in Dahuria.

For the foregoing account of the genus *Ranunculus*, the author is indebted to Mr. David Don, who also favoured him with detailed descriptions of the new species, of which the nature of the present work has for the present precluded the publication.

TRIB. IV. HELLEBOREÆ.

VI. CALTHA.

47. *C. Govaniana;* (Wall. Cat. 4710) caule erecto folioso, foliis amplis rotundato-cordatis serrato-dentatis, auriculis magnis approximatis, foliis floralibus inciso-serratis, floribus subumbellatis, sepalis 5 oblongo-ovalibus, stigmatibus elongatis subaduncis.—*Caulis* pedalis, bipedalisve. *Sepala* sulphurea, basi lutea.

HAB. Choor. Urukta.

48. *C. Himalensis* (Don Prod. Fl. Nep. 195) caule erecto nudo paucifloro, foliis radicalibus longè petiolatis cordato-reniformibus argute serrato-crenatis, floralibus consimilibus auriculis rotundatis hiantibus, sepalis 5 v. 6 latis ovatis paralleli-venosis, capsulis rectis rostratis.—*Caulis* dodrantalis. *Flores* intensè lutei. An prioris varietas?

HAB. Kedarkanta.

VII. TROLLIUS.

49. *T. pumilus* (Don. Prod. 193).

HAB. Tuwe kedhar towards Cashmere. Gossainthan. *Wallich.*

VIII. ISOPYRUM.

Sect. 1. Caules foliosi, multiflori.

Huc pertinent *I. fumarioides*, *I. thalictroides*, et *I. aaoxoides*.

Sect. 2. Cauliculi subnudi, uniflori.

50. *I. grandiflorum* (Fisch. D.C. Prod. 1. 48) capsulis 5, foliis biternatis, foliolis cuneatis apice tridentatis, v. tripartitis lobis lineari-oblongis, petalis emarginatis basi subtubulosis. (Tab. 1. fig. 3.)

HAB. Kunawur. Kherang Pass, July. *R. Inglis, Esq.*

This plant is one of those common to Kunawur and the Altai mountains, flowering in the former in the month of July. The *root* is perennial, the stem extremely short, either simple, or immediately dividing into several equally short branches, each surrounded by a cluster of the dilated persistent bases of the petioles of former years, from the centre of which arise the single flowered scape and a few long petioled *leaves*. These are biternate, with the *leaflets* small, cuneate, tridentate at the apex, or tripartite, with linear oblong divisions, the *petioles* dilated at the base and auriculate. The slender, simple, single-flowered *stem* or *peduncle*, rises from the centre of the leaves, bearing two minute, linear or awnshaped *bracte-like leaves*, with generally expanded rounded membranous bases. These leaves are opposite, sometimes alternate, frequently of a lance-shape, or bifid, and supported by a short petiole. The *flower* is large and showy for the genus. The *sepals* five imbricate, ovate obtuse, veined, and coloured. The *petals* five, about one-fourth the length of the sepals, oblong, a little tubular at the base, and emarginate at the apex. *Stamens* numerous, half the length of the sepals; filaments linear; anthers oblong, fixed by their base, two-celled, cells opening laterally. *Ovaries* five oblong-acuminate, terminated by the elongated style, straight on the inner angle, ventricose externally, five or six seeded. The specimens of this plant from Kunawur differ so much among themselves, that if it were not for the gradations, they would appear to belong to different species. Some are four times the size represented in the figure, and varying in the subdivisions of their leaves, but none have the petals bifid, as described by Ledebour, and to be seen in the specimens of this plant in Professor Lindley's herbarium.

51. *I. microphyllum;* capsulis 5, foliis ternatim supradecompositis, foliolis tripartitis, lobis-cuneatis trifidis segmentis oblongis acutis obtusisve, petalis emarginatis.—(Tab. 1. fig. 4.)

HAB. Jumnotri: Buddrinath. *Wallich.*

I am indebted to Wilson Saunders, Esq., for the excellent drawing of this plant, of which, specimens in an imperfect state exist in the East-Indian Herbarium,

barium, procured by Dr. Wallich's plant collectors in the neighbourhood of Budrinath. It is abundant in the neighbourhood of Jumnotri, whence I first obtained a specimen from the late M. Victor Jacquemont. The *root* of this species is perennial, long, cylindrical and stem-like, insinuating itself between the crevices of the rocks: at the apex it divides like the former species into several little tufts of leaves, from the centre of which arises the very simple stem or single-flowered scape. The *petioles* are long, dilated, membranous, or as if winged at the base. The *leaves* most delicately divided, supradecompound with ternate subdivisions, the ultimate *leaflets* three-parted, segments cuneate, three-lobed, lobes oblong, separated by obtuse angles. The *stem* or *scape* is slender, longer than the leaves, single flowered, having, as in the former species, two *bracte-like leaves*, which are broad, rounded and membranous at the base, and either simple, lanceolate, or trifid at the upper part. The *sepals* are five, four times longer than the petals, ovate, blunt, coloured. *Petals* five, minute, cuneate, emarginate. *Stamens* numerous, half the length of the sepals. *Pistils* five, oblong, acuminate, terminated by the lengthened style.

IX. Nigella.

52. *N. sativa;* Lin. var *Indica*. D.C. Syst. Veg. 1. 330. *N. Indica.* Roxb. Fl. Ind. 2. 646.

Arab. Shoonez and hub-ool-sowda. *Pers.* Seeah dana. *Hind.* Kulownjee, kala zeera v. jeera, mungrela. *Sans.* Musavi, Krishna jiraka. Melanthium, Melanospermum, Cuminum nigrum et Nigella *veterum.*

Hab. Cultivated in India.

X. Aquilegia.

53. *A. pubiflora* (Wall. Cat. 4714) calcaribus incurvis petalorum limbo brevioribus, capsulis villosis, caule multifloro dichotomo folioso pubescente, stylis stamina non superantibus.

Hab. Mussooree, Choor, and common at elevations of from 6,000 to 10,000 feet.

Var β. *Mussooriensis* calcaribus incurvis, petalorum limbo quadruplo brevioribus, capsulis villosis, sepalis acutis, caule striato folioso petiolis foliisque pilosis, stylis stamina non superantibus.

Hab. This, which in my catalogue I had marked as a distinct species, does not appear to be more than a variety of *A. pubiflora;* when growing on the Mussooree range the stems were thicker, more hairy, the leaves more fleshy, and of a deeper green, and the flowers of a lurid hue.

54. *A. Moorcroftiana* (Wall. Cat. 4713) calcaribus elongatis incurvis limbum obovatum æquantibus sepalis lanceolatis duplo longioribus, stylis stamina non superantibus petalis brevioribus, capsulis 5 villosis.—*Herba* elata gracilis. *Folia* longe petiolata, foliola membranacea glauca. *Flores* erecti magni.

Hab. Luddak. *Moorcroft.* and mountains of Cashmere.

XI. Delphinium.

55. *D. Ajacis.* Lin.

Hab. Cultivated in gardens in India during the cold weather.—*Hind.* na furman.

56. *D. pubescens.* Lin.

Hab. Cashmere.

57. *D. pauciflorum.* Don Prod. 196.—*D. denudatum.* Wall. 4719.

Hab. Mussooree, and every where in the Himalayas at moderate elevations. Hill name, *Nirbisa.*

58. *D. incanum;* petiolis brevibus vix dilatatis parallelivenosis, foliis palmatim multipartitis lobis lineari-lanceolatis divergentibus subtus incanis, pedicellis bractea multo longioribus, petalis calyce brevioribus, duobus inferioribus bifidis extus barbatis, calcare recto acuto pedicello subæquali, capsulis pendulis demum erectis oblongis apice obliquis subtorulosis pilosis; seminibus 3-angulatis, rugis alatis transversim armatis.—*Caulis* erectus rotundus striatus incanus bipedalis; *racemus* elongatus, axillaris terminalisque. *Flores* magni cærulei. *Planta* tota *D. grandifloro* similis, sed petala inferiora bifida, semina rugosa transversim alata.

Hab. Cashmere. Purbunee, July. *R. Inglis, Esq.*

59. *D. Cashmerianum;* petiolis basi non dilatatis, foliis latis cordatis 5-lobis dentato-serratis utrumque pilosis, superioribus sessilibus, racemo laxo paucifloro, pedicellis flore longioribus, sepalis latis ovalibus petalis longioribus, calcare subrecto sepalis æquali. (Tab. 12.)

Hab. The specimens of this plant were brought me from the garden of Shalimar, in Cashmere, where it was described as being a highly ornamental plant. It is easily distinguished from the other Himalayan species by the form of its leaves, size of its flowers, and lanceolate bracteoles.

Stem round, slender, hairy. *Petioles* long, scarcely dilated at the base, equalling the leaves in length. The *leaves* are broad, cordate, 5-lobed, lobes cuneate, dentate, serrate, with both surfaces hairy. *Racemes* lax, few flowered. *Pedicels* long, slender, hairy; *bractea* 3-lobed sessile: *bracteolæ* narrow lanceolate, opposite or alternate, about the middle of pedicels. The *flowers* large, showy, few in number, of a fine blue colour: the *sepals* broad, oval, reticulato-venose, hairy: the *spur* broad, straight, nipple-shaped, equal to the sepals in length: the two *inferior petals* with slender claws, limbs broad, inserted obliquely, bifid, divergingly veined: the two *upper petals* straight, broad and crenate at upper end, tapering towards end of spur: the *stamens* numerous, filaments broad-membranous tapering towards apex: *ovaries* three.

60. *D. vestitum* (Wall. Cat. 4715), petioiis longis basi dilatato-vaginantibus, foliis latis cordatis 5 lobis, lobis cuneatis

cuneatis grosse dentato-serratis hirsutis, racemo elongato conferto; calyce basi bibracteolato, calcare rectiusculo ventricoso pedicellis breviore sepalis æquali, ovariis tribus hirsutis. *Caulis* erectus hirsutus bipedalis.

HAB. Choor. Tuen. Nagkanda. Peer Punjal.

61. *D. rectivenium;* foliis floralibus sessilibus trilobatis subintegris rectiveniis, superioribus lanceolatis pedicello subæquali, calcare incurvo pedicello breviore, petalis omnibus apice barbatis, ovariis tribus subglabris.

HAB. Tuen tibba; flowering in October.

62. *D. Brunonianum;* petiolis basi dilatato-vaginantibus, foliis rotundatis 5-lobis, auriculis approximatis, omnibus cuneatis grosse dentatis, bracteis trilobatis superioribus cuneatis dentatis, racemo coarctato, calcare brevissimo obtuso, sepalis maximis ovalibus petalis que undique lanatis, ovariis 5 villosis.—*Radix* perennis; *caulis* dodrantalis foliosus. *Flores* maximi cærulei, *Petalorum* superiorum calcara incurva, inferiorum lineari-unguiculata; limbus-bifidus segmentis angustis. *Filamenta* lata, petaloidea.

HAB. This very distinct and well-marked species I have named, in honour of the illustrious botanist to whom I am indebted for the use of the Herbarium collected by *R. Inglis, Esq.*, in Kunawur. This plant was found by that gentleman on the Kongno Pass; flowering in August.

63. *D. pyramidale;* petiolis basi vix dilatatis, foliis cordatis acuminatis 5-lobis inciso-serratis, racemis elongatis axillaribus patulis, calyce basi bi-bracteolato, calcare elongato pedicello subæquali, petalis inferioribus bifidis limbis obliquis extus barbatis, ovariis tribus ovatis acuminatis pilosis.

HAB. Peer Punjal.

XII. ACONITUM.

64. *A. dissectum.* Don Prod. 119. Wall. Cat. 4724. *Anthoris* associandum.

HAB. Aorgaon below Kedarkanta. It is remarkable that all the specimens yet seen of this plant are without fructification. It must therefore be still considered as an uncertain species.

65. *A. multifidum;* floribus paniculatis, panicula floribusque pubescentibus, galeâ subconicâ apice acuminata, sacco cucullorum magno, calcare obtuso, labio elongato emarginato, filamentis basi alatis, alis membranaceis cuspidatis, ovariis 5 villosissimis, foliis longe petiolatis multifidis segmentis linearibus, folliculis 5 inflatis membranaceis transversim venosis stylo persistente mucronatis.—Planta *A. Anthoræ* affinis. Caules 2 v 3 ex eadem radice, glaberrimi apice pubescentes. *Folia* radicalia numerosa longe petiolata, caulina superiora breviter petiolata, omnia in segmentis linearibus dissecta. *Flores* ochroleuci cæruleo variegati.

HAB. Mountains bounding Cashmere to the S.W. Wyrung Pass. Sept., *R. Inglis, Esq.*

66. *A. læve;* galea conico-cylindracea basi subclavata, calcare incurvo, labio elongato acuminato, filamentis basi dilatatis, ovariis 3 glabriusculis, foliis amplis glaberrimis 5-lobis, pagina inferiore glauca, lobis cuneatis inciso-serratis ciliatis.—Planta *A. Lycoctono* affinis. *Caulis* 3-pedalis striatus infra lævis super pilosus, pili horizontales. *Flores* lutei paniculati, paniculæ axillares terminalesque, pedicelli pilosi, bracteæ longæ lanceolatæ, bracteolæ subulatæ.

HAB. Choor, Kunawur, and Peer Punjal.

67. *A. cordatum;* floribus racemosis galeâ glabrâ semicirculari adscendente, sepalis patulis, calcare ovoideo obtuso, limbo crispo reflexo, filamentis sagittato-alatis, ovariis 5 villosissimis, bracteolis remotis petiolatis basi latis cuneatis, apice acuminatis dentato-serratis, foliis cordatis rotundatis vel acuminatis coriaceis 5-costatis serrato-vel inciso-dentatis mucronatis.—Planta *A. heterophyllo* affinis, an ejus varietas?—*Caulis* pedalis, teres, subtus lævis, super pubescens, folia inferiora longe petiolata, superiora sessilia forma varia. *Racemus* pauciflorus; pedicelli longissimi. *Flores* cærulei.

HAB. Cashmere.

68. *A. heterophyllum.* Wall, Cat. 4722. (*A. atees.* Royle. Journ. As. Soc. 1. 459.—floribus racemoso-paniculatis; galeâ pubescente semicirculari adscendente antice acuminata, calcare ovoideo obtuso limbo elongato recurvato, filamentis sagittato-alatis, ovariis 5 pubescentibus, bracteolis approximatis rotundatis v. oblongis integris, foliis cordatis acuminatis vel cordatis subquinque-lobatis acuminatis dentato-serratis v. sinuato-dentatis coriaceis 5-costatis. (Tab. 13.)

HAB. This highly ornamental species is found on such lofty mountains as Choor, Shalma, and Kedarkanta, at elevations of about 9,000 to 10,000 feet, and is particularly interesting on account of its roots, called *atees*, having long been an article of Indian Materia Medica. It varies a good deal in size as well as in the form of its leaves, whence the specific name assigned to it by Dr. Wallich. The *root* is composed of two oblong oval tubers, of a light ash colour externally, and white in the inside, of a pure bitter taste; *fibres* numerous, spreading; the *stem* is generally from two to three feet in height, obscurely angled, smooth and shining below, round and pubescent above; the *lower leaves* are long-petioled, round or sagittate-cordate, acuminate occasionally almost lobed, five or more ribbed, the lateral ones spreading, the central slightly curved, running from the base to the apex of the leaf; margins divided into broad lengthened teeth, which are generally mucronate, or sharp serratures, of a leathery consistence; both surfaces without any kind of pubescence. The upper leaves are short petioled or sessile, embracing the stem, cordate-acuminate, five-ribbed, margins inciso-serrate, or serrate, serratures mucronate. The inflorescence is a panicled raceme, or the racemes are axillary and terminal. *Pedicels* long, pubescent, thickened towards apex, closely applied to stem. *Bracte* leaf-like, cordate, acuminate, *bracteoles* oval or oblong, entire sub-opposite inserted

inserted near, and supporting the calyx. The *galea* or helmet is broad, arched, convex, slightly acuminate, reticulato-venose: the *wings* equal in size to the helmet, obliquely triangular, the lower sepals lanceolate, smooth, pendulous and spreading. The *superior petals*, an inch in length, long-clawed, incurved: the *spur* short, egg-shaped, blunt, forming a small sac; the *limb* a little elongated, acuminate, with a slightly reflexed border; the *inferior petals* abortive. *Stamens* numerous, filaments dilated and bidentate at the apex of the dilated membranous base, slightly hairy. *Ovaries* five, oblong-acuminate, pubescent; *style* short; *stigma* pointed. *Capsules* follicular, inflated, oblong, rounded on the inner, and straight on the outer angle, terminated by the small persistent style. *Seeds* numerous, inserted along the inner angle, flat, surrounded by a circular membranous wing.

Plate 13. The upper part of the Plant, with the tuberous root. 1. Flower. 2. The two upper Petals, with the Stamens and Pistils. 3. Carpella. 4. Seed.

69. *A. ferox.* Wall. Plantæ Asiat. Rar. 1. p. 35 t. 41.

Hab. Choor, Kedarkanta, Gossainthan, and Sheopore. *Hind.* Bikh. v. p. 45.

70. *A. palmatum.* Don Prod. 196. Wall. Cat. 4723.

Hab. This species, though not found by the author, no doubt exists in the same tract of country as the foregoing species, as there is a drawing from Dr. Govan, marked A. *hibiscifolium*, by Dr. Wallich, which is quite different from any of the foregoing, though a good deal resembling this species.

Trib. V.? PŒONIACEÆ.

XIV. Cimicifuga.

71. *C. frigida;* ovariis 3-8 glabris stipitatis, racemis paniculatis, foliis bipinnatim biternatimve sectis, segmentis ovato-lanceolatis acuminatis inciso-dentatis v. serratis terminali trilobato.—*Actæa frigida*, Wall. Cat. 4725.

Hab. This plant, procured by Dr. Wallich from Gossainthan, was brought to me from Cashmere. It is closely allied to the Siberian species *C. fœtida.* The *stem* is four or five feet in height, hollow or filled with pith, obscurely angled, striated, smooth. The *leaves* alternate, petioled, either bipinnately or biternately divided; terminal segment 3-lobed: the others ovate-lanceolate, frequently with a lengthened point; margins either inciso-serrate or dentate; both surfaces smooth, the lower pale-coloured. The *inflorescence* an elongated panicled racemes, with recurved spike-like raceme from the axilla of the upper leaves. *Pedicels* short, pubescent, supported by a small subulate bracte. The *flowers* vary in the number of their parts from five to seven, and no distinction is perceptible between the calyx and corolla: the *sepals* are imbricate, concave, oval, ciliate, one or two of the interior ones frequently marked with a central line of junction, bifid at the apex, the upper part of a white colour, frequently having a jointed appearance, looking like an incompletely-formed anther. The *stamens* are numerous, filaments, at first equal to, afterwards longer than petals; *anthers* globular, two-celled; cells opening laterally. *Pistils* two to five or more; *ovary* oblong, tapering towards both ends; *style* short; *stigma* pointed. *Carpella* oblong, compressed, obtuse with an oblique apex, terminated by the elongated recurved style. *Seeds* 6-8, oblong, oval, covered, especially on the edges, with membranous scales, which from their closeness in the fresh state, appear to be continuous, and have also this appearance in the figure from the indistinctness of the impression.

Plate 14. Cimicifuga frigida.—*a.* Upper part of raceme.—*b.* A leaf.—*c.* A flower seen from above.—*d.* The same from below.—*e.* The carpella.—*f.* A carpellum, with the seeds inserted along its inner edge.—*g.* The same cut transversely.—*h* and *i.* A seed.

XV. Actæa.

71. *A. acuminata.* (Wall. Cat. N. 4726) racemo simplici elongato, petalis staminibus brevioribus rotundatis, baccis subglobosis nigris, foliis triternatim v. tripinnatim sectis, segmento ultimo trilobato, alteris ovato-lanceolatis acuminatis inciso-serratis, omnibus subtus pilosis. Royle Ic. ined. 15.

Hab. Shady places on Choor and Acharanda; flowering in May; closely allied to *A. spicata.*

XVII. Pœonia.

72. *P. Emodi;* (Wall. Cat. N. 4727) foliis biternatim sectis lobis decurrentibus lanceolatis acuminatis glabris, floribus monogynis, foliis floralibus tribus involucrantibus, folliculis tomentosis erectis.—*Planta* tripedalis. *Flores* albi. *Calyx* sæpe trisepalus. *Petala* 8. *Discus* vix expansus.

Hab. Shalma Mountain. Kemaon. *Wall.*

2. DILLENIACEÆ.

Though the *Dilleniaceæ* occur, as long ago stated by Mr. Brown, in the greatest abundance in Australia, yet as so many species exist in the East-India islands, the family must be considered chiefly as a tropical one, and would hardly require notice in the present work, were it not one of its objects to compare the Flora of the hills with that of the plains of India. It is interesting to observe species of this family creeping from the islands up the Peninsula, and along the foot of the Himalaya nearly to 28° of northern latitude, where *Dillenia aurea* was found on the banks of the Gogra by General Hardwicke, and *D. speciosa* in the valley of Noakote within Nepal by Dr. Wallich. The latter thrives also in the open air in 30° of N. lat. in the Botanic Garden at Saharunpore. The species of *Colbertia* extend from the Peninsula and Circar mountains, up to those of Pachette and Monghir about lat. 24° and 25°. Species of *Tetracera* and *Delima* being found in Travancore and Silhet, connect the Flora of Southern India with that of the Eastern Archipelago. With regard to the properties of the plants of this tribe, it is interesting to observe, that as the leaves of *Curatella* and *Trachytella* are employed in Guyana and China for polishing wood, and even metal, so are those of *Delima sarmentosa* employed in Ceylon for the same purpose. The leaves and bark of this tribe of plants yield astringent decoctions, which are used in medicine. The species of *Dillenia*, in addition to being highly ornamental trees, afford valuable timber; and the fleshy divisions of the calyx of *D. speciosa* and *D. scabrella*, which, as they enlarge, unite and enclose the *carpella*, and have, when ripe, a pleasant acid flavour, are eaten by the natives, as well as added to their curries. According to Rheede, the acid juice, added to syrup, is considered useful as a cough mixture.

3. MAGNOLIACEÆ.

The *Wintereæ* or Winter's bark tribe, separated from this family by Mr. Brown, chiefly on account of their dotted leaves and aromatic qualities, hardly require notice in this work, as none of the species are found in India or its mountains, were it not that the natives employ the seeds of *Illicium anisatum* most extensively as a stomachic and carminative; it would be advisable therefore to introduce the tree itself into the country, and there is little doubt of success, as it is known to extend from 23½° to 35° of N. latitude, or from Canton to Japan. The capsules, known by the name of Star-anise in Europe, are in India called *badian-khutai*, or Chinese anise. The two other species of *Illicium* are found only in Florida. The Winter's bark, *Drimys Winteri*, though found in the Strait of Magalhaens beyond 50° of S. latitude, might also find a suitable locality on the slope of the Himalaya.

The true *Magnoliaceæ*, distinguished by the showiness and fragrance of their flowers, as well as by the beauty of their foliage, form but a small portion of the Flora of the plains of Northern India, *Michelia Champaca* being alone found; and that only in gardens from Calcutta to Saharunpore, in vallies within the Himalaya, even as far

north

north as Sabathoo and Deyra beyond the Choor Mountain, being a tree much esteemed by the natives of India for the fragrance of its flowers and their use in religious ceremonies. Seven species of *Michelia* have been found in Nepal, whence the genus extends southwards to Java, where the original species of *Manglietia* is found, of which a representative, *Magnolia insignis* of Dr. Wallich, also exists in Nepal. *Magnolia pterocarpa,* Roxb., existing in the latter, as well as in the mountains above Silhet, Dr. Wallich proposes forming into a new genus, *Sphenocarpus*. Hence we perceive, that in India *Michelia* chiefly prevails, while in China and North America, between which the rest of the family are distributed, *Magnolia* is the most prevalent genus. It may be further remarked, that though in the latter the *Magnoliaceæ* extend from 20° to 40° of N. latitude, and nearly as high in China and Japan, they hardly reach beyond 27° in India or its mountains. This is probably owing to the plains being both too hot and too dry before the accession of the rainy season, and the cold of winter too considerable even in the vallies of the Himalaya to the northward of that latitude.

The Nepal *Magnoliaceæ* being highly ornamental, and at the same time useful timber trees, their introduction into England would be highly desirable, but it is much to be feared that, if the winter be not too severe, the spring is too changeable for plants accustomed to a constantly regular rise and fall of temperature. In the south of Europe they would certainly succeed, and perhaps also on the coast of Devonshire, where the extremes of temperature are modified by proximity to the ocean. The Chinese and American species of this order might easily be introduced into the places where their congeners flourish in Nepal; and as the barks of both *Magnolia glauca* and *Liriodendron tulipifera* are, like others of the order, possessed of bitterness, and useful as tonics, the naturalization of these trees would be useful in India.

4. ANONACEÆ.

The Anonaceæ, which form so magnificent a feature of the East-Indian Herbarium, consisting of nine genera and about eighty species, are hardly to be seen in the author's collection; indeed, if it were not for the effects of cultivation, not a single species would probably be found in it. The species of this family are distributed over the equinoctial parts of Africa, America, and Asia, and though of the two latter each has genera peculiar to itself, *Anona* and *Guatteria* are common to both; and these, with *Artabotrys* and *Uvaria*, have numerous species in India, spreading from the Peninsulas to Silhet, whence a few straggle upwards as far as the hills about Monghir in 25° of N. latitude. The species found in more northern provinces, as *Uvaria longifolia,* the *debdaroo* of the Hindoos, have evidently been introduced from the south; and though species of all the genera succeed in the Botanic Garden as far north as Saharunpore, the only species which I have found within the Himalaya is *Guatteria velutina,* but in so suspicious a place, the banks of the Ruenka Lake, a little to the northward of Nahn, that, notwithstanding it having been shown, p. 12, that the jungly tract along the foot of the Himalaya is favourable to the northward extension of tropical plants, I suspect this must have been

been planted there, as well as the palms and other plants of the southern provinces growing with it to the very water's edge.

Anona squamosa affording a delicious fruit, and belonging to a genus of which all the species, except *A. Senegalensis*, are confined to America, has been so completely naturalized in India, as to appear indigenous, particularly as it has several native names applied to it. Of these, *shurifa* is evidently of Persian origin; but *Gunda gutra* is Sanscrit; and as it is well known that there are few remarkable Indian trees without a Sanscrit name, it has been inferred that every plant with a Sanscrit name must be of Indian origin. In this difficulty I requested the opinion of Professor Wilson on the antiquity of the Sanscrit name applied to the custard-apple. He has been good enough to inform me, that "it does not follow, because a plant has a Sanscrit name, that it is therefore indigenous to India, or of remote introduction; for tobacco has a Sanscrit name, *tamrakuta*, and its history is known." The name, *Ganda gatra*, applied to *Anona squamosa*, by Dr. Carey, in the *Hortus Bengalensis*, is inserted in Professor Wilson's Sanscrit Dictionary, he informs me, on the authority of the *Sabda Chandrika*, a comparatively modern compilation; and further, that the common term for the other species (*A. reticulata*) common in India, is no doubt derived from *Anona*, as it is called either *nona* or *lona*, which in Sanscrit is made *Lavuni*. There is little doubt, therefore, that the custard-apple is one of the fruits for which India is indebted to America. The only place where I have seen it growing apparently wild, is on the sides of the mountain on which the hill-fort of Adjeegurh in Bundlecund is built, and this it covers in company with the teak-tree, which attains only a dwarfish size. The other species which have been ascribed to Asia, are *A. Forskolii* and *A. Asiatica*; the former, according to Dunal, a variety of the latter, which, according to Mr. Brown, is only *Anona muricata*.

Three species of *Anona* having been perfectly naturalized in India, and *A. cherimolia*, so much lauded by Humboldt, flourishing in the Botanic Gardens, both of Calcutta and Saharunpore, there is no doubt that other species, such as *A. palustris* and *sylvatica*, might also be introduced into India; to these might also be added, *Monodora myristica*, or American nutmeg, as it is called; as well as *Xylopia sericea*, which bears a fruit with the flavour of pepper, and has a bark from which cordage may be prepared.

Besides the pleasant-tasted fruit, for which the section with *concrete carpella* is best known, others of this family are remarkable for possessing a bark with acrid and aromatic properties, participated in by their distinct *carpella*; hence both have been used in India and America in medicine, and the fruit of *Uvaria febrifuga*, according to Humboldt, as a cure for fevers. From their aromatic properties, the seed of some have been used as condiments: thus, the dry fruits of *Unona aromatica* are said, by Professor Lindley, to be the *Piper Æthiopicum* of the shops. *Unona Æthiopica*, an African plant, most likely afforded the old *Piper Æthiopicum*, probably the *Filfil-ool-Soudan*, Soudan pepper, described by Persian authors. It is not generally known that the leaves of *Anona squamosa* have a heavy disagreeable odour, and the seeds contain a highly acrid

principle

principle fatal to insects, on which account the natives of India use them powdered and mixed with the flour of *gram*, or *Cicer Arietinum*, for occasionally washing their hair.

5. MENISPERMACEÆ.

The plants of this family are confined chiefly to the tropics, both of Asia and America, though a few straggle beyond those limits. We may expect them, therefore, to be abundant in the eastern islands, and both the Indian and Malayan Peninsulas, whence they extend to 31° of N. latitude, both in the open plains from the general uniformity of temperature, and in the close vallies found at the foot of the hills. Many of the same species, indeed, are found over the whole country, as *Cocculus villosus, cordifolius*, and *Roxburghianus*. *C. laurifolius* is found in the same latitudes, but only in the hills, at elevations of from 3,000 to 5,000 feet. Species of *Cissampelos* also, as *C. convolvulacea*, and *hernandifolia*, have the same extent of distribution, and are enabled to support this great range of dryness and moisture by possessing large fleshy roots. As one species of this genus has been found in Siberia, so is there one indigenous to the Himalayas. This is *C. obtecta* of Wallich (perhaps *C. hirsuta?* Buch.), but other genera of this family are more interesting, as showing the analogy between the Flora of the Himalayas and that of China and Japan. *Stauntonia*, a genus originally constituted of only a single Chinese species, has three more species in the Himalayan mountains. *S. latifolia* and *angustifolia*, figured by Dr. Wallich, Tent. Fl. Nep. t. 14 and 15, I have found as far north as 31° of lat., at elevations of from 5,000 to 6,000 feet, in cool and shady situations. *S. Brunoniana* is found in Silhet. Species of this genus, therefore, extend along the whole tract of these mountains from the latter place to Gurhwal. In the mountains of Silhet also is found *Kadsura Japonica*, showing another point of analogy with the Flora of that island. So closely is *Sphærostemma* allied to this genus, that the two species of this genus, figured by Dr. Wallich, Tent. Fl. Nep., were originally referred to *Kadsura*. *S. grandiflorum* I have found within the Himalaya, on the slope of Mussooree and in the deep vallies at the foot of the Choor Mountain, generally near water, where there is warmth, moisture, and considerable shade from the luxuriant vegetation. The other species are found in Nepal and the mountains of Java.

The relation of *Menispermaceæ* to *Berberideæ* has been pointed out by botanists, but it seems much less in structure than in the possession of similar properties. The bark and wood of many species of both orders are of a yellow colour and bitter taste, and used as tonic and febrifuge medicines, while the berries of several of the *Menispermaceæ*, like those of many of the *Berberideæ*, are edible, though an acrid poisonous or bitter principle, called *Picrotoxine*, is no doubt deposited in *Cocculus Indicus*, the seed of *C. suberosus*, as well as in those of *C. flavescens* and *C. lacunosus*, both used in the eastern islands for poisoning fish. *Cocculus palmatus*, affording the well-known Columbo root, has been grown at Madras, and might be introduced generally into India, as far at least to the northward as it now grows to the southward of the Line, where *C. cordifolius*, the *Galancha* or *Giloh*, is extensively used as a tonic and febrifuge, containing, like the *Columba*,

Columba, a bitter principle, in conjunction with starch. The latter is separated by the Indian Hukeems, and prescribed in various diseases, but can be useful only as a demulcent. As *C. platyphylla, cinerascens* and *ovalifolia*, on account of their bitter principle, are used by the Brazilians for the cure of intermittent fever, so are *Cocculus peltatus, crispus* and *Fibraurea* employed by the Malays in eastern countries for the same purpose. The latter is the *Fibraurea tinctoria* of Loureiro, which, like *C. flavescens*, besides its bitter principle, yields a yellow colour to water. *C. crispus* is considered nearly as powerful as Peruvian bark, in the cure of intermittent fever. *Cissampelos Pareira*, yielding the *Pareira brava*, might no doubt be grown in India, if the indigenous species, as *C. convolvulacea*, used by the natives in medicine, do not possess similar properties, and afford an efficient substitute, as *C. Mauritiana*, also an Indian species, does in the Isle of France. The berries of *Cocculus Limacia* are said by Loureiro to be acid and edible, as are those of *C. cebatha*, described by Forskol as having an acrid taste, but from them a spirit is distilled, called *khumr-ool-majnoon;* the root of *Cissampelos obtecta*, I found used for the same purpose in the mountains of Gurhwal. The fruit of both species of *Stauntonia*, as well as of *Sphærostemma grandiflorum*, are eaten by the Hill people in the Himalayas. The species of both these genera would form desirable additions to the gardens of England.

6. BERBERIDEÆ.

The *Berberideæ* have been said to be allied to the *Menispermaceæ*, notwithstanding their single ovary, which is ascribed by De Candolle to the others having become abortive, as happens in *Ranunculaceæ*, with the single styled species of *Delphinium Actæa*, and of which the Himalayan *Pæonia* affords an additional instance. The relation to *Podophylleæ* is very evident. The *Berberideæ* are chiefly confined to the temperate zone of the northern hemisphere; few have been found in India or its mountains, and these all belong to the genus *Berberis*, of which species extend from the southern parts of Europe along Caucasus and Hindoo-koosh to the Himalayas, but are also found on the Neelgherries, as well as on the mountains of South America, even to the Strait of Magalhaens. Of the section with pinnate leaves forming the genus *Mahonia* of De Candolle, species are found in North America, Japan, and the Himalayas, from Silhet to the Sutlej in Gurhwal. I have generally seen *B. Nepalensis* at elevations of 5,000 and 6,000 feet, in shady situations frequently attaining an elevation of twelve feet. Though we have this section extending from 25° to 45° of N. latitude both in the New and in the Old World: to show the influence of elevation in counteracting the effects of latitude, *B. Nepalensis* is also found on the Neelgherries in 11° of N. latitude.

Under *Menispermaceæ* some of the properties of this tribe have been hinted at: it may be added, that as *Barberries* from containing malic acid, are in Europe used for their mild astringent acid, and substituted in some northern countries for the lemon tribe, so do the fruit and leaves of the Indian species possess the same acid properties; when ripe, the fruit of all is eaten; and of one species, *B. aristata* moreover dried by the

the Hill people as raisins, and sent down to the plains. The root and wood being of a dark yellow colour, forming the *dar-huld* (yellow wood) of Persian authors, are used as a dye, and being bitter and a little astringent, are also, as well as the bark, employed in medicine. The variety of *B. Asiatica* found on the Neelgherries, and called by M. Leschenault de Latour *B. tinctoria,* from the use to which it has been applied, has, by the experiments of M. Vauquelin, been proved to be inferior to few woods for dyeing a yellow colour.

The wood and bark of the Himalayan species of Barberry are not only used simply in India, but an extract is prepared from them, which is to be found in every bazar, and described in all the works on Materia Medica. This is prepared by digesting in water sliced pieces of the root, stem, and branches, of any of the species of Barberry, in an iron vessel, boiling for some time, straining, and then evaporating to a proper consistence. This extract is much employed in Indian medicine, and every where known by the name of *rusot.* Of this the Arabic synonyme is *Hooziz,* and the Greek is said to be *loofyon* لوفين which I have no doubt should have been written لوقين *lookyon,* as the letters *f* ف and *k* ق, in writing, differ only in the first having one, and the other two diacritical points placed over it; and the one is therefore frequently confounded with the other by transcribers, particularly in writing foreign words. That the mistake has been made here is evident from the description attached to Hooziz being almost a literal translation of the Lycium (λυκιον) of Dioscorides, lib. 1. c. 133. where two kinds are described, and the λυκιον ινδικον considered the best. The first, or that which was the produce of Lycia and Cappadocia, is considered by Dr. Sibthorp to have been procured from *Rhamnus infectorius.* In India, where every thing has remained for so many centuries without any change, it is probable that in the most ancient, as in the present times, *Hooziz hindee,* or *Lycium Indicum,* was procured from the several species of *Berberis,* which are indigenous to the Hindoo-koosh and Himalayan Mountains.* The *rusot* is much used by native practitioners as an external application, both in the incipient and advanced stage of ophthalmia; it is frequently also employed by European practitioners, either alone, or with equal parts of opium and alum rubbed up in water, and applied round the eye. I have seen it particularly useful when the acute symptoms have subsided, and the eye is so much swoln as to prevent the effectual application of any other remedy. By one surgeon of rank and experience it was found particularly useful in the ophthalmia, with which the European soldiers were afflicted on their return from Egypt; and Mr. Playfair, the translator of the Taleef-Shureef, says, that it is perhaps the best application in ophthalmia ever used.

The most remarkable and best-known Indian species of *Berberis,* are *B. Nepalensis,* which is considered to be the same as the *Ilex Japonica* of Thunberg; *B. Wallichiana,* Pl. As. Rar. t. 243; *B. Asiatica,* of which *B. tinctoria* is considered by De Candolle to be only a variety; and *B. aristata.* To these a new species from Kunawur has been added.

* *v.* a Paper on the Lycium of Dioscorides in the forthcoming part of the Transactions of the Linnean Society.

added. Under *B. aristata,* I conceive two species, or at least two such very distinct varieties have been included, as to require particular notice. These are distinguished by the natives, apt to confound things together, by the names *kushmul* and *chitra.* The former, growing at as low elevations as 3,000 feet, and therefore easily acclimated in the plains of India, has the leaves and branches paler coloured, more thorny, flowers numerous, racemes erect, appearing earlier in the season and having less pleasant tasted fruit; while *chitra,* which I conceive to be the true *B. aristata,* and have not found below 5,000 feet of elevation, with brownish-coloured branches, smooth, shining, almost entire leaves, each flower much larger than those of *kushmul,* though less numerous, on each of the drooping racemes. The fruit of this species, as well as that of *B. Nepalensis,* is dried as raisins are in the sun, and sent down to the plains for sale.

1. *Berberis aristata;* D.C. Syst. Veg. 2. p. 8. spinis infimis 3-partitis superioribus simplicibus compressis basi vix bidentatis, foliis 4-6 fasciculatis viridibus obovatis oblongisve nitidis basi attenuatis integerrimis spinuloso-dentatisve, racemis 15-floris nutantibus folio longioribus, pedicellis sæpe trifidis trifloris, squamulis rotundatis, ovariis subpilosis, baccis oblongis utrinque acutis.—*B. aristata;* D.C. Syst. Veg. 2. p. 8. Prod. 1. 108. Wall. Cat. N. 1474 ex parte. *B. chitria,* Don Prod. Fl. Nep. 204. Hooker Ex. Flora t. 98.

Hab. Jurreepanee to Mussooree and Choor Mountain 5,000 to 8,000 feet of elevation; flowers in May. Hill-name *Chitra.*

Arab. *Amburbarees;* Pers. *zirishk;* wood—*dar-huld* and *dar-chob.* Extract *hooziz.* Hind. *rusot.*

2. *B. Lycium;* spinis 3-partitis conicis, foliis 5-8 fasciculatis pallidis coriaceis venosis oblongis lanceolatis v. obovatis basi attenuatis mucronatis, marginibus spinuloso-dentatis v. integris, racemis 20-floris erectis patulis demum (fructificatione) pendulis, pedicellis longis simplicibus, floribus parvis, squamulis lanceolatis, ovariis glabris tetraspermis, baccis ovatis utrinque obtusis.—*B. floribunda.* Wall. Cat. 1474? Kemaon. An *B. angustifolia.* Roxb. Fl. Ind. 2. p. 183?

Hab. Rajpore to Mussooree, or from 3,000 to 7,000 feet of elevation; also from Nahn to Choor; flowers in April. Hill-name *Kushmul,* chiefly employed in Gurhwal and Sirmore for making *rusot.*

3. *B. Kunawurensis;* spinis tripartitis foliis subæquantibus, foliis internodiis longioribus 4-5 fasciculatis ovato-lanceolatis mucronatis spinoso-serratis, summis integris, panicula sæpe foliosa foliis duplo longiore suberecta, pedicellis 3-v-5-floris, bracteolis subulatis.

Hab. Kunawur.

7. PODOPHYLLEÆ.

The *Podophylleæ,* from which have been separated the *Hydropeltideæ,* were considered to be entirely an American family; but Dr. Wallich's *Podophyllum Emodi,* and another species, have shown that this is a family well calculated to indicate the analogy between the Flora of the Himalayas and that of North America. *P. peltatum* extends in the latter from 35° to 45° of N. lat. *P. Emodi* was found by Dr. Wallich in Nepal and Kemaon, and by myself on the Choor Mountain, at an elevation of 10,000 feet, whence it extends to Cashmere. The second species, which I found on Kedarkanta, at an elevation of 12,000 feet, in a moist and shady situation, in company with a species of *Trillium,* I have called *P. hexandrum;* it differs in having only four petals, and six stamens, the leaves 3 or 5-lobed, with the lobes narrow acute and serrulate towards the apex. The number of stamens of this species makes it correspond with the shrubby *Berberideæ,* and the number of floral envelopes with the herbaceous plants of the same family, and in both particulars

particulars with *Epimedium hexandrum.* I know not if the Himalayan *Podophyllums* possess any of the properties ascribed to the American species, but this could be easily grown.

8. NYMPHÆACEÆ.

This very natural order has been observed by botanists not to obey the general law of the same species of aquatic plants being found in the most distant regions, as each particular species appears to be confined to only a limited range of territory. India is certainly the head-quarters of this family, as species of all the genera, except of *Nuphar*, are found in it; as of *Nelumbium, Euryale, Barclaya* in Rangoon, and of *Nymphæa*, a greater number of species than in any other country. These all require elucidation from recent specimens. The order *Nelumboneæ* has been formed of *Nelumbium*, and its species; of these *N. speciosum*, unless, as De Candolle suspects, that several species be confounded under one name, is certainly an exception to the *Nymphæaceæ* being restricted to a limited sphere, as it is found from Java up to the mouths of the Volga, and in the intermediate countries, as in every part of India, within the Hills near Sabathoo, in Persia, and formerly in Egypt. Nothing can be more splendid than to see the sheets of water covered with the large poppy-like, rose-coloured flowers of this beautiful plant. *Euryale ferox* was found by Lord Valencia, now the Earl of Mountnorris, between Lucnow and the foot of the Hills, and by Dr. Roxburgh in the lakes of Tipperah and Chittagong, where it is probably indigenous, as it has a special Bengalee name. I have met with it in the jheels beyond Saharunpore, but it has no doubt been introduced there, as the names given it are synonimous with *Southern Nymphæa* and *purple Nelumbium.* It is mentioned by Sir G. Staunton as occurring in the province of Kianang, and by the Chinese missionaries, it is said to have been introduced into China for 3,000 years. It may, however, be one of those plants which belong equally to China and India. The species of *Nymphæa* are found in every part of India, from 8° to 32° of N. lat., and almost the same species in the most remote parts of the country, with the exception of the red varieties of *N. rubra;* but a new species has been brought me from Cashmere. The other species are found both in the southern and northern hemispheres, in the former as far as 34° of S. latitude at the Cape and in Madagascar. To the north of the line they are found in every latitude up almost to the arctic circle, but the same species are not found to extend over a wide space of territory.

The seeds of *Nelumbium, Euryale,* and of several species of *Nymphæa,* being farinaceous, are eaten by the natives of India, either in a raw state, or after having been roasted in heated sand. They are also prescribed by their physicians as diet in some diseases. The stalks both of the leaves and flowers dried, form one of the articles in their prescriptions of what they call cooling medicines. They are said also to be a little bitter, and may therefore be also useful as tonics. The *rhizomata* or creeping stems, commonly called roots, are also eaten as in China, either boiled or in their curries, as well as the little farinaceous tubers, which are found nestling among the radicles,

radicles, and which are generally employed for procuring young plants. It is not uninteresting to remark, that the Egyptian mode of sowing *Nelumbium speciosum*, the Egyptian bean of Pythagoras, *bakla koobtee*, Coptic bean of Persian authors, by enclosing it in a ball of clay before throwing it into the water, is still practised in India.

9. PAPAVERACEÆ.

The *Papaveraceæ* inhabit every part of Europe, and the northern parts of Asia: one species extends as far north as Melville Island, and some new genera, as *Eschscholtzia*, have been lately discovered in California. We do not find them forming any portion of the Flora of the plains of India, but *Argemone Mexicana* is so naturalized every where as to appear indigenous, and the Poppy forms so extensive an article of cultivation, as to yield a revenue of nearly two millions annually: a remarkable instance of the benefits to be derived by one country from acclimating the productions of another, when its own climate, soil, &c. are favourable for the attempt. The Poppy was probably introduced into India from Persia, as the common Indian name *post* is one of the Persian names for the poppy-head; and the Arabic *khushkhush* is probably the original of some other of the Asiatic synonimes, perhaps even of the Sanscrit *chosa*. Opium is described in Indian works on Materia Medica, under the name *afeeoon*, *aphim*, evidently derived from the Greek; *apaynum* is given by Dr. Ainslie as the Sanscrit name. Both the white and red varieties are to be found cultivated in India, and both yield opium of an excellent quality. The white is generally cultivated in the plains, and the red I have seen at Chowrass in the hills, at 7,000 feet of elevation. *P. dubium* and varieties of *Papaver Rhoeas* are found in the gardens of Northern India, having been introduced by either or both its English and Persian conquerors. The species which I have named *P. glabrum*, closely allied to *P. Caucasicum*, is the only one of the genus *Papaver* which can be said to belong to the Flora of India, as I have found it in several places in the corn-fields in the hills, at elevations of from 5,000 to 7,000 feet. The Himalayas, however, possess three species of the genus *Meconopsis*, of which the other species are found in the colder parts of Europe and in North America.

The valuable nature of opium, whether considered as a medicine, or as an article of commerce, is too well known even to be alluded to here, were it not for the prevalence of the idea, that East-India opium is always, and some seem to think necessarily inferior to every other. This opinion has originated in the opium, which is the produce of Patna, being the best known in Europe, and that upon which experiments have been principally made. This is no doubt of an inferior quality, in some measure perhaps owing to the climate of the Lower Provinces not being so favourable for its culture as some others, but a great deal more to the mode of preparation, and even adulteration, to which the Patna opium is understood to be frequently subjected: by which, though rendered inferior as a medicine, it becomes more palatable to the Chinese, its principal consumers. That much better opium can however be made at Patna than was formerly the case, is evident from the great improvement which has of late years taken place in

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the manufacture of opium at that place, so that Dr. Thomson mentions in his late work, "That some specimens of the Bengal opium have been lately sent to Europe, which in "appearance equal the best Turkey opium."

In a paper by Dr. Smyttan, inspector of opium at Bombay, lately read before the Medical Society of Calcutta, an account is given of the varieties of East-Indian opium, and a comparison drawn between the quantity of morphia afforded by Bengal, Malwa, and Turkey opium respectively, from a series of experiments made by himself and Dr. Maxwell at Bombay, and by Dr. Jamieson in Calcutta. Dr. S. observes, that good Turkey opium is said to contain nearly three times the quantity of morphia found to be procurable from the product of the Bengal provinces. The best produce of the Malwa districts, he adds, differs from Bengal opium, both in appearance and quality, quite as much as the Turkey opium does; and that while the latter yielded 6½ per cent. of morphia, the Malwa afforded 6 per cent., the Bengal about half as much, but some fine specimens of Bareilly opium, no less than 8½ per cent. of morphia. Still further to the north-west than Bareilly, I made some opium at Saharunpore, which in colour, smell, and general appearance, resembled the Turkey, or rather Persian opium, more closely than any that I have seen. The opium cultivated in the hills, as also that in the plains of the Seik country, is also, when unadulterated, of a superior quality. Indeed, if it were an object to make the best opium for the European market, there is no doubt that Malwa and the north-western provinces of India would be best suited for the experiment, as the climate during the season of cultivation most nearly resembles that of the provinces where the best Persian (commonly called Turkey) opium is made.

Papaver glabrum; capsula glabra obconica, caule ramosissimo multifloro glaberrimo, foliis glaucis pinnatisectis, segmentis lanceolatis integris dentatisve seta terminatis.—*Planta* pedalis bipedalisve. *P. Caucasico* affinis.—*Corolla,* calyxque caducissimi, *P. Rhœadis* magnitudine et colore.—*Capsulæ* obconicæ elongatæ.—*Stigmata* 5-7 radiantia.—Hab. Corn-fields on the terraced mountain sides of the Himalaya, at elevations of from 5,000 to 7,000 feet; flowering in April and May.

Meconopsis aculeata, caule erecto sulcato ut plantæ omni parte aculeato, foliis longe petiolatis oblongis decurrentibus subpinnatisectis sinubus obtusis, floribus axillaribus solitariis terminalibusve paniculatis, capsulis oblongis utrinque acutis dense aculeatis. (Tab. 15, plant in flower, and a specimen in seed.) —Hab. This plant is common on the Choor and Kedarkanta, as well as in Kunawur, and has also been brought me from Peer Punjal. The *root* is long and tapering. *Stem* ascending, erect, from one to two feet in height, leafy, furrowed, and like every part of the plant, except the petals and stamens densely aculeate. The *leaves* long-petioled, oblong, subpinnatifid, with irregular and obtuse sinuses, frequently decurrent on the petioles, upper ones sessile. *Petioles* broad and sheathing at the base. *Flowers* axillary and terminal, often in the axillæ of all the leaves, long peduncled. *Calyx* 2-sepaled; *sepals* roundish-oval, caducous, aculeate. *Petals* 4, obovate roundish, red. *Stamens* very numerous; *filaments* capillary; *anthers* oblong, inserted by the base; *ovary* ovate, pointed, aculeate. *Style* half the length of the ovary; after the flower has fallen, it becomes elongated and twisted. *Stigmas* 4, oblong, united into a capitate head. *Capsules* oblong, tapering towards both ends, 1-celled. *Placentæ* ribbed intervalvular; *valves* 4 to 5, separating from the placentæ at the apex of the capsule for the escape of the seeds. *Seeds* numerous, minute.

10. FUMARIACEÆ.

This family, common in the temperate parts of the northern hemisphere, is, like others of the same locality, common in the Himalayas from Nepal to Cashmere, where about

about fifteen species of *Corydalis* have been found, as well as Dr. Wallich's new genus *Dactylicapnos*, distinguished by having indehiscent fruit, or fleshy, oblong, subcylindric berries. There is another bicalcarate plant of this family in the Himalayas, which being cirrhose and scandent, resembles the last, as well as *Adlumia*, in habit; from the latter, it differs in not having its four petals united into one, and from the former in having a dry oblong-acuminate, siliquose fruit, which is many-seeded, and, when ripe, opens with an elastic spring. With *Dielytra* it agrees in the parts of fructification, but differs entirely in its cirrhose scandent habit. With *Dactylicapnos thalictrifolia* it may be easily confounded, as in describing it is difficult to avoid using the very terms which have been employed by Dr. Wallich, Tent. Fl. Nep. p. 51. t. 39, in describing this plant. Hence specimens of both plants have been mixed together in the East-Indian Herbarium, N. 1426. It may be distinguished by its stem being five-angled, with the angles expanded, the racemes generally 2, or 3-flowered, and the siliquose dehiscent fruit.

Some of the species of *Corydalis* from Kunawur are more closely allied to the species which are indigenous to Siberia, as *C. crassifolia* to *C. Marschalliana* and *parviflora*. In the plains only a single species of this family is found, and that belonging to the genus *Fumaria*, and this, like all other plants belonging to families of the temperate zone, flowering only in the cold weather months. This referred by Drs. Roxburgh and Wallich to *F. parviflora*, but agreeing very closely with the character and specimens of *F. Vaillantii*, may have been originally introduced into India from the S. of Europe, either with the corn in fields, of which it is common, or from its use in medicine, being considered the καπνος of the Greeks. Its numerous Asiatic synonimes, however, prove that it has long been acclimated in the East; and in India it is at the present day considered, in conjunction with black pepper, an efficacious remedy in common agues.

Besides the species described and figured by Dr. Wallich, the following are some of the more remarkable Himalayan species:

1. *Corydalis crassifolia*; caule simplici esquamato, foliis crassis caulinis 2 v. 3 supra medium bipinnatisectis, segmentis latis cuneatis 3-lobatis, terminali sub-reniformi, lobis inciso-crenatis v. emarginatis, bracteis tripartitis, summis integris, racemo conferto 15-floro.—*Calcar* apice incurvatus, obtusissimus, pedicello fere æqualis.—*Siliqua* ovalis, pedicello duplo brevior.—*C. parvifloræ et Marschallianæ* affinis.—Hab. Chango in Kunawur; flowering in July. Rarung, *R. Inglis, Esq.*

2. *C. crithmifolia*; foliis radicalibus 2-4 longe petiolatis pinnatisectis, segmentis sæpe dichotome partitis, laciniis uti bracteis longissimis lineari-lanceolatis, racemo patulo 20-floro.—*Scapus* unus vel duo foliis æqualis.—*Calcar* pedicello duplo brevior rectiusculus sub-acutus.—Hab. Leeo in Kunawur.

3. *C. nana*; caule erecto folioso, foliis ternatim supradecompositis, segmentis cuneatis lobatis, lobis linearibus acutis, racemo coarctato paucifloro, calcare brevi incurvo obtuso pedicello 4-duplo breviore.—*Herba* spithamea.—Hab. Soongnum in Kunawur.

4. *C. vaginans*; caule ramoso diffuso, foliis membranaceis longe petiolatis biternatim sectis, segmentis oblongis cuneatis 3-4-lobatis, lobis oblongis angulis obtusis, petiolis basi membranaceis vaginantibus racemis laxis paucifloris.—Hab. Kanum in Kunawur.

5. *C. filiformis*; caule ramoso, foliis triternatim sectis, segmentis cuneatis bi vel trilobatis, omnibus apice rotundatis, racemo laxo paucifloro, bracteis lobatis, summis integris, pedicellis longis fructificatione elongatis, calcare acuto pedicello duplo breviore transversim equitante.—*Planta* pedalis bipedalisve debilis filiformis.—Hab. Surkunda to Mussooree; flowering in June.

6. *C. cornuta;* caule erecto ramoso striato, foliis tripinnatim sectis, segmentis oblongis cuneatis 3-lobatis, lobis oblongis subacutis vel rotundatis submucronatis, racemo laxo pauci-et parvifloro, calcare elongato erecto pedicello 3-plo longiore.—Hab. Choor Mountain; flowering in July and August; a variety of this species also from Cashmere.

7. *C. Cashmeriana;* caule simplicissimo erecto, foliis caulinis subsessilibus pinnatisectis, segmentis lineari-lanceolatis integris rarissime subdentatis, terminali cuneato trilobato, racemo coarctato paucifloro, bracteis foliaceis, summis integris 3-dentatis, calcare pedicello breviore obtuso incurvo.—*Corollæ* petala externa cærulea, inferiora rotundato-ovata, unguiculata.—*Petala interiora* unguibus flavis, limbis purpureis. (Tab. 16. fig. 1.)—Hab. Cashmere.

8. *C. Govaniana;* (Wall.) foliis petiolatis oblongis bipinnatisectis, segmentis cuneatis profunde pinnatilobatis, lobis lineari-oblongis obtusis cum cuspidula integris vel bilobis, racemis secundis, bracteis foliaceis cuneiformibus inciso-lobatis pedunculos superantibus, supremis lanceolatis integris, calcare pedicello subæquali, siliquis pendulis oblongis utrinque acutis apice stylo longo acuminatis. (Tab. xv. fig. 2.)—Hab. This plant was first described by Dr. Wallich, in his Tent. Fl. Nep. p. 55, and there is little to be added to his description. It was originally sent to him by Dr. Govan from Gurhwal. It is extremely common in the mountains, particularly on the Choor, above 8,000 feet of elevation. By the Hill people, who are as superstitious as the mountaineers of any other part of the world, the root is called *bhootkes*, and valued as a charm against the influence of evil spirits. It varies from a few inches to nearly a foot in height.

11. CRUCIFERÆ.

The *Cruciferæ* are, like the *Ranunculaceæ*, an European family, of which few are found in the plains of India, but numerous species in the Himalayan Mountains. These belong chiefly to genera which are common in Europe and the northern parts of Asia and America, and of which several new species have been described in the Floras of Siberia, Caucasus, and of the Altai Mountains. The species hitherto discovered are about 70 in number, belonging to the genera *Nasturtium, Barbarea, Turritis, Arabis, Cardamine, Dentaria, Draba, Thlaspi, Hesperis, Sisymbrium, Alliaria, Erysimum, Lepidium, Capsella, Sinapis?* the latter, mentioned with doubt, as the only species known, are those described in the *Flora Indica*, obtained by Dr. Buchanan from Tibet. The genus *Tauscheria*, which from its singular fruit I had named *Navicularia*, is the only one of the peculiar Siberian genera which extends to Kunawur, where the arid and saline nature of the soil must be as favourable to its growth, as the deserts of the Kirghis, or the banks of the Irtisch. The European species of the above genera, which have been found extending as far southward as the Himalayas, are, *Turritis glabra, Thlaspi arvense, Capsella Bursa Pastoris, Alliaria officinalis* and *Sisymbrium Sophia.* Besides *Tauscheria desertorum, Crambe cordifolia* is another plant belonging to the Flora of Siberia, as well as to that of Caucasus, which extends to Kunawur. *Draba radicans* of the present work, with its radicating stems and yellow flowers, is closely allied in general appearance to *Draba repens*, figured by Ledebour, t. 145. The other species of the same genus are closely allied in habit to their European congeners, and equally inhabiting, like them, the cold and exposed summits of mountains.

In the gardens of Northern India, *Mathiola incana* and *Cheiranthus cheiri* are common; and as I have received specimens of both plants from Cashmere, there is no doubt that both have been introduced from that direction into India, being still much used in medicine,

medicine, and known by the names of white, purple, and yellow *khueree*, or, as commonly written, *cheiri*. In the plains of India, but few species of this family are met with. *Nasturtium officinale*, growing in the vicinity of water in most parts of the world, seems to be found in all parts of India, though the natives ascribe its introduction to the English. I have found it near Hurdwar; Dr. Wallich met with it in Rohilcund. *Lepidium sativum* belonging to a genus, of which species are found in Syria, Arabia, and Persia, has long been known and cultivated in India. From the medicinal and dietetic uses, as well as from the Arabic and Persian synonymes of this plant, it is probable that it was introduced into India from Caubul or Persia, where also we must look for the route by which the cabbage, radish, and turnip, have found their way into India, as all were known and cultivated there long before they could have been introduced by Europeans. I have received the seeds of all from Cashmere, and grown them in the Botanic Garden of Saharunpore. The turnips, moreover, in Kunawur, are described as being remarkably fine. Besides these, which are confined to gardens or the neighbourhood of villages, there are other species of this family, which form very extensive agricultural crops, but, like the former, only during the cold weather months. The majority of these have been referred to the genus *Sinapis*, and one species, which agrees very closely with *Brassica erucastrum*, to both *Brassica* and *Eruca*; this is called *tira*; a variety apparently of the same is cultivated in the hills. The species or varieties referred to *Sinapis* still require careful revision. *Sinapis ramosa* of Dr. Roxburgh appears to be the species which is called *raee*, Indian mustard, and is much used as a condiment. *S. glauca* may be the *toria*, *S. dichotoma* the *kalee-surson*, and *S. juncea* the *bunga-surson*; the three latter, as well as *tira* and *Sesamum orientale*, being extensively cultivated for the oil which is afforded by their seeds, as the natives of the greater part of India depend upon them chiefly for oil for burning in lamps, as well as for that necessary for dietetical purposes. Some other species are described as being indigenous to and growing wild in India; but regarding all there is some uncertainty, and though there is no doubt that the cultivated species have been long acclimated, yet having only been met with in that state, their native country must still be considered undetermined. But though there is this uncertainty respecting the cultivated *Cruciferæ*, species of this family are no doubt found in the plains of India: of this a curious instance is the existence of a species of *Farsetia*, in the neighbourhood of Delhi and Agra, where it was first found by Dr. Hamilton, and subsequently by myself in the same locality. The existence of the species of this genus only in Syria, Egypt, and north of India, may be considered as confirmatory of the opinion stated, p. 7, that the Oriental or Persian, or better, as Professor Lindley calls it, the *Syrian region*, may be considered as extending to the north of India. Another plant more singular was also first discovered by Dr. Hamilton, *Cochlearia flava*, and has been described by Roth under the name of *Alyssum Cochlearioides*, which the celebrated De Candolle has called *Cochlearia*? *Alyssoides*, in his Prodromus, with a query, whether it be not a species of *Vesicaria*. In its accumbent cotyledons, oval dissepiment and convex valves, it resembles *Cochlearia*, but it differs in habit,

which

which, with the peculiar rounded form of its silicule, long funiculus, yellow flowers, and Indian locality, might entitle it to form a new genus. It is found all along the banks of the Ganges, in Northern India, as high as Hurdwar.

The *Cruciferæ*, one of the most natural of families, presents also the most perfect analogies in respect to sensible and medical properties. Most of the species, though of course in different proportions, contain an acrid volatile oil, which renders the Indian, as well as the European species, useful as stimulants and vesicatories, a fixed oil in their seeds, for which many of them are cultivated, together with azote, fecula, mucilage, and saccharine matter. When the acrid principle is small in proportion to the mucilaginous or saccharine matter, many of the *Cruciferæ* become, as is well known, useful articles of diet. So many of the family being cultivated in the cold weather months in India, there is no doubt that others, as both *black and white mustard*, as well as the *horse radish*, might be grown. The species affording oil forming important articles of agriculture to the natives of India, it would be extremely useful to ascertain, if the species cultivated in Europe for the same purpose, as *Brassica napus* and *campestris*, *Myagrum sativum* and *Erysimum perfoliatum* in Japan, yield a larger quantity or a better quality of oil than that afforded by the Indian species. There is little doubt of all succeeding well in the northern provinces of India. *Isatis tinctoria* or *woad*, though of little value in a country where indigo is so abundant, was perfectly at home in the Mussooree experimental garden.

The following are a few of the more remarkable plants, above alluded to, of this family:

Farsetia Hamiltonii; caule herbaceo ramoso cum foliis linearibus adpresse pilosis incano, staminibus omnibus edentulis, siliculis elliptico-oblongis adpresse pilosis, pilis glandulosis patentibus intermixtis, septis integris, stigmate capitato.—*Caulis* teres.—*Racemi* axillares terminalesque.—*Calyx* pilis adpressis scaber, marginibus membranaceis.—*Petala* obovato-cuneata, laminis venosis.—*Cheiranthus Farsetia.* Wall. Cat. 4801. Herb. Hamilt. a ripa Jumnæ.—Hab. Western bank of Jumna from Delhi to Agra.

Draba.—Sect. 1. Aizopsis.

D. setosa; scapis nudis pilosiusculis, foliis confertissimis lineari-lanceolatis rigidulis carinatis ciliatis, petalis staminibus æquantibus calyce longioribus, siliculis glabris ovato-oblongis pedicello longioribus stylo brevissimo terminatis.—Hab. Soongnum in Kunawur.

Sect. 2. Chrysodraba.

D. radicans; caulibus foliosis pilosis, foliis ovato-oblongis acutis integris subdentatisve pube simplici adpresse pilosis, surculis repentibus, siliculis oblongis glabris stylo longo terminatis.—*Calyx* basi sub-bisaccatus.—*Petala* flava subemarginata calyce duplo longiora.—*Planta D. repenti* affinis.—Hab. Shalma and Manma.

Sect. 3. Leucodraba.

D. glomerata; scapis 1 v. 2 folia ovata gerentibus, foliis cæteris aggregatis, oblongis basi attenuatis integris uti omni parte plantæ pube stellata tomentosis, siliculis elliptico-oblongis.—*Petala* alba obovato-cuneata calyce duplo longiora.—*Siliculæ* stylo brevissimo, stigmate capitato terminatæ.—*Planta D. stellatæ* affinis.—Hab. Soongnum.

D. lasiophylla; foliis radicalibus ovali-oblongis basi attenuatis pube stellata cano-tomentosis, scapis folia 1 v. duo gerentibus, racemis corymbosis demum elongatis, siliculis ovali-oblongis pubescentibus corolla longioribus post florescentiam valde contortis.—*Planta D. stellatæ* affinis.—Hab. Shalkur and Lippa.

Sect. 4. Holarges.

D. lanceolata;

D. lanceolata ; caulibus simplicibus erectis foliosis, foliis lanceolatis denticulatis pube stellata pubescentibus, siliculis ovalibus corolla brevioribus stylo brevi terminatis post florescentiam contortis.—*D. contortæ et confusæ* affinis.—Hab. Shalkur.

Cochlearia? flava ; floribus flavis, siliculis globosis inflatis, foliis radicalibus petiolatis sinuato-partitis, caulinis oblongis sinuato-dentatis omnibus glabris crassiusculis.—Cochlearia flava. Buch. *Hort. Beng.* p. 48. Alyssum Cochlearioides. Roth. nov. pl. spec. 322.—Cochlearia? Alyssoides. D.C. Prod. 1. p. 172. Camelina Caisir. Wall. Cat. 4802. An Genus novum? Silicula globosa inflata, valvis hemisphæricis, septo membranaceo.—Semina plurima pleurorhizea immarginata funiculis longissimis.—*Calyx* æqualis petaloideus flavus.—*Petala* sulphurea (in siccis alba) integra.—*Stamina* edentula.—*Glandula* inter stamina lateralia et pistillum.—*Germen* globosum stylo brevi terminatum.

Hesperis glabra ; pedicellis inferioribus calyce longioribus summis brevioribus, petalis obovatis longe unguiculatis, foliis crassis petiolatis ovato-lanceolatis dentatis subruncinatisve glabris, scapis plurimis erectis glabris apice pilis subglandulosis.—*Racemus* patulus multiflorus ebracteatus.—*Flores* albi forma et magnitudine *H. apricæ*—Siliquæ teretiusculæ subtorulosæ.—Hab. Nako in Kunawur.

Tauscheria desertorum ; α lasiocarpa. Ledeb. Ic. pl. Fl. ross. Alt. illustr. t. 139.—Flora Altaica, iii. p. 200.—*T. lasiocarpa,* D.C. Syst. Veg. 11. p. 563. Prod. 1. p. 210.—Hab. This plant, formed into a species, as well as the variety β *gymnocarpa,* and distinguished from it by having the silicules hairy on their convex side, has been so fully described by the celebrated De Candolle and by Ledebour, as to require but little notice in this work; it has been figured as a remarkable instance of the existence frequently on the N. face of the Himalayas of the same genera and species, which were thought to be peculiar to the S. of Siberia and the Altai Mountains. The radical leaves are petioled, but wanting in some specimens; but the flowers in all the specimens from *Shalkur,* in Kunawur, are of a yellow colour. The genus *Tauscheria,* closely allied to *Isatis,* is distinguished by its one-celled, one-seeded, boat-shaped silicule, and by its valves, which are likewise boat-shaped, having inflexed, concave coriaceous wings, which form a hollow on the upper surface of the silicule.—Tab. 17. 1. Stamen and Pistil; 2. a Silicule; 3. cut longitudinally; 4. cut transversely; 5. the Seed; 6. cut transversely; 7. Embryo.

12. CAPPARIDEÆ.

The *Capparideæ* being chiefly a tropical family, form a conspicuous figure in the Flora of India. In the same way that we have seen species of European families creeping down to the limits of the tropical zone, so do we find plants of this family, as *Capparis spinosa* and *Cleome violacea,* extending nearly up to the centre of the temperate zone. In like manner, though nearly twenty species of *Capparis* have been found in the plains of India, besides others in the Malayan Peninsula, only two occur in the Himalayas. Of these, *C. Nepalensis* I have only found growing in the crevices of rocks, in the hot valley in the neighbourhood of Raengurh. *C. obovata* grows in similar situations in Kunawur. Species of *Polanisia* and *Gynandropsis* also occur as high as six thousand feet in the mountains, but only during the moisture and equable temperature of the rainy months. This is a family well calculated to show the community of many genera to both the New and the Old World, as species of *Capparis, Gynandropsis, Cleome, Polanisia* and *Cratæva,* are found in the hotter parts of America, as well as in India. *Capparis horrida* and *sepiaria, Cratæva religiosa, Gynandropsis pentaphylla* and *Polanisia viscosa,* occur as far north as Saharunpore, as well as in the most southern parts. *Capparis aphylla,* which, notwithstanding its name, has early in the season plenty of oblong, obovate deciduous leaves, is restricted to the drier and more barren parts, and flourishes, as we learn from Mr. Elphinstone, even in the midst of the desert. From

India

India we may trace the *Capparideæ* into Arabia, Persia, and other countries of the Syrian region, and in Africa they abound. *Cadaba Indica* appears to be restricted to the Peninsula; other species of the same genus are found in Persia, Arabia, Abyssinia, and Senegal; but *Niebuhria oblongifolia*, belonging to an African genus, extends from the Peninsula into Arabia, where it was first found by Forskal, and also to the neighbourhood of Agra and Delhi, where I have found it in flower in the months of December and January; a specimen in the East-Indian Herbarium from my late friend, Mr. Finlayson, is, I have no doubt, from the same locality, as I know he had a small collection of plants from the neighbourhood of Meerut, Agra, and Cawnpore.

As the flower-buds of the caper-bush are in Europe employed as a seasoning, so the fruit of the *kureel* or *capparis aphylla*, is in India formed into a pickle. The former, as it extends to Egypt and Syria, would no doubt thrive in Northern India, particularly as *C. Nepalensis* and *obovata* are closely allied to it. It is curious to observe, that the seeds of *Polanisia Chelidonii*, and *viscosa*, having a considerable degree of pungency, are used by the natives as an addition to their curries, in the same way that mustard is, belonging to a family to which the *Capparideæ* are most closely allied through *Cleome*. The flower-buds and seeds of the caper of Mount Sinai, *Capparis Sinaica*, are pickled, and the latter is called *filfil-i-jibbul*, mountain-pepper.

Capparis obovata; stipulis spinosis rectis, foliis secundis ellipticis v. obovatis mucronulatis apice subattenuatis breve petiolatis cum ramis parce pilosis, pedunculis solitariis unifloris foliis æqualibus.—*Planta* ramis prostratis foliisque secundis *C. spinosæ* et *Nepalensi* affinis.—Hab. Hango in Kunawur.

13. FLACOURTIANEÆ.

The *Flacourtianeæ*, allied to *Capparideæ* by the structure of their fruit, parietal placentæ, and indeterminate stamens, are all natives of the hottest parts of the West Indies, of Guiana, and of Africa, whence they straggle into Java, and the other islands of the Eastern Archipelago. We trace them in India from one end of the plains to the other in 31° of latitude, and also to the same extent along the hot and jungly tract at the foot of the Himalaya. It must be in the low and hot vallies, or the beds of rivers, that the species are found in Nepal; as *Flacourtia cataphracta, sepiaria* and *sapida*, are the species found there, as well as in every part of India. The fruit of the last, though small, is of a sweetish and pleasant flavour. *F. Ramontchi*, from Madagascar, and *F. inermis*, from Java and the Moluccas, have been introduced into and flourish in Bengal. The fruit of the latter is large, purple-coloured, and of a pleasant acid taste. Species of *Roumea* are mentioned with doubt in the Flora of India, and *Hydnocarpus venenata* is well known in Ceylon from its property of intoxicating fish.

14. BIXINEÆ.

The *Bixineæ* are all found in warm parts, of the Old, but chiefly of the New World; no species has yet been found in India, though Dr. Roxburgh seemed to be of opinion, that *Bixa orellana*, or a variety of it, with white flowers and green imma-

ture capsules, figured by Rumphius, was a native of India. The plants grown from West-India seeds have rose-coloured flowers, and the immature seed-vessel red, and succeed remarkably well in India, as far north as 28½°, in the Resident's garden at Delhi. I know not if any *Arnotto* has been obtained from the plants in Bengal, but the natives employ it as a temporary dye in the festival of Krishna.

15. VIOLACEÆ.

The genus *Viola*, so well known from many of its species forming the favourites of the flower-garden, is distributed throughout Europe and Siberia, as well as North America and the elevated parts of South America; it is found in every part of the Himalayas, at different elevations, as well as on the Neelgherries. About 17 Indian species have been named, but there is some confusion among them, and varieties have perhaps been raised to the rank of species: the only ones which have been hitherto figured are those in the present work. The species of the genus *Ionidium*, found in the warm parts of America, as well as at the Cape and in Madagascar, form also a part of the Flora of the plains of India; and it is worthy of remark, that the same species, *I. suffruticosum*, extends from the Peninsula up the Gangetic Valley, nearly as far as Delhi. Other species have been indicated, but they very much resemble one another. *Pentaloba* is the only genus of the tribe *Alsodineæ*, which has been found in Asia; but as this does not extend beyond the island of Penang, it cannot be considered in the Flora of India.

Many species of *Viola* and *Ionidium*, containing mucilage and emetine, have been used as demulcents and as substitutes for the true ipecacuanha. As the roots of *Viola odorata, canina* and *tricolor*, are emetic, it is probable that those of some of the Himalayan species may possess similar properties. The whole plant of some of these in a dried state may be procured in most Indian bazars, under the name *bunufsa*, being used in native medicine. *Ionidium suffruticosum*, we learn from Dr. Ainslie, is used in the Peninsula as a demulcent. It would be interesting to ascertain, if it do not contain emetine, like some of the American species; as *I. Ipecacuanha*, which yields the *Poaya da praya*, is used by the Brazilians, and also, in Cayenne, as a substitute for the true ipecacuanha. *I. parviflora* and *I. Poaya* are also in use for the same purpose.

1. *Viola serpens* (Wall.) pilosiuscula, caulibus prostratis stoloniferis, foliis ovato-cordatis acuminatis, sinu lato, auriculis rotundatis, stipulis lanceolatis dentatis, pedunculis foliis brevioribus, corolla resupinata, petalis duobus mediis barbatis, calcare brevi obtusissimo.—Wall. Fl. Ind. 2. p. 449. 1824. D.C. Prod. 1. p. 296—v. Tab. 18. fig. 1.—Hab. Mussooree flowering in March. Nepal. *Wall.* The figure is taken from a drawing in the collection formed by Dr. Wallich, which has been placed in my hands by the Hon. the Court of Directors of the East-India Company.

2. *V. reniformis* (Wall.), caule erectiusculo, foliis reniformibus serratis pubescentibus, inferioribus longe petiolatis, stipulis ovatis dentatis, sepalis linearibus acutis calcare subulato dimidio brevioribus.—*Flores* flavi suaveolentes.—*Petalum* inferius obovatum cæteris latius calcaratum.—*Calcar* tenue cylindricum calyce duplo longius.—Wall. Fl. Ind. 2. p. 451. ed. 1824.—Hab. This plant was first found by Dr. Wallich on Sheopore, and by myself on the Choor Mountain, flowering in both places in June; introduced into the Botanic Garden at Saharunpore, it flowered as early as the month of March.—The drawing, Tab. 18, fig. 2, and my specimens, agree very well with Dr. Wallich's full original description; but the specimens in the East-India Herbarium, No. 1443, are more fleshy, as well as more

more diffuse, flowers more numerous on each plant, as well as in the axilla of each leaf, as represented in Wall. Ic. ined. No. 850. This difference may probably be owing to the latter being from a moister climate than that whence my specimens, which are closely allied to *V. biflora*, were procured.

3. *V. Kunawurensis;* glaberrima, caulibus radiciformibus duriusculis humilibus, foliis ovato-lanceolatis basi attenuatis longe petiolatis, stipulis adnatis, sepalis ovatis venosis, petalis liberis omnibus imberbibus cæruleis, calcare brevi obtusissimo, stylo claviformi recurvo.—Hab. Kunawur. Tab. 18. fig. 3.

16. DROSERACEÆ.

The plants, constituting the genus from which this family is named, depend less on the temperature, than on the moisture of a climate, for their distribution; we find them therefore wherever there is a damp atmosphere and moist soil, in Europe and in America even to the Straits of Magalhaens, in Van Diemen's Land, at the Cape of Good Hope, and also in China. In India species of *Drosera* are found in the northern, as in the most southern parts. *D. Burmanni* and *Indica* being found in Bengal and the Peninsula, while *D. lunata* occurs in the mountains from Silhet to the Sutlej. This I have found in the small valleys enclosed within the different lateral projections of the Mussooree Range, where the ground is rather flat, and the soil moist. In such situations it springs up and flowers in considerable quantities, but only during the rainy season, when the thermometer has a range of not more than ten degrees, between 60° and 70°, and the hygrometer always indicates a degree of moisture approaching that of saturation. This species, which in my MSS. Catalogue I had named *D. muscipula* from the glandular ciliæ of its viscous leaves closing upon flies and other insects, which happen to light upon them, is remarkable, as in this respect resembling *Dionæa muscipula*, which is placed in the same natural family. It is probable that this species would yield a valuable dye, as the paper in which the plants were dried became dyed of a pink colour. As the plant is interesting in so many respects, it was intended to have given a figure of it; but there being no space either in Plate 17 or 18, it is intended to figure it whenever a favourable opportunity occurs for so doing. Besides this genus, *Aldrovanda vesiculosa* is described as being found in "paludosis Indiæ," and Dr. Roxburgh has a new species, *A. verticillata*, but I have not met with either, neither are they enumerated in Dr. Wallich's Catalogue.

17. POLYGALEÆ.

The genus *Polygala*, from which this order is named, being found in most parts of the world, whether hot or cold, is also met with in India, both in the plains and in the mountains. About thirty Indian species have been enumerated; of these nine belong to the Himalayas, the remainder are found in the Peninsula and Burhmese country. *P. telephioides* and *arvensis*, which hardly differ from one another, are those which extend all over the plains of India, as far north as the latitude of Delhi. *P. oligophylla* is found at the foot of the Himalayas, and *P. Gerardiana* on their northern face. *Salomonia* is one of the genera common and peculiar to China and Nepal. *Securidaca*, which was thought to be restricted to the warmer parts of South America, has also been found in Silhet

and at Goalpara; *Xanthophyllum* is a new genus, consisting of large timber trees, figured in Dr. Roxburgh's Coromandel Plants, t. 284, and found in the forests of Silhet and hilly parts of Chittagong.

Many of this family are known to possess considerable bitterness, with some astringency. *Soulamea amara,* esteemed in the Moluccas and Java as a medicine, was, on account of its bitterness, called by Rumphius, "*Rex amaroris.*" *Polygala Senega,* now employed as a stimulant diuretic, was first introduced into European practice in consequence of information that it was employed by the natives of South America as a cure against the bites of venomous reptiles. It is remarkable that a species of the same genus is employed in the Himalayas for the same purpose. This plant (*P. crotalarioides*) was first sent me by Major Colvin, of the Bengal engineers, with a note informing me that the root was employed by the people of the Hills as a cure against the bites of snakes. A remarkable instance of the same properties being ascribed to plants of the same genus in such widely distant parts of the world, and a striking illustration of the utility which may attend investigations into the medical properties of plants connected by botanical analogies. *Krameria triandra,* referred with doubt to this order, is well known, as its roots, which are extremely bitter and astringent, form the Ratanhia of the shops.

P. elegans (Wall) foliis lanceolatis lucidis marginibus reflexis, caule suffruticoso erecto, racemis foliosis elongatis paucifloris demum ebracteatis, carinis cristatis, alis ovato-oblongis capsulis alatis duplo-longioribus, ovario subsessili. Wall. Cat. 4186.—Hab. This very elegant plant, procured by Dr. Wallich from Nepal, I found in flower in the month of June on the mountains which separate the Pabur and Tonse rivers. It has been figured in Plate 19, fig. A., under the name *P. myrsinites,* assigned to it in my MS. Catalogue; and it was not until all the plates had been struck off, that I discovered that this, as well as the following plant, already existed in the East-India Herbarium, under the names by which they are here described. Tab. 19, fig. A.—1. Crested corolla and stamens.—2. Wings or two interior sepals.—3. Pistil and three exterior sepals.—4. Capsule cut transversely.—5. The same cut vertically, showing a single pendulous seed in each cell, and that the capsule is winged and emarginate at the apex.—6. The seed hairy, with the trifid caruncula surmounting the hilum.—7. Seed cut transversely.—8. The embryo.

P. glaucescens (Wall) foliis ovato-lanceolatis teneris minute ciliatis versus caulis apicem aggregatis, caule simplici erecto apice ramis furcatis, racemis spiciformibus terminalibus demum ebracteatis, alis obovatis capsula orbiculata emarginata duplo longioribus. *P. glaucescens.* Wall. Cat. 4182.—*P. furcata.* Tab. 19, fig. B.—1. A flower.—2. The same, with the wings and the outer sepals of the calyx, as well as the corolla, separated from the pistil.—3. The orbicular emarginate capsule.—4. The same cut transversely.—Hab. Mussooree during the rainy season.—Nepal. *Wallich.*

P. crotalarioides (Hamilt.) caule a basi ramoso suffruticuloso decumbente piloso, foliis obovatis basi cuneato-petiolatis, racemis 8-10-floris, alis ovato-oblongis capsula suborbiculata ciliata duplo-longioribus. —*Bracteæ* persistentes acutæ. D.C. Prod. 1. p. 327. Wall. Pl. As. Rar. p. 19. t. 185.—Hab. Mussooree and everywhere in the Himalayas.—Nepal. *Wallich.* v. Tab. 19. fig. C.

This plant having been figured by Dr. Wallich, it would have been unnecessary to repeat it in the present work, were it not for its being employed in the Himalayas for the same purposes that *P. senega* or *rattle-snake-root* is in America; it is therefore desirable to call the attention of medical officers, who may be favourably situated for the purpose, to make experiments on the subject, and ascertain if this could be applied to the same purposes as the American snake-root.

P. triphylla (Hamilt.) floribus nudis non cristatis, alis obovatis, petali lobis lateralibus foliatis apice truncatis bidentatisque, foliis ovatis acutis glabris tenuissime serrulatis petiolatis, caule apice trichotomo,

ramis

ramis triphyllis. Don Prod. Fl. Nep. p. 200.—Hab. Mussooree in the rainy season.—Nepal. *Hamilton* and *Wallich*. Tab. 19. fig. D.

18. PITTOSPOREÆ.

This family, first formed by Mr. Brown of New Holland plants, is composed of but few genera and species, but has a very extensive distribution. Mr. Brown has remarked that "*Pittosporum*, the only genus of the order which is not confined to Terra Australis, "has the most extensive range in that country, and has been found in many other parts "of the world,"—as New Zealand, Norfolk Island, the Society and Sandwich Islands, the Moluccas, China, Japan, and even Madeira, but not in America. To these it may be added, that I have found species of the same genus nearly as far north as Madeira, both in the Kheree Pass, where the shrubs and trees belong chiefly to tropical genera, as well as at Mussooree, at 6,700 feet above the sea, where the same kind of vegetation is of an European nature. A species of *Senacia* is also mentioned, as occurring in Nepal; but there is reason for supposing that *Pittosporum floribundum* is the same plant. It is probable that the latter genus occurs all along the foot of the Himalaya, whence it extends into the Peninsula, where two or three species have been found by Dr. Wight.

Pittosporum floribundum (Wight and Arnott); foliis lanceolatis undulatis reticulato-venosis supra nitidis, junioribus pubescentibus, floribus terminalibus corymbosis, capsulis late cordatis subcompressis breviter pedicellatis 1-4-spermis.—*Frutex* 10-pedalis, *folia* numerosa versus apices ramulorum conferta. *Calyx* 5-sepalus, sepala imbricata oblonga versus basin marginibus ciliatis læve coherentia. *Corolla* 5-petala, petala lineari-oblonga libera patentia demum recurvata. *Stamina* 5 hypogyna petalis alternantia, sepalis opposita. *Germen* bacciforme subbi v. triloculare, loculis polyspermis. *Styli* 2 v. 3 breves recti. *Stigmata* simplicia. *Capsula* complanata late cordata extus rugosa 2-3-valvis 1-locularis. *Semina* 1-4, (tria sæpe abortiva) capsulæ basin adnata, pulpa resinosa rubra arilliformi obducta, albumen corneum semini conforme. Embryo minimus.—Hab. Kheree Pass, elevation 2000 feet; flowering in March.

P. eriocarpum; foliis petiolatis ovatis utrinque attenuatis tomentosis, floribus terminalibus corymbosis, capsulis polyspermis ovoideis villosis.—*Sepala* 5 squamiformia imbricata. *Petala* 5 lineari-oblonga imbricata medio cohærentia apice recurvata. *Stamina* 5 hypogyna. *Germen* villosissimum. *Stylus* unus. *Stigma* simplex. *Capsula* villosa, ovoidea, basi styli persistente terminata, bivalvis 1-locularis polysperma. *Semina* compressa pulpa resinosa rubra obducta placentariis parietalibus adnata.—Hab. From above Sansadhara to Mussooree, or from 3000 to 6700 feet of elevation in 30½° of northern latitude.

19. ELATINEÆ.

The *Elatineæ*, distinguished by their capitate stigma and want of albumen, from *Caryophyllaceæ*, in which they are included, with a doubt, by the celebrated M. de Candolle, form but a small family, found in marshes and their neighbourhood, in Europe and Asia, as well as Africa and America, have a few species in India, in similar situations. Of these, *Bergia verticillata*, referred, as all the other species, by Dr. Wight and Mr. Arnott, to *Elatine*, is found in Egypt as well as in India.

20. CARYOPHYLLACEÆ.

The plants of this family being inhabitants of the temperate and frigid zones, chiefly of

of the northern hemisphere, we have them, like the *Ranunculaceæ* and *Cruciferæ*, abundant in the Himalayas, and comparatively absent from the plains of India. A few species occur on the Neelgherries, where elevation, as in other tropical parts of the world, compensates for lowness of latitude, and allows the existence of plants of the temperate zone. In the plains of India, it is only during the cold weather months that any of the genera analogous to those of Europe, are found; as *Stellaria media*, *Spergula indica*, closely allied to, if not the same, as *Sp. pentandra*, *Saponaria vaccaria*, and *Silene conoidea;* the two latter being European species, and occurring in corn-fields, it is probable that they have spread southwards with the wheat and barley which are so extensively cultivated in the north of India. *Mollugo*, the most tropical genus of the family, has several species in the lower provinces and peninsula of India; and *Drymaria extensa*, hardly to be distinguished from *D. cordata*, found in Surinam, Jamaica, and New Spain, belonging to a genus, of which the rest of the species are American, is found in the south of India, and all along the foot of the Himalaya.

The species which occur on the slopes and summits of these mountains, belong to the genera *Gypsophila*, *Dianthus*, *Cucubalus*, *Silene*, *Lychnis*, *Spergula*, *Stellaria*, *Cerastium*, *Arenaria*, and the new genera *Leucostemma*, *Alsinella*, *Odontostemma*, and *Brachystemma*. The *Sileneæ* are twenty-two in number, and of them, *Dianthus barbatus*, *Cucubalus bacciferus*, and *Lychnis coronaria*, of which specimens were brought me from Cashmere, and the seeds produced plants in the Saharunpore Botanic Garden, cannot be distinguished from European specimens; while *Dianthus caucaseus*, *Silene inflata*, *viscosa*, and *viscaginoides*, with *Arenaria serpyllifolia*, plants of Caucasus, Siberia, and Dahuria, are all found in the Himalayas. I am indebted to Mr. Bentham for the following account of the Himalayan species of this tribe. The *Caryophylleæ*, of the tribe *Alsineæ*, are about forty in number, many having the closest resemblance to European species; while there is great similarity between the species found in Kunawur, and those of Siberia and North America. These have been sent to M. Fenzl, of Vienna, who has been kind enough to undertake to incorporate them in the monograph, which he is about to publish, of that tribe.

Though many of this family are well known as handsome garden flowers, few are employed in medicine, as they are remarkable only for their insipidity. The flowers of *Dianthus caryophyllus* are employed for making a sirup and a conserve, on account of their colour and fragrance. It is remarkable, that the name *kurunphool* (Καρυφυλλον) is applied in India to *Dianthus chinensis*, cultivated in gardens. *Saponaria vaccaria* is also used in native medicine, and from its saponaceous and slightly bitter properties, may be useful in some cases.

ENUMERATION

ENUMERATION

Of the CARYOPHYLLEÆ of the Tribe SILENEÆ, contained in the Indian Collections of Dr. WALLICH and Mr. ROYLE, by GEORGE BENTHAM, Esq.

I. GYPSOPHILA.—Linn. Ser. in DC. Prod. 1. 351.

Sectio *Struthium*. Ser. in l.c. 352.

1. *G. cerastioides*.—Don Prod. Fl. Nep.

Acosmia rupestris. Benth. in Wall. Cat. Herb. Ind. n. 644.

HAB. Lofty mountains in the Himalaya.—*Royle. Wallich.*

A Gypsophila differt habitu et calycibus nec angulatis nec margine membranaceis et in revisione Caryophyllearum verosimiliter ut genus proprium habenda.

II. DIANTHUS.—Linn. Ser. in DC. Prod. 1. 355.

Sectio *Armeriastrum*. Ser. in DC. l.c.

2. *D. barbatus*.—Linn. Ser. l.c. 355.

HAB. Cashmere.—*Royle.*

Sectio *Caryophyllum*. Ser. l.c. 357.

3. *D. Caucaseus*.—Linn. Ser. l.c. 363.

HAB. Cashmere and Jhilum.—*Royle.*

4. *D. angulatus* (Royle MSS.) glaucescens, caulibus subunifloris vel paniculatis paucifloris, foliis glaucis rigidis margine scabriusculis, squamis calycinis senis ovato-lanceolatis adpressis, petalorum unguiculis calyce subbrevioribus, lamina parva cuneata fimbriata.

HAB. Kunawur.—*Royle.*

Ab affini *D. Caucaseo* differt calycibus brevioribus, unguiculis petalorum non exsertis, et limbo triplo quadruplove minore.

III. SAPONARIA.—Linn. Ser. in DC. Prod. 1. 365.

Sectio *Vaccaria*. Ser. in l.c.

5. *S. vaccaria*.—Linn. Ser. in l.c.—*S. perfoliata*. Roxb. Ser. in l.c.

HAB. Corn-fields in India.—*Royle. Wallich.*

IV. CUCUBALUS.—Gaertn. Ser. in DC. Prod. 1. 367.

6. *C. bacciferus*.—Linn. Ser. in l.c.

HAB. Jumbo.—*Royle.*

V. SILENE.—Otth. DC. Prod. 1. 367.

The Sections established by Otth in the Prodromus are far from being natural, and several species are repeated under different names in different sections; but the Indian species are so few, that it may be more convenient to refer them to those sections than to establish new groups upon this occasion.

Sectio *Behenantha*.—Otth. l.c.

7. *S. inflata*, Sm.—Otth. in DC. Prod. 1. 368.

HAB. Lofty mountains in Kemaon and Nepal. *Wallich.*—Choor and Mussooree. *Royle.*

8. *S. viscaginoides*, Horn.—Otth. l.c. 368.

HAB. Peer Punjal.—*Royle.*

Sectio *Otites*.—Otth. l.c. 369.

9. *S. Kunawurensis* (Royle MSS.) glabra vel vix pubescens caule ramoso, foliis lineari-lanceolatis inferioribus latioribus petiolatis, spica elongata pauciflora, pedunculis calyce duplo triplove longioribus, floribus nutantibus, calycibus subinflato-clavatis 10-striatis, petalis bifidis, genitalibus exsertis.

HAB. Kunawur.—*Royle.*

Affinis *S. multifloræ, elatæ, &c.* distincta præsertim floribus paucis nutantibus longe pedunculatis. An potius ad *Stachymorpham* referenda?

10. *S. Falconeriana* (Royle MSS.) basi pubescens superne glabra, caule simplici, foliis linearibus vel inferioribus lineari-lanceolatis, spica elongata pauciflora, pedunculis calyce longioribus, floribus erectiusculis, calycibus cylindrico-clavatis 10-striatis, petalis integris. (Tab. 20. f. A.)

HAB. Tuen and Manma.—*Royle.*

A *S. multiflora* differt habitu graciliore petalis integris genitalibus brevioribus.

11. *S. viscosa*, Pers.—Otth. l.c. 370.

HAB. Jhilum and Kunawur.—*Royle.*

Sectio *Coniomorpha*.—Otth. l.c. 371.

12. *S. conoidea*.—Linn. Otth. l.c. 371.

HAB. Kemaon and Deyra Doon. *Wallich.*—In corn-fields in India. *Royle.*

This is, I believe, an Asiatic species, or found only in south-eastern Europe. It is common in botanical gardens, but those authors who have mentioned it as growing "in Germaniæ, Galliæ arenosis," have probably mistaken for it the larger specimens of *S. conica*.

Sectio *Stachymorpha*.—Otth. l.c. 371.

13. *S. Moorcroftiana* (Wall. Cat. Herb. Ind. n. 626) pubescens, caulibus numerosis basi prostratis foliosis, ramis strictis subnudis, foliis lanceolato-linearibus obtusiusculis, floribus in summis caulibus solitariis vel paucis alternis pedunculatis, calycibus cylindraceo-clavatis 10-striatis, anthophoro longo glabro, petalis cuneatis bifidis longe unguiculatis.

HAB. Luddak.—*Moorcroft.*

This species is allied to *S. altaica*, Pers. from which it differs by its shorter and broader leaves, and by the calyxes nearly as long as in *S. longiflora*.

Sectio *Siphonomorpha*.—Otth. l.c. 377.

14. *S. Webbiana* (Wall. Cat. Herb. Ind. n. 627) foliis lato-ovatis acuminatis, superioribus cordato-amplexicaulibus nervosis, floribus elongato-paniculatis nutantibus, calycibus ventricoso-subclavatis, petalis semibifidis longe unguiculatis coronatis.

HAB. Mountains of Sirmore.—*Wallich.*

Closely

Closely allied to *S. viridiflora* (Linn.) from which it is distinguished by the shorter and less abundant pubescence, and the more cordate and broader leaves, which are marked especially on the upper side, with nine, eleven, or more, somewhat prominent nerves.

VI. Lychnis.—Ser. in DC. Prod. 1. 385.

This genus as at present characterised, is distinguished from *Silene* by a purely artificial character, the number of styles, and consequently of cells of the capsule. The following species cannot be separated from *L. apetala*, although several of them have usually but four styles, and the *L. indica* has often but three. It is probable that the form of the calyx, the pubescence and length of the anthophorum, and perhaps the form of the unguiculæ of the petals might be taken in conjunction with the usual number of styles, to establish more natural groups among the very numerous species now known of the two genera, which stand much in need of the labours of a monographist capable of clearing up their very confused synonymy.

Sectio *Physolychnis.*—Calyx fructifer inflato-vesiculosus ovoideus vel sphæricus nec basi attenuatus striis 10 sæpius purpurascentibus notatus, apice breviter 5-dentatus, dentibus obtusis margine submembranaceis. Anthophorum breve. Lamina petalifera villosa. Petalorum unguiculæ dilatatæ, lamina emarginata bifida vel fimbriata sæpius latiores. Coronæ squamæ in quoque petalo duæ. Styli 4-5 rarius 3.

15. *L. macrorhiza* (Royle MSS.) caulibus numerosis cæspitosis humilibus subunifloris, foliis lanceolato-linearibus, floribus solitariis erectis, calycibus vesiculoso-inflatis striatis pubescenti-hirtis, petalis calyce subbrevioribus, lamina brevi vix crenulata.

Hab. Kunawur.—*Royle.*

Radix crassus elongatus. Caulis basi perennis cæspitoso-ramosissimus. Rami floriferi adscendentes 3-4-pollicares tenues pubescentes. Folia inferiora basi in petiolum longe angustata, superiora sessilia, omnia leviter pubescentia. Calyx minor et minus inflatus quam in *L. apetala*, et superficies plantæ totæ præsertim calycis pubescens nec glabra. Corona brevissima, squamis subintegris.

16. *L. cuneifolia* (Royle MSS.) caulibus cæspitosis humilibus subunifloris, foliis obovato-cuneatis crassis obtusis pubescentibus, flore solitario erecto, calyce vesiculoso-inflato vix striato pubescenti-hirto, petalis calyce brevioribus, unguiculis ovatis, lamina brevi truncata emarginata.

Hab. Kunawur.—*Royle.*

Habitus et statura *L. macrorhizæ.* Differt foliorum forma et pubescentia densiore.

17. *L. inflata* (Wall. Cat. Herb. Ind. n. 618) caule subunifloro erecto, foliis ovato-oblongis pubescentibus, flore nutante, calyce maximo inflato-vesiculoso striato pubescenti-hirto, petalis calyce sublongioribus, lamina bifida, lobis integerrimis ovatis.

Hab. Kemaon.—*Wallich.*

Perennis. Caulis pedalis, pubescens, simplex vel rarius apice dichotomo-paniculatus 3-7-florus. Folia inferiora petiolata, superiora sessilia latiora. Calyx *L. apetalæ* longior, striis fusco-purpureis, et inter strias subreticulatus. Lamina petalifera pilis purpurascentibus dense villosa. Coronæ squamæ crenatæ.

18. *L. pumila* (Royle MSS.) caule erecto subsimplici pubescente subunifloro, foliis lanceolato-linearibus pubescentibus, flore suberecto, calyce oblongo vesiculoso-inflato striato pubescenti-hirto, petalis calyce brevioribus, unguiculis lineari-dilatatis, lamina brevissima emarginata.

Hab. Mussooree.—*Royle.*

Annua? Specimina Royleana vix semipedalia simplicia uniflora. Calyx fructifer magnitudine fere *L. inflatæ* sed minus inflatus, viridis nec purpureo-striatus. Differt etiam ab *L. inflata* foliorum et petalorum forma.

19. *L. multicaulis* (Wall. Cat. Herb. Ind. n. 622) caulibus numerosis cæspitosis elongatis paucifloris, foliis lanceolato-linearibus linearibusve, inferioribus glabris, floribus nutantibus subpaniculatis, calycibus vesiculoso-inflatis striatis pubescentibus, petalis calyce subbrevioribus, lamina brevissima dentata.

Hab. Nepal.—*Wallich.*

Perennis. Caules 1-2-pedales fere glabri vel superne uti folia superiora pubescentes. Folia inferiora petiolata, superiora sessilia. Flores 3-7 dichotomo-paniculati. Calyces minores quam in speciebus præcedentibus. Petalorum laminæ corona breviores.

20. *L. nutans* (Wall. Cat. Herb. Ind. n. 620) caulibus adscendentibus laxe dichotomo-paniculatis, foliis lato-ovatis, inferioribus utrinque angulatis, superioribus basi cordato-amplexicaulibus, floribus nutantibus, calycibus vesiculoso-inflatis striatis pubescenti-hirtis, petalis calycem superantibus, lamina brevi dentata, dentibus integris. *L. ciliata.* Wall. Cat. Herb. Ind. n. 621.

Hab. Gosainthan. *Wallich.*—Kunawur. *Royle.*

Perennis. Caules 1-2-pedales basi procumbentes uti tota planta breviter pubescenti-hirti. Panicula laxa divaricata. Calyx minor quam in *L. inflata*, dentibus margine sæpe fimbriato-ciliatis, et ideo nomen *L. ciliatæ* huic speciei in herbario Indico imposui, sed ob characterem quam maxime fallacem, nomen Royleanum retinere malui. Petalorum laminæ squamas coronæ duplo superantes, breviter 3-5-dentatæ dentibus linearibus. Styli 4-5.

21. *L. Cashmeriana* (Royle MSS.) caulibus erectis dichotomo-paniculatis, foliis ovatis, inferioribus basi angustioribus leviter pubescentibus, floribus erectiusculis (?), calycibus vesiculoso-inflatis striatis pubescenti-hirtis, petalis calycem superantibus, lamina bifida, laciniis obovato-cuneatis 2-3-fidis.

Hab. Cashmere.—*Royle.*

A *L. fimbriata* vix differt nisi petalorum forma et calycibus forsan majoribus fere *L. inflatæ.* Specimina suppetentia imperfecta sunt.

22. *L. fimbriata* (Wall. Cat. Herb. Ind. n. 619) caulibus erectis dichotomo-paniculatis, foliis ovato-lanceolatis pubescentibus, inferioribus petiolatis, floribus erectiusculis, calycibus vesiculoso-inflatis striatis pubescenti-hirtis, petalis calyce longioribus, laminis lacero-fimbriatis, laciniis linearibus bifidis. *L. eriostemon.* Wall. Cat. Herb. Ind. n. 620. (T. 20. f. B.)

Hab. Kemaon. *Wallich.*—Mussooree and Jumbo. *Royle.*

Perennis

Perennis. Caules 1-2-pedales uti tota planta breviter pubescentes. Folia angustiora et panicula strictior quam in *L. nutante*. Calyx *L. nutantis* paullo major, striis purpureo-rufescentibus pubescenti-hirtus, inter strias subreticulatus. Petalorum unguiculi cuneato-dilatati. Coronæ squamæ lamina breviores crenatæ. Styli 4-5. A *L. indica* differt calycibus fere duplo majoribus, petalis magis incisis.

23. *L. indica* caule erecto ramoso, foliis ovatis vel ovato-lanceolatis pubescentibus, panicula stricta multiflora, floribus subnutantibus, calycibus fructiferis erectis oblongis inflatis striatis pubescentibus, petalis calyce longioribus, lamina bifida, lobis integerrimis bidentatisve. *Silene indica.* Roxb. Hort. Beng. 34.

HAB. Nepal.—*Wallich.*

Herba 1-2-pedalis. Habitus *L. fimbriatæ* sed panicula angustior strictior et petalorum forma diversa. Calyces minus inflati. Styli 4 vel sæpe 3.

Ad hanc sectionem referendæ sunt *L. apetala* Linn. *sylvestris* DC. *dioica* Linn. et verosimiliter *L. Magellanica.* Lam. *variegata* Desf. et *diclinis* Lag. An cum Silenibus Behenanthis plurimis genus proprium?

Sectio *Agrostemma.* DC. Prod. 1. 386. excl. speciebus calycibus inflatis.

24. *L. coronaria.* Lam. DC. l.c. 387.

HAB. Cashmere.—*Royle.*

TRIBE ALSINEÆ.

In addition to his account of the Indian *Sileneæ*, Mr. Bentham has been good enough to favour me with the following characters of the genus *Leucostemma*, and the two species named by him in Dr. Wallich's Catalogue of the East-Indian Herbarium. These, as well as the following, will be included in M. Fenzl's monagraph of the tribe *Alsineæ*, and therefore short specific characters have only been given.

LEUCOSTEMMA.

Sepala 4. Petala 4, bifida. Stamina 8. Styli 2. Capsula 1-locularis, apice dentibus 4 dehiscens, polysperma.

This genus differs from *Stellaria* in the number of parts, and cannot be joined to it without breaking through the principles upon which the genera of *Caryophylleæ* have hitherto been established. It is, however, probable that, in a general revision of the order, much better characters may be found, and in that case *Leucostemma* may find its place as a section of *Stellaria.*

1. *L. latifolium* (Benth. in Wall. Cat. Herb. Ind. n. 643), foliis inferioribus cordato-ovatis, superioribus oblongo-lanceolatis. (Tab. 21. fig. 1.)—Habitus *Stellariæ. Caules* teneri basi decumbentes ramosissimi. *Rami* apice dichotomi, junioribus pubescentibus. *Folia* inferiora 3-4 lin. longa, basi cordata, superiora semipollicaria, basi angustata, omnia acuminata. *Pedunculi* tenues elongati uniflori. *Corolla* magnitudine fere *Stellariæ nemorum*, alba petalis calyce duplo longioribus. *Sepala* lanceolata, acutissima, viridia, glabra vel tenuissime pubescentia, margine membranacea. *Capsula* ovoidea. *Semina* numerosa, glochidiata.—Hab. Bhogtibba between Ganges and Jumna rivers. *Royle.*—Kemaon. *Wallich.*

2. *L. Webbianum* (Benth. in Wall. l. c. n. 642), foliis omnibus oblongo-linearibus basi angustatis. *L. Angustifolium* (Royle). Tab. 21. fig. 2.

A *L. latifolio* constanter distinctum foliis angustioribus longioribusque, cæterum eo simillimum est.—Hab. Near the village of Mutrogh, on the side of Budraj. *Royle.*—Sirmore. *Webb.*—Kemaon. *Wallich.*

Arenaria festucoides; cæspitosa, foliis gramineis subulato-filiformibus curvatis sub lente ciliato-scabris, radicalibus fasciculatis, caulibus simplicibus adscendentibus calycibusque glanduloso-pilosis unifloris, sepalis 5-nerviis acutissimis margine scariosis petala ovata $\frac{1}{4}$ brevioribus.—*A. nardifoliæ* Ledeb. affinis.—Hab. Kunawur. Tab. 21. fig. 3.

21. LINEÆ.

This order, named from, and chiefly composed of the genus *Linum*, of which one species has been known for its important uses from time immemorial, is found chiefly in Europe and the north of Africa, but also in most other parts of the world, though not very numerous in species any where. In India, one species, *L. Mysurense*, has been found in the Peninsula, and by myself on the Mussooree and Kedarkanta moun-

tains. At the foot of the hills, and at moderate elevations within them, are found the different species, *L. Cicanoba, trigynum, repens,* and *tetragynum,* which are all distinguished by the showiness of their flowers, are closely allied among themselves, and differ from the rest of the genus. Mr. Bentham suggests that *L. repens* is only a variety of *L. Cicanoba.* This I have found varying so much, that even *L. trigynum,* of which the older leaves, as Dr. Roxburgh mentions, are serrate, may be a variety of it, as well as *L. tetragynum.*

In the plains of India, *Linum usitatissimum* is found every where in a cultivated state in the cold weather months. This plant, so well known for the tenacity of the flax yielded by its fibrous bark, from which, in the present, as in the most ancient times, linen cloth was manufactured, and which is subsequently converted into paper, is valuable also for the mucilage yielded to water, and the oil to pressure, the first by the covering, and the other by the almond of its seed; while the residue forms an oil-cake fit for the food of cattle. Flax, extensively cultivated in Europe, is imported into England, chiefly from Russia; and linseed from both America and Holland. In Egypt, as in ancient times, it is much cultivated in the present day; it must long have been introduced into India, probably from the northward; but its names do not give us any assistance in tracing it to its source; as the Sanscrit *atasee,* Hindee *atees,* Bengalee *mushina,* have no resemblance to the Hebrew *pishtah,* Arabic *akshoot,* Greek λινον, or Persian *kutan.* The latter, remarkable for its resemblance to *qootn* or *kutun,* the Arabic name of cotton, but this is written with the Arabic, and the former with the Persian *kaf.* In India, the flax is cultivated only on account of its seed, of which the mucilage is valued as a demulcent in medicine, and the oil in the arts; but the plant, which in other countries is most valued, is there thrown away; and others, such as *Hibiscus cannabinus* and *Crotalaria cannabina,* are cultivated almost in the same field, for the very products which this would yield. It seems worthy of experiment, therefore, to ascertain whether a valuable product might not be added to the Indian agriculturist's profits, without much additional expense. Flax having been manufactured into linen cloth, both by the Egyptians and the Hebrews, as we learn from the sacred writings, as well as from Herodotus, and know from the mummies being exclusively, as far as hitherto ascertained, wrapped up in linen clothing, it is curious that the practice of converting flax into linen should not have passed into India. This, I conceive, can easily be accounted for by the latter possessing the cotton plant, of which the weavable portion is more obvious, elegant, and well suited to the climate.

I have the pleasure of annexing, from Mr. Bentham, an improved character of *L. Mysurense,* which, as above mentioned, is found in several parts of India.

Linum Mysurense (Heyne. Benth. in Bot. Reg. 16. ad calc. n. 1326), glabrum, erectum, foliis alternis basi attenuatis, inferioribus ovatis obtusis, superioribus oblongis acutis, floribus paniculato-corymbosis, sepalis ovatis acutiusculis margine subciliatis, petalis calycem breviter superantibus, stylis basi connatis.—Affine *L. gallico,* differt sepalis acutiusculis nec acuminatis, petalis brevioribus.

22. MALVACEÆ.

22. MALVACEÆ.

The relation of this order, with those which follow, as *Bombaceæ*, *Byttneriaceæ*, and *Tiliaceæ*, is so considerable, as to have induced Mr. Brown to recommend their being included in one natural class, of which the orders appeared as nearly related as the different sections of *Rosaceæ* are to each other. On this occasion Mr. Brown made the valuable remark, which, though followed up by several celebrated botanists, is to be regretted has not yet become universally adopted as a law. "In both these, as well as in several other cases that might be mentioned, there seems to be a necessity for the establishment of natural classes, to which proper names, derived from the orders best known, and differing, perhaps, in termination, might be given." The *Malvaceæ* occurring within the tropics, both in the New and the Old World, both as trees and herbs, and only in the latter state in the temperate zone, are found in considerable quantities in every part of the plains of India, but a few species only on the slope of the Himalaya. These belong to the same genera as the European *Malvaceæ*. *Althæa rosea* and a species of *Lavatera* have been brought me from Cashmere: the former most likely cultivated, as it is every where, in the gardens of India. *Malva sylvestris* and *rotundifolia* occur in the same localities. The latter is also found, both on the northern and southern face of the Himalaya, as well as in the plains of India; but in the latter situation, only during the months which constitute the winter, both of Europe and of the Himalayas; but in the mountains, it is found only during the summer months, which in the plains are so hot, as to scorch every thing requiring a moderate temperature. Both plants and seeds of *Hibiscus Trionum* have been brought me from Cashmere, and grown in the botanic garden at Saharunpore, and the wild specimens now deposited in the Museum of the Linnean Society scarcely differ from the plant found in European gardens. The genera of which species are found in the plains and peninsula of India, are *Sida*, *Pavonia*, *Thespesia*, *Lebretonia*, *Hibiscus*, *Abelmoschus*, and *Urena*, which are also common to America; together with *Gossypium*, found commonly in a cultivated state, and *Lagunæa*, which is common to India and Africa. Many of the same species of some of these genera extend from the peninsula to the most northern parts, as *Hibiscus rigidus*, *Surattensis* and *crotonifolia*, to the neighbourhood of Delhi; the last constituting the new genus *Decaschistia* of Dr. Wight and Mr. Arnott. *Sida humilis*, *cordifolia*, *populifolia*, and *graveolens*, are found every where in the plains; while *Urena repanda*, *Hibiscus Lampas*, *Abelmoschus moschatus*, and *cancellatus*, extend along the foot of the Himalaya, with the jungle and forest, as far north as the banks of the Jumna in 31° of latitude. In such situations only, and in the vallies near the plains, have I seen any of the above-mentioned Indian *Malvaceæ*; they are therefore most probably found in the same situations in Nepal and Kemaon. Many of the species, however, from the south, succeed remarkably well as far north as Saharunpore; as *Hibiscus macrophyllus*, *populneoides*, and others, with the usual garden species; among these some American species, as *Hibiscus Sabdariffa*, may be mentioned as quite at home in every part of India.

The *Malvaceæ,* and the other orders which have been mentioned as being allied to it, are not more remarkable for general accordance in structure, than for the possession of similar properties, as will be seen in the remarks on each of the orders. The greater number of species abounding in mucilage, which is of an innocuous nature, may all, almost indifferently be used as demulcents in medicine, as mallows and marsh-mallows have been from the earliest times in Europe, and as *Sida indica, asiatica,* and *populifolia,* are in India. The mucilage of some being abundant and wholesome, they are much used as food, as the fruit of *Hibiscus esculentus,* or the *ochro* (Gombo *Fée*) is in America; and as *H. longifolius,* or *ram turai,* replete with mild mucilage, is in India; and as other species, though less nourishing, have been in other parts of the world. The *Malvaceæ* are still more remarkable, for many of them having the bark abounding in flax-like fibres, which, from their tenacity, are manufactured into cordage. In the West Indies, whips are manufactured from *Hibiscus arboreus. Malva crispa* was found by Cavanilles fit for making cordage. *Sida abutilon* is said to be cultivated in China, as we know *Hibiscus cannabinus,* or *sun,* is in India as a substitute for hemp. Several other species have been recommended for this purpose, as well as for conversion into paper. *Sida rhomboidea* and *rhombifolia, Urena lobata* and *sinuata, Hibiscus tortuosus, furcatus,* and *collinus,* are all described by Dr. Roxburgh as abounding in strong and serviceable flaxen fibres. *Sida periplocifolia* and *Hibiscus strictus,* from the plants shooting into long single twigs, particularly if closely sown, are especially recommended for cultivation. The fibres of the last are described as being long, fine, and strong, of a beautifully glossy white, and therefore well worthy of experiment, whether it might not be profitably substituted for some of the plants which now engage the Indian agriculturist's attention. *Abelmoschus moschatus,* long known for its musk-scented seeds (*hub-ool-mooshk*) which, in Arabia, are said to be added to coffee, and in India are used as a cordial medicine, abounds in mucilage, which, in the Saharunpore district, is employed in clarifying sugar. A few species of this order are remarked to be possessed of anomalous properties, as *Hibiscus Sabdariffa,* cultivated for the pleasantness of the acid of its red calyxes, while the flowers of a few have astringent properties, as *Malva alcea,* and *Hibiscus rosa sinensis,* which in India, as in China, is employed for blackening the eyebrows, as well as the leather of shoes.

But Cotton is by far the most important product of the plants of this family; it was known in very ancient times; its consumption has increased in proportion to the progress of the arts and of civilization. It appears to have been originally known only as a product of India, the country which at the present day is supposed by many incapable of producing any but the inferior kinds. As this is an opinion which appears to me to have been hastily formed from the results of experiments in a few situations, instead of after an investigation into the nature and variety of the soils and climates of the different provinces of this extensive country, it will not be perhaps irrelevant to enter into a few details on the subject.

That cotton was originally introduced from India into Egypt, seems probable from

Herodotus

Herodotus not mentioning it among the products of the latter country, which he would hardly have failed doing had it been common or cultivated, as its novel and singular appearance must have struck a traveller from Europe; particularly as in his account of the Indians, he mentions that they possess a kind of plant, which, instead of fruit, produces wool of a finer and better quality than that of sheep: of this the natives make their clothes. In another place, he mentions that the Egyptians, as well as the priesthood, are so regardful of neatness, that they wear only linen clothing, and that always newly washed. Book 2. c. 37; and again at c. 71. "Their habit is made of linen; over this they throw a kind of shawl made of white wool, but in these vests of wool they are forbidden by their religion either to be buried, or to enter any sacred edifice." By some authors, it has been suggested that we ought in some places to read *cotton* instead of *linen;* but this seems to be taking for granted, that the former was as common in Egypt in ancient times, as it is at present; and it appears to me, that in other places we ought to read *linen* instead of *cotton,* as in the account of the Egyptian mode of embalming, the body is said to be wrapped up in bandages of cotton. That this was not the case, is proved by all the mummies which have been opened and the cloth carefully examined under the microscope, having been found to be swathed only in *linen* cloth; which it is not likely would have been the case, if cotton had been as common an article of clothing in those, as it is in the present day, particularly as some of that used for this purpose appears to have been previously worn, as it is repaired in some places. It is not improbable, however, that cotton fabrics were imported into Egypt from India even at the earliest historical periods, with cinnamon, cassia, and frankincense. Pliny, writing about 500 years subsequent to the time of Herodotus, mentions, lib. 19, c. 1, that the upper part of Egypt, verging towards Arabia, produces a small shrub, which some call *gossypion,* others *xylon,* and from the latter the cloth made from it, *xylina,* bearing a fruit like a nut, from the interior of which a kind of wool is produced, from which cloths are manufactured inferior to none for whiteness and softness, and therefore much prized by the Egyptian priesthood. Dr. Harris, in his Natural History of the Bible, quotes several authors to show that cotton was known to the Hebrews, adding that the name *butz,* by which it is distinguished, is not found among the Jews till the time of their royalty, when by commerce they obtained articles of dress from other nations. The author of the *Ruins of Palmyra* has shown that the East-Indian trade by that city into Syria was as ancient as the days of Solomon; and Heeren concludes, that cotton fabrics formed an article of the ancient commerce with India, as Ctesias mentions that the Indians possess an insect,* which affords a red colour more

* Heeren supposes that this is the *lac insect,* but as he traces it to the high land of Tibet, it is improbable that the same insect exists in the sultry plains of India, and the cold and arid table-land of Tartary; but from the recent travels of Lieut. Burnes and Dr. Gerard, we learn (*Journ. As. Soc. of Bengal. vol.* ii. *p.* 652) that a species of cochineal is found on the root of a plant which flourishes in a marsh (near Herat), but the natives being unable to dry it, import it from Bokhara and Yarkund, paying about 32 sicca rupees per Indian seer. *Coccus polonicus,* the scarlet grain of Poland, is also found on the roots of a plant, the *Scleranthus perennis.*

more brilliant than cinnabar, which they employ in dyeing their stuffs. Theophrastus, lib. 4, c. 9., and Pliny, lib. 12, c. 10, who follows him, mention that the islands Tylos and Aradus, the modern Bahrein, in the Persian Gulf, produce abundance of cotton, which was manufactured into clothing. Heeren, *Commerce of the Ancients, vol.* ii, *p.* 278, *Fr. ed.*, concludes by saying, "Il est fort probable que les plantations de Tylos furent le resultat du commerce avec l'Inde, veritable patrie du coton."

Dr. Harris, in assigning *butz* as the Hebrew name of cotton, mentions that this bears some resemblance to *bessa*, its Arabic name, according to Prosper Alpinus Exot. t. 38, whence the βυσσος of the Greeks, and the *byssus* of the Latins. The European names have evidently been derived from قطن *qutn, kutn,* or *kootn,* which is the most common Arabic name, though others are assigned it in that copious language. The other Asiatic names do not appear to have any connection with this or with one another; as Persian, *poombeh*. Hindee, the plant *kupas*, the cotton *rooe*. Bengalee, *kapase, tula, banga*. Sanscrit, *karpassee*. From the last the Hindee and Bengalee have no doubt had their origin; and the resemblance between these and the term *Gossypium,* which has been considered of Egyptian origin, in being written with so many of the same consonants, is remarkable.

It has sometimes been considered a subject of doubt, whether the cotton was indigenous to America, as well as to Asia; but without sufficient reason, as it is mentioned by very early voyagers, formed the only clothing of the natives of Mexico; and as stated by Humboldt, is one of the plants of which the cultivation among the Aztec tribes was as ancient as that of the *pili* (*Agave*), the maize and the *quinoa* (*Chenopodium*). If more evidence be required it may be mentioned, that Mr. Brown has in his possession cotton not separated from the seeds, as well as cloth manufactured from it, brought by Mr. Cumming from the Peruvian tombs; and it may be added, that the species now recognized as American, differ in character from all the known Indian species.

In a cultivated state, cotton is now distributed over a very wide expanse of the globe on both sides of the Equator: on the north extending as far as the southern shores of Europe, and on the south to the Cape of Good Hope; in the islands of the Pacific Ocean, it is found both in the Friendly and the Society Islands. Nearly under the Line it is cultivated in the islands of Celebes, Java, Timor, and the Seychelles, as well as in Kutung, where the best is said to be grown, extending northwards up the Malayan Peninsula, along the coast of Tenasserim into the Burhmese territory, and from this westward into Siam and China, whence there is a peculiar species. Cotton is common in every part of India; a wild species was found in Ceylon, and another in Silhet by Dr. Roxburgh. From India the cotton seems to have travelled by the way of the Persian Gulf into Arabia, as well as into Persia, and from thence to Syria and Asia Minor. From Arabia and from the ancient commerce by the Red Sea with India it was probably introduced into Egypt, whence it seems to have spread into the interior of Africa, and to both its western and northern coasts. The islands and shores of the Mediterranean long supplied Europe with all the cotton it required; during the reign of Napoleon, he

he caused it to be introduced into Corsica, Italy, and the southern parts of France; and Mr. Kirkpatrick cultivated it in Spain, near Malaga. In America, cotton is extensively cultivated in the Spanish, Portuguese, Dutch, and English settlements; one species is peculiar to Peru; others are cultivated in the West-India islands; also in Mexico, and in the southern states, as Georgia and Carolina of the United States of North America.

Knowing the countries through which cotton is already spread, the next interesting subject of inquiry is to ascertain the kind of climate it requires, as well as that of the countries where the best kinds are grown, and, if possible, to determine whether this superiority depends on the excellence of the seed, the goodness of the climate, or care in the culture; and here the general results which have been deduced by the illustrious Humboldt render the most essential assistance. He remarks that *Gossypium barbadense, hirsutum,* and *religiosum,* have their favourite climate, from 0° to 34° of latitude, where the annual temperature is from 82° to 68°, but that *G. herbaceum* is successfully cultivated in the temperate zone, where, with a mean summer heat of 75° or 73°, that of winter is not less than 46° or 48°. Cotton is, however, cultivated as high as 37° of N. latitude in America; beyond latitude 40° in Europe, and even as far North as 46° near Astrakhan.

As the British possessions in India extend from 8° to 31° of N. latitude, the whole are included within the favourite tract of the cotton; and as Mr. J. Prinsep has presented us with an epitome of the meteorological phenomena at five places from 12° to 30°, it will be seen that the mean temperature of the year, along the whole extent, is what is required for the cultivation of this plant. By all the observations to which Mr. Prinsep had access, the mean temperature of Madras is found to be 81.69°; of Ava, 78.39°; of Calcutta, 78.13°; of Benares, 77.81°; and of Saharunpore, 73.5°: to these may be added that of Nagpore, about 80°; Nusseerabad, 76°; Bancoorah, 74.5°; Delhi, about 75°. The mean temperature of the winter months at Saharunpore, the most northern station, is moreover about 55°, and though we are without any precise data respecting the nature of the climate of the Tinnevelly district, the most southern portion, where, however, the best cotton is at present grown, we may safely assume that in point of temperature, and, I believe, in the course of the seasons, every part of the Indian territories is fitted for the cultivation of cotton.

With respect to elevation, Humboldt mentions that in the æquinoctial regions of America, cotton extends to nearly 9,000 feet above the level of the sea, but in Mexico, in 19° 22′ of N. latitude, it reaches only to 5,500 feet. In the Himalayas I have seen it at above 4,000 feet in the tract between the Ganges and Jumna rivers; Dr. Govan mentions it as extending with the sugar-cane to about 4,200 feet between the Jumna and Sutlej rivers; both situations are within 28° to 31½° of N. latitude; but in neither is it cultivated to any extent, a few plants only are grown about the villages, of which the produce is used up by the females of the family. Mr. Trail mentions that the cotton of the Kemaon district is superior to that of the plains in softness of texture, gloss of colour, and length of fibre.

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In addition to the information which has been obtained regarding the temperature required for the successful growth of cotton, and the notices we have from cultivators respecting the soil, it is desirable also to ascertain the degree of atmospheric dryness and moisture which is best suited to the formation of cotton-wool. Respecting this I have been unable to obtain any information, but there is no doubt that from the extent of their distribution, the several cultivated species must be subjected to very different degrees of evaporation, and the production of cotton, both as regards quantity and quality, must, I conceive, be influenced by this as well as by other causes, particularly as we know that the formation of flowers and fruit depends upon the nature and quantity of the secretions which are formed by the leaves, and in the cotton, probably, by the leaflets of the involucel or exterior calyx. As the density of these secretions depends as much upon the rate of perspiration as upon the supply of moisture by the roots, it follows that different states of humidity in the atmosphere, checking or exciting perspiration, will influence the retention of the fluids in the state of sap, or their conversion into concentrated secretions; and as it is upon the latter that depend the formation of flowers and fruit, it follows that whatever favours the former will be useful to the latter; or, as Professor Lindley has well and briefly expressed it, Transplantation, a dry and heated (and it may be added a rarified) atmosphere, a judicious pruning of the extremities of young growing branches, a great decomposition of carbonic acid by full exposure to light, or whatever interrupts the rapid flow of the sap, favours its concentration and the diminution of excessive vegetative vigour, assists the formation of flower-buds, and consequently the production of flowers. But a moist or richly-manured soil, high temperature, with great atmospheric humidity, a free and uninterrupted circulation of sap, or a great accumulation of oxygen, in consequence of the imperfect decomposition of carbonic acid, have all a tendency to dilute the sap, promote excessively rapid growth, the almost exclusive production of leaf-buds, and are therefore unfavourable to the formation of flower-buds. v. *Principles of Horticulture*, p. 35, and p. 54. The same reasoning will apply to the production of fruit and the perfection of seed, as well as cotton, and any other accessaries or secretions.

The degree of moisture and dryness which is best suited to each species, and for the production of its several parts and products varies so much, that what is excessive of either for one plant, may be just the degree that is requisite for another. What this is, can only be known in general from experiment and observation; and in the present case we only know what some cultivators have stated that, according to the moisture or dryness of a climate, the cotton was long or short stapled, fine or coarse, early or late in flowering, as well as varying in the quantity it bore. There is no doubt considerable differences must exist in this respect between the equability of insular climates within the tropics, the moist climates of Bengal and Guiana, and the moderation in temperature and evaporation of Georgia and Carolina, as well as of the south of Europe.

It is generally admitted that the quality of cotton improves in proportion to its vicinity

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to the sea; but the Pernambuco cotton is said to be injured by this proximity, and to improve in proportion as its cultivation advances into the interior (*Koster's Brazil*). With regard to latitude, the cotton of Java under the Line is almost the worst in the market, and that from Guiana and Brazil, within a few degrees of the Line, is the second in quality; while that from Jamaica, in 20° of N. latitude, more costly in production, is 30 per cent. worse than that from Demerara, 14° more to the southward; while the cotton of Georgia and the Carolinas, nearly at the most northern limit of its extension, is the best that is produced; and the cotton of Egypt, of which the cultivation, with returning civilization, has returned to the country by which it was first made known in Europe, is of excellent quality. In India, though some fine cotton is produced in the neighbourhood of Dacca, and some other places, that of Bengal, according to Mr. Colebrooke, is worse than that of the north-western provinces; and the natural vegetation of these, as we have seen in so many instances, corresponds to that of the coast of Coromandel, where the cotton is grown, of which the Madras long-cloths are made. It would appear, therefore, that not only is temperature necessary to be considered, but also the due balance between the supply of moisture to the roots, and its escape by the perspiratory surfaces of the leaves, as well as all the varied processes of a judicious culture, in addition to the choice of the species or variety to be cultivated in any particular locality.

In the choice, however, of seeds, it does not follow that that which is best suited to one climate, is the kind most eligible for introduction into another, where the requisites of soil and climate may be neither identical nor analogous. Dr. Rohr and Mr. Bennet mention, that even in the same field some plants were ten times more productive than others, and that a variety which was sterile in one situation, became fertile when removed to another, which did not appear more favourable; while a kind that in one bore but little cotton, became most productive in a neighbouring farm. Much, therefore, may be done in improving the kinds which already exist in India, by ascertaining with precision the parts of the country where the best cotton is already produced, the peculiarities of soil, climate, and culture, selecting the most prolific plants, and extending their cultivation, to the exclusion of less fertile and inferior kinds; exchanging the produce of one place with that of another, when others can be induced to take the same trouble in selecting and preserving only the best kind of seed. Doing, in fact, what is everywhere done by all who are interested in the improved cultivation of grain, vegetables, fruit, or flowers; though some varieties are difficult to propagate by seed, yet others may be continued sufficiently long to attain the permanency of species, instead of the liability to change of varieties.

Much, moreover, may be effected by introducing into India the different species and varieties which are already successfully cultivated in other countries; and here the chief thing is not to restrict ourselves to too small a number of varieties, because they happen to be those which at present produce the best kinds of cotton. Not contented in America with possessing already the best kinds of cotton, they have tried those of

other countries to see if there were not among them some suited to the peculiarities of their country and climate. Mr. Spalding, in an interesting letter published in the evidence before the East-Indian Committee, informs us that the cultivators in America confine their attention to such plants as are of annual growth. 1st. The *nankeen cotton* introduced at an early period from China; this is abundant in produce, but the seed, covered with down, produces wool of a dirty yellow colour, which does not bring the price of the other short staple cottons. 2d. The *green-seed cotton,* with white wool, which, with the former, is grown in the middle and upland districts, whence the latter is called *upland cotton,* also *short staple cotton;* and from the mode in which it was cleaned, *bowed Georgia cotton.* This, Mr. S. says, was cultivated in Georgia and Carolina previous to the revolutionary war, and considers it impossible to trace whence it was introduced, but supposes it may have been from Smyrna by one of the southern states. To this it may be objected, that *G. herbaceum,* with grayish seed, being the kind generally cultivated in Asia Minor, this *green-seed cotton* is probably one of the cultivated varieties of *G. hirsutum.* 3d. The *sea island,* or *long staple cotton,* which is distinguished by the black colour of its seed, and the fine, white, strong, and silky long staple by which it is surrounded. This is grown in the lower country near the sea, and on several small islands, which are not very distant from the shore. This was introduced into Georgia from the Bahama Islands, where it had been introduced from a small island in the West-Indies, celebrated for its cotton, called Anguilla.

In attempting the introduction into India of new kinds of cotton, it would appear advisable to include in the experiments every kind that could be procured from any part of the world, whether in their present site, affording the best or only an indifferent kind of cotton; for some which do not appear so good, may find a more suitable locality in some parts of India. Another consideration, not less important, is to extend the experiments over as wide a field as circumstances will at present admit of; and it will be extraordinary, indeed, if the extended coasts and wide-spreading plains of the Indian empire do not afford a sufficient choice of soil and climate for some one, if not several, of the superior varieties of a plant, which is already cultivated in every part of the country.

With respect to the improvement of the kinds already in cultivation in India, it will not be useless to call attention to the evidence given before the Committee of the House of Commons on the Affairs of the East-India Company, where several places are mentioned, which already produce some fine kinds of cotton,—as the neighbourhood of the Silhet Hills, which is said by Mr. Bracken to produce a cotton equal to any from the South Sea Islands, and which he states that Mr. Finlay, of the Calcutta Cotton Mills, considered equal to any cotton he had ever seen. There is also a fine variety in the neighbourhood of Dacca; though the fine muslins of that name are no doubt more owing to the workmanship than to the raw material. Mr. Colebrooke (*Bengal Husbandry,* p. 140) states, that the best cotton imported into Bengal is brought by land from Nagpore, in the Dukhun, to Mirzapore. Another kind, superior in the length and fineness

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of its staple, is brought by a land-carriage of more than 500 miles from Ameraweti, a well-known mart in the Dukhun, situated about thirty miles south of the city of Elichpore. The best cotton on the eastern side of India is now said to be grown in Guzerat, and that from Cutch is particularly fine in the staple, and well cleaned; but the finest is produced at a village near Manyrole, in Kattywar. The great improvement in the Tinnevelly cotton is well known, and owing to the introduction of foreign varieties, especially from the Isle of Bourbon. The Seychelle cotton should also be tried, as well as the different kinds which are produced in Siam, and the several islands of the Indian Archipelago, as well as of the Pacific Ocean. That of Pernambuco appears particularly desirable, as it is said to improve the further it is carried into the interior. The Brazils and West-India Islands afford endless varieties; and the trials with the seed from Georgia and the Carolinas, as well as from Egypt, should be repeated in every part of India, but especially on the coast of Cutch, in Malwa, and in the north-western provinces of India. With respect to the best mode of cultivation, it is unnecessary to enter into all the details, as they are given in works lately published available to every one, especially the *Tropical Agriculturist,* Captain Basil Hall's *Travels in America, Poiret Dict. des Sciences Naturelles,* tom. xi.; but as it will be useful to contrast the principles with the practice in India, I have made the following abstract, chiefly from the first-mentioned work.

The soil best adapted for the cotton is a light and sandy soil, particularly if held together by a little clay or calcareous earth, and mixed with a small portion of vegetable matter; but volcanic deposits are said to be the most favourable, and the banks of rivers which are overflowed, and become covered with mud. A moderate degree of moisture is essential, but too great aridity is injurious, and must be counteracted by irrigation; and as an excess of moisture induces the production of a profusion of leaves and flowers, though the latter fall off, and the roots rot, it must be obviated by drainage. No great depth of soil is required, but it ought to be light and friable, so that the delicate fibrils of the root may penetrate in every direction. The tap root of the perennial species should, however, be able to descend to some depth; the sub-soil, therefore, should not be hard. Two or three ploughings are necessary to pulverize the earth, destroy all weeds, and expose every particle of soil to the atmosphere, and to light and heat. In China the soil is harrowed after each ploughing, and the latter is made twelve or fifteen inches deep. If the soil be barren or exhausted, manure suited to the nature of the soil is added, in China, after the last ploughing, and consists of mud from the bottom of ditches, ashes of all kinds, and oil-cakes. Previous to being sown, the seed is generally soaked in water: oil has been recommended for the purpose, but lime-water would be preferable. The sowing takes place in Georgia from November to April, in lines or furrows: the latter may be five feet apart. In America and the West-Indies, where the land has not been previously cleared, the practice is to fell and set fire to the timber, and dig holes for sowing the seed. These may vary in distance, but are often eighteen inches apart, and about as deep. From twelve to twenty or thirty seeds are

sown in each hole, as soon as possible after ploughing, digging, or hoeing, and are covered with one or one and a-half inch of soil. The most important operation is weeding; this is repeated every eight or ten days in China, until the bushes put forth blossom, and every month in Guiana; it ought to be carefully performed so as not to injure the young fibrils; it is useful not only in removing weeds, but also in turning up the soil. When plants are three or four inches high, all, except three or four in each hole, are pulled up; at the end of the third month, all the plants but one are withdrawn; in Georgia, after a month, six or seven are left in each hole; at next hoeing, only one, or the two which are most apart. When the remaining plant is eighteen or twenty-four inches high, only twelve inches in China, the top is pinched off, that the lateral branches may shoot out, which, after a time, are treated in the same manner to favour the formation of flower and fruit. This process is objected to by Von Rohr. The blossom generally appears about the end of July, or beginning of August: pods open about six weeks after the blossom, and the crops begin in September, both in Georgia and Guiana; but most of the cotton is ready about the middle of October, and the whole of the first crop is not got in before the end of December in Guiana; when as in India, Christmas rains occur; the plants afterwards sprout out new shoots and blossoms, and about the end of February the picking may be resumed, and continued to the middle of April. The ground is carefully weeded between the crops; women and children are employed in picking the cotton out of the pods, and as moisture is injurious, the gathering is not commenced until the dew is dissipated; and as the pods ripen in succession, it is repeated at short intervals; the cotton is then sorted, that which had fallen on the ground is kept separate, the whole cleaned, and then dried in the sun: this hardens the seeds, and enables them to separate more easily from the cotton, and is moreover useful in preventing the latter spoiling from heating. If left too long on the plant, the withered leaves and calyx become mixed with the cotton, as is so frequently the case in India.

In Guiana the perennial cotton produces a full crop the second year, and remains productive for four or six years. In China it is kept only three years; young plants are put in wherever deficiencies occur. In Guiana the pruning of the perennial cotton-plant takes place in the second year of its growth, after the whole of the produce is gathered in. May is considered the most favourable month, when the trees are cut to about four feet high, premising with a good weeding of the ground. Dry weather and the early part of the day are recommended, that the sun may dry up the wounds.

In addition to the cultivation, it will be interesting to be able to compare the expenses in different countries. In the West Indies, Mr. Edwards states that each able-bodied labourer can perform a task equal to the cultivation of five acres; and a plantation is considered capable of yielding 1,000 pounds of merchantable cotton for each able-bodied labourer employed. In Georgia it is calculated that the usual expenses on the cultivation of cotton are twopence halfpenny a-pound on the produce, but in the West-Indies,

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owing to a less-productive species being employed, of which the produce is only one-half the weight per acre, the expenses are said to be as high as sevenpence a-pound.

In comparing the careful culture of America with that which is practised in India, we shall find it, as truly stated by Mr. Crawford, no where considered as a matter of primary importance, but made secondary to rice, wheat, and grain generally; and, I may add, that I have never observed any care bestowed on the selection or exchange of seed, the preparation of the soil, or the growth of the plant, and, least of all, in the collection of the produce; being in its earlier periods grown with some other crop, and in the later overgrown with weeds, while the picking does not take place until the leaves are so brittle, that it is impossible to prevent them mixing with the cotton.

Mr. Colebrooke mentions that a fine sort of cotton is grown in the eastern districts of Bengal for the most delicate manufactures; and that a coarse kind is gathered in every part of the province, from plants thinly interspersed in fields of pulse or grain. Captain Jenkins describes the cotton in Cachar as gathered from the Jaum cultivation: this consists in the jungle being burnt down after periods of four to six years, the ground roughly hoed, and the seeds sown without further culture. But the fullest account of the mode of cultivation in India, is that by Dr. Buchanan Hamilton, in his statistical account of Dinagepore, where we are informed that some cotton of bad quality is grown along with turmeric, and some by itself, which is sown in the beginning of May, and the produce collected from the middle of August to the middle of October, but the cultivation is miserable. A much better method, however, he adds, is practised in the south-east parts of the district, of which the cotton is finer than that imported from the west of India; the land is of the first quality, and the cotton is made to succeed rice, which is cut between the middle of August and the middle of September; the field is immediately ploughed until well broken, for which purpose it may require six double ploughings. After one-half of these has been given, it is manured with dung or mud from ditches. Between the middle of October and the same time of November, the seed is sown broad cast; twenty measures of cotton, and one of mustard. That of the cotton, before it is sown, is put in water for one-third of an hour; after which, it is rubbed up with a little dry earth to facilitate the sowing; a month afterwards the field is weeded. About the beginning of February the mustard is ripe, when it is plucked, and the field weeded. Between the 12th of April and the 12th of June, the cotton is collected as it ripens. The produce of an acre is about 300 lbs. of cotton, worth ten rupees, and as much mustard-seed, worth three rupees. A still greater quantity of cotton, Dr. B. continues, is reared on stiff clay land, where the ground is also high, and tanks numerous. If the soil is rich, it gives a summer crop of rice in the same year, or, at least, produces the seedling rice that is to be transplanted. In the beginning of October the field is ploughed, and in the end of the month the cotton-seed is sown, mingled with *sorisha* or *tora* (species of *Sinapis* and *Eruca*), and some rows of flax and safflower are generally intermixed. About the end of January, or later, the

the oil-seeds are plucked, the field is hoed, and manured with cow-dung and ashes, mud from tanks, and oil-cake; it is then watered once in from eight to twelve days. The cotton is gathered between the middle of April and the middle of June, and its produce may be from 360 to 500 lbs. an acre.

In the most northern provinces of India, I have never observed so much care bestowed on the cultivation. The seasons for sowing are about the middle of March and April, after the winter crops have been gathered in, and again about the commencement of the rainy season; the crops are commenced being gathered about the conclusion of the rains, and during October and November; after which the cold becomes considerable, and the Christmas rains severe. About the beginning of February the cotton plants shoot forth new leaves, produce fresh flowers, and a second crop of cotton is produced, which is gathered during March and beginning of April. The same occurs with the cottons of Central India, one crop being collected after the rains, and the other in February, and what is late in the beginning of March.

Experiments having been frequently made to introduce into India the finer kinds of American cotton, and these having generally proved unsuccessful, it would appear an unnecessary expense to repeat them; but as it is highly desirable to substitute a superior kind for the coarse cottons now in cultivation, the experiments should still, I conceive, be continued, both with foreign seed and with that which is indigenous to India. The late attempts which have been made in Bengal have proved unsuccessful with the long staple cottons; and as it is stated that the plant runs too much into leaf, the ill success would appear to be owing to the climate, and therefore irremediable with that kind of cotton; but this was ascertained many years ago by Dr. Roxburgh, who mentions that the Bourbon cotton attains a good size in Bengal, but yields little cotton, and that it succeeds better in the more elevated, dryer, and less fertile soil of Coromandel. Much, however, may no doubt be done by selecting such seeds as are best suited to the peculiarities of the soil and climate, especially as some cotton grown in the fields by Mr. Piddington forty miles N.E. of Calcutta, instead of degenerating, had improved in quality, and was so luxuriant, as to oblige him frequently to root it up. This was pronounced by seven cotton-brokers of Liverpool to be a very useful description of cotton, worth $6\frac{1}{4}d.$ per pound, whilst the average quality of Surat and Bengal was not more than $5d.$ per pound, and that of nine-tenths of the cotton grown in the United States of America of the value of $6\frac{3}{4}d.$ per pound. The introduction of the Bourbon cotton into the southern part of the Indian Peninsula has been eminently successful, as the soil and climate are said to be favourable; but the experiment had also the advantage of Mr. Hughes' skill and superintendence; and his cotton and senna have both long been known as the best from India. The former has frequently sold for $1s.$ per pound, when other Indian cottons did not fetch half the price. Mr. Charles Groves, to whose intelligence as a merchant I have been indebted for much valuable information respecting the commercial products of India, has been good enough to

procure

procure for me the following note respecting the last investment imported of this superior cotton: 8 bales of it, of 300lbs. each, were sold 10th September last, marked "Hughes, Tinnevelly cotton," at $10\frac{1}{8}d.$, at the same time with 222 bales of a very superior kind, at $8\frac{1}{2}d.$ and $8\frac{3}{8}d.$ The ordinary Madras, grown in the same country, being at the same time worth $7d.$, and some of the other Indian cottons not more than $5\frac{1}{2}d.$ The principal superiority of this cotton consisted in its being of a more silky quality and of longer staple, though a small part of its value was also owing to its being cleaner. Though the island of Salsette and the coasts of Guzerat and Cutch appear particularly eligible for the cultivation of cottons, the experiments on the introduction of American long staple cottons have hitherto failed, though the first crop has sometimes been good, from the subsequent deterioration of the seed. This might perhaps be remedied by exchanges of seed between different districts, particularly as upwards of thirty years ago cotton was grown by Dr. Scott in the island of Salsette, which was considered equal to Bourbon cotton. Much might here, as elsewhere, be done by trying all the varieties of seed, improving the native seed, varying the cultivation according to circumstances, and when all the information possible has been obtained by experiments on a small scale, extending the cultivation to the desired extent. The introduction of American seed into the upper provinces of India does not seem to have inspired the experimenters with any idea of the inapplicability of the climate of India for the production of the finer cottons; though Mr. Colebrooke relates a failure which occurred at Benares. Mr. Gisborne mentions that a friend of his procured a few seeds, he believes of Brazil cotton, from which he in time obtained three bales of cotton, which was sold in London for a shilling a-pound, at the time that Indian cotton generally was between $4d.$ and $5d.$ Mr. Huggins raised cotton from the Upland Georgia seed about Allahabad, of which the produce was much more abundant than from any other description of cotton that he had seen, the pod more than double the size, the cotton good, and the plants did not require more labour than the common cotton of the country. Major Colvin also sowed some seed of American cotton early in 1832, in the vicinity of the Delhi canal, and the produce was obtained about the middle of October, and during the following month; the capsules were very large, and the superiority of the cotton in quantity and quality over that usually grown in the country where cotton is very extensively cultivated, was so manifest, that all the zumeendars were anxious to procure some of the seed.

So few attempts have been made to improve the cottons indigenous to India, that no idea can be formed of what is practicable. From some experiments made with Broach and Surat cotton, it appears, that by bestowing more care in picking and cleaning, some sold for $5\frac{1}{4}d.$, and some which was still more carefully cleaned sold for $6\frac{1}{4}d.$, which was quite as high as that of Upland American cotton at the time. I commenced some experiments at Saharunpore, which it was my intention to have prosecuted, as the results, though the soil was too clayey, were satisfactory. The Bourbon cotton, which had been several

several years in the garden, but in too luxuriant a state, produced some cotton, which Mr. Saunders pronounced of a much better staple than that usually cultivated in India; but he considered that produced by the tree cotton (*Gossypium arboreum*) of the best description, as both the fabric and staple were good. It appears worthy of being subjected to further trials, particularly to ascertain its productiveness, for of the fineness and silky nature of its staple there can be no doubt, as it is employed by the natives for making only the finest muslins. It was cultivated like the common Indian cotton, and gave its produce in the first year in October and November, and a second crop in February.

At p. 4, it is stated that Malwa and the north-western provinces of India seemed well adapted for the cultivation of cotton. It is already extensively cultivated there, and that so cheaply, being sold at 2*d.* and 2½*d.* per pound, that it supports a successful competition in Bengal, notwithstanding the heavy expenses of distant transport by land and water.—(Colebrooke.) From the westward it is conveyed on bullocks to Calpee, Banda, and Mirzapore, where it goes down the Jumna and Ganges rivers, with the cotton grown in the northern provinces. The cotton plants which I saw in many places from Agra to Allahabad seemed more prolific than any I have seen elsewhere. Notwithstanding the careless cultivation, the cotton in the capsules was more abundant; these were larger and more numerous than I had seen either higher up or lower down the country. The climate also, I conceive, well suited to them, notwithstanding the great heat of the months of April, May, and June; as the plants grow well, and attain maturity during the rainy months, which terminate just when the drying up of the soil, the dryness and clearness of the atmosphere are most necessary to check vegetative vigour, and determine the secretions towards the formation of fruit, and the perfecting of the seed. Bundlecund above the Ghauts, and Malwa, are also extensive cotton districts, and peculiarly eligible, on account of the soil, which is frequently emphatically called a *black cotton soil,* and a climate which is also most favourable. The soil, formed in many parts of decomposed trap-rocks, is a loose friable black earth, penetrable by the most delicate fibrils. The temperature of this province, from its elevation, is moderate, when compared with the plains; the range of the thermometer is small, the hot winds comparatively mild, and of short duration, the fall of rain less than in the plains; and though fevers occur at their conclusion, the climate may be considered on the whole salubrious.—(*Hamilt. Gaz.*) From the slope of the country, and its elevation, we may conclude that the circulation of air is free, and evaporation favoured, so as to induce dryness of the atmosphere, which seems essential for the formation of fruit of any kind. In such a climate it would not appear a work of great difficulty to substitute a superior species or variety for that which is already cultivated. It may be added, that the author has heard that Sir John Malcolm, than whom no one was better acquainted with Malwa, was of opinion that it was particularly well adapted for the cultivation of cotton, and that it could supply an amazingly increased quantity.

It would be interesting to ascertain precisely what peculiarities of climate are best

suited

suited to the formation of cotton-wool, but so few meteorological registers give the dryness and moisture of a climate, as well as its temperature, that we cannot at present draw any just conclusions. An insular climate, though comparatively moist, may be useful from the equability of temperature, the freedom of atmospheric circulation which promotes evaporation, as much as from mere vicinity to the sea.

Considering, therefore, that Mr. Bennet, after years of experience and attentive observation, concludes his statement by saying, " that he has hitherto gained some new insight every year, and sees clearly that there is an hundred times more to be learned about cotton than its planters imagine," (*Trop. Agricult.* p. 46.) it is not unreasonable to suppose that much may be done for its improvement in India, where few have paid sufficient attention to the subject, and the cultivation has hitherto been left almost entirely in the hands of the natives. Much also may be hoped from the experiments of the " Agricultural Society of India" being extended to every part of the country. I have no doubt that by the importation of foreign, and the selection of native seed; attention to the peculiarities not only of soil, but also of climate, as regards the course of the seasons; and the temperature, dryness, and moisture of the atmosphere; as well as attention to the mode of cultivation, such as preparing the soil, sowing in lines, so as to facilitate the circulation of air; weeding, ascertaining whether the mixture of other crops with the cotton be injurious or otherwise, pruning, picking the cotton as it ripens, and keeping it clean; great improvement must take place in the quality of the cotton. Experiments may at first be more expensive than the ordinary culture, but the natives of India, when taught by example, would adopt the improved processes as regularly and as easily as the other; and as labour is no where cheaper, any extra outlay would be repaid fully as profitably as in countries where the best cottons are at present produced.

The subject is one of great importance not only to India, but also to England, as the latter must always be interested in having her manufactures supplied from as wide a surface as possible, so as to be independent at all times of temporary interruptions to commerce. To India the subject is one of vast consequence, as the consumption of cotton in England is about 300,000,000 pounds annually, of which India does not supply above a twentieth part; any improvement, therefore, in the quality of the cotton or the productiveness of the plant, could not fail to be of great benefit, both to the agriculturist and to the merchant.

In addition to the above considerations, in attempting improvements in the cultivation of cotton, it is necessary to ascertain the species or varieties which are cultivated in different countries; but in this, there are great, and, in some respects, insurmountable difficulties, as botanists have generally neglected the subject, and omitted mentioning the cultivated species; while cultivators have used provincial names, or applied new ones of their own, to the exclusion of any notice of the names in use among botanists. This has rendered it impossible for others to ascertain to what species their otherwise valuable observations refer. The celebrated De Candolle has admitted thirteen species, observing that they are all uncertain, and that no genus more requires the labours of a monographist; two additional species have been described by Dr. Roxburgh, one by Ræusch, and another in the Flore de Senegambie. Dr.

Von Rohr describes 29 species or varieties, Mr. Badier 18, and Mr. Bennet mentions that he knew more than 100 kinds, and that they appeared to him never ending.

But there is no doubt that species have been established from imperfect specimens, indifferent drawings, and frequently from insufficient characters, and these liable to change. Swartz and others have observed, that the several species varied in the size of parts, in the division of leaves, in the number of glands, in hairiness, in having the leaflets of the exterior calyx more or less divided, in the capsules having three or four cells; in the colour of both the seeds and the wool, as well as in the adherence and tenacity of the latter; so that from the difficulty of distinguishing the several species, Swartz thought that they might easily be believed to be only varieties of one species. Some intelligent cultivators, as Rohr and Badier, who found it difficult to refer their varieties to the small number of recognised species, have made the same observation. To the first, the seeds appeared to furnish the most certain and least changeable characters. But it may be doubted whether from being unaccustomed to make those nice distinctions, and at the same time make allowances for the variations due to culture, cultivators have not exaggerated the difficulties, and as they were most interested in the produce of the seed, ascribed a higher value on its permanency than even their own observations will warrant, especially as Mr. Spalding, in the interesting letter given in by Mr. Crawford to the East-India Committee, states that "the same cotton-seed planted in one cotton-field will give quite a black and "naked seed; while planted in another, different in soil and situation, will be prone to run into large "cotton with long boles, and with seeds tufted at the ends with fuzz." But this liability to run into varieties, so far from being accounted a disadvantage, ought to be considered the reverse, as it is the great distinction between a cultivable plant, and one that is not so; it is desirable only to know the species from which the most useful varieties have been procured in countries where the best cottons are grown. This is a work, as has been before mentioned, of considerable difficulty; but with the assistance of the observations of Dr. Roxburgh, who states having studied the subject for thirty years (*Flora Indica*, vol. 3. p. 187), and those of Dr. Swartz, who has described with great care (*Observ. Bot.* p. 265) the species of cotton which he found cultivated in the West-Indies, the author hopes that he has been able to refer some of the kinds cultivated in different countries, to their true species.

1. *G. obtusifolium* (Roxb.) Shrubby, very ramous. *Leaves* small, with three, rarely five, obtuse, ovate, entire lobes. *Stipules* falcate. The *exterior calyx* with entire divisions. *Capsules* ovate, *cells* three-seeded. *Seeds* free, and clothed with firmly-adhering, short greenish-gray down, under a small portion of ash-coloured wool.—*Roxb. Fl. Indica.* vol. 3. p. 183. A native of Ceylon, but not cultivated. Flowers during the rains and cold season in the Botanic Garden at Calcutta.

2. *G. acuminatum* (Roxb.) Sub-arboreous. *Leaves* from three to five lobed, lobes oblong, tapering, very acute. *Exterior calyx* deeply laciniate. *Stipules* linear-lanceolate. *Capsules* long, ovate, much pointed. *Seeds* many, adhering firmly to each other, black, and free of every pubescence, except the long white wool, which is easily removed.—*Roxb. Fl. Ind.* 3. p. 186.

Dr. Roxburgh states, that this species is easily distinguished by its superior size and large black seeds, which adhere firmly to each other. It is said to be a native of the mountains to the north and westward of Bengal, but he does not find that it is ever cultivated; but it is apparently a species well worthy of trial in different parts of India, as it is indigenous, and desirable on account of the facility with which the wool separates from the naked seeds.

3. *G. herbaceum* (Lin.) *Stems* woody, bi-triennial, 4-6 feet high in tropical, herbaceous and two feet high, in temperate climates, the older parts reddish, the younger, as well as the flower and foot-stalks, hairy, frequently marked with black spots. *Leaves* hairy, palmate, 3, generally 5-lobed, in herbaceous varieties, lobes broad and rounded with a little point; in those which are woody sub-lanceolate and acute, with or without glands. *Stipules* falcate-lanceolate. *Flowers* axillary, generally solitary towards the extremities of the branches, petals of a lively yellow colour, with a purple spot near the claw. *Segments of the exterior Calyx* or *involucel*, D.C. cordate at the base, margin dentate, sometimes entire. *Capsules* ovate, pointed, 3 or 4-celled. *Seeds* free, about five in number, clothed with firmly-adhering, grayish down, under the short-staple white wool.—*Xylon s. Gossypium antiquorum.*—*G. herbaceum.* Linn. sp. Pl. 3. p. 355. Lamarck Encycl. 2. p. 133. Cav. Diss. 6. p. 310. t. 164. f. 2. Wild. 3. p. 803. Roxb. Fl. Ind. 3. p. 184. D.C. Prod. 1. p. 456. This and its varieties are by far the most generally cultivated in India. Dr. Roxburgh particularly distinguishes three varieties:—1st. *Dacca Cotton*, which furnishes that fine long soft cotton-wool, employed in manufacturing the very delicate beautiful muslins of that place. v. Roxb. Corom. Plants. vol. iii. t. 269. 2d. *Berar Cotton*, distinguished by growing to a greater size, and having smooth and straight branches, leaflets of the exterior calyx more deeply divided, and the wool of a finer quality, than in the common variety of this species. This is cultivated in Berar and the Northern Circars, and with its cotton the fine Madras, more properly Northern Circar, long-cloth is made. 3d. *China Cotton*, introduced into Bengal, where its wool, according to Dr. Roxburgh, is reckoned 25 per cent.

cent. better than that of Surat. Lamarck's *G. indicum.* Encycl. 2. p. 134. Capas, *Rumph. Amb.* 4. p. 33. t. 12. Dr. R. says, is no doubt one of these varieties; Cavanilles (*Diss.* 6. p. 314. t. 169.) having seen it in flower in Paris, was of the same opinion. The variety cultivated about Cawnpore and in the Doab, is figured tab. 23. fig. 1. from a drawing in General Hardwicke's collection. There are also specimens from Saluen and Tavoy.

Besides India, this species is cultivated in Syria, Asia Minor, and the Mediterranean. Specimens of it have been brought by Mr. Wilkinson from Egypt. "Wild cotton from the oases," appears to be also a variety, as well as *gotun biladi.* in the same collection deposited in the British Museum. *G. punctatum*, cultivated on the banks of the Senegal, and in the country between it and the river Gambia, is nearly allied to it, according to the authors of the *Flore de Senegambie.* Varieties must have been introduced into America, as seed is said to have been taken from Smyrna, when the Americans commenced the cultivation of cotton.

4. *G. arboreum*, *Stem* arboreous, 15 to 20 feet, sometimes shrubby, young parts hairy, tinged of a reddish colour. *Leaves* palmate, 3 or 5-lobed, hairy, dotted with blackish spots, of a dark green colour, lobes elongated, lanceolate, sometimes mucronate, sinus obtuse, glands one, sometimes three. *Stipules* awl-shaped. *Flowers* solitary, with short peduncles, red, with a yellowish tinge near the claws. *Leaflets of the exterior calyx* cordate-ovate, entire, sometimes dentate. *Capsule* ovate-pointed, 3 or 4 celled, four to five seeds, covered with a greenish-coloured fur, enveloped in a fine silky yellowish-white wool.—*Xylon arboreum auctorum. Gossypium arboreum gotnem segiar* (i.e. the large cotton) Prosp. Alp. Exot. t. 38. *G. herbaceum vel Xylon maderaspatense rubicundo flore pentaphyllæum.* Pluk. Alm. 172. t. 188. f. 3. *G. arboreum. cotn el sadjar.* Forsk. Ægyp. p. 70. *An G. rubrum.* Forsk. p. 116. Wild. 3. p. 804. Lamarck Encycl. 2. p. 135. Cav. Diss. 6. p. 310. t. 165. Roxb. Fl. Ind. 3. p. 182. DC. Prod. 1. p. 456. Dr. Roxburgh was of opinion, that *Cadu pariti* of Rheede, *Hort. Mal.* 1. p. 55. t. 31. is not this plant; but observes, it may be *G. religiosum of Gærtner.* 2. p. 246. t. 134. f. 1. It is remarkable, that one specimen of *G. barbadense* is marked *G. arboreum* in the Linnean Herbarium, and that it should be marked *G. religiosum* in Heyne's Herbarium. I was informed by Huree Sing, the head-gardener in the H. C.'s Botanic Garden at Saharunpore, that the cotton of this plant was never used for making any of the lower garments, but only for turbans for the head, as it was sacred to their deities. Some legend of this kind may have reached Linneus, though the name is now applied to a different species. *G. arboreum* is found in the island of Celebes, in Arabia, Egypt, and in India; in the latter it is called *nurma-barree*, and is generally found in the clumps of trees which surround temples, or the abodes of Fuqueers. As stated at p. 96, it may be cultivated like the common cottons.

5. *G. micranthum* (Cav.) *Stem* branched, reddish-coloured, free from pubescence, but covered with black spots. *Leaves* 5-lobed, lobes roundish acuminate, with a single gland. *Stipules* lanceolate. *Flowers* solitary opposite to the leaves. *Leaflets of the exterior calyx* cordate, striated and laciniate, much longer than the corolla, three whitish glands between the base of the inner and the divisions of the outer calyx. *Corol* yellow, petals ovate acute, rather hairy, claws purple. *Germen* globose.—*Cav. Diss.* 6. p. 311. t. 193. This species, grown in Persia, near Ispahan, flowered in the Paris Garden, and enabled Cavanelles to write his description. I have not been able to ascertain what species is cultivated in Persia, but the cotton from that country is frequently of good quality. Mr. Bruce, in a short notice communicated to the Agricultural Society of India, states that the cotton improves the nearer it is to the sea-coast; and also that the same plant is annually cut down, and springs up again, so as to bear a crop for twenty or thirty years in succession.

6. *G. religiosum.* Perennial. *Stem* 3-4 feet, branches and petioles a little velvetty, hirsute towards the apex, and loaded with black points. *Leaves* cordate, superior 3-lobed, inferior 5-lobed, deeply divided, lobes ovate-acuminate, entire pubescent (some of the lower ones ovate-acuminate), one to three glands. *Stipules* lanceolate deciduous (cordate acuminate. *Roxb.*) *Flowers* large fulvous, peduncles short, dotted. *Leaflets of the exterior calyx* large, cordate acuminate, deeply laciniate, hairy and dotted. *Capsule* ovate acuminate, dotted, 3, 4, or 5-celled. *Seeds* black, covered with firmly-adhering, short tawny fur, under the long tawny-coloured wool.—*Swartz. Observ. Bot.* p. 267. *Roxb. Fl. Indica.* 3. p. 185.

Sir James Smith says, "what Linneus intended by *G. religiosum* is rather doubtful; that in his herbarium appears to be *G. Barbadense.*" *Rees Cycl.* The distinguishing characteristic of what is at present considered such, is the bearing *tawny* instead of *white* cotton; but there is considerable difficulty in ascertaining whether only one or more species have such, or whether the colour is sufficiently permanent to allow of its being depended on as a specific character. There are certainly two distinct localities for it, one China, the other Siam. Swartz described the species from plants cultivated in Jamaica from seed sent from China, under the name of *Nankin cotton.* Dr. Roxburgh also describes from cotton introduced into Bengal, and called *Nankeen cotton.* Specimens, in Dr. Lindley's Herbarium, from the neighbourhood of Macao, with tawny cotton, show the species to be very distinct from the other cultivated cottons. A specimen in the British Museum, brought from Otaheite by the Forsters, and marked *G. religiosum*, much dotted, and with small globular acuminated capsules and tawny cotton, resembles that from Macao. A specimen from the Sandwich Islands, with downy-looking dotted velvetty leaves, also belongs to this species, and is marked *G. religiosum.* In America and the West-Indies the tawny-coloured cotton seems to be generally considered the produce of Siam. Lamarck alludes to a reddish-coloured cotton from Siam, and mentions that in the Antilles a similar kind is cultivated, called "*Cotonnier de Siam.*" Rohr has three species, "*Cotonnier de Siam a duvet brun;*" "*Coton lisse de Siam brun;*" "*Cotonnier de Siam couronné brun.*" Cavanilles describes his *G. religiosum* as being from the Cape of Good Hope, but with very white wool; and refers to it *G. tricuspidatum* of Lamarck, believed to be from the warm parts of America, Poiret, *Dict. des Sc. Nat.* also unites

unites them; the first states, that in the Royal Garden at Paris he had seen a plant, known as the *yellow cotton of Siam*, which very much resembled his *G. religiosum*, but that its cotton was of a yellow colour. Dr. Roxburgh considers the species he describes under this name, Nankeen cotton, as allied to *G. hirsutum*, and says, that it is not productive. Mr. Spalding states, that in Georgia the tawny cotton is most productive; if it proved so in India, though of inferior quality, it would be useful as clothing for the natives.

It appears to me that two distinct species yield tawny-coloured cotton, one with small velvetty-looking leaves, and much dotted in every part, to which may be referred Dr. Lindley's specimen from Macao, as well as that from Otaheite. Of this there is also a specimen in the British Museum from Guzerat. The other is a much larger plant, with the general appearance and leaves of *G. Barbadense;* of it there is an excellent specimen in the East-Indian Herbarium, No. 1875. This is marked, Herb. Madras. (*a.*) *G. flore albo læviter flavescente dat xylon obscure flavescentum;* another is (*b.*) *G. hirsuti var. Nanquin Baumwolle;* Tanjore, April 1813. Mr. Wilkinson has brought specimens from Egypt of rather tawny-coloured cotton, with brownish seed, free from fur, which is there called *gotun hindee.*

7. *G. hirsutum;* Shrubby, about six feet high, young parts very hairy. *Leaves*, the upper undivided cordate, acute, the lower 3 or 5-lobed, lobes ovate, acute (triangular *Roxb.*) hairy on the under, and smooth on the upper surface. *Petioles* very hairy, dotted with black spots. *Glands* 1 or 2 to 3. *Stipules* lanceolate (*Cav.*) *Corol*, base yellow, purplish towards apex (uniform yellow *Roxb.*) *Exterior calyx*, ovate-acute very hairy (cordate, 3-toothed *Cav.* laciniate *Roxb.*) *Capsule* large, ovate-acute. *Seeds* many, free, clothed with firmly-adhering green down, under the fine long white wool.—*Swartz, Observ. Bot.* p. 265. *Roxb. Fl. Ind.* 3. p. 187. *Cavanilles Diss.* 6. p. 312. t. 167.

This species, according to Swartz, is cultivated in Jamaica, where it is frequently called *French cotton*, and every where in the West-India islands. It would appear from the character of the seed, to be the *green-seeded short-staple* or *upland cotton* of the Americans. Smith, in Rees' Cycl. supposes this to be only a hairy variety of *G. herbaceum.* Dr. Roxburgh states that this *green-seeded variety* had only been lately introduced into India, where the cotton was much admired by the natives. Specimens, apparently of this species, from the hairiness of the leaves, and dentate cordate exterior calyces, and marked *G. indicum*, may be seen in a paper with *G. arboreum* (marked *G. religiosum*), and *G. herbaceum*, in the East-Indian Herbarium.

8. *G. Barbadense.* *Stem* shrubby, 6-15 feet, smooth. *Leaves*, the upper 3-lobed, the lower 5-lobed, lobes ovate, acute, smooth, often pubescent on the under surface. *Leaflets* of exterior calyx large, deeply laciniate. *Flowers* yellow. *Capsule* ovate-acuminate smooth. *Seeds* 8-12, free, oblong, black, and without any other pubescence than the long, fine, easily separable white wool.—*Swartz, Obs. Bot.* p. 266. *Roxb. Fl. Ind.* 3. p. 187.—*G. vitifolium. Cav. Diss.* 6. p. 311. tab. 166.

G. barbadense was first taken up from Plukenet, *Alm. t.* 188. *f.* 1., published in 1695, but this figure may answer equally well for some other species. That described by Swartz under this name, he states is more extensively cultivated than any other kind in the West-Indies. Dr. Roxburgh says, that *G. barbadense* was introduced into India from the Isle of Bourbon; hence it is known there by the name of *Bourbon cotton*, adding, at what period it was introduced from the West-Indies into that island is uncertain. Sir James Smith was of opinion, that *G. barbadense*, of the Linnean Herbarium, was the *G. vitifolium.* of Cavanilles; previous to knowing this, I had formed the opinion that *G. vitifolium*, of which I first saw a specimen from Egypt in Professor Lindley's Herbarium, which agreed in every respect with the description by Cavanilles, was the same as the *G. barbadense*, or *Bourbon cotton* of India. On examining the Linnean Herbarium, I could observe no difference between *G. barbadense* of that collection, and that grown in India, and known by that name, nor between these and *G. vitifolium*, in Smith's Herbarium, from the Isle of France; and all correspond with the figure and description, by Cavanilles, of *G. vitifolium*, which are from a plant in Commerson's Herbarium, gathered also in the Isle of France. I have, therefore, no doubt but that *G. barbadense* of Swartz and Roxburgh, is the same as *G. vitifolium* of Cavanilles, and consequently of many other authors. It is singular that the latter author, when describing all the species which he could procure of *Gossypium*, mentions *G. barbadense* as a plant unknown to him; and Swartz, in describing the West-Indian species, omits all mention of *G. vitifolium;* but the information that his *G. barbadense* is the species most cultivated in the West-Indies, is important, as showing that from it, probably, some of the most valuable of the cultivated varieties of cotton have been obtained. Specimens, marked *G. barbadense*, in B. M., brought by Dr. Wright from Jamaica, may be referred to this species, and considered the type of the variety *vitifolium.* The leaves are palmate, 5-lobed, acuminate, like those of *Ricinus communis*, hairy underneath, with stellate pubescence, stem reddish, as well as the cordate, deeply laciniate leaflets of the exterior calyx. The corol is large and yellow. A specimen bearing leaves of both varieties may be seen in the Smithian Herbarium.

Taking the smooth and shining stem and leaves, black seed enveloped only in the easily-separable long wool, as the characteristics of this species, we may refer to it, several varieties of cultivated cottons in the British Museum, brought by Mr. Millington from the West-Indies; also, *G. vitifolium*, brought by M. Bové, as the cotton cultivated near Cairo, in Dr. Lindley's Herbarium. It was also brought by Mr. Wilkinson, as one of the cultivated cottons of Egypt. It seems to be distributed in the Pacific Ocean, as Dr. Lindley has a specimen from Owhyhee. As the Egyptian was most probably imported from America, the best cotton country when the cultivation was re-established in Egypt, it is more than probable that the *Sea-island*, or *long-staple*, is a variety of this species, as its seeds agree in character. As it succeeds so well in Egypt, of which the climate in many respects resembles that of the north-western provinces of India, some of its varieties may probably succeed as an article of culture in that country; that it does so as a plant there can be no doubt, as it has been for many years in the Saharunpore Botanic Garden. It exists in the East-Indian Herbarium, under the name of

Maurice

Maurice cotton, from Tanjore. Dr. Roxburgh was of opinion, that it succeeds better in the more elevated, dryer, and less fertile soil of Coromandel, than in Bengal.

G. vitifolium is cultivated in Brazil, according to M. St. Hilaire, in the province of Mines, near Rio de Janeiro, and also in other parts, according to M. Gaudichaud. M. Martius adduces, among the common plants of the province, this and some other species, as *G. herbaceum* and *G. barbadense*. Without specimens or a full description, it is impossible to know to what plants these names refer, nor the plant which Dr. Roxburgh describes under this name, having seed clothed with firmly-adhering short greenish gray down, under the long fine white wool, respecting which, however, he himself appears uncertain, as he does not mention it in his enumeration of the number of distinct species he had been able to make out.

Several other species are enumerated; but it is impossible, from the want of specimens, to ascertain whether they are entitled to the distinction, or should only be considered varieties. *G. peruvianum*, figured by Cavanilles, tab. 168, is nearly allied to his *G. vitifolium*, at tab. 167; and the seeds are black and free from fur. *G. racemosum* is supposed to afford the cotton of Porto Rico. Specimens of other species may be seen in the British Museum, which it is difficult to know where to refer, as one from the Sandwich Islands, which is very large, with shining coriaceous leaves, and large entire cordate-acuminate leaflets of the exterior calyx: flowers having a bilabiate appearance, with a very long style.

23. BOMBACEÆ.

The *Bombaceæ*, closely allied in structure and properties to the last order, are chiefly confined to the warmer parts of South America and the West Indies; but several species of *Helicteres* have been discovered by Dr. Wallich within the Burhmese territories, and others are found in China. In India, some of the same genera are found, but only a few species of each. *Bombax Malabaricum* referred to *B. heptaphyllum* by Dr. Roxburgh, and *Helicteres Isora*, extend from one end of India to the other, particularly along the foot of the Himalaya. *Eriodendrom anfractuosum* is confined to the Peninsula, and *Durio zibethinus*, or *Durian tree*, remarkable for having fruit fœtid in smell, and delicious in taste, is found only in Penang, and the islands of the Indian Archipelago. *Adansonia digitata*, an African plant, must have been long introduced into India, as large trees of it exist at Allahabad; also in the Peninsula, and in the island of Ceylon.

The plants of this family, allied to the *Malvaceæ* in structure, are equally so in properties, as many are mucilaginous, and the inner bark of others affords material for cordage; while the silky cotton, which envelopes the seeds of *Bombax*, and some other genera, is employed in stuffing cushions and pillows, as it is unfit for the purposes of spinning. Several species of *Bombax* have, in the relations of travellers, been called the *cotton*-tree; and hence some confusion has resulted, as these have been mistaken for the true tree cotton, *Gossypium arboreum*. The wood of *Bombax malabaricum* is white, light, and spongy, frequently used in India for floating rafts. An astringent gum-resin is yielded by this tree, called *mochrus*, which, as well as the young roots, called *mooslee-suffed*, are considered very strengthening. The natives of India, like those of Europe in former times, believing that external signs point out the properties possessed by plants, consider that the twisted fruit of *Helicteres Isora*, indicates that it is useful, and they therefore prescribe it in pains of the bowels. *Adansonia digitata*, or *baobab* tree, though not a native, is quite at home in India. It is emollient and mucilaginous in all its parts. The leaves dried and reduced to powder, constitute *lalo*, taken daily by the Africans to diminish excessive perspiration. The fruit, slightly acid and agreeable, is frequently eaten, while the expressed juice, mixed with sugar, is valued as an antiseptic drink.—*Hooker Bot. Mag.* 2792.

24. BYTTNERIACEÆ.

24. BYTTNERIACEÆ.

This order, sometimes called *Sterculiaceæ*, includes plants agreeing in many respects among themselves, as well as with the following and the two last orders, but differing in some particulars so as to require subdivision into sections: they are chiefly found in the hot parts of Africa, America, and Asia. They extend as far north as 31° of latitude in India, and southward as far as New Holland and the Cape of Good Hope.

The genera *Sterculia, Byttneria, Pentapetes, Reidleia, Waltheria,* and *Melochia,* are common to India, as well as to America, and the two first to other parts of the world; while *Heretiera, Abroma,* and *Pterospermum,* extend from the Moluccas and Indian Islands into the Peninsula, and southern parts of the province of Bengal. *Eriolæna, Wallichia, Microlæna,* and *Kydia,* are genera which have only been found in India; the last in every part, and the others in the forests which skirt Nepal and Kemaon. The species of *Byttneriaceæ,* which are found in the most northern parts of the plains of India, are *Melochia corchorifolia,* an annual, which springs up during the rainy season; *Waltheria indica* in the Deyra Doon; while of arboreous species, a yellow variety of *Sterculia coccinea, S. villosa,* and *Kydia calycina,* are found in the tract of forest, which extends from Hurdwar to the Jumna, and as high as four thousand feet above the level of the sea, on the road from Rajpore to Jurreepanee. But though the arboreous species are absent from the plains, those which have been introduced succeed remarkably well in the Botanic Garden at Saharunpore; as *Pterospermum acerifolium, suberifolium* and *semisagittatum,* and *Abroma augusta;* the last would succeed in every part of India, as the climate of Saharunpore so far to the north is favourable to it. *Guazuma ulmifolia,* from America, is also now perfectly acclimated in many parts of India, as at Allahabad, and in the Saharunpore Botanic Garden.

As the nearly allied order, *Malvaceæ,* has been shown to abound in mucilage and in fibre useful for its tenacity, so is it with many of the *Byttneriaceæ.* The young bark of *Guazuma ulmifolia,* abounding in mucilage, is used in Martinique to clarify sugar. The bark of *Kydia calycina* is employed in the northern provinces of India for the same purpose, as well as *Abelmoschus moschatus,* both abounding in mucilage. The gum *Tragacanth* of Sierra Leone is produced, as we are informed by Dr. Lindley, by a species of *Sterculia,* which he has called *S. Tragacantha. Sterculia urens,* a native of the mountains on the coast of Coromandel, as well as of Hindoosthan, yields a gum which is exceedingly like *Tragacanth,* and has been imported as such into England. *Sterculia guttata* yields a bark, which the Malabars convert into a flaxy substance, of which the natives of Wynaad make a sort of clothing. *Roxb.* Fl. Ind. 3. p. 149. *Microlæna spectabilis* yields fibres fit for rope-making, and *Abroma augusta* abounds in strong white fibres, which make a good substitute for hemp, and as the plant succeeds well in every part of India, grows quickly, and yields annually two, three, or even four crops of cuttings fit for peeling; it is particularly recommended by Dr. Roxburgh for cultivation. As the seeds of *Sterculia chicka* are eaten by the Brazilians,

so

so are those of *S. Balanghas, urens,* and *fœtida,* after being roasted, in India. The concrete oil, or buttery substance, called *cacao,* accompanied by an agreeable aromatic principle, yielded by the seed of *Theobroma cacao,* and from which chocolate is prepared, is too well known to require notice; but it is not uninteresting to remark, that this plant thrives and bears fruit in the Botanic Garden of Calcutta, nearly in $22\frac{1}{2}°$ of N. latitude, and that it succeeds remarkably well at Courtallum in 9° of N. latitude. The cultivation therefore may probably be undertaken with every prospect of success in shady places in the Tinnivelly district.

25. TILIACEÆ.

The *Tiliaceæ,* though named from an European timber-tree, are chiefly found in tropical countries. The genera *Corchorus, Triumfetta,* and *Grewia,* of which numerous species are found in India, are also abundant in the warm parts both of Africa and America; and as has been remarked with the plants of some other families, many of the same species are found in the most widely separated parts of India. *Grewia betulæfolia,* with *Corchorus linearis* and *fascicularis,* extend from the Peninsula up to the arid region on the western bank of the Jumna, where a new species, *C. prostratus,* is also found. *Corchorus capsularis* and *acutangulus,* as well as *Triumfetta angulata,* are common at Saharunpore, as in the most southern provinces. In the tract of jungle and forest, which clothes the foot of the Himalaya, we have several of the species which are found in similar situations in Bengal and Assam, as *Triumfetta æstuans, Grewia helicterifolia, tiliæfolia,* and *sapida,* which is apparently the same as *G. pumila,* Don, and *G. nana,* Wall. *Triumfetta oblongata* extends as high as Jureepanee, or five thousand feet above the sea; and *Corchorus humilis* (nob) shews itself fifteen hundred feet higher up, but both only during the rainy season. *Grewia sclerophylla, didyma, oppositifolia,* and *elastica,* are found in the Kheree Pass, in the Doon, as well as higher up within the Himalaya, particularly in the neighbourhood of villages.

As we have seen with the *Malvaceæ,* and the other allied orders, so are the *Tiliaceæ* remarkable for mucilaginous properties, as well as for tenacity of fibre; and several species of the genus *Grewia* have pleasantly-tasted acid berries, as was found among the *Malvaceæ,* in the fruit of *Hibiscus Sabdariffa. Corchorus olitorius* is in India, as in Egypt, used as a pot-herb, and is in Bengal cultivated for the fibres of the bark, which are called *jute* and *pat. C. capsularis* is likewise cultivated in Bengal as in China, for the same purpose. Its fibres, as well as those of *C. olitorius,* are employed in making a coarse kind of cloth, called *tat,* of which *gunny,* or rice-bags, are made; also a coarse kind of linen worn by the poorer people in some parts of Bengal, as we are informed by Dr. B. Hamilton; of it also the cordage employed in agriculture, and for rigging boats, is formed, and it is the material from which paper is made. The inner bark of *Grewia oppositifolia,* as that of *Tilia,* or lime-tree, is in Europe, is employed for the same purposes, at lower elevations within the Himalaya; and the leaves of some species,

species, as of *G. didyma*, are given as fodder to cattle, and are even stacked up for winter use. As the wood of the lime-tree is valued for its close grain, lightness, and smoothness, so *Berria Amomnilla*, or Trincomalee wood-tree, affords timber, valued also for its lightness and strength, and is employed in the construction of the excellent Massoola boats of Madras. *Grewia elastica*, figured at Pl. 22, called *dhamnoo* by the natives, and common in the Himalayas in northern latitudes, at moderate elevations, affords timber which is highly valued for its strength and elasticity, and therefore much used for bows, buggy shafts, and bangy sticks. Some of the species of *Grewia*, as before mentioned, yield pleasant acid berries, much used for making sherbet. Of these, *G. asiatica* may be instanced as common in gardens; but *G. sapida, helecterifolia, sclerophylla*, and others, are used for the same purpose.

Grewia elastica; foliis 5-nerviis ovatis acuminatis sæpe subtrilobatis serratis, supra stellato-pilosis subtus stellato-tomentosis canis transversim reticulatis, pedunculis 3-floris petiolo longioribus, sepalis 1-nerviis petala triplo superantibus.—Hab. This tree is common in the Himalayas, in the tract between the Ganges and Sutlej rivers, and well known, as above mentioned, for the elasticity of its timber, whence the specific name has been applied. It attains a height of from fifteen to twenty feet, the older branches smooth, the younger densely hoary or rufous, with stellate pubescence. *Leaves* ovate-acuminate, frequently tapering towards and unequal at the base, sometimes obscurely 3-lobed towards the apex. *Petioles* short, thickened towards the apex. *Stipules* subulate, very hairy. *Peduncles* lateral or axillary, solitary or aggregated, twice as long as petioles, hoary as all the young parts, 3-flowered, each pedicel supported by a subulate bracte. *Alabastra* globose, hoary. *Sepals* coriaceous, hoary externally, coloured and rather smooth internally. *Petals* small, oblong, smooth. *Stamens* very numerous. *Germ* very hairy, 4-celled. v. Tab. 22. *Grewia elastica.*—1. A flower.—2. The same, with the sepals and petals separated.—3. Anther magnified.—4. Two ripe drupes.—5. One cut transversely, containing, by abortion, two nuts.—6. Another, containing only one nut.

26. HUGONIACEÆ.

Hugonia temporarily placed at the end of *Chlenaceæ* by M. De Candolle, has been formed into a separate order by Dr. Wight and Mr. Arnott. The three known species of the genus are distributed between the island of Mauritius and that of Ceylon; the one, *H. mystax*, found in the latter, extends into the coast of Malabar, but not higher up in India.

27. ELÆOCARPEÆ.

This family, formed of few genera, but which are distributed over a very extensive space, being found in Penang, Cochin-china, and the Moluccas, in New Holland, Van Diemen's Land, and New Zealand, as well as in Chili and Peru, has several species of the genus *Elæocarpus* in India, which has itself the distribution of the order in the Old World. The Indian species are found in the Peninsula and from the Burhmese territories, along the foot of the Himalayas, and one species, *E. serratus*, as far north as the province of Kemaon; but I have not met with it, or any other species, to the northward of the Ganges.

The name *julpai*, or olive, is applied to the fruit of some species of *Elæocarpus*, which is eaten; while that of others is dried and used in the curries of the natives of India, and also pickled, according to Dr. Roxburgh, though he mentions having been unable to extract

extract any oil from the fruit. The hard and dry, deeply-grooved and elegantly-sculptured seeds of this genus, particularly of the species *E. ganitrus, tuberculatus,* and *lanceolatus,* are frequently worn as beads, by the holy men in India; and set in gold, are sometimes even sold as ornaments in shops in Europe.

28. DIPTEROCARPEÆ.

The existence of this order was first indicated by the junior Gærtner, who described and figured together the genera *Shorea, Dipterocarpus,* and *Dryobalanops,* pointing out their close affinity to one other, as well as to his father's *Caryolobis.* Dr. Roxburgh also fully recognized its distinctness; and in addition to the two first, referred to it his *Hopea,* as well as *Vateria* of Linneus. The order he named *Shoreaceæ,* but his work having remained so many years in manuscript, the name *Dipterocarpeæ* was applied by Blume, and has been generally received. This order is readily recognised by the fruit being surrounded by the dilated, foliaceous, frequently unequal calyx: it has been shewn by Blume and Dr. Lindley to be allied to *Malvaceæ,* by its crumpled cotyledons, and the contorted æstivation of the corolla; in the latter respect, it is allied to *Bombaceæ,* but may be readily distinguished from both by its calyx not being valved, as well as by its free filaments, two-celled subulate anthers opening towards the apex, and by the coriaceous one-celled fruit. From *Byttneriaceæ* it is only distinguished by the imbricate æstivation of the calyx, free stamens, and inverse embryo; approaches *Tiliaceæ* in the free stamens and stipulate leaves, and *Elæocarpeæ* in habit and in the form of the anther, but may be distinguished by its petals not being fringed, and by the want of albumen. Their resinous juice, solitary superior ovarium, drupaceous fruit, numerous long anthers, irregular-coloured calyx, and single exalbuminous seed, allies them, as Blume remarks, to *Guttiferæ,* from which their stipulæ and the æstivation of the corolla abundantly distinguishes them. (*Lindl. Nat. Syst. of Botany,* p. 42.) Dr. Lindley includes them in his Nixus, *Malvales,* with *Byttneriaceæ, Malvaceæ,* (of which *Bombaceæ* is considered a section), *Elæocarpeæ* and *Tiliaceæ:* Mr. Don places them near *Ochnaceæ.* The dilated persistent leaflets of the calyx seem to be useful in preventing the seed sinking into the ground, as those of *Shorea robusta* will not germinate, unless kept near the surface.

The distribution of this order is peculiarly Asiatic, almost Indian, extending from the line up to 31° of northern latitude. *Caryolobis* is only referred to the East Indies. The genera *Dryobalanops* and *Dipterocarpus* are found, the first only in Sumatra, and the second, though occurring in Java, is also found in India, with *Shorea, Hopea,* and *Vateria;* the two latter only in the peninsula of India, though the first is mentioned by Dr. Roxburgh as occurring in the Balaghaut Mountains, but all three, with *Dipterocarpeæ,* in the lower provinces of Bengal, such as Tippera and Chittagong, whence, with the exception of *Vateria,* they extend southwards into the Burmese territories and the Malayan peninsula. *Shorea robusta* alone extends to the most northern distribution of the order, being found all along the foot of the Himalaya,

to the neighbourhood of the Jumna, forming vast forests, frequently unmixed with any other tree, but generally confined in the most northern parts within the first range of hills. The trees of this family are conspicuous for their size, beauty, and for the excellent timber which most of them afford—*Shorea robusta* or *Sal* affording the best and most extensively-used timber in India; the goodness of which must depend in a great measure on the resin, called *ral* in the northern, and *dhoona* in the southern provinces, which it contains, and for which so many of the family are conspicuous.

Dryobalanops Camphora, the *Shorea Camphorifera* of Dr. Roxburgh, is, perhaps, the most remarkable species of the order, as it affords both the camphor and camphor-oil of Borneo and Sumatra. Mr. Prince, of Tappanooly, on the western coast of the latter island, writes that this tree grows spontaneously in the forests, and is to be found in abundance from the back of Ayers Bongry as far north as Bacongan, a distance of twenty-five miles. It is one of the largest trees that grows on that coast, several being six or seven, others only two and a-half feet in diameter. The same tree which yields the oil, would have produced camphor, if unmolested; the former being supposed to be the first stage of the latter's forming, and is consequently found in younger trees (*Roxb. Fl. Ind.* 2. p. 616.) This camphor is highly valued by the Chinese, as we learn from the writings of Sir G. Staunton and Dr. Abel. By Mr. C. Groves I was informed that they actually give a higher price for it in its coarse state, than they afterwards sell it for when purified. This is confirmed by what Sir G. Staunton relates, that " owing to the Borneo camphor being so pure and strong, as readily to communicate its odour and virtues to other inspissated oils, which thus pass for real camphor; and this adulterated drug is sold by Chinese artists, at a vastly lower price than they themselves give for the genuine substance from Borneo." (*Staunton. Trav.* vol. iii. p. 289.) This can be accounted for, only by supposing that they dilute it, when purifying, by subliming it with their own camphor, obtained by the sublimation of the substance procured from the maceration and decoction of the branches of *Laurus Camphora;* of this the timber is too valuable to allow of its being cut up for the much purer and stronger camphor, which it contains in a solid state.

As many of the *Dipterocarpeæ* might, without doubt, be extensively introduced either as timber-trees, or for the products which they yield, into the southern provinces of India, I annex the remarks which Mr. Colebrooke has subjoined to his paper on *Dryobalanops Camphora.* By this able summing up of details, apparently taken from Dr. Roxburgh's manuscripts, it will be seen that this philosophical botanist early appreciated the advantages of studying the properties of all the plants of a natural order, in conjunction with their structure.

"*Shorea robusta* and *Tumbugaia,*" Mr. Colebrooke remarks, "and perhaps other species of the genus, yield in great abundance the resin, called by the Hindoostanees *dhoona,* and by the English, in India, *dammer,* which is very generally used as a substitute for pitch for marine purposes. The natives of India also employ it in their temples, in the manner of incense. *Dipterocarpus costatus, turbinatus, incanus, alatus,* and probably other

other species of the genus, afford the several sorts of balsam, called by the natives of India *gurjun;* by the Cinghalese *dhoonatil;* and by the English *wood-oil.* *Vateria indica* produces the resin in India called *copal,* (in England known by the name of *gum anime,*) as very nearly approaching the true resin of that name. The best specimens are employed as ornaments, under the denomination of amber (*kahroba*), to which it bears external resemblance: in its recent and fluid state it is used as a varnish (called Piney varnish) in the south of India (*Buchanan's. Mysore,* ii. p. 476,) and dissolved by heat, in closed vessels, is employed for the same purpose in other parts of India. Another plant of the same genus, *V. lanceæfolia,* affords a resin, from which the Indians prepare one of the materials of their religious oblations." (*As. Res.* xii p. 539.)

29. TERNSTRŒMIACEÆ.

This order, with *Camellieæ,* first formed by Messrs. De Candolle and Mirbel, of some genera separated from Jussieu's *Aurantia,* was subdivided by the former into several sections. Dr. Lindley, however, states that "no solid difference exists between this order and *Camellieæ,* the *Theaceæ* of Mirbel; and Cambessedes, after a careful revision of the whole, has come to the conclusion, that even the sections proposed by De Candolle among *Ternstræmiaceæ,* are untenable." As this opinion appears to me the most correct, I have followed the two latter authors in uniting the two orders.

The geographical distribution of this order is particularly interesting, on account of its containing a plant, which, scarcely known a century ago, has given rise to a most extensive commerce, and changed the habits of the most civilized nations, who hardly, in any other respect, agree with the people from whom they receive, and follow in the use of the refreshing beverage, afforded by the leaf of the tea-plant. This order, numerous in genera, though few of these are very abundant in species, is confined to the warm parts of Asia and America, with only one genus (*Ventenatia*) of doubtful affinity, consisting of but a single species existing in Africa. The Asiatic species are chiefly confined to China and the mountains which form a barrier between it and India; and as there is considerable resemblance it will be seen between the cultivation of the plains, so is there no less analogy in the vegetation of the mountains of the two countries; and this order is well suited to prove the point. The genera *Camellia* and *Thea,* forming the *Camellieæ* of De Candolle, and *Theaceæ* of Mirbel, distinguished from *Ternstræmiaceæ* on account of the seeds being destitute of albumen, were at one time considered exclusively Chinese. Species of the former were originally found in China and Japan. *C. Japonica* was figured by Kempfer at p. 851; *C. Sasanqua* by Thunberg, in t. 29, in their Floras of Japan; and *C. oleifera* by Dr. Abel, in his Journey in China, at p. 174. In addition to the original Chinese species, others have been discovered in India, where species have been found by Drs. Wallich and Buchanan in the mountains near Munnipoor, Pundua, and Silhet, about 24° of N. latitude; and one species, *Camellia Kissi,* in the mountains surrounding the valley of Nepal, between 27° and 28° of N. latitude, which is figured

at t. 256 of Dr. Wallich's magnificent work, *Plantæ Asiaticæ Rariores.* The genus *Thea,* which is itself referred by some botanists to *Camellia,* is almost exclusively confined to China and Japan, and some of the neighbouring islands; but consisting chiefly of cultivated plants, it is difficult to ascertain the native country of the genus. With respect to the distribution of the other genera of this order; *Cleyera* and *Eurya* were both thought peculiar to China; but of the former, the variety *Wallichiana* of *C. ochnacea* has been found in Nepal, the other variety *Kæmpferiana,* is figured in Sir Joseph Banks's plates of Kæmpfer's plants; and *C. Japonica,* in Kæmpfer's own work, at p. 774. So also *Eurya,* of which the two first known species were found, the one in Japan, figured by Thunberg, tab. 25; and the other in China, figured in Dr. Abel's Journey, p. 378, has also afforded several Himalayan species, of which *E. acuminata* is figured at tab. 24 of the present work, occurring at an elevation of 6,500 feet, in 30° of N. latitude, near pines, and among oaks and rhododendrons; the rest of the species extend along the Himalaya, in Kemaon, Nepal, and the mountains of Silhet and Pundua. Species are also found in both the Indian and Malayan peninsulas, as well as in the island of Penang. Dr. Wallich's new genus *Anneslea* (*Pl. As. Rar.* t. 5), allied to *Cleyera,* is found at Moulmein. The genera *Saurauja, Gordonia,* and *Cochlospermum,* are divided between India and America. *S. Nepalensis* (*Pl. As.* t. 148) extends as far north as *Eurya acuminata,* but is found at lower elevations, as about Sahunsadhara, near the Deyra Doon, whence it extends with *S. fastigiata* (*Pl. As.* t. 178) to Kemaon and Nepal. The other Asiatic species are found in Silhet, Penang, and Java, and the American species in Mexico. *Cochlospermum,* of which one species is found in *Mexico* and *Brazil,* has another, which is found in all the hilly parts of India. This, *C. gossypium,* D.C. (*Bombax gossypium* of authors) Dr. Wight has figured (*Suppl. Hooker's Fl. Exot.* Pl. xviii.) from a drawing made in the Peninsula; Dr. Roxburgh describes it as common in the Circar Mountains; I have seen it in abundance in Bundlecund, on the hills round and near Adjigurh and Kallinjur, as well as on those near Hurdwar and the Kheree Pass. The genus *Gordonia,* of which species exist in Jamaica, as well as in Virginia and Carolina, has also one species, *G. Wallichii,* in Nepal, Silhet, and Chittagong; and others in the Malayan Peninsula. Several other plants from the Malayan Peninsula have been referred, but all with doubt, to the genus *Ternstrœmia,* from which the order is named, and of which the species are found in the warm parts of America.

The properties, with the exception of those of tea, are not well known of the plants of this family. The leaves of the tea-plant, owing to the tannin and gallic acid which they contain, are tonic and astringent, while the fragrant volatile principle which they likewise contain, makes them act as stimulants, and be injurious to some constitutions; though affording a highly grateful and refreshing beverage to the generality of people. The leaves of *Thea Cochinchinensis* are likewise used to make a warm and diluent beverage. The seeds of the common tea-plants contain much oil, but it is expressed only from those of *T. oleosa,* and used in Canton and Macao for many

economical

economical purposes. In like manner some species of *Camellia*, as *C. drupifera*, in Cochin-china, and *C. oleifera*, extensively cultivated in China, yield, especially the latter, a valuable esculent oil. *Camellia Japonica* is chiefly known as one of the most ornamental of plants; but *C. Sasanqua* is said by Thunberg to have leaves with a very agreeable odour, which are sometimes mixed with tea to improve its flavour. So also the Nepal *Camellia, C. kissi*, is conspicuous for the oiliness of its seed, and for the leaves acquiring on being dried the peculiar fragrance of tea. (*Wallich. As. Res.* xiii. p. 429.) The seeds of *Cochlospermum Gossypium* are surrounded with cotton of a soft silky nature, and the tree yields the gum called *kuteera*, which in the north-western provinces of India is substituted for tragacanth: a decoction of the roots of *C. insigne* is supposed in Brazil to have the power of healing internal abscesses. (*Lindl. Nat. Orders*, p. 44.)

But of all those which belong to this family, the Tea-Plant is alone of any commercial importance, but this in so pre-eminent a degree as to render it a most desirable acquisition to other countries. An inquiry into its history and habits therefore becomes interesting, that we may ascertain whether it be so local and peculiar in its nature, as to render futile any attempt to introduce it elsewhere. To do this satisfactorily, it will be necessary to enter into some detail, respecting the varieties or species which afford the different teas of commerce, the extent of their distribution, the climate, soil and culture, which they prefer, as well as the plants with which they are associated, either in a wild or cultivated state.

The tea-plant has been supposed to be indigenous in the mountains which separate China from the Burmese territories; but we are informed by Dr. Abel that he found a small shrub, of what is commonly considered the green variety, apparently in its natural habitat, and near no plantation, at See-chou, in the province of Kiang-see, about N. lat. 26°, where the hills were covered with pines. Thunberg states that tea grows every where in Japan, both naturally (*sponte*) and cultivated, on the margins of fields. One species, so named, is described by Loureiro, as found both cultivated and in a wild state, in the northern provinces of Cochin-china; and the same author describes *T. oleosa* as common about Canton, both wild and cultivated. To the kindness of Mr. Reeves, I am indebted for the information that there is a species of *Thea*, growing wild in the neighbourhood of Macao, which is much larger in the leaf than either the black or green tea plants.

But it has been made a question, whether the varieties of tea known in commerce are due to difference in species, or only to differences in soil, climate, culture, and mode of preparation. The latter appears to be the opinion of Kæmpfer, Thunberg, and Siebold, as they admit of but one species of *Thea*, and is that now generally entertained; Thunberg notices two varieties of *Thea bohea*, but says they can hardly be distinguished into species. Siebold states that the variety *viridis* of *T. chinensis*, D.C., is a shrub every where cultivated in Japan; but the variety *bohea* he had only seen in gardens, introduced from China. From this fact one would be inclined to conclude that

that they were distinct; and as all the observations were made in Japan, it is probable they all three only saw one species cultivated there: as there is reason for believing, that the opinion of Linneus that two species of *Thea* yield the teas of commerce, is the more correct.

Dr. Abel, when passing through the tea country, had little doubt of there being two species of tea-plant; but he could not at the time define the character, and was unfortunate in losing his specimens in the shipwreck of the Alceste. But he mentions that the plants from the *black* and *green* tea-districts differed in the form, colour, and texture of their leaves; those of the green tea being larger, thinner, and of a lighter colour than those of the black, though growing in the same soil: these differences he also observed in a large plantation near Macao. Dr. Hooker, in the Botanical Magazine, t. 3148, has given the characters of the two species. *Thea viridis,* which is the species figured, he describes as "a large, strong-growing, almost hardy, plant, with spreading branches; its leaves three to five inches long, very broadly lanceolate, pale green, singularly waved, with the margin reflexed; the flowers large, solitary, mostly confined to the upper axil. These appear in autumn, six weeks or two months earlier than those of *T. Bohea,* which is of smaller size, with remarkably erect stiff branches; leaves not above half or two-thirds the size of the former, perfectly flat, more coriaceous, of a dark green, bearing in the axils of numerous leaves two or three flowers, which are smaller, and have a slight fragrance; and are in perfection during winter. This plant cannot withstand the frosts of an English climate."

Mr. Reeves, whose opinions, from his long residence in China, and attention to subjects of natural history, are entitled to the greatest weight, is the most recent author who has referred to this subject; and he expresses his surprise "that any person who has been in China, or, indeed, any one who has seen the difference in the colour of the infusions of black and greea tea, could suppose for a moment that they were the produce of the same plant, differing only in the mode of curing; particularly as they do not grow in the neighbourhood of each other." (*Loudon's Gard. Mag.*, v. ix. p. 713.) To this opinion, it will be seen, he still adheres, as in a letter with which I have been favoured, he informs me that he believes that the *Thea viridis* of the gardens is the plant from which the green tea of commerce is prepared, and that the plant which produces the black tea of commerce, as souchong, congou, &c., is not so common in England. Both may be seen in great perfection in the Messrs. Loddige's rich and extensive nursery-grounds at Hackney, where a green-tea plant has lived for many years in the open air. The first impression on seeing them, is that of surprise at their ever having been confounded; as nothing can be more distinct, than the large, membranous, light green, wavy leaf, with large and irregular serratures, and straggling habit of the green-tea plant, from the smaller, flat, thick and coriaceous, dark green leaf, with small and even serratures, and erect port of the black tea. Both plants have been figured in Loddige's Bot. Cab. t. 226 and 227, and the characters well given, as also in the above extract from Dr. Hooker. I would only add, that the flowers, though commonly, are not always single in the axils of

of *Thea viridis;* and this, though earlier in flowering, is not so much so as described. The green tea being the hardier, is cultivated, as we shall see, in the northern, and the black tea in the southern provinces of China. The former is the only kind cultivated in Japan, according to Siebold, and is that figured by Kæmpfer, *Amœn. Exot.*, p. 607.

Notwithstanding the above opinions, and the distinctness in the characters of the two species, as above given, there is an unaccountable discrepancy in the statements, as to the plants which afford the *green* and *black* teas of commerce, especially as Dr. Abel, after giving his opinion that there were two species of tea-plant, mentions that "from persons perfectly conversant with the Chinese method, he learnt that either of the two plants will afford the black or green tea of the shops; but that the broad thin-leaved plant is preferred for making the green tea." (*Journ. to China*, p. 222.)

This is in conformity with the information communicated to Dr. Hooker, and also with that originally given by Mr. Pigou (*As. An. Reg.* 1802), on the authority of a Chinese, who had been eight times in the bohea country, remaining there from four to six months each time, and who stated that "bohea may be cured as hyson, and hyson as bohea." To this Mr. Reeves replies in the letter to which I have alluded, that "the Chinese manufacturers do not, and *they* say they cannot convert black tea into green, and *vice versâ:* and this I believe to be true; indeed, the colour of the infusions is alone sufficient evidence." The discrepancy in the information Mr. Reeves explains, by adding, that "there is a species of tea grown in the province of Canton of a pale-coloured leaf (occasionally mixed with congou tea, to make the tea imported under the name of bohea), and this tea can be coloured and made up to imitate various qualities of green tea, and large quantities are yearly thus made; but still it is only an appearance that can be given; the deception is detected as soon as it is put into water." Owing no doubt to these mixtures, is the difficulty in detecting the two kinds of leaf in the teas of commerce; but in good teas they may be distinctly recognised. Dr. Abel's information having been obtained from hearsay at Canton, most probably refers to the kind described by Mr. Reeves, as he most particularly distinguishes, and lays down on his map, the green and black tea districts; but arguing upon the correctness of the information he had obtained, concludes that the differences observed may be produced by a due management of the heat used in drying the plant. Mr. Millet's account, Mr. Reeves says, he himself knows refers to some of this tea.

A very important consideration being to ascertain the climates in which the tea-plants are chiefly cultivated, it is necessary, in the first instance, to determine the extent over which they are distributed, before we can form any idea of the degree of heat and cold to which they are subjected. Dr. Abel states, that "*the green-tea* district in the province of Keang-nan is embraced between the 29th and 31st degrees of north latitude, and is situated on the north-western base of a ridge of mountains, which divides the provinces of Che-kiang and Keang-nan. The *black-tea district*, in the province of Fokien, is contained within the 27th and 28th degrees of north latitude, and is situated on the south-eastern declivities of a ridge of mountains, dividing the province of Fokien from

that

that of Keang-see." p. 223. Hence we perceive that the tea districts have both a north-western and a south-eastern aspect, and that Dr. Hooker's statement that the *Thea viridis* is able to withstand the greater degree of cold, is confirmed by the fact of the green teas being procured from the more northern latitudes. This has reference to the teas usually manufactured for foreign trade, and is conformable to the information given by Mr. Reeves (*Bot. Mag. l. c.*), who states that "the black teas are chiefly grown in the N.W. corner of the province of Fokien, in about lat. 27° 50′, long. 1° 30′ E. of Peking, and the green tea in the southern part of Keang-nan province, about lat. 29° 58′, long. 2° E. of Peking." At Hwuy-chow-Foo in the latter, the greater proportion of hyson and twankay is manufactured, and the black teas at Gan-ki-hien in Fokien. By Mr. Reeves I am further informed, that in a Chinese Herbal, in which the plants used in medicine are described, tea is said to be produced (among other places to the northward of 31°) in nine places in Hoo-Qwang, three places in Ho-Nan, one place in Shensi, and two places in Shan-tung; one of these latter, and the most northward of the whole is Tang-chow-Foo, in 36° 30′ north latitude. From Kæmpfer, Thunberg, and Siebold, we learn that the tea-plant is extensively cultivated in the islands which form the Japanese territory; and these extend from 30° to 41° of north latitude. It is also cultivated in the southern province of Yunan, whence we learn from Du Halde and Sir G. Staunton, the tea is procured, which is made up into balls; and likewise at Ho-ping in the province of Quang-tung; Dr. Wallich further mentions, that it is also cultivated in Cochin-china, as far south as 17° of north latitude.

But as from the information obtained by Sir G. Staunton, we learn that the tea-plant thrives best between 23½° and 30°, and as the principal cultivation of the best teas for the foreign trade is between 27° and 31° of north latitude, the space included between these forms a belt, which will serve as a criterion of the soil and climate best suited to this plant. With respect to the former, Dr. Abel gives the only precise information I have been able to obtain, and he states that from every account given of the tea-plant, it succeeds best on the sides of mountains, where there can be but little accumulation of vegetable mould. The plantations which he saw were always at some elevation above the plains, in a kind of gravelly soil, formed in some places by disintegrated sandstone, and in others by the debris of primitive rocks. A large and flourishing plantation of all the varieties of the plant brought together by Mr. Ball, the principal tea-inspector at Canton, is situated on an island close to Macao, in a loose gravelly soil, formed by the disintegration of large grained granite. "Judging from specimens," Dr. Abel continues, "collected in our route through the province of Keang-nan, whence the green tea is procured, its rocks consist chiefly of sandstone, schistus, and granite. As to what may be the exact nature of the rocks of the black tea country in the province of Fokien, I have no precise information. But as the great ridge separating that province from Keang-si is a continuation of the one dividing the latter from Canton, it is perhaps legitimate to conclude, that their constituent rocks are the same; and that the hills and soil on the eastern are the same as

we

we found them on the western side of the ridge, or that they are covered by a soil like that in which the *Camellia* flourishes." (*Abel*, p. 224.) This is most likely to be the case, as Sir G. Staunton states, that a chain of granite mountains begins at Hang-choo-foo, with a direction to the southward, and that vast tracts of hilly land are planted with tea in the province of Fokien. Mr. Reeves, from the views he has of Soo-Ei-Shan, where the best black teas are grown, suspects that the hills are schistose.

With regard to the climate of this tract of country, or that best suited to the cultivation of the tea-plants, we are without precise information, as no one competent to make observations has resided throughout the year in the principal tea districts; but the approximative results we are able to obtain will perhaps be sufficient for practical purposes, particularly if connected with a view of the vegetation. In the first place, if we look at the tables which have been calculated, and those of Mr. Harvey are the latest, we shall find the probable mean temperatures of Canton, of the parallels of latitude of 29° and of 31°, as well as of Pekin, to be 74.73°; 72.62°; 69.86°; and 62.43° respectively. But it is desirable to have these theoretical results confirmed by practical observations, especially as temperature is not invariably found to go along with latitude, particularly with regard to the eastern and western sides of continents. This the illustrious Humboldt has long ago shewn in his paper on Isothermal lines: where he has remarked that "the whole of Europe, compared with the eastern and western parts of America and Asia, has an insular climate, and upon the same isothermal line, the summer becomes warmer, and the winters colder, in proportion as we advance from the meridian of Mont Blanc towards the east or the west; the western parts of all continents are not only warmer at equal latitudes than the eastern, but even in the zones of equal annual temperature, the winters are more rigorous, and the summers hotter on the eastern, than upon the western coasts of the two continents. The northern part of China, like the Atlantic region of the United States, exhibits *excessive climates* (as Buffon indicated) and seasons strongly contrasted, while the coasts of New California and the embouchure of the Columbia, have winters and summers almost equally temperate. Thus we find at New York, the summer of Rome and the winter of Copenhagen; at Quebec, the summer of Paris and the winter of Petersburgh. In China, at Pekin, for example, where the mean temperature of the year is that of the coasts of Brittany, the scorching heats of summer are greater than at Cairo, and the winters as rigorous as at Upsal." These results have been deduced by their illustrious author from the observations of Amyot, which were carried on for a period of six years: by these it appears, that Pekin, in N. lat. 39° 54′ and E. long. 116° 27′, and at the level of the ocean, has an annual mean temperature of 54° 9′, that of the warmest month being 84° 38′, and of the coldest 24° 62′; while the mean temperature of the three winter months is 26° 42′. The severity of the cold may be judged of by this, and by the thermometer sometimes falling, it is said, as low as 63° below zero, as well as by the great thickness of the ice with which the rivers are frozen over. The summer is as warm as that at Naples, with a mean temperature of 82° 58, and the greatest

heat as high it is said as 121°. The mean temperature of the three spring months is 56.30°, and of those of autumn 54.32°, but it frequently freezes in both March and November; the mean temperature, however, of seven months is above 51.8°, or that of the months in which trees vegetate that lose their foliage. The temperature of the spring months being of March 41.4°, of April 57.0°, of May 70.3°, and of June 84.2°: the increase of the vernal temperature and the differences between these four months are seen to be very great, and very equal (15.7°, 13.3°, and 13.9°) as characteristic of climates where the division of the annual heat between the seasons is very unequal (*Humboldt on Isothermal lines. Brewst. Journal,* vol. iii. iv.)

In some works it is stated that there are properly only two seasons at Pekin, summer and winter, or the seasons of snow and rain. The months of June, July, and August, are stated to be very rainy, and the average of rainy days to be fifty-eight. The climate of the northern provinces must, however, be considered a dry one, as we learn, from both Sir G. Staunton and Dr. Abel, that large stacks of salt are left in the open air, on the banks of the Pei-ho, covered only by bamboo matting under a coating of clay. The showers are described as being light; no indications of a damp atmosphere are mentioned, but heavy dews occur in the evening. The season in which China was visited by Lord Macartney's embassy was peculiarly dry, as it is mentioned that from July to November scarcely a shower had fallen, and the country had been traversed from Zhehol to 30° of N. latitude. Lord Amhert's embassy also, which arrived on the Pei-ho on the 12th of August, had hardly any rain until the beginning of November, when they had got into the tea country. Le Compte also mentions a drought which had continued for five months in the year he arrived in China. The foregoing view of the climate of Pekin, though more severe than what the tea-plant is subjected to, will serve as an approach to a true estimate of the extremes of temperature which it is capable of bearing, as it is cultivated in 36½° north, and also in Japan.

As an indication of a southern climate where the tea-plant is cultivated, and the only one of which we have any account, it will be useful to refer to the following view of the climate of Canton furnished by Mr. Reeves to Dr. Lindley. I have deduced the mean temperatures from the maxima and minima, the results, therefore, though somewhat too low, cannot be very far from the truth. The range of the thermometer, and its means in the several months at Canton, are: in

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
Maxima	74	78	82	86	88	90	94	90	88	85	80	70	
Minima	29	38	44	55	64	74	79	75	70	57	40	45	
Means	51.5	58	63	70.5	76	82	86.5	82.5	79	71	60	57.5	... 69.7 Mean annual temperature.

The cold weather months, or from November to February, are fine, dry, and bracing, with a range of the thermometer from noon to night of 10° and 20°, the prevailing winds being N. and N.E. February is cold and rainy, March warm and foggy. In April and May the weather is warm, but pleasant, with variable winds, chiefly from the S. and S.E. In June and July there are often heavy showers with thunder, lightning, and

and occasionally typhons. During these two months and in August, the thermometer attains its highest elevation, but seldom exceeds 90°. The heat, however, is very oppressive to many; for at the latter part of this period, when the wind is westerly, there is little variation of the thermometer night or day, a sufficient indication of the moisture of the climate during this season.

It would be desirable to know the quantity of rain which falls, but the only register that I have met with is one kept at Macao, and appended to the above thermometrical register of Canton. The climate is much the same in the two places, with the exception of a much smaller range of the thermometer at Macao, as might be expected in an insular climate; for though the heats are nearly as great in the warm months, the fall of the thermometer at night and in winter is much less. The quantity of rain which falls at Macao, on an average of eighteen years, is about 69½ inches annually—107 inches is the largest, and 49 the smallest quantity which fell in any year. Some rain generally falls in almost every month, though comparatively little from November to March; about five inches in both April and October, and about ten inches in each of the months from May to September, both included. If we compare the climate of Canton with that of Calcutta, which is not a degree to the southward, we shall find that with a maximum temperature of 93.6°, 3.6° above that recorded at Canton, the minimum is only 56.8°, being 27.8° above that at Canton; and while the mean temperature of the latter is 69.7° (74° according to some), that at Calcutta is above 78°.

But as a great part of China, with a portion of the tea districts, has been traversed by the two British embassies, it will be useful to refer to the thermometrical observations which were made, though only for a short period of the year. The only meteorological register saved from the shipwreck of the Alceste, was that kept by Dr. Lynn during Dr. Abel's illness, from the 8th September to the 24th of November, that is, from Tiensing, near lat. 39°, to Nanchang-foo, about lat. 28° 40′, which is about the northern extent of the black tea, and the southern limit of the green-tea district. Previous to this, and while at Tung-chow, nearly in N. lat. 40°, Dr. Abel observes, that Fahrenheit's thermometer from 20th August to the 2d of September, frequently stood in the shade during the day at 88°, rose once to 93°, and never fell below 83°. In the night it generally fell to 72° and 70°, and the weather felt chilly. From the above register, it appears that the range of the thermometer was: in the

		Morning.	Noon.	Evening.
Province of Pechelee	from 8th to 15th Sept.	65° to 70°	77° to 82°	76° to 80° (1)
——— Shantung	... 16th Sept. to 2d Oct.	54 — 64	72 — 80	66 to 77
——— Keangnan	... 3d to 18th Oct.	54 — 65	65 — 76	to 70
——— Ditto	18th to end Oct.	56 — 62	60 — 72	
——— Ditto, Tea-plant first met with	2d Nov. to 13th	52 — 63	54 — 76	
——— Kiangsee	... 13th Nov. 24	44 — 62	50 — 58	

(1) A month later in the season, Lord Macartney's embassy had found the thermometer at Tien-Sing varying from 40° in the morning to 80° at noon.

If

If we compare the range of the thermometer in the two latter periods, or during the month of November, when the embassy passed from 31° to 28° 40° of N. latitude, as before, with some place in India, we shall find that Saharunpore, in lat. 30°, and elevated 1,000 feet, approximates in climate during this month, as the thermometer ranges from 45° to 55° in the mornings, and from 60° to 84° at the hottest time of the day, which is always, at least, two hours after noon. If we suppose the decrease of temperature to be only equal to what takes place at Saharunpore, we shall have a mean temperature of 52° in the coldest month, January; with the thermometer sometimes down to the freezing point, and ranging up to 65° in the warmest part of the day: but the extremes we know must be greater from what takes place both at Canton and Pekin, on account of the eastern exposure of China. This is confirmed by Mr. Reeves, who informs me, that "snow has been on the ground for days together upon the green teas, and the manufacturers of the black tea complain of the coldness of their country at times." With respect to moisture, we have seen that the largest proportion of rain falls at and near Canton, while the sun is in the neighbourhood of the tropic of Cancer; so that there may be said to be a rainy season there, though not so decidedly as in Bengal; and Mr. Reeves has known the black-tea manufacturers complain "that their first picking (in May and June), often suffers from rain, and cold easterly winds."

These few indications of the climate being premised, it would be interesting to connect with them a precise idea of the vegetation; but this is hardly attainable, as so little is known of the interior of China, from the want of competent observers of the localities of plants; but there is no doubt that the vegetation must differ in the northern and southern provinces, and also where these consist of elevated lands or of plain country. From Du Halde, and the progress of the British embassies through the provinces of Pe-che-lee, Shan-tung, and the northern portion of Kiang-nan, we learn that from Tien-sing nearly to Nankin, or from N. lat. 39° to about N. lat. 32°, and in a S.E. direction to the termination of the grand canal at Hang-cheu-foo, the country consists of level and extensive alluvial plains, rich and highly cultivated; intersected by numerous rivers and canals, and covered in some places with extensive swamps and broad lakes. In the most northern parts of this tract, with many genera found in temperate and European climates, we find some plants which we should expect to find only in more southern latitudes, as *Lagerstræmia indica, Ipomœa Quamoclit, Celosia cristata, Gomphrena globosa*, species of *Gynandropsis, Tribulus, Clerodendron*, &c.; the lakes abounding with *Nelumbium speciosum, Trapa bicornis, Pontederia vaginata*, and others; while the fields are cultivated with rice, millet, cotton, sesasum, and castor-oil plant. *Sida tiliæfolia*, referred by Dr. Roxburgh to *S. abutilon*, affords fibres for rope-making; and the gardens capsicums, gourds, melons, and water-melons, the egg-plant, yams, and sweet potatoes, with species of *Soja, Dolichos*, and *Lablab*, all of which are also cultivated in every part of the plains of India.

As the two embassies separated at the great river Yang-tse-kiang, and both shortly afterwards

afterwards met with hilly country, as well as with the tea-plant, it is necessary to notice both, and more in detail than we have done above. Lord Macartney's embassy found a chain of granite mountains extending southwards from Hang-cheu-foo, about lat. 30° 20′, on each side of the river Che-tang-chaung, along which they proceeded after issuing from the grand canal. Here they found the large-leafed chestnut, and the towering larch; the purple-leafed tallow-tree growing near, and the shining-leafed camphor-tree further from the water, with *Thuya orientalis* in the valleys. About lat. 29° 40′ the banks receded from the river, and were chiefly cultivated with sugar-cane in the neighbourhood of groves of orange-trees. About this part of the route they were supplied with grapes, oranges, apples, pears, chestnuts, walnuts, pomegranates, melons, and a kind of date, as well as the Chinese fruits see-chee (*Diospyros*), and lee-chee (*Euphoria*). On the sides of the hills, pines were met with, and on the sides and tops of earthen embankments, dividing the gardens and groves of oranges, the *tea-plant* was first seen growing like a common shrub, and along with it the *oil-plant* or *Camellia oleifera*.

Lord Amherst's embassy having taken the direct route to Canton, proceeded up the Yang-tse-kiang first to Nankin, and then along the sides of the Poyang lake, to Nan-chang-foo, where the two routes united. In the neighbourhood of Nankin they found the country become hilly, fir-trees were first seen, and the cultivation of the mulberry and tallow-trees with that of rice and cotton. Near that town Dr. Abel found *Rosa Banksiana, Cotyledon spinosa, Hamamelis chinensis,* and *Ficus repens* abundant, as well as *Pinus chinensis* (*Pinus Massoniana,* Abel), with *Salisburia adiantifolia.* Near Tatung, about lat. 31°, which they reached on the 2d of November, where the country was hilly and picturesque, the chief interest was owing to the plants. The tallow-tree was abundant, and the *tea-plant* was first seen; the barometer on the river stood about 30.13°; but on the hills close to it five species of oak were found, among them *Quercus densifolia* and *chinensis,* dwarf chestnuts, and among the many ferns *Pteris piloselloides.* Much ginger was also grown here. A few days' further progress brought them to the confines of the province of Keang-see; near this they found the *tea-plant* cultivated on the hills, which also abounded with oaks and fir-trees; and near the banks of the river there was extensive cultivation of rice, cotton, and bamboos.

The province of Keang-see, which in its northern parts is flat, full of rivers and marshes, and in winter has a mean temperature of 60° (*Enc. Metrop. Art. China*) the embassy traversed along the borders of the Poyang lake, of which the neighbourhood is hilly, and covered with plantations of oaks and firs, to which were now added *Cunninghamia sinensis* (*Pinus lanceolata*), and *Abelia chinensis.* There were considerable quantities of the tallow, varnish, and camphor-trees. At Nan-kang-foo, situated about lat. 29½°, at the foot of a lofty mountain, of which the top was covered with snow, which melted next day, pines were seen at the greatest elevation. The barometer on the river stood at about thirty inches, so that the neighbouring country must be about the level of the sea, and the banks were covered with rice, cotton, and bamboo, and with them were

cultivated

cultivated *Arum esculentum* and *Arachis hypogæa.* On the hills many ferns were found, as species of *Adiantum, Asplenium, Aspidium, Blechnum, Davallia, Polypodium, Pteris,* and *Woodwardia;* an *Ilex* allied to *I. aquifolium, Pinus chinensis,* several species of oak and the tallow and camphor trees.

At Nan-chang-foo the route of the two embassies becomes again united. From the 24th Nov. to the 18th Dec. Lord Amherst's embassy proceeded up the river Kan-kiang, which flows into the Poyang lake; the banks were chiefly composed of red sandstone, resting on granite; when low, cultivated with rice, sugar-cane, bamboo, camphor-tree, and a *Ficus,* much resembling the banyan-tree; and when high, with the oil bearing *Camellia,* or *C. oleifera,* which was first met with by Dr. Abel shortly after leaving Nan-chang-foo, bearing abundance of flowers in November, varying in height from six and eight feet to that of a moderate-sized cherry-tree, and flourishing best in a red sandy soil; deer, pheasants, and partridges were seen; and a woodcock, at Quachow. The sugar-cane was observed ready to be cut down, and great fields of wheat were springing up. On the 6th Dec. *Pinus chinensis* and *Cunninghamia sinensis* were again met with; and on the 8th at Seechou, about lat. 26°, the *tea-plant* was found apparently wild; in the neighbourhood of *Elæococcus verrucosus* (*Dryandra cordata*) and *Eugenia microphylla.* Beyond this were extensive plantations of *Camellia oleifera,* where *Eurya japonica* was abundant.

On the 20th Dec. they crossed the Meiling Mountain, which divides Keangsee from Quantung, where groves of fir-trees skirted their way; and a species of *Prunus* was seen in full flower at the top. On descending from this, they entered the province of Canton, which at first they found mountainous and barren, but shortly met with groves of *Pinus chinensis,* intermixed with *Cunninghamia sinensis.* The vegetation on the surface of the hills least decomposed, consisted of the species of *Lycopodium,* which resembles a tree in miniature. A few days after passing Chaou-chou-fou, which is situated near the 25th parallel of latitude, they found the neighbourhood of their anchorage hilly, and very abundant in wild plants. *Myrtus tomentosa* was of great size, and very abundant, *Smilax China,* famed for its sudorific properties, scarcely less in quantity; with another species, like *S. lanceolata.* A *Begonia,* resembling *B. grandis,* was also found growing to the height of twenty feet; and a wild species of *Camellia,* which Dr. Abel considered to be probably a variety of *C. oleifera;* while the rocky banks of some small streams were covered with species of *Marchantia* and *Jungermannia.* Two *Rhexias* of doubtful species grew in the rocks, with several plants of questionable genera. (*Abel,* p. 199.) Plantations of sugar-cane were frequent in this part of their route, as well as in the southern portion of the province of Kiang-see. As they approached Canton, groves of orange-trees, of bananas, and of the rose-apple, relieved extensive fields of rice. A great extent of this province towards the coasts consists of level plains, and though so near the tropic, the winters we have seen are severe; ice is sometimes formed, but snow does not fall: owing, however, to the general mildness of the climate, and the alternations of hot and cold months, two crops, as in India, are annually obtained;

obtained; and sugar, rice, and cotton, cultivated, as well as an inferior kind of tea. The fruits consist of oranges and shaddocks, bananas, pine-apples, and jack-fruit; with those which are peculiar to China, as the lee-chee, longan, wampee, &c.: grapes, pears, prunes, chestnuts, and peaches, are also found, but do not ripen well. In a garden near Canton, Dr. Abel found the *Moutan Paeony*, *Camellias*, *Azaleas*, and roses, with the black and green-tea plants, which he also saw in a plantation at Macao; as well as *Vaccinium formosum*, the tree like *Lycopodium*, and the dwarf elm. The province of Fokien, which is celebrated for the production of the best black tea, lies to the northward of the province of Canton, between the tropic of Cancer and 28° of north latitude. It is mountainous, but warm and healthy. The mountains are terraced, and covered with firs: the cultivation consists of rice and sugar, and in the cold season of wheat; oranges, lee-chees and longans are abundant.

From the above few notices of the temperature and vegetation, though during only a portion of the year, in some of the provinces of China, we may perceive a considerable resemblance to what we have seen to be the characteristics of the Flora of India and its mountains: that is, considerable uniformity in these respects over an immense extent of plain country, and a rapid change from a tropical to a European vegetation, whenever we begin to ascend the mountains. But this is a more remarkable occurrence in China than in India, as its plains stretch into more northern latitudes, and the extremes of temperature between winter and summer, as well as the differences in this respect between the northern and southern provinces, is much greater than in India. But if we enter more particularly into details, we shall find that this resemblance in the vegetation and cultivation of different provinces with one another, and of all with India, is almost entirely confined to annuals. Such plants, cultivated in summer, are subjected every where to nearly similar degrees of heat; while those which constitute the winter crops, meet only with congenial cold. But the perennials of mountainous situations, as well as those of the northern provinces, being exposed alike to the severity of a Chinese winter and the heats of summer, which, though great, are excessive only for a short time, resemble the plants of northern latitudes, and such as are found on the slope of the Himalaya: belonging to such genera as *Pinus*, *Taxus*, *Juniperus*, *Cupressus*, *Quercus*, *Betula*, *Populus*, *Salix*, *Celtis*, *Ulmus*, *Æsculus*, *Castanea*, *Morus*, *Fraxinus*, *Syringa*, *Tilia*, *Acer*, *Rhododendron*, *Andromeda*, *Azalea*, *Rhus*, *Juglans*, *Pyrus*, *Prunus*, *Cratægus*, *Cydonia*; together with *Berberis*, *Sambucus*, *Viburnum*, *Lonicera*, *Evonymus*, *Rhamnus*, *Ilex*, and *Staphylea*; and among herbaceous plants, many *Ranunculaceæ*, *Fumariaceæ*, *Cruciferæ*, *Caryophylleæ*, *Rosaceæ*, *Sempervivæ*, *Umbelliferæ*, and *Primulaceæ*; as well as species belonging to the genera *Viola*, *Erodium*, *Geranium*, *Hypericum*, *Ruta*, *Lythrum*, *Saxifraga*, *Chrysosplenium*, *Rubia*, *Galium*, *Linaria*, *Hyoscyamus*, *Statice*, *Plantago*, *Iris*, *Lilium*, *Allium*, *Convallaria*, and *Paris*. With these genera are associated others, of which the species are most prevalent about the centre of the temperate zone, and to which great extremes of temperature may be supposed to be obnoxious, as *Pistacia*, *Olea*, *Punica*, *Cercis*, *Nerium Oleander*, *Papaver Somniferum* and *Rhoeas*; and

and others, of which the species are chiefly diffused through tropical countries, as *Melia, Diospyros, Sterculia, Grewia, Zanthoxylum, Acacia, Tamarix, Indigofera, Lespedeza, Hedysarum;* but of these only single species have in general been enumerated in the northern provinces of China, in the same way that we have seen species of the same genera, extending to the most northern parts of India, and ascending up the sides of the Himalaya within the thick covering of jungle and forest, when they could not exist in the moderate cold even of the open places of Northern India.

But the great resemblance of the Flora of the mountains, and of the northern provinces of China and Japan, is to that of Europe, as may be inferred from the existence in each of the above genera and a number of the same species; as *Humulus Lupulus, Chelidonium majus, Hyoscyamus niger, Hedera Helix, Lithospermum arvense, Thlaspi arvense,* and *Capsella Bursa Pastoris;* with several others, which are likewise found in the mountains and north of India. But as the north of China forms the southern boundary of Tatary, which indeed terminates only at the range of mountains, over the vallies and across the ridges of which the great wall is built, we may expect to find in the province of Pe-che-lee, many of the plants of the Tatarian and Siberian Regions, which are themselves nearly identical in genera, but distinct in species, in consequence of the greater dryness of the former: but all three have a considerable resemblance in being subjected to great dryness and great extremes of heat and cold. Hence we meet with many of the plants of Pallas, Ledebour, and others, as included by Bungé in his enumeration of the plants of China. (*Mem. De l'Acad. Imp. des Sciences de St. Petersbourg.*) As for instance, *Clematis angustifolia, Delphinium grandiflorum, Menispermum dauricum, Papaver nudicaule, Viola variegata, Amygdalus pedunculata, Potentilla supina, bifurca, soongorica,* and *fragarioides;* with *Astragalus adsurgens* and *melilotoides,* and species of *Caragana, Oxytropis,* and *Patrinia,* which are characteristic of these regions; with many others, as *Serratula centauroides, Aster tataricus, Scorzonera radiata, Apocynum* and *Cynanchum sibiricum, Gentiana squarrosa, Convolvulus subvolubilis, Iris dichotoma, Lilium tenuifolium,* and *Asparagus maritimus.* As Kunawur forms the western limit of the Tatarian region, we have some of the plants which extended into it from more northern latitudes, found also in this part of China, as *Ranunculus salsuginosus,* and *Sisymbrium Sophia.* And as some resemblance was shown to exist, in appearance at least, between the plants of Kunawur and those of Delhi, we have some of the genera of the latter in the province of Pechelee, as *Ailanthus, Lycium,* and *Salsola.* Thunberg has long ago remarked, that in Japan the cold is great in winter, and the heat considerable in summer; and that its botany resembles that of the north of China: this is fully confirmed by a comparison of his Flora with Bunge's list. He at the same time alluded to the affinity with the Flora of Northern America: this may be seen in the prevalence of the genera *Magnolia Illicium,* and *Gleditschia. Panax pseudo-ginseng,* found by Dr. Wallich on Sheopore in Nepal, differs but little from the American *P. quinquefolium,* which is supposed to be the same as the plant yielding the Chinese ginseng; some species are identical, as *Veronica virginica, Ribes Cynosbati,* and *Datura Stramonium;* of which the last, as well as the genera

genera *Chaptalia* and *Ampelopsis*, has been found in America, China, and the Himalayas. Between the two latter, however, the analogy in genera is the greatest; and even some species which were first discovered in the Himalayas are now enumerated in the Flora of China; as *Evonymus micranthus, Fraxinus floribunda, Rhamnus globosus* (*R. virgatus?* Roxb.) and *Convallaria cirrhifolia;* while others, which were only known as Chinese and Japan plants, are found in abundance within the Himalayas, as *Houttuynia cordata, Hovenia dulcis, Ophiopogon spicatus* and *japonicus, Kadsura japonica, Hastingia coccinea, Murraya exotica, Hypericum patulum, Spiræa callosa, Viola prionantha* Bge, *Lonicera japonica* and *chinensis*, with *Daphne cannabina*, and many others.

In conjunction with such genera as were first enumerated, it may excite surprise to see so many annuals and such cultivation as we expect to meet with only in tropical countries; but this is far from surprising, when we consider that the temperature of the summer months diminishes but little, and in some places rather increases with the latitude; as Bruce, in Abyssinia, found the climate on account of the rain 12° cooler when the sun was over-head, than when 36° distant to the southward. Thus, at Calcutta, the temperature of the three warmest months, April, May, and June, is 85.05°, and of the rainy months, July, August, and September, 82.83°; at Benares, in N. lat. 25.18°, the mean temperature of the first period is 90.99°, and of the second 83.01°; and at Saharunpore 84.3° and 82.3°; while at Canton, in the three warmest months, it is 83.6°, and at Pekin 82.58°; while at the last, the temperature of no less than seven months, is above 51.8°. Hence we find the lakes in the northern as in the southern provinces, abounding with *Nelumbium speciosum* and *Trapa bicornis*, and like those of India with *Euryale ferox*, and species of *Nymphæa, Pontederia, Sagittaria, Utricularia, Myriophyllum* and *Leersia*. *Saururus* supplies the place of *Aponogeton; Phrynium capitatum* employed in making the excellent Calcutta mats, is found in both countries. Species of *Scirpus*, as in India, yield tuberous roots, which are used as food; and species of *Typha, Acorus, Lemna, Ceratophyllum*, and *Menyanthes*, are found as in more northern latitudes; while in the plains of the northern provinces, as we have seen, many tropical plants occur. In the central provinces, as we learn from the list given by Sir G. Staunton of the plants found in Shan-tung and Kiang-nan; we have such tropical plants, as *Grislea tomentosa, Vitex negundo* and *trifolia, Biophytum sensitivum, Boerhaavia repanda;* species of *Jasminum, Clerodendrum, Justicia, Basella, Rottboellia, Anthistiria, Andropogon*, and *Cenchrus*, with many of those beforementioned, as occurring in the most northern provinces. With these there is a mixture of European genera, such as exist also in the southern province of Canton, where species of *Galium, Scabiosa, Lycium, Chelidonium, Saxifraga, Sedum*, and *Reseda*, are stated as occurring by Loureiro. It may also be mentioned, that many of the same flowers are common to Indian and Chinese gardens, some of which may also be seen in the summer in gardens in Europe; while others which have been introduced from China, are now common in every part of India, as Chinese *Aster, Dianthus, Iris, Pardanthus*, and *Justicia;* with

Lagerstræmia indica, Dracæna ferrea, Hypericum monogynum, Kerria Japonica, Hiptage obtusifolia, Olea fragrans, Thuya orientalis, &c.

It is not surprising, therefore, that the cultivation of every part in the warm weather months, is, as we have seen it to be the case even in the most northern province, like that of India; to the list there given we have only to add sugar, and the mulberry for the silk-worm, to have a cultivation identical with that of India during the warm weather and rainy season. Irrigation supplies in China the want of a regular rainy season in the most northern provinces. The analogy is still greater, for at the termination of the rice and millet crop we find wheat, barley, buckwheat, peas, beans, lucern, and tobacco, are grown. For we learn from Staunton and Abel, that as the *Sorghum vulgare*, the *Jooar* of India, and *Kow-leang*, or tall corn of the Chinese, was cutting down in the northern, and sugar-cane in the southern provinces, wheat was seen springing up, and about two inches high, about the middle of October and November. Thunberg states, that it flowers in March; so that the crop must be gathered in, about the same time as in India, that is, about the end of March or beginning of April. Mr. Gutzlaff more specifically mentions the two crops, one of rice, and the other of wheat, in the cold season. That the accession of the cold weather is sudden we may infer from being informed by Mr. Bell, that on their arrival in China, near the great wall, they were supplied with water and musk-melons, and on the 6th November, only a few days afterwards, they encountered a "great fall of snow, and a cold frosty wind." Mr. Gutzlaff also states, that the 9th of November, when in 40° of latitude, was a very pleasant day, but during the night the wind changed, and a strong northerly breeze began to blow, the cold was piercing, and in a few hours the rivers and creeks were frozen over. (*Voy. to China*, p. 147.)

That the perennials and the botany in general of the southern provinces is very distinct from what we have seen to characterise the central and northern provinces, with the exception of a few annual species of European genera, allowed to exist during the coolness of the winter months, we may learn from the writings of Loureiro and Roxburgh, the relations of travellers, and the plants which have been introduced into Europe. From these sources we learn the existence of a species of *Nepenthes*, near Macao, with numerous *Scitamineæ*, and tropical *Epiphytal Orchideæ*, several *Palms*, as the *Cocoa*, *Areca*, and *Cane* palms, together with species of *Caryota*, *Rhapis*, *Chamærops* and *Tacca*, in the most southern provinces; with *Pandanus odoratissimus*, and *Cycas inermis*. *Aloexylon Agallochum*, the *Eagle wood* of the ancients, and *Aloes wood* of the moderns, *Baryxylum rufum*, iron wood, with species of *Canarium*, *Phyllanthus Emblica*, and *Guilandina Bonduc*, are specimens of some of the trees. *Laurus Cinnamomum*, *Camphora* and *Culilaban*, affording camphor and cinnamon. *Augia sinensis*, *Elæococcus verrucosus*, and *Stillingia sebifera*, yielding varnish, wood-oil, and vegetable tallow, are some of those affording useful products; while the fruits consist of pine-apples, papayas, guavas, custard-apples, and such as are mentioned at p. 118.

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The principal families to which the rest of the known plants of the southern provinces of China may be referred are, *Dilleniaceæ, Anonaceæ, Malvaceæ, Aurantiaceæ, Sapindaceæ;* tropical *Leguminosæ,* as *Anagyris, Poinciana, Erythrina; Melastomaceæ,* many tropical *Rubiaceæ* and *Synanthereæ, Scrophularineæ, Verbenaceæ* and *Acanthaceæ, Laurinæ, Euphorbiaceæ, Urticeæ, Commelineæ,* and tropical *Gramineæ.* Species of the genera *Cocculus, Capparis, Helicteres, Hiptage, Aglaia, Cissus, Combretum, Quisqualis, Marlea, Lawsonia, Myrtus, Eugenia, Passiflora, Callicarpa, Cordia, Convolvulus, Argyreia* (*Lettsomia.* Roxb.) *Bignonia, Jasminum, Hoya, Ardisia, Sideroxylon, Trophis, Antidesma, Boehmeria, Basella, Begonia, Musa, Crinum, Philydrum, Aloe, Amaryllis, Asphodelus, Melanthium* and *Eriocaulon.*

If we compare this with the Flora of Southern India, we shall find that the same great features are common to both; and though the northern provinces of China are more European in their Flora than we any where meet with in the plains of India, yet do their lakes abound with the same plants, and their plains are covered with similar crops. But the Flora of the mountains, including that of the most northern parts of China, has an almost universal identity of genera with that found covering the elevated belt of the Himalaya. If we commence with the bases of these mountains, and pass successively through the several belts, and analogous to what takes place between the parallels of latitude of 40° and 45°, experience the rapid decrease of mean temperatures, and the quick succession of vegetable productions, we shall first find a vegetation similar to that of the southern provinces; with the agriculture of the banks of the canal, consisting of rice, millet, amaranth, and an esculent arum, with ginger, turmeric, a little cotton and sugar, at one season, succeeded by wheat, barley, and buckwheat, in the cold weather months, (v. p. 18); even the mountain rice, lauded by Loureiro, meets here with a congenial climate. Along with plantains, oleander, and some of the orange tribe, and the various plants enumerated at p. 13, we meet with some which were long considered peculiar to China; as *Marlea begonifolia,* and *Houttuynia cordata,* with species of *Chloranthus, Incarvillea,* and *Hiptage.* At the foot of the mountains of Silhet we meet even with the Chinese fruit *Longan* and other species of *Euphoria.* In ascending we pass through different gradations of vegetation, until reaching the regions of the oaks, and rhododendrons, which is immediately succeeded by that of the pines, we meet in the mid region with a Flora which must approximate to that of the mountains of the central provinces of China; for here we find the Chinese genera *Abelia* and *Eurya,* together with *Stauntonia, Kadsura, Hovenia, Ophiopogon,* and *Pardanthus,* as well as *Deutzia,* first found in Japan, to which new species have been added by Bungé from the north of China, and by Dr. Wallich from the Himalayas. In Nepal the latter has also discovered *Hovenia dulcis, Taxus nucifera,* and species of the equally Chinese genera *Camellia, Cleyera, Podocarpus, Raphiolepis, Photinia,* and *Eriobotrya.** But it is in

* A resemblance may also be carried on between the products of the mountains of the two countries. As the camphor, varnish, wood-oil, oil and tallow trees, constitute a part of the natural riches of China; so we have in the Himalayas and at their foot, *Camphora glandulifera,* discovered by Dr. Wallich, containing solid grains

in the midst of similar vegetation that the tea-plant is everywhere found; and as we have some of the very genera and species, which were first found in the tea regions, they point out, that here it may most fitly be introduced. It cannot be a difficult task to transfer from one country to another a plant, which grows naturally and is cultivated extensively, in one which possesses so many of the plants which are common to the two, and not found elsewhere. Particularly when we consider that a tea-plant introduced from China by one of the triennial embassies, has lived for many years in the open air in Nepal, and was there seen ten feet high by Dr. Wallich.

There is little doubt, therefore, that many situations fit for the growth of the tea-plant, may be found in the Himalayas; but it is important to consider whether all the circumstances are so similar, as to render it probable, that the leaves would secrete only the present quantity of astringent, and retain the full proportion of volatile and fragrant matter, upon which their virtues especially depend. The territories of the British in the Himalayas, as Kemaon, or those under their protection, as Gurhwal and Sirmore, extend from 28° to 31½° of N. latitude, and present every diversity of climate and vegetation from their tropical bases to their snow-clad summits (v. p. 12 to 24): but as the same latitudes are warmer in India than in China, we must go further north, or ascend higher to obtain a similar temperature. Dr. Abel, from the correspondence in climate, and the soil being composed of the detritus of granite, schistus and sandstone, recommended the Cape of Good Hope as well suited to the cultivation of the tea-plant; but the soil in the Himalayas, consisting chiefly of the debris of primary rocks (v. Geol. Sect. Pl. 1. Sect. 1 and 2), must be equally eligible for the purpose. Further, as he advises hilly situations, a meagre soil, and a moderate temperature, while another author states, that leaves of the finest quality are only produced in light stony ground, we may hope to see the slopes of the Himalaya covered, and the edges of the terraced flats—for here, more completely than either in Italy or China, "The peaks are shelved and terraced round,"—surrounded with plantations of the tea-plant.

A climate less severe than that of Pekin, but cooler than that of Canton, is indicated. Dr. Wallich has stated a temperature between 30° and 80° as requisite, and this cannot be

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grains of camphor in its wood, while his *Melanorrhœa usitata* (Pl. As. Rar. p. 9 t. 11 and 12) yields abundance of excellent varnish; besides *Rhus vernicifera*, the varnish-tree of Japan is common in the Himalaya. Wood-oil is yielded by several species of *Dipterocarpus*. Oil is procured as in China from the apricot, and also from *Prinsepia utilis* and other plants; and even a vegetable butter is yielded by *Bassia butyracea*, common in the hills about Almorah, and most probably allied to the *shea-tree* of Bruce. Paper is equally made in both countries from *Daphne cannabina*; and the Indian *Shola* is analogous to the Chinese *rice-paper*. But a few Chinese genera have not been found in India or its mountains, as *Illicium*, *Nandina*, *Bocconia* (Maclayea) *Koelreuteria*, *Vatica*, which may, however, be the same as *Vateria*, *Chimonanthus*, *Broussonetia*, *Astranthus*, *Apactis*, *Bladhia*, *Bæckea*, *Aucuba*, *Polychroa*, *Elæococcus*, *Salisburia*, *Cunninghamia*, and *Hamamelis*; though *Bucklandia*, a new genus of the small, but widely-spread order of *Hamamelideæ*, is found in the mountains above Silhet. *Cookia*, *Triphasia*, and several of the Chinese fruits succeed in every part of India. A few new genera have, moreover, been added by Bunge from the north of China.

be far from the truth. Mussooree (v. p. 16, and Geol. Section, Pl. 1. fig. 2) has a range of the thermometer from 27° to 80°, and Deyra (v. p. 13) in the valley at its foot, one from 101° to 37°; on the slope intervening between them, Jurreepanee elevated 5,000 feet, is a particularly eligible situation; but experiments on a small scale might be made at all three stations; and at the same time be carried on in Kemaon, at Almorah, and Hawulbagh, as well as in the neighbourhood of the lake, called Bheemtal (v. p. xviii.); and in Sirmore, near Nahn, as well as at Sabathoo; and in a warmer situation in the garden of Shalimar, in the Pinjore valley. Keeping in mind that *Thea viridis*, or the *green-tea plant* in China, as in Europe, is able to bear the greater degree of cold, while *Thea bohea* will succeed only in sheltered situations, as it is only produced in the southern provinces of China, and cannot bear exposure in England.

But as temperature is not the only thing desirable, we shall find that the course also of the seasons is favourable, and that even the strong contrasts of a Chinese climate may be met with, and taken advantage of, if desired. For although the tops of peaks and ranges, from the equalizing effects of the atmosphere, have a small annual range of the thermometer, yet the *cleared* and elevated vallies within these mountains, (very different from the low, moist, and forest-covered flats at the plainward base) have a great contrast of temperature between summer and winter. Because during the short days of the latter, owing to their obliquity, few of the sun's rays reach the sheltered valleys, while the free radiation in a clear atmosphere greatly increases the cold. But the nearly perpendicular rays of a summer sun, impinging on the same places, are greedily absorbed, and being reverberated from side to side increase the temperature much beyond what we should expect, either in the latitude or elevation. As the finest crops of tea-leaves are obtained when they are young, and as the revival of nature takes place at Mussooree about the month of March, there is abundance of time for two crops of leaves to be collected before the accession (about the middle of June) of the more severe rainy season. The seeds would ripen in the autumn at the same time as the nearly allied *Camellia* and *Eurya* of these mountains.

Being so important and valuable a plant, it may be asked, why, if so easily transferable, it has remained so long confined to its native country; and without consideration, it has been inferred, that it must, like the cinnamon, nutmeg, clove, cardamom or camphor-trees, be very peculiar in its nature, and confined in its habitat; and it has therefore resisted the attempts made to cultivate it in Java, Penang, and Ceylon, as well as at Rio Janeiro. With the cold and deserts of Tatary on the north, and the continual heats of the tropics on the south, it could only have spread in the zone of favourable temperature, but here the ocean throws a barrier on the east, and the snow-clad Himalayas an equally impassable one on the west. But where it was possible, we have seen that the tea-plants have spread in their native country over a wide extent of territory, and are subjected to a great diversity of climate. The attempts which have been made to introduce it elsewhere, so far from deterring, ought rather to encourage its cultivation in more congenial climates; for the experiments have proved that the

plant

plant will thrive under the Line, and the green tea even in the open air in England, especially in Devonshire; so that Desfontaines recommended its cultivation in the south of France. Dr. Wallich has already remarked, "that a very slight acquaintance with the character of the countries where the attempts were made to introduce the cultivation of the tea-plant, is sufficient to account for the total failure of them."—(*Observ. on the Cultiv. of the Tea-plant, App. Report of the East-India Committee.*)

The most southern limit of the regular tea country being 27° of N. latitude, and its having been calculated that in tropical countries every 396 feet of vertical ascent is equivalent to 1° of latitude, we require at the Line an elevation of 10,692 feet, at the tenth parallel 6,732, and at the 20th an elevation of 2,772 feet, to attain a temperature equivalent to that of open flat countries in 27° of latitude; but the tea-plant is even in that latitude fond of a hilly country. "In Penang, situated between 5° and 6° N. of the Equator, where the highest hill does not exceed 2,500 feet in elevation, and every feature of the vegetation is tropical," Mr. Brown, as we are informed by Dr. Wallich, "established a tea-plantation at Glugor, and procured Chinese to superintend the undertaking; but it is not surprising that though the plants grew well, the leaves were not well flavoured." Neither was success to be expected in Java or Ceylon, where there is little contrast of seasons, and the vegetation in both is tropical; but in all, as well as in Calcutta, the plants thrived well. At Rio Janeiro, in 23° of S. latitude, we are informed by Dr. Abel, that many Chinese plants were growing in full vigour, as the tallow-tree, the wax-tree, *Ligustrum lucidum*, and *Camellia sasanqua;* and that the tea-plant had been successfully cultivated, and effectively manufactured. But the vegetation and seasons are so tropical, that the situation cannot be considered favourable, and the cultivation has since been given up, it is reported, in consequence of the expence of labour, but the produce is said also to have had a bad flavour. At St. Helena, in 20° of N. latitude, the tea-plant also grows vigorously; but here the country is elevated, and enjoys the equability of an insular climate, with a range of the thermometer from 64° to 78°. The English oak and Scotch fir, with the common furze, grow in the open air as luxuriantly as *Araucarias, Mimosas* from New Holland, and *Furcræa gigantea* from South America, with some Nepal plants; and alongside of them may be seen plantains, arborescent Cassias, *Ficus indica* and *religiosa,* the banyan and peepul-trees of India.

But in the Himalayas, where so great an analogy exists in latitude, elevation, soil, climate, and the course of the seasons, as well as considerable identity of vegetation, there cannot in my mind be a doubt of success in introducing the cultivation of tea, with the strongest probability of all its properties remaining unchanged, as every requisite is so similar to what it experiences in its native country. It is not an unimportant consideration, that the cheapness of labour exceeds even that in China, where, I am informed by Mr. Reeves, about eightpence a-day is earned in the tea countries; but in India and its mountains women and children get about a fourth, and able-bodied labourers not more than one-half that sum. But even supposing that the finest flavoured

teas

teas should not at first be successfully cultivated, an immense consumption would be found among Asiatic nations for even inferior kinds, which would still be superior to what they now use. This would greatly increase the resources of the Hill provinces, give rise to an extended commerce with Northern and Central Asia, as the Tatar nations habitually use it, and all Asiatics, even the natives of India, think so highly of the virtues of tea, as to have recourse to it, whenever they can procure even the most inferior kinds in cases of sickness. But at all events, an article of which the exports amount in quantity to about fifty millions of pounds weight, and its value to about two and a-half millions of money, is well worthy the consideration of a Government which possesses territories apparently so favourable for its cultivation.

To shew that these opinions have not been hastily formed, or adopted in consequence of the change in Indian commerce, I beg to quote a few lines from a report which I addressed to Dr. Wallich for the information of the Indian Government, by which it will be seen that so long ago as the end of the year 1827, when it would have been my duty, had it been desired to have carried the suggestion into execution, in recommending the cultivation of the tea-plant in the Northern and Hill provinces of India, I remarked that "it does not appear by any means so delicate or so limited in geographical distribution as is generally supposed. It is said to delight particularly in sheltered valleys, the declivities of hills, or the banks of rivers, where it enjoys a southern exposure to the sun. These warm situations do not, however, appear to be essential to its welfare, as it is found on the rugged tops of mountains; and although it appears to attain the greatest perfection in the mild climate about Nankin, yet it flourishes in the northern latitude of Pekin and in Japan, as well as about Canton; and thus appears to be confined within the parallels of 20° and 40° of northern latitude."*

Eurya acuminata; (Wall. Cat. N. 1464) ramulis ultimis pilosiusculis, foliis elliptico-oblongis acuminatis inferioribus caducis, floribus axillaribus fasciculatis.—*E. acuminata* et *E. multiflora*. D.C. Prod. 1. p. 525. v. Tab. 25. fig. 1.—This shrub attains a height of about eight to ten feet, and is common at 6,500 feet

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* Though not essential to the above attempt at proving the strong probability of a successful cultivation of tea in the northern parts of India, it will render it more complete to add a short account of the cares which are bestowed on the cultivation and subsequent preparation. These appear to be few and simple. The month of February is said to be the usual time for sowing the seeds. Siebold, however, states (and from the oiliness of the seeds most likely very correctly) that they should be sown in autumn. Several are dropped into a hole a few inches deep, which are in rows from four to five feet asunder. The seeds come up easily, and the plants require little subsequent culture, except keeping them free from weeds, which must also be useful in stirring the soil. When the plants are three years old, the first crop of leaves is gathered; and when three or four years older, they are cut down to encourage the production of fresh shoots, which abound more than the old in leaves. In the province of Kiangnan, the green-tea plant is kept low by pruning; but in the black-tea country the plant is allowed to attain its full height. The leaves are usually gathered singly; first in March, when the young leaves are scarcely expanded; the second in May and June; and the third in August. But authors vary in their accounts of the numbers and the seasons of the crops; and differences must necessarily exist according to the nature of the crop which is desired, as well as according to the climate in which it is grown; though many of the varieties are known to be produced by mixtures at Canton. When the tea-leaves

6,500 feet of elevation on the Mussooree range. The *leaves* are thick, coriaceous, finely serrate and smooth, the younger ones hairy. The *flowers*, owing to the early fall of the leaves from the lower parts of the branches, appear to be lateral, but actually arise from the axillæ of the fallen leaves, either solitary or 2-3-fascicled, short peduncled, supported by two small *bracteæ* (f. *b*), which are of the form and consistence of the sepals, but smaller. *Sepals* (*a*) 5, imbricate, unequal in size, coriaceous, the three inner the largest, rounded, ciliate, concave, and covered with a few hairs on the inside, one or two of them sometimes bifid. *Petals* (*c*) five, conjoined at the base, short and rounded at the apex, two exterior, larger. *Stamens* about fifteen in number, inserted into the receptacle; *anthers* (*f*) adnate, point of filament projecting beyond the two lobes, which are placed on the opposite sides of the oblong *connectivum*, and open laterally by a longitudinal slit. *Pistil* none. In the female flowers, the *calyx* and *corolla*, as in the male. *Ovary* ovate. *Styles* 3, very short, spreading. *Stigma* simple. *Capsule* (*d* and *e*) 3-celled. *Seeds* flattish, triangular, numerous, suspended by a long funicle from an axillary placenta.

30. OLACINEÆ.

The place of this small order in the natural series is uncertain. By M. De Candolle it is placed next *Aurantiaceæ*, to which it has some affinities. By Mr. Brown it has been shewn, that in possessing a unilocular ovarium, with a central columnar placenta, at the top of which three pendulous ovules are inserted, *Olax* is allied to *Santalaceæ*; but to this it has been objected, as originally stated by Mr. Brown himself, the double floral envelope and ovarium superum of *Olax*, which is opposed to the simple perianthium and ovarium inferum in *Santalaceæ*. Of this family there are several species belonging to the genus from which the order is named. The Indian species extend from Ceylon up to Monghir, and from Silhet along the foot and within the valleys of the Himalaya to the most northern portion of the British territories. *Olax scandens* and *zeylanica* do not extend, the former beyond Rajmahl, and the latter the Peninsula. *O. nana*, allied in structure to them, was first found by Dr. Hamilton at Gorakpore. I have seen it in large quantities on the banks of the Tonse and Jumna, within the mountains, and beyond 31° of northern latitude. A species of the genus was found on the Congo, and the remainder referred by Labillardiere to the genus *Spermaxyrum*, in New Holland. *Ximenia* is found

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leaves are gathered, they are cured in houses which contain small furnaces about three feet high, on each of which there is a large flat iron pan. Upon this, when heated, a few pounds of the fresh-gathered leaves are thrown. These crackle, and require frequent shifting. When all become properly roasted, they are thrown out with a shovel upon mats before the rollers, who, taking small quantities at a time, roll them in the palms of their hands in one direction, while others are fanning them, that they may cool the more speedily, and retain their curl. This process is said to be repeated two or three times, and should, in the first instance, on making any experiments on the subject, be intrusted to Chinese, who have been accustomed to the process; as was done in both Penang and Rio Janeiro: and there would be no difficulty in getting some of the numerous Chinese, who migrate to almost every part of Asia, to accept employment in the northern provinces of India. With a little scientific attention in the choice of a suitable climate and soil for the growth of the plant, and the application of practical experience in the preparation of the leaf, there can be but little doubt, after the details we have entered into, with respect to the successful issue of an experiment, which need not be very expensive, if not commenced on too large a scale.

found in the warm parts of America and Jamaica; and one species, *X. Russeliana*, in the Peninsula of India. The rest of the order is found in Africa and its islands. A genus, common to Africa and Guiana, affords *Heisteria coccinea*, the partridge wood of cabinet-makers, imported from Martinique.

31. AURANTIACEÆ.

This family, well known from containing oranges, lemons, and limes, is remarkable for the dotted appearance of all parts of the plants, in consequence of their abounding in little cells filled with volatile, frequently highly fragrant oil. The order is allied, on one hand, to *Amyrideæ*, and on the other to some *Rutaceæ*, and is almost entirely confined to India and China, where all the genera are found in some part or other of their widely-extended territories; with some species only spreading into the islands of the Indian Archipelago, and a few into Java, and some even as far south as Madagascar. The genera *Atalantia* and *Triphasia* are found only in the southern parts; but *Bergera*, *Glycosmis*, *Feronia*, *Ægle*, *Limonia*, *Murraya*, and *Citrus*, also in the most northern parts of India. The three last, with *Triphasia*, are common to it and China. *Feronia elephantum* and *Ægle marmelos*, are found every where in the plains; but *Murraya exotica*, *Bergera Kœnigii*, *Limonia crenulata*, and *Glycosmis pentaphylla*, extend in the jungly tract along the foot of the Himalaya, nearly as far north as the banks of the Sutlej.

So great a diversity of opinion being entertained respecting the different plants of the genus *Citrus*, whether they should constitute species or varieties, it becomes difficult to say what are such, if only seen in a state of cultivation; but as some are still found wild, an opinion may be formed, at least respecting those. In the tract of forest so frequently alluded to, as well as in the valleys within the Himalaya, I have seen two plants growing apparently wild, one called *bijouree*, and the other *biharee nimboo*; the first having the characteristics of the *citron*, and the other, called also *puharee kaguzee*, those of the *lemon*: both when transferred to gardens retain their peculiar characters. From the Rungpore forests a round kind of lime is obtained: in those of Silhet, and as it is stated also on the sides of the Neelgherries, the orange is found wild. Captain Turner describes the oranges as delicious, and Mr. Saunders, who accompanied him, mentions finding many orange and lime-trees at the foot of the hills in approaching Buxedwar (v. Turner's Tibet, p. 20 and p. 387). *Citrus decumanus*, Shaddock or *Pompelmoes*, does not appear indigenous to India, as its name, *batavi nimboo* or *Batavia lime*, denotes, as remarked by Dr. Roxburgh, its being an exotic; and as it retains its characteristics even where it does not succeed as a fruit, it may also be reckoned a distinct species. I therefore feel inclined to consider as distinct species, the orange, lemon, lime, citron, and shaddock, without being able to say whether the sweet kinds should be considered varieties of the acid, or ranked as distinct species.

One thing remarkable in the orange tribe is, that though a tropical genus, it ripens its fruit only in the winter months; and has thus probably been enabled to travel from

India to the southern shores of Europe, and find a congenial climate in the equable and temperate climate of the Azores. In confirmation of their being natives of India, it may be adduced, that the Asiatic names of the orange are, in Sanscrit, *Nagrunga;* Hind. *Narungee;* Arab. *Narunj;* and of the lemon, Sans. *Nimbooka;* Beng. *neeboo;* Hind. *neemoo, leemoo, leemboo.* It is further worthy of notice, that the Persian and Arabian authors do not, as is their wont, give any Greek synonyme of either, but of the citron, which is supposed to have been known to the Romans; they say that *marseeska* مارسيسقا is the Yoonanee, and *atrogha* اطروغا the Syrian name, neither of which have I been able to trace. The Sanscrit name of the citron is *Beejapoora,* the Arabic *ooturuj,* and the Persian *toorunj.* By the latter it is also known in the northern provinces of India.

Limonia laureola, figured by Dr. Wallich (*Pl. As. Rar.* t. 245), is remarkable, as the only plant of this family, found on the tops of cold and lofty mountains, where it is for some months of the year buried under the snow. The Hill people call it *kidar-patri* and *kuthar-chara,* and fancy that it is by feeding on its leaves that the musk acquires its peculiar flavour. As the leaves are highly fragrant, they are, like others of a similar kind, employed in the religious ceremonies of the inhabitants of the hills.

The wood of many of the orange tribe is hard, compact, and durable; that of *Feronia elephantum* attains a considerable size, and a gum exudes from the tree. Most of this family abound in stimulant essential oil: the pulp of the fruit of many is sweet, and of others acid, yielding abundance of citric acid. In addition to those commonly known as yielding edible fruit, the Chinese wampee, *Cookia punctata,* may be mentioned, as well as *Ægle marmelos* and *Feronia elephantum, Glycosmis citrifolia, Triphasia trifoliata,* and *Limonia pentaphylla.* The astringent rind of the fruit of *Ægle marmelos, bel* of the Hindoos, is used in dyeing yellow, while the glutinous and tenacious matter which surrounds the seeds is considered an excellent addition to mortar, especially in well-building. *Bergera Kœnigii* is cultivated near villages, as its leaves are considered in the northern, as in the southern provinces, a pleasant addition to curries and other dishes in use among the natives of India.

32. HYPERICINEÆ.

This order is of very extensive distribution, particularly with respect to the genus *Hypericum,* which is found in most parts of the world. In the Himalayas, where about fifteen species have been discovered, it is met with at very different elevations, as well as on the mountains of the Peninsula. *H. cernuum,* Roxb. (*H. speciosum,* Wall.) of which the seeds were originally procured by General Hardwicke in the neighbourhood of Hurdwar and Sireenuggur, is very nearly allied to *H. chinense.* It is met with in Nepal and Kemaon, and in the hills above the Deyra Doon, at 3,000 feet of elevation, where the heat is considerable at the hottest time of the year; while the species *H. uralum, elodeoides,* and *lysimachioides,* are found on the tops of the mountains; the last only on the highest, as Kedarkanta, with *H. Japonicum* and *perforatum,* where the snow covers the soil for nearly six months in the year. The last, found in most parts of the world,

world, is also common in many parts in the Himalayas and in Cashmere: the former, found originally in Japan, has a most extensive distribution along the Himalayas from Silhet to Sirmore, and also on the Neelgherries. *H. patulum* is another plant common to Japan and Nepal, from which *H. oblongifolium* does not appear to me to differ. Two new species, both from the Mussooree range, may be added to those already enumerated as Himalayan plants: *H. debile*, which is allied to, and may be a variety of *H. perforatum;* and *H. coriaceum*, which resembles *H. lysimachioides*, of which the leaves are like those of the *rouns* or *Cotoneaster acuminatum*.

In the soft parts of many of this tribe being covered with dotted glands, which contain a fragrant oil, this family resembles *Aurantiaceæ;* and in secreting a yellow juice, the *Guttiferæ;* to which, moreover, it is in many points of structure closely allied. In the European species, this yellow juice being in small proportion to the essential oil and the rest of the vegetable matter, they have been used as tonics and astringents. *H. perforatum* and *H. Androsæmum*, in use in the earliest times, are referred to by Persian authors under the name *hoofarikoon*, corrupted from the Greek. The former we have seen is common in the Himalayas, and is available, if necessary, for the Indian Materia Medica.

Some of the American species of this order are possessed of more copious yellow juice, and more energetic properties; that obtained from *Vismia Guianensis*, a Mexican and Surinam tree, is known in commerce, and called American *Gummi Gutta*. Some of the more remarkable arborescent species of this order from the south of India, and from Penang and Singapore, may possess similar properties; but they are, of course, less valuable where the original and more energetic gamboge is so easily procurable.

Hypericum Japonicum; D.C. Prod. 1. p. 538.—Thunb. *Fl. Japonica*, p. 295. t. 31.—Wall. Cat. E. I. Herb. N. 4,871. v. Tab. 24. f. 2. (*a*) Flower seen from above. (*b*) Do. from below. (*c*) Capsule with persistent calyx and withered corol.—This plant, enjoying a very extended distribution, as above-mentioned, is subject to considerable variation in appearance, as may be seen in the E. I. Herbarium. It is frequently long, slender, and straggling; but the specimens I have met with are short, erect or ascending, frequently dichotomous. *Stems* 4-cornered, leafy. *Leaves* shorter than internodia, opposite, oval, entire, half embracing the stem. *Flowers* single in axillæ of leaves or terminal, short peduncled, yellow, withering. *Bracts* leaflike. *Sepals* 5, oval, acute, dotted, straight-veined, erect, persistent, *Petals* 5, oval-oblong, nearly equal to the sepals, light yellow, of delicate texture, 3 or 5 parallel-veined; in dried specimens rolled up at the apex, so as to appear much shorter than the calyx. *Styles* 3, spreading. *Capsules* 3-celled; cells many seeded. *Seeds* ovoid.

33. GUTTIFERÆ.

This family, named from many of the species producing the yellow gum-resinous juice, resembling gamboge, which was formerly called *gummi gutta*, is strictly a tropical order, and abundant in the Malayan Peninsula and islands to the eastward of the bay of Bengal. A few species are found in Ceylon and the Peninsula of India, as *Calophyllum inophyllum* and *spurium*, *Mesua ferrea*, *Xanthochymus pictorius* and *ovalifolius*, *Garcinia cambogia*, *zeylanica* and *pictoria*, the last from the higher parts of Wynaad, where, as Dr. Roxburgh remarks, there is constant moisture from fogs during the dry

season, and abundant rains during the wet. Species of all the Indian genera, as above enumerated, are also found in Silhet, whence they extend a little further northward along the tract of forest. *Garcinia cowa* was found by Dr. Hamilton at Monghir, and *Mesua speciosa* by Dr. Wallich in Nepal; but there we know there are valleys with a tropical vegetation, where the heat is great, and the moisture considerable. The effects of culture and of an artificial climate have been mentioned at p. 6, where it has been shewn that one of the *Guttiferæ* can exist even so far north as Delhi, in 28° of N. latitude, when no other species are known to grow nearer than 4° further south. This is *Xanthochymus pictorius*, the *dephul* of the natives; but *X. dulcis*, which it closely resembles in foliage, has been inadvertently mentioned: the same reasoning will, however, equally apply to both species. The greater portion, however, of the genera belonging to this order is not found in India, though the species are numerous; but in the West Indies and warm parts of South America, as well as in Madagascar, where the approximation in climate is greatest to the Malayan and Indian Peninsulas, as well as to the climate of Chittagong and Silhet. The *Guttiferæ* are in some points related to the *Ebenaceæ*, as may be seen by comparing species of *Garcinia* with some species of *Diospyros*.

The natural method is in no point better calculated to display its advantages to the general observer, than in the fact that the properties or products of the same parts of the plants of a family have in general the closest resemblance to one another; and though anomalies present themselves, yet these appear more numerous than they are likely to do, because from the little investigation that plants were formerly subjected to, we are not yet acquainted with all the anomalies of structure. This possession of similar properties is strikingly exemplified in so many plants of this family producing a resinous exudation, which is similar in both physical and medical properties to gamboge, *ossareh-rewund*, rhubarb-juice of Persian authors. This has long been known as a pigment and as a drastic purgative, introduced by Clusius, for which we are indebted to the East; but the tree has not been well ascertained, probably in consequence of so many of the family yielding a similar product. Two kinds are known in Indian bazars; one, the best, is the produce of Siam: this is in rolls, having been apparently rolled or cast in moulds when in a soft state: it is solid and compact in texture, and forms the best pigment. It is supposed to be procured from *Stalagmitis Cambogioides*, a plant which, according to Dr. Wight and Mr. Arnott, is a species of the genus *Garcinia*, and probably identical with *G. cochinchinensis*. The other kind, in smaller pieces, granular, brittle, less valued as a colour, and less effective as a purgative, is the produce of Ceylon. This, there can be little doubt, is the produce of *Xanthochymus ovalifolius*, the only plant in Ceylon (W. and A.) that yields a gamboge fit for the arts; an indifferent kind is also yielded by *X. pictorius*. *Garcinia zeylanica*, *cowa*, *cornea*, and *pictoria*, all yield, like most plants of this order, an inferior kind of gamboge. The last, originally sent by Mr. Dyer, surgeon, at Tellicherry, to Dr. Roxburgh, who found it, even in its crude unprepared state, superior in colour while recent to every other kind, but not so permanent as that from Siam. (*Fl. Ind.* 2. p. 629.)

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It is not contrary to natural analogies to find different kinds of juices secreted in different parts of the plants of the same family. Thus we find the mangosteen, the most delicious of fruits, according to the concurrent testimony of travellers, is afforded by one of the *Guttiferæ*. This, the *Garcinia mangostana*, is confined to the Malayan Peninsula, and the islands to the eastward of the bay of Bengal, which form the *India aquosa* of old authors as quoted by Dr. Jack; but is so local in its habits as to have resisted all Dr. Roxburgh's attempts, repeated through a course of thirty-five years, to get it to thrive, no further north than 23½° of latitude. Other species yield an edible, but less palatable fruit, as *G. cowa, lanceæfolia, kydia*, and *paniculata*, the last is most like the mangosteen. *G. pedunculata*, yields an acid fruit (*Roxb.* 2. p. 626); *Xanthochymus dulcis, pictorius*, and *ovalifolius*, that which is edible. Many would no doubt afford useful timber, as *Calophyllum angustifolium* yields the straight spars called *peon*, at Penang, and in the islands to the eastward of the bay of Bengal. The blossoms of *Mæsua ferrea* are to be found in a dried state in every bazar, under the name *nag-kesur*, being used in medicine, as well as esteemed for their fragrance. The seeds of *Calophyllum inophyllum* yield an oil, and a resin exudes from the roots, which is supposed by some authors to be the same as the *Tacamahaca* of the Isle of Bourbon.

34. HIPPOCRATEACEÆ.

This small order is placed by M. De Candolle between *Marcgraviaceæ* and *Erythroxyleæ*. By Mr. Brown it was shewn to be in some important respects allied to *Celastrineæ*, which some of the species also resemble in general appearance. It is chiefly found in the warm parts of America, and also in Africa. In India it is found in the Peninsula, whence one species, *Hippocratea indica* (*Roxb. Corom.* t. 130) extends up into Bengal as far as the prolongation of the central range of mountains at Monghyr; while *H. arborea* (*Roxb. Corom.* t. 205) is found at the foot of the mountains on the N.E. frontier, as Silhet, Morung, Tipperah, and Chittagong. The genus *Salacia*, to which *Johnia* of Roxburgh has been referred in Dr. Wallich's Catalogue, has a similar distribution, with one species from Nepal, probably from the low forests or warm valleys, whence they extend downwards along the N.E. frontier, to the Burmese territories and the Malayan Peninsula. I have not met with any of the species in the northern parts of India.

35. ERYTHROXYLEÆ.

The *Erythroxyleæ* form a small order separated from *Malpighiaceæ*, to which they are, however, considered by Mr. Brown to be closely allied. They are distributed in South America and the West Indies, and some species are found in Madagascar and the islands of Mauritius and Bourbon. One, the only species of the genus *Sethia*, has been found in India, and this only in the Peninsula up to the Circar mountains. This, *S. indica*, D.C., is the *Erythroxylum monogynum* of Roxburgh. Another species from Silhet has been referred, with doubt, by Dr. Wallich, to this order.

36. MALPIGHIACEÆ.

This order, named from an American genus, is nearly confined to that quarter of the globe,

globe, as out of about 200 species only fifteen are found in India and the Burmese territories, about half as many in Java, only one in China, Arabia, and the Cape of Good Hope; a few in the equinoctial parts of Africa and the island of Madagascar. *Niota* is referred by M. Ad. de Jussieu to *Simaroubeæ*;* but Dr. Wallich has added a new genus, *Ancistrocladus*, of which four species have been discovered, distributed from Penang up to Pundua. Of *A. extensus* there is a figure, No. 1,264, among Dr. Wallich's collection of the East-India Company's unpublished drawings. A new genus, *Platynema*, has been formed by Messrs. Wight and Arnott, of *Gærtnera laurifolia*, found in the Indian Peninsula. The only genera found in every part of India, and these both climbers, are *Hiptage* and *Hiræa*. The former, common to India and China, and the latter chiefly found in the warm parts of America; with a few species in Java, and one at the Cape of Good Hope. *Hiptage Madablota* extends from the Peninsula up the foot of the Himalaya to the warm valley of Noakote, in Nepal, and as far north as the Deyra Doon, and other valleys within the Himalaya, where it climbs to the tops of lofty trees, and may frequently be seen, with its racemes of elegantly-fringed white flowers, delicately tinged with pink and yellow, covering the saul-tree, or *Shorea robusta*, the winged-seed vessels of which, those of this plant much resemble in external appearance The Chinese species, *H. obtusifolia*, is perfectly naturalized in the gardens of Northern India. *Hiræa nutans*, from which *H. lanuginosa* (Wall. No. 1,058) does not appear to me to differ, is similar in its distribution and habit, though a more humble climber. *H. indica* is confined to the Peninsula and the province of Silhet; while other species extend along the Burmese territories to more southern latitudes. I have not learnt that any of the Indian species are applied to any use, nor are the properties of the plants of this tribe well known; but the fruit of some species of *Malpighia* is eaten in the West Indies, and called Barbadoes cherry.

37. ACERINEÆ.

This order, named from so common and well-known a genus as that which contains the maple and sycamore, indicates that some at least of its species require a temperate climate. But all are found in such, in Europe, North America, Taurus, Tatary, and Japan. And as none in other countries extend to southern latitudes, so we are without them in the plains of India, and also on the Neelgherries. But immediately we commence ascending the Himalayas, either in Nepal or Sirmore, we meet with species of this family, especially of the genus *Acer*. Of this seven new species have been discovered in these mountains, of which *A. oblongum* is that which descends to the lowest level, being found in Nepal and further north in the Deyra Doon, between 2,000 and 3,000 feet of elevation. *Acer cultratum* is found at 6,500 feet on the Mussooree range, and at similar heights in Sirmore and Gurhwal, while *A. caudatum* (Wall. Pl. As. Rar. t. 132, and *A. acuminatum*? Don) *sterculiaceum* and *villosum*, are only seen with pines and birches on

* Vol. ii. p. 4.

on the loftiest mountains, which are for many months covered with snow. *A. sterculiaceum* (Wall. Pl. As. Rar. t. 105) is closely allied to *A. villosum*, which differs but little from *A. pseudo-platanus*, or sycamore; and as this affords timber which, from being light and tough, is much used by turners, and for making the trees of saddles, so it is probable that both the Himalayan species would answer equally well for the same purposes. The wood of *A. cultratum* is white, light and fine-grained, and might be turned to the same uses as that of the maple, which is esteemed by turners, and also occasionally for making gun-stocks. *A. caudatum* is also found in Kunawur, and *A. sterculiaceum* extends to Cashmere. Though this family contains only another genus, *Negundo*, which has been separated from *Acer*, a new one, *Dobinæa*, has been discovered in Nepal by Dr. Hamilton; and is distinguished, according to Mr. Don, by its monœcious flowers, companulate 4-toothed calyx, with the eight stamens united into a column round the sterile style. It is only a shrub of six feet in height, but judging from the dried specimens, it must, when in flower, have a very light and elegant appearance.

Acer oblongum and *Negundo fraxinifolium*, the latter a native of North America, from which sugar is said to be made, succeed remarkably well in the plains of Northern India; and there is no doubt that *Acer saccharinum*, or sugar maple, would succeed equally well in the valleys and slopes of the Himalaya, if it should be thought worthy of being introduced; and it might be a valuable gift to the people of the Hills, who are often too poor to buy sugar, and cannot grow the cane.

38. HIPPOCASTANEÆ.

The few plants which compose this order are confined to the temperate parts of North America, and mountainous parts of Asia. The native country of *Æsculus Hippocastanum*, or the common horse chestnut, is yet unknown, though stated in some works to be the north of India, but it is not enumerated in Dr. Wallich's Catalogue, nor has it ever been distributed by him. I have never met with it, though often visiting the lofty mountains of Northern India, where, if any where, it was likely to be found, and where the nearly allied Indian *Pavia* is so abundant. The genus *Pavia*, common to North America and the Himalayas, frequently included in *Æsculus*, is distinguished from it by the surface of its fruit being destitute of the spines with which that of the horse chestnut is covered. *Pavia indica*, or Indian horse chestnut, called by the Hill people *kunour* and *pangla*, is found on mountains at elevations of from 8,000 to 10,000 feet in Kemaon, Gurhwal, and Sirmore; also near the sources of the Ganges and in Kunawur. It is a lofty and not less ornamental tree than the common horse chestnut. The bulky seed of this species containing a large proportion of fæcula, though combined with some bitter principle, is eaten in the Himalayas, as those of the horse chestnut have been in other parts of the world, in times of famine. The bark of the latter, from its astringent properties, being employed as a tonic and febrifuge, it is worthy of inquiry whether the Himalayan species of *Pavia* is possessed of any of the same properties.

39. SAPINDACEÆ.

This order, named from the genus of which the fruit is remarkable for its saponaceous properties, is almost entirely confined to the equinoctial parts, both of the Old and of the New World. Thus the greater number of the species and genera are found in the West Indies, in Mexico, and the warm parts of South America; a few of them in Africa, and in the islands of Madagascar, Bourbon, and Mauritius, whence we trace them into the Indian Archipelago and the Malayan and Indian Peninsulas. In the southern parts of India they are abundant, and a few of them extend into China.

It has been remarked, that as the *Sapindaceæ* come near to *Meliaceæ*, so they resemble them in habit and in their pinnated leaves, and thus dried specimens of the two orders are apt to get mixed together, of which an instance occurs in the unadjusted portion of the East-Indian Herbarium, where some of the *Meliaceæ*, as well as species of *Millingtonia*, have got intermingled with the *Sapindaceæ:* and as there is also resemblance between these and some of the *Terebinthaceæ*, so some of the species of *Millingtonia*, closely allied to the former, were found among the roughly-adjusted portion of the latter. *Odina wodier* resembles some genera of *Sapindaceæ* in a few points of structure, as well as in general appearance, when seen in a dried state.

In India are found species of the genera *Cardiospermum, Sapindus, Schmidelia, Cupania, Melicocca,* and *Dodonæa,* all of which are also found in the warm parts of America. The last also extends from the islands of Ceylon and Bourbon to New Holland. *Harpullia* is a new genus, formed by Dr. Roxburgh, of a tree found in Chittagong, which is allied to *Cupania,* and comes near *Tina.* (*Fl. Ind. ed Wall.* 2. p. 442.) The genus *Euphoria* is common to India and China, several species having been found in the district of Silhet; and even the Chinese fruit, *E. Longan,* Dr. Roxburgh mentions being indigenous in the mountainous country which forms the eastern frontier of Bengal, as well as cultivated in China. Specimens of it may be seen in the East-Indian Herbarium, procured by Dr. Wallich from the same tract of country, where the fruit is eaten, and called *gooloom.* Dr. Roxburgh also states having had specimens even of the *Li-chi* sent him from old trees growing on the Garrow mountains, when the trees in Bengal were but small. The genus *Pierardia,* of which *P. sapida* affords an edible fruit in Tippera, to the east of Calcutta, and *P. dulcis,* in the Malayan Peninsula, would appear also to be cultivated in China, as Dr. R. was informed by his Chinese gardeners, that *P. sapida, lutco* of the Hindoos, is also a native of their country, where it is called *Lutqua,* and is cultivated for its agreeable fruit. With the exception of *Cupania* and *Dodonæa,* which seem restricted to the Peninsula, all the above genera are found in Silhet and the neighbouring districts, which would appear to be the head-quarters of this family in India. Here there is also a new genus, *Cardiopteris* of Dr. Wallich, referred by him to the section *Paullinieæ,* of which the greater proportion are natives of America. This, in its climbing habit and lobed leaves, somewhat resembles a Bryony, but has a winged fruit something like a *Hiræa.* This was called *Sioja sanguinaria* by Dr. Hamilton, and first

first found by him at Goalpara, specimens of, apparently, the same species were procured by Dr. Wallich from Silhet and from Ava.

The species of this family in Dr. Roxburgh's *Flora Indica* are thirty in number, in which are included a few from the countries to the eastward of India. More than twice as many are enumerated in the unadjusted *Sapindaceæ* of the East-Indian Herbarium; but among these are necessarily included many of the described species, while others are probably only varieties, as are some, perhaps, of Dr. Roxburgh's species; but, of these, without having an opportunity of seeing their habits in the living state in addition to their appearance in a dried one, I am unwilling to suppress any, from the care and acuteness which he usually displayed in the elucidation of species. It is seldom that any botanist enjoys the opportunities of Dr. Roxburgh, who, after studying the botany of the Peninsula, was transferred to the Calcutta Garden and the tropical riches of the eastern frontier of Bengal.

The only genera which are found over all parts of India are, *Cardiospermum*, *Sapindus*, and *Melicocca*. Of the first, the species *C. Halicacabum*, which extends also into Arabia, is found in every part of India. Of *Sapindus*, though so tropical a genus, we find a species, *S. acuminatus*, in the most northern parts of India, having been found by Dr. Wallich in Silhet, at Bechiaco on the entrance into Nepal, and by myself, attaining a great size on the banks of rivers in the valleys within the Himalaya in 30½° N. latitude. *Melicocca trijuga* (*Schleichera*, Roxb.) is found in similar situations, being common at the foot of the hills in the Deyra Doon, and also in the most southern parts, as well as in the Peninsula. The species of *Schmidelia* (*Ornitrophe*, Roxb.) do not extend northwards, though common in Silhet, and southwards in the Malayan as well as in the Indian Peninsula. *Allophyllus ternatus* (*Roxb. Fl. Ind.* 2. p. 263), of which there is a specimen in the East-Indian Herbarium under Dr. Roxburgh's first name, *A. ornitrophioides*, appears from the characters which he gives of the genus, to be distinct from *Schmidelia*. The species of *Dodonæa* seem to be entirely confined to the Peninsula.

The *Sapindaceæ* having been divided into sections on account of differences in botanical structure, a like difference is observed in the properties of the plants belonging to the respective sections. Thus, of the *Dodonæa*, *Magonia pubescens* and *glabrata*, according to M. A. St. Hilaire, are, like some of the *Paullineæ* which are acrid and narcotic, used as *Paullinia pinnata* for stupifying fish. *Seriana triternata* is employed for the same purpose. *Paullinia australis*, and some other species of the genus, are said to be poisonous; and *P. cupania* Humb. is used for making an intoxicating liquor. *P. subrotunda* is an exception, in furnishing, like so many of the following section, an edible aril. Of these, the *Sapindeæ*, the species of the genus *Sapindus*, are remarkable for so many of them being used as a substitute for soap. Thus, in America, the *S. Saponaria*, and in Java *S. Rarak*, and in India *S. acuminatus*, *laurifolius*, *emarginatus* and *detergens* (the last, according to Dr. Roxburgh, nearly allied to *S. Saponaria*,) are all used for the purposes of soap; owing, it is now ascertained, to the presence of the vegetable principle

ciple called *saponine.* This has been traced in many other vegetables, which have the property of forming a lather with water, or as Messrs. Merat and De Lens express it, "dans toutes les plantes blanchissantes." In some recent works, as in the excellent one of M. Fée, it is stated, in speaking of the soap-berry, that "les fruits ont une chair "huileuse dans laquelle la potasse abonde;" reference is at the same time made to *Raffles' Java,* where it is mentioned, that these berries have been analysed, and the constituent principles of the best soap obtained. The root and bark of many species are also said to be saponaceous. The exact nature of this principle might be advantageously investigated by chemists favourably situated in the native countries of the plants, and the nature of the changes ascertained which takes place from the unripe and acrid, to the bland and saponaceous ripe fruit.

The subject is interesting, as so many of this section afford edible fruit; and our ignorance of the exact constituents may sometimes induce us to adduce as exceptions to the rule of the properties of plants being in conformity to their structure, that which may be only a confirmation. Thus even some of this genus, as *Sapindus esculentus* and *senegalensis,* yield edible fruit. That of *Euphoria Li-chi* is one of the most delicious and delicate-flavoured of the East, and though a native of China, would succeed well in most parts of India, as it does so in Calcutta, and also in the Botanic Garden at Saharunpore. *E. Longan* and *Nephelium,* the Rambootan of the Malayan Archipelago, yield edible fruits; as well as *E. rimosa* and *rubra,* both inhabitants of the Silhet district, which are eaten by the natives of that district; so are those of *Melicocca trijuga,* called even in the distant parts of India, where this tree is indigenous, *kusoombha* and *guosum,* and where, as in the Doon in April, it may be readily recognised at a distance by the red colour of its young leaves. All its parts of fructification are liable to considerable variation. The pulpy subacid aril, as Dr. Roxburgh remarks, forms a grateful fruit; the wood is hard and used as timber. *Schmidelia serrata,* of which the root is said to be astringent, yields also an edible fruit. The wood of several species is close grained and hard, and forms valuable timber, as of *Sapindus rubiginosus,* and of *Euphoria Longan* and *Li-chi;* the latter also one of the most ornamental of trees. The edible fruit of the Indian and Malayan species (*P. sativa* and *dulcis*) of *Pierardia,* a genus referred by M. Blume to *Euphorbiaceæ,* has been already mentioned. The latter, Dr. Jack is of opinion, consists of two varieties; the *Rambeh,* of which Mr. Marsden has given a figure in his History of Sumatra, pl. vi. p. 101, belonging to the peninsula of Malacca, but unknown at Bencoolen; while the *Choopa,* from which Dr. Jack has described the species, is abundant at the latter place, but not found in the former. To this genus is nearly allied, as Dr. Jack states (*Lin. Trans.* xiv. p. 118), his *Hedycarpus;* of which the only species, *H. Malayanus,* yields the *Tampui,* a fruit ranking in point of taste and flavour along with the *Lanseh.* This, belonging to the genus *Lansium* of Jack (l. c. p. 115) is closely allied to *Milnea* of Roxburgh, also yielding an edible fruit, and both belonging to the *Meliaceæ,* and in many respects resembling *Pierardia,* and shewing the connection between the two families.

Sapindus

Sapindus acuminatus (Wall. MSS. E. I. Herb.); rachi foliorum angustissime marginata, foliolis 5-6-jugis oblique lanceolatis acuminatis lucidis suboppositis breve petiolatis, unico breviore terminali; panicula ramosissima terminali.—HAB. Deyra Doon and other valleys within the Himalaya, flowering in May; also at Bechiaco, in the entrance to Nepal and at Silhet: the native name *reetha*. Fruit used for the same purposes as the soap berries of the West Indies and South America.

40. MILLINGTONIACEÆ.

Dr. Roxburgh having found it necessary to deprive the late Sir S. Millington of the genus assigned to his memory, in consequence of ascertaining the only species thereof to be a true *Bignonia*, restored the name to the system by assigning it to two timber-trees, which at that time, as he expresses himself (Fl. Ind. i. p. 102), "constituted this strongly-marked family," of which one species, *M. simplicifolia*, was figured in t. 254 of his Coromandel plants; and with it, another species described in the *Flora Indica*. In 1824 Dr. Wallich sent to England what he considered three more species; *M. dillenifolia*, *pungens*, and *integrifolia*; of these the two last appear to me identical, as no great reliance can be placed on the entireness of the leaves, as some with entire and spinulose margins may occasionally be seen on the same specimen. *M. pinnata* was procured from Silhet; *M. simplicifolia* and *pungens* from that district, and the entrance into Nepal; the two last were also found by Dr. Wight; the first on the Neelgherries, and the second on the mountains of Madura. *M. dillenifolia* Dr. Wallich obtained from Chundraghiry, and other elevated mountains in Nepal. The trees I have met with belong to Dr. Wallich's two species, *M. dillenifolia* and *pungens*: the former found about Dhunoultee and Simla, between 6,000 and 7,000 feet of elevation; and *M. pungens* is common about the rivers below both the Mussooree and Suen ranges. To this is allied another tree found in the valley about Mugra, which I have called *M. acuminata*, but it may be only a variety of *M. pungens*.

This genus, therefore, consisting of four or five species, is spread over a considerable extent of territory from 10° to 31½° of northern latitude, or from the Neelgherries and Madura, along Silhet and the foot of Nepal to Mussooree and Simla; and has been formed into an order, and an excellent account given by Messrs. Wight and Arnott in Jameson's Journal for July 1833, p. 178; at which time they state (Prod. Fl. Indiæ Penins. p. 115) they had not seen the similar remarks made by Jack (Mal. Misc. 2. p. 32). The authors observe, that the habit of the *Millingtonias* is much that of *Semecarpus mangifera* and *Buchanania*: it may be added, that in inflorescence they also resemble the mango. In some of the species, extending to a considerable elevation in the Himalayas, they also resemble some of the *Terebinthaceæ*; but Dr. Hooker having suggested an affinity with *Sapindaceæ*, the authors see little objection to its forming the type of a new order next them.

41. MELIACEÆ.

The *Meliaceæ*, it has been observed, are closely allied to *Sapindaceæ*; and it has been further remarked by M. Adrien de Jussieu, in his excellent memoir on the former

order, that the genus from which the latter takes its name, presents a disk or short annular tube, situated between the petals and stamens; which if elongated to the height of the stamens, and united with the filaments applied on its surface, would afford a counterpart of the staminal apparatus of the *Meliaceæ*. M. Ad. Jussieu further remarks, that they are moreover allied in the number, as well as in the relative situation of the parts of the flower, and the structure of the seeds is absolutely that of the *Trichilieæ*, or the largest group of *Meliaceæ*. The resemblance in habit is considerable, as already mentioned under *Sapindaceæ:* the edible fruit afforded by so many species of the latter, is also produced by some of the *Meliaceæ*, as by *Lanseh* (*Marsden's Sumatra*, v. p. 101), and by *Lansium montanum*, the characters of which, Dr. Jack remarks, coincide very nearly with those of *Milnea edulis*; the large succulent, lucid, and edible aril of which is compared by Dr. Roxburgh to that of the *Li-chi*. From this resemblance in so many points, and their affording conjointly the variety of highly-esteemed fruits, which, as Dr. Jack remarks, may be considered peculiar to the Malayan Archipelago, one is induced to wish to see them in the same natural order; but it has been observed by M. Ad. Jussieu, that in classification, *Monadelphia*, or the union of stamens, appears to him of consequence, particularly as so much importance is attached to the union of the several pieces which compose the corolla.

The *Meliaceæ* being a family found chiefly in the equinoctial parts of the world, may be expected in the plains and southern provinces of India, but not as forming a portion of the Flora of the Himalayas. M. A. Jussieu has remarked that they are found in equal numbers in America and Asia, but only about one-fourth the number in Africa; though this may be owing to the less perfect investigation of that continent. They extend in the two hemispheres beyond 40° of latitude, as *Melia Azedarach* is naturalized in Provence, a *Cedrela* is found near Pekin, and a *Hartighsea* in New Zealand. But these isolated species become more and more numerous as we approach the tropics, between which they have their maxima of numbers. In the most northern parts of India we have three genera and five species, of which one at least seems to have been introduced from Persia, and the others are common either in the plains of India, or occur in the belt of the tropical forest which girds the base of the Himalaya. As we proceed southwards, they increase in numbers until they reach their maximum in the islands of the Indian Archipelago. By Mr. Brown they have been divided into *Meliaceæ* and *Cedrelaceæ;* those by M. A. Jussieu into the tribes *Melieæ* and *Trichilieæ*, and these into *Swieteniea* and *Cedreleæ*. Some species of all the tribes are found in India.

Of *Melieæ*, which are confined to Asia and Africa, and of which one species has crept into Europe, and another is mentioned with doubt as being a native of America, species of most of the genera are found in India. The *Neem* tree, or *Margosa* tree of the Peninsula, has been separated from *Melia* into a distinct genus, *Azadirachta* (from the Persian name *azad-i-durukht*, the free or excellent tree), on account chiefly of its ternary, not quinary structure of the parts of the pistil, and its single-seeded fruit. Of the genus *Melia*, two species are found in Northern India:—one, there called *dek*,

the

the *Melia Azedarach*, or Persian lilac, Hill margosa of Dr. Ainslie, mentioned by Dr. Roxburgh as being a native of China, &c.; the other species, is one, which has by Dr. Roxburgh been considered the same as the American *M. sempervirens* of Swartz, and both by some authors accounted only varieties of *M. Azedarach*. The Indian plant no doubt very closely resembles this both in inflorescence and foliage, but may be easily distinguished by its larger berries and extremely hard pentagonal nut, covered with a sweetish viscid sarcocarp, which, on drying, assumes a semi-transparent appearance, like that of soap-berries; the leaves also in my specimens are longer, the pinnæ more numerous, and the leaflets more membranous and less serrated. This is universally distinguished in the northern provinces of India from *Melia Azedarach* or *dek*, by the Hindoostanee name *bukayun* or *bukain*, of which the synonimous Arabic name given is *ban*, the Persian *azad-i-durukht*, and the tree said to be a native of Persia; its synonymes, moreover, in the northern provinces of that country are also given. It is probable, therefore, that this, if not exclusively, at least in conjunction with *Melia Azedarach*, is the *Azedarach* of Avicenna. Dr. Roxburgh also states the *bukayun* to be a native of Persia, though common throughout India, and that its Arabic name is *ban*. This, in addition to the specimens in the East-Indian Herbarium, perfectly identifies his plant with that of Northern India. The Sanscrit name of *maha-nimba*, or great neem, corresponds rather with its appearance in the northern than in the southern provinces of India, where Dr. Roxburgh describes it is as a small delicate evergreen of short duration, perfectly distinct from *Azedarach*. He considers it, however, the same as *Melia sempervirens* of Swartz, mentioning that plants reared in the Calcutta Botanic Garden, from seed received from the West Indies, did not in any respect differ from the Asiatic sort. Having considered the subject as settled, I regret that I did not pay more minute attention to the plants in the living state; for on referring to an original specimen of *Melia sempervirens* from Dr. Swartz, in the late Sir James Smith's Herbarium, it does not appear to me to correspond with that to which the same name has been applied in India, and which, I conceive, is a distinct species. This I would propose calling *Melia bukayun*, easily distinguished from *M. Azedarach* by its fruit, as *M. sempervirens* is, according to Swartz, by being "planta minor et sæpe floret biennis, quod foliola læte viridia raro plusquam 7, rugosiuscula, profundius et magis inæqualiter serrata et acuminata." The author of the *Mukhzun-ool-Udwieh* moreover describes four kinds of *Neem*, or *Melia*, as formerly constituted,—1. Neem; 2. Bukayun; 3. Dek; and the 4th without a name, may perhaps be the *Melia composita* of the Peninsula.

Mallea (*Ekebergia indica*, Roxb.) is found at the foot of the Circar Mountains, and, as well as *Sandoricum indicum*, in the Peninsula. The species of *Turræa* seem confined to the Indian Islands, as *T. pinnata*, Pl. As. Rar. t. 119, a native of Silhet, is mentioned with doubt as belonging to this genus. Of the tribe *Trichilieæ* (abundant in South America, the islands of the Indian Archipelago, and extending to New Holland), we have also species in India, especially in the southern parts. *Heynea trijuga*, *Amoora laxa*, and *Sphærosacme fragrans*, Wall. (*Aglaia decandra*, Wall. Fl. Ind. 2. p. 427) extend as far north

north as the valleys of Nepal. The other species of *Amoora*, Roxb. Corom. Plants, (*Andersonia*, of the *Flora Indica; Aphanamixis?* of Blume) extend from Silhet to the Delta of the Ganges, and from that to the Peninsula. *A. cucullata*, and *Xylocarpus granatum*, mentioned by Dr. Wallich, under Lamarck's name *Carapa moluccensis*, are also found in the two latter situations. From *Amoora* must be kept distinct the decandrous species which constitute the genus *Sphærosacme* of Dr. Wallich, of which one species has been mentioned above, and is represented at t. 853, and another *S. spectabilis*, at t. 351, of his unpublished plates. The dissections given in these plates resemble those given of *Lansium* by Dr. Jack, in Lin. Trans., vol. xiv. t. 4. In Silhet are also found *Milnea edulis*, allied to *Lansium;* species of *Walsura;* and the several plants which have been referred to *Guarea*, but which do not agree with the characters of that genus, as defined by M. Ad. de Jussieu; who states that Dr. Roxburgh's two species, *G. binectarifera* and *paniculata*, ought to be referred to some other genus. The authors of the Prodromus of the Flora of the Indian Peninsula* have referred the first to *Epicharis*, and the second to *Disoxylon*, genera which are both indigenous in Java. Dr. Wallich's species they have referred to the last genus, and to *Hartighsea*. To one of these also, or to *Epicharis*, ought probably to be referred Dr. Wallich's *Melia penduliflora*, No. 1255.

Of the small order of *Cedreleaceæ*, *Soymida* (*Swietenia*, Roxb.) *febrifuga*, is found in all the central and southern parts of India, and *Chikrassia tabularis* in the Peninsula, with *Chloroxylon Swietenia*. *Cedrela toona* extends over every part of India, and may be seen all along the foot of the Himalaya. The specimens from Nepal having frequently a sixth part added, Dr. Wallich was induced to call this variety *C. hexandra*. There is, however, a distinct species, *C. serrata*, which may be readily recognised by the great length of its racemes of flowers, and may frequently be seen with *Sapindus acuminatus*, growing in the close valleys within the Himalayas.

The group of *Meliaceæ* was admitted by M. De Candolle as one of those which rather confirm than weaken the rule of the accordance of properties with the affinities and structure of vegetables. This has been proved by extended experience, and the better defined nature of the order. The *Cedreleaceæ*, as remarked by Ad. de Jussieu, are remarkable for the bitterness and astringency of several of their parts; to which is frequently added an aromatic principle. To this is owing the absence of insects from their wood, and its consequent durability; and the febrifuge properties for which these plants are noted in their native country. Thus, *Soymida febrifuga*, the *rohuna* of Hindoostan, known for its astringent and particularly bitter taste, is reckoned a good stomachic and powerful febrifuge, and an excellent substitute for the Peruvian bark. (As. Res. xi. p. 190.) So the *Khaya* is employed for the cure of fevers, on the banks of the Gambia. In India, again, the bark of *Cedrela toona*, as well as that of the *Chikrassee*,

* This valuable work I have just received; the previous references have been made from a hasty glance at a copy in sheets, with a sight of which I was favoured by Dr. Wight, previous to his departure for India.

Chikrassee, is described as being astringent, but without bitterness; and is useful, as the *Cedrela febrifuga* of M. Blume, and the bark of *Swietenia mahogani,* in the cure of intermittent fevers.

It is not unworthy of remark, that many of the *Cedreleaceæ* are remarkable for the excellence of their wood. The mahogany is too well known to require further notice, than that it succeeds well in the most northern, as in the southern parts of India. The *Cedrela toona,* though a lighter and more open-textured wood, forms the mahogany of India, and is much used for making furniture. The *Chikrassee,* also, a large timber-tree, is much esteemed for its "light-coloured, elegantly-veined, close-grained wood," as well as the *satin-wood,* afforded by another of this tribe, the *Chloroxylon Swietenia.* All might with great benefit to the country be more extensively cultivated in different parts of India. M. Jussieu remarks that the existence of an essential oil is indicated in *Chloroxylon* and *Flindersia* by the transparent points in their leaves. The former is mentioned by Dr. Ainslie as one of those yielding wood-oil in India.

M. Adrien Jussieu remarks that the bitter, astringent, and tonic principles found in most of the *Cedreleaceæ,* may also be observed in some of the *Meliaceæ,* but with easily-observable differences; while principles of a more energetic nature develope themselves, which make others of the tribe dangerous of employment. A tree, of the name of *jito,* is known to be of a purgative nature in Brazil, and said to be oftener of a poisonous than remedial nature. M. Jussieu supposes it probable that the same name may be applied to several of the *Meliaceæ,* rather than to only one species of *Guarea. Guarea Aubletii* and *G. trichilioides* have bark, which is purgative and emetic; *Trichilia cathartica* and *S. trifoliata* have both the former property; and Forskal informs us, that in an Arab book, his *Elkaja, Trichilia emetica* is described as being of an emetic nature.

In India, the bark of *Walsura piscidia* is thrown into ponds to kill fish, which, coming to the surface, are easily taken, and not considered injurious to be eaten. *Melia Azedarach* has been accounted poisonous from the time of Avicenna, but it is only in larger doses that its fruit can be considered such. Loureiro recognises the utility of *Azedarach* in worm cases, and M. Blume states, that both *M. Azedarach* and *Azadirachta* are employed in Java as anthelmintics. The root of the former, which is bitter and nauseous, is considered a powerful anthelmintic in America: by Dr. Barton, as one of the best. A decoction of the leaves is said to be astringent and stomachic, and also to be injurious to insects, and employed with success against porrigo.

In India the *Azadirachta* is much more employed than the *Azedarach,* every part, but especially the bark, being bitter, and considered a valuable tonic: Mr. Piddington, in consequence, presented the Medical Society of Calcutta with a sulphate of *Azadirine,* which had for its base the bitter principle of the *Azadirachta.* The fruit is said to be useful in leprosy, and yields a bitter fixed oil, which is anthelmintic and stimulant:—another instance (as well as the *Azedarach*) after the olive, as observed by M. Richard (Lindl. Nat. Ord. p. 121), of the pericarp yielding a substance usually afforded by the seed.

seed. *Neem* leaves are universally used in India for poultices; and the seeds called *nibuolee,* are employed for killing insects, being first skinned; the kernel powdered and mixed with water is used for washing the hair. A kind of toddy is, moreover, procured from tapping healthy young margosa trees, according to Dr. Ainslie. The seeds of *Melia bukayun,* called *hub-ool-ban,* are considered emetic, laxative, and anthelmintic; and the bark is accounted bitter and anthelmintic in Java, that is, if *M. sempervirens* be the same as *bukayun.*

Many of the other *Meliaceæ* possess bitter and tonic principles, as the bark, leaves, and tender parts of *Heynea trijuga.* M. Blume ascribes to *Sandoricum indicum* some of the same properties as to *Melia:* it is employed as an astringent, with the bark of *Carapa obovata.* The bark of *Xylocarpus granatum,* as well as the seeds, is very bitter.

Cedrela serrata; foliolis 12-jugis ovato-lanceolatis acuminatis marginibus irregulariter serratis subtus glaucescentibus, racemis pendulis foliis longioribus. v. Tab. 25.—This tree, called *durloo* by the natives, is found in the valleys of the Himalaya, growing in similar situations with the *toon,* but with lighter-coloured wood, and attains a smaller size; though it may be readily recognised by its large leaves, which are, however, exceeded in length by the immense racemes of flowers, which are diminished more than one-half in the figure. The flowers are also larger than those of *C. Toona,* and have five sterile stamens, which have not, however, been represented by the artist, alternating with the erect fertile ones.

42. AMPELIDEÆ.

This order, named from the Greek name of the grape-vine, is also called *Sarmentaceæ, Vites,* and *Viniferæ.* It includes the genera *Cissus* and *Vitis,* which are now generally united into one, under the latter name, forming, with *Ampelopsis,* one section of the order, while *Leea* and *Lasianthera* form another:—the latter an African genus, the former confined to India and the islands of Ceylon and Mauritius. The genus *Ampelopsis,* formed by Michaux of some North American plants, distinguished from *Vitis* by its distinct and spreading petals, has also been found in the north, both of Africa and of China, as well as in the Himalayas, at Mussooree and Simla. The genus *Vitis* is found in the equinoxial parts, both of the Old and New World, extending into both the temperate zones; as southwards, to the Cape of Good Hope and New Holland, and northwards, to Japan and North America, as well as from the plains of India to the defiles of Caucasus. We may therefore expect to meet species of the genus, as we have done so many others with a similar geographical distribution, at the foot as well as at moderate elevations in the Himalaya. The species of *Vitis* are numerous in India, as Dr. Wallich has enumerated upwards of fifty in his Catalogue; of these several are common to the peninsula of India, the lower parts of Bengal, and the country about Silhet. *V. auriculata, tomentosa,* and *adnata,* travel upwards towards Rajmahl and Monghir. *V. quadrangularis* may be traced further north in the plains of India, near villages and the abodes of *Fuqueers;* but *Vitis* (*Cissus,* Roxb.) *carnosa* is common in the plains of Northern India; and *V. latifolia* in the jungles towards Kheree and at the foot of the hills: both send up their young shoots during the rainy season, and have their great roots, or rather under-ground stems, covered by the ground

from

from the cold of winter, as well as the great drought of the hot weather. *V. lanata* (*rugosa*, Wall.), *lanceolaria*, *repens* (*glauca*, Wall.), common in the Indian and Malayan Peninsulas, extend northwards from Silhet to Nepal; and the first, with *Cissus rosea* nob. t. 26, f. 1, is found in the Deyra Doon and the jungles at the foot of the mountains of Kemaon and Sirmore. *C. feminea*, Roxb., was recognised in my Herbarium by Dr. Wight, as his *Vitis Roxburghii*. It therefore exists in the Peninsula, as well as in the valley of the Agurwal, beyond 30° of N. latitude, and may be found in intermediate situations, but is not mentioned in Dr. Wallich's Catalogue. Having found it always hermaphrodite, though otherwise agreeing in every respect with Dr. Roxburgh's description, I had a drawing made, that it might afford better means of future comparison. (v. *Ic. ined.*, t. 58.)

Cissus Nepalensis, obtained from Dr. Wallich, is the only Himalayan species mentioned by De Candolle, but is not contained in the East-Indian Herbarium; at least under that name. Mr. Don has a *Vitis capreolata*, Prod. Fl. Nep. p. 188, which I have figured at t. 26, f. 2, and consider the same as *V. hederacea*, N. 6019 of Dr. Wallich, and to which, from its habit of clinging to and climbing up trees, I had given the same name. This may possibly be the *V. serrulata* of Dr. Roxburgh (v. Wallich's Cat. 6034), in which case this name must be substituted for *V. capreolata*.

In addition to these, Dr. Wallich has seven Nepal species of *Vitis*. Of these I am acquainted with *V. parvifolia*, *cymosa*, and *obtecta*, which are found in the higher vallies near, as well as on Mussooree, where, however, a new species, *V. macrophylla*, is most conspicuous, from climbing trees and hanging down in elegant festoons from their tops. The species of *Leea* ascend as high as 5,000 feet on the mountain side, one species, *L. rubra*, being found near Jurreepanee, and also about the Kheree jungle. *Leea aspera*, found by Dr. Wallich in Nepal, also occurs in the Doon and about Nahn. The other species of this genus are found in Silhet and the Indian and Malayan Peninsulas.

With respect to the properties of the plants of this family, little can be said that has not reference to the grape-vine, which has almost exclusively engrossed the attention of botanists. But several species of *Cissus* are remarkable for being acid, especially the fruit, owing to the presence of tartaric acid; hence *Cissus carnosa*, (of which a variety was at one time called *C. acida* by Dr. Roxburgh,) is used in Hindoo medicine, as well as the roots of *C. latifolia*, called *kusar*

Forskal also describes three species of *Cissus* under his name *Sælanthus*, of which the leaves are acid, and edible, when cooked; but not the stems and roots. But the leaves of *C. cordata* and *C. setosa* are described by Dr. Roxburgh as being acrid, as well as the berries of the latter, of which the leaves are said to be useful in bringing indolent tumours to suppuration. The young, tender, and succulent stems of *Vitis* (*Cissus*) *quadrangularis* are said, by Dr. Roxburgh, to be very generally eaten by the natives of India. When old, it is considered acrid in the parts of India where I have seen it, and accounted useful in medicine; as it is also stated to be by Dr. Ainslie, as well as by Forskal in Arabia, who says, "Venenatum putant incolæ Morenses;

linguam manusque urente dolore afficit. Sectio caulis, aquam copiose emittit. Solent Arabes dorsi dolore laborantes, hujus caules nocte sibi substernere." (Descr. p. 34.)

But the grape-vine is alone of any importance for the utility of its products. The sap was at one time used in medicine, and the juice of the leaves, particularly of a variety in which they are red, considered astringent. Verjuice, expressed from unripe grapes, is well known for its acidity, and use in making syrups, &c. Lieut. Burnes mentions, that in Caubul they use grape powder, obtained by drying and powdering the unripe fruit, as a pleasant acid. When ripe it is every where valued as a fruit, either fresh, or in the state of *raisins*, and of one variety, as *currants*. The juice of the ripe fruit, called *must*, is useful as an agreeable beverage, from containing sugar. By fermentation, other valuable products are procured, as wine, alcohol, and vinegar; while the lees yield tartar or impure cream of tartar, from which tartaric acid may be obtained: an oil is sometimes extracted from the seeds, and even the ashes are considered useful in medicine, from containing, like that of so many other woods, salts of potass.

The grape-vine being a plant of so much value and importance, its distribution is an interesting subject of inquiry, though there is little prospect of its becoming in India of greater value than as affording an agreeable fruit; though this is of sufficient importance to render highly desirable the introduction and trial of different and superior kinds from Europe. The native country of the vine seems now to be better ascertained than that of many other as extensively cultivated plants. Bieberstein, in his *Flora Tauro-Caucasica* (1. p. 174) states, "Nusquam non præter alpestria, per omnem de qua sermonem facimus regionem sponte in sylvis atque dumetis nascitur, et altissimas quandoque arbores ascendens, totas quantas occupat." The author of the "Mukhzun-ool-udwieh," who was an inhabitant of the district, describes the vine, as found both wild and in gardens at Tinkaboon, in Deilim, about lat. 37°, on the southern shores of the Caspian, and that it is there called *dewaz*. Humboldt, also, in his "*Geographie des Plantes*," p. 26, mentions that the vine "grows wild on the coasts of the Caspian Sea, in Armenia, and in Caramania. The species of *Vitis*, which are found wild in North America, and which gave the name of *Winenland* to the first part of the New Continent which Europeans discovered, are very different from our *Vitis vinifera*." These, as we learn from Pursh, are *Vitis labrusca*, called fox-grape; *V. æstivalis*, summer-grape; and *V. cordifolia*, winter-grape. From the sacred writings we know that the grape was cultivated in Asia in the earliest periods. M. Bové, the latest scientific traveller, informs us (Ann. des Sc. Nat. 1834, p. 172) that it is still cultivated, and a good wine made in the vicinity of Jerusalem; but that in Egypt he found wine made only at *Medinet-el-Fayoum* (l. c. p. 76) which is in lat. 29° 20′. "From Asia," Humboldt continues, "it passed into Greece, and thence into Sicily. The Phocæans carried it into the south of France, the Romans planted it on the banks of the Rhine;" and we have it now extending to 51°, or even 52°, in England, where it ripens well, as in the present fine season, in the open air; and wine is made in a few places in Devon-

shire.

shire. Southward the vine extends as far as 12° of northern latitude; as we learn from Dr. Ainslie (Ind. Mat. Med. 1. p. 156) that "the French are particularly successful in cultivating the grape at Pondicherry, notwithstanding the great heat of the Carnatic." The illustrious Humboldt, in his *Proleg. de distrib. Geograph. Plant.* p. 159, where, from the examination of a multitude of facts, he has deduced the requisites for the successful cultivation of many plants, has observed, that "the vine in Europe yields a generous and excellent wine between the latitudes of 36° and 48°, where the mean annual temperature is from 62° to 50°, or even 47°·5, provided that of winter is not below 38°, nor that of summer below 66° or 68°. These conditions are fulfilled on the sea-coast as high as lat. 47°, in the interior as high as lat. 50°, and in North America only as high as lat. 40°. The vine may therefore be cultivated for wine in a belt of from 12° to 15° of latitude in breadth on both sides of the Line; though to a much greater extent, if required, for its fruit only: but for both purposes, in a narrower space in the New than in the Old World. Further north than 48° of latitude, grapes do not generally secrete sufficient succharine matter to undergo a proper vinous fermentation, and further south than 35° (or 32° in an insular situation like Madeira), though they are both sweet and high-flavoured, the temperature is so great that the juice passes rapidly into the acetous fermentation; and therefore the grapes of the most southern parts of Europe are more frequently dried as raisins than converted into wine. The climate of India is such as to exclude it from benefiting either by preserving the grape, or converting it into wine; though in the north-western provinces, the vines thrive well and bear abundantly. They flower in February, and ripen the fruit (which is well, though perhaps not so delicately flavoured as in more temperate climates) about the middle of June, or about the time the vine is said to flower in Caucasus: at this time the mean temperature being about 90°, is evidently much too great to allow of a slow and gradual vinous fermentation; while the accession of the rainy season immediately afterwards produces so great a degree of moisture, as to render it impossible to dry the grapes as raisins, unless this could be effected in ovens, after being plunged in boiling water, as is done in some parts of Europe. It might, perhaps, be practicable even to make wine by growing the grapes at the foot of the mountains, where free from jungles, as in the country beyond the Jumna, and conveying them to a moderate temperature on the mountain side. A brewery has been established in a situation where the mean temperature in the houses hardly ever varied from 60° in the warm weather, and the distance was so inconsiderable, that it was thought preferable to bring the barley from the plains, rather than use that which was grown on the spot. The Deyra Doon would be a particularly favourable situation; but at present there is too much uncleared jungle, and the climate too moist, to ripen the grape properly in the short season, from the middle of March to the middle of June; the greatest pains were taken in their cultivation, but without success, by the Hon. Mr. Shore while resident there.

But it is observed, that when the warmth of a low latitude is compensated for by elevation, or a barrier is opposed to the inundating influence of the rainy season,

grapes are ripened as fruit, dried as raisins, and converted into wine. Thus, in Kunawur, between N. lat. 31° and 32°, or nearly that of Madeira, where elevation produces the same moderation of temperature, that is, in the latter, the consequence of its insular situation, we have luxuriant vineyards between 9,000 and 10,000 feet of elevation, with grapes of delicious flavour, which the moderation of temperature in September allows of being converted into wine, and the dryness (v. p. 34) to be preserved as raisins. Two degrees further north, or in the valley of Cashmere, at an elevation of 5,500 feet, we have grapes both excellent and plentiful, as we learn from both Mr. Foster and Mr. Moorcroft. The latter says, that "many thousands of acres skirting the foot of the hills, are covered with apple and pear trees in full bearing, but without owners." (Jour. of Geog. Society, 1. p. 241 and 253.) My plant collectors expressed their admiration, by describing the fruit-trees as forming a perfect jungle in Cashmere. The moderation of temperature, with the existence of moisture, has been mentioned at p. 27, as accounting for the magnitude attained by many species of European genera. This will also explain the great size of the vines, which Mr. Moorcroft informs us, "scales the summit of the poplar," as well as for the want of a fine flavour, observed in the grapes brought to India, packed in layers of cotton. At Khoten, also, the vine is described by Mr. Moorcroft as being very productive. The different kinds of raisins called *monukka, kishmish,* and *bedana,* are brought chiefly from Istaulik. At Cabool, nearly in the same latitude, but more to the eastward than Cashmere, and elevated 6,000 feet, the grapes are described by Lieut. Burnes to be so plentiful, as to be given for three months to cattle. They are also abundant at Bokhara, and in both places are converted into wine, and dried as raisins. Astrakhan, in 46° of N. latitude, seems to be the most northern point in Asia where the grape thrives, and there the vineyards are described as being numerous. Every traveller mentions the grapes and wine of Persia. Dr. Ainslie says, it was from thence, as well as from the banks of the Rhine, that grape-plants were originally sent to the Cape of Good Hope, and that some of these from Persia now produce the red and white Constantia. This is generally considered the only good wine from that settlement. Dr. Ainslie thinks highly of the Madeira, made from the *groene druyf;* but Pontac is also a good and very sound wine. The Persians, it may be added, claim the discovery of wine, and call it *zuhr-i-khoosh,* or the delightful poison.*

Vitis

* It may not be uninteresting to mention, that in the northern provinces of India, where we have at one season a climate analogous to that of European latitudes, and at another a degree of heat which is never attained even within the tropics, the only wines which are relished, after the stimulus of a single glass of Madeira, are the light Clarets of France, or the Hock of Germany; while in the cold weather Port is frequently drank, though never seen at any other season of the year, unless sometimes during the moisture of a damp situation in the rains;—showing that climate influences the taste of northern nations for the stronger wines, rather than the habit one regrets to see ascribed to the English in a work generally of much research, published only during the present year: "Les Anglois ne boivent guère que des vins alcoholisés, ils trouvent les naturels trop doux ou trop faibles, ce qui ne doit pas étonner de gens qui usent, à leurs repas ordinaires, de l'eau de vie coupé de moitié d'eau, en place de vin."—*Dict. de Mat. Med.* tom. vi. p. 935. *Paris* 1834.

Vitis (Cissus) rosea; foliis rotundato-cordatis acuminatis, marginibus sinuato-serrulatis, ramis, petiolis pedunculisque pilosis, stipulis coloratis ovato-oblongis villosis, umbellis decompositis foliis oppositis, fructibus oblongis utrinque attenuatis (v. Tab. 26. f. 1.) This elegant species of *Vitis*, found in the Kheree Pass and similar situations at the foot of the Himalaya, very nearly approaches *C. cordata* of Roxburgh from Amboyna, which is referred to *V. repens* by M. De Candolle, but may be distinguished by its villous habit and barberry-shaped fruit, in which respect it resembles *C. vitigenia*, D.C. The stems are climbing, round, striated, hairy; stipules small, rounded, hairy; peduncles leaf-opposed longer than petioles; hairy bractes at each subdivision of the compound umbel or cyme. *Petals* 4, distinct, spreading, of a light pink colour (*a. b.*) *Stamens* 4, inserted into the disk (*c.*) *Germen* surrounded by disk with truncate style, two-celled, 4-seeded (*c. d.*) *Fruit* pyriform (*c.*), one or two seeded, when double, each is flattened, with radicle and cotyledons, as in the genus (*d. e. f.*)

Vitis (Cissus) capreolata; foliis pedato-5-foliolatis glabris, foliolis ovalibus utrinque attenuatis setacco-serratis, pedunculis petiolo longioribus, umbellis multifloribus.—*Cissus capreolata*, Don Prod. Fl. Nep. p. 188. *Vitis hederacea*, Wall. Cat. N. 6019.b. *Cissus hederacea*, Royle MSS., Tab. 26. f. 2. (*a. b.*) flowers. 2.* The fruit. The species which has been figured in this plate, I am informed by Mr. Don is his *Cissus capreolata*, though his character does not in all respects agree with the plant. The group with pedate leaves (of which the two lateral ones are in pairs) to which this belongs, contains several species so nearly allied to one another—as *Vitis japonica, nepalensis, serrulata* and *cymosa*—that it is difficult to ascertain whether the differences in appearance be dependent on distinction of species or on differences of locality. The two last are found at the foot of the hills, and may be distinguished by the great size of their bracteæ; and *V. serrulata*, obtained first by Dr. Roxburgh from Chittagong, by the fewness of flowers in each umbel, shortness of the peduncles, and by its straggling habit. *V. capreolata* is found at elevations of 6,000 and 7,000 feet, clinging to the trunks of trees as closely as ivy, some of the cirrhi performing the office of roots in fixing the plant in the covering of moss, &c. with which the bark is covered in the rainy season, and perhaps even drawing nourishment from that receptacle of moisture.

Ampelopsis Himalayana; foliis palmato-3-foliolatis, foliolis coriaceis petiolatis utrinque glabris subtus glaucescentibus reticulato-venosis mucronato-dentatis, medio basi attenuato, lateralibus inæqualibus, omnibus apice acuminatis, racemis dichotomo-corymbosis.—This, I was informed by Dr. Wight, was immediately recognised by Dr. Torrie, on his late visit to England, as a genuine species of *Ampelopsis*, when seen by him in the splendid collection formed by the Countess of Dalhousie at Simla. My specimens, belonging to the same species, were procured at Mussooree, where the plant is common, climbing to the tops of lofty trees. *Vitis semi-cordata*, Wall. No. 6020. Ic. ined. 852, appears also to be a species of *Ampelopsis* from Nepal.—Whether this genus be continued distinct, or considered only a section of *Vitis*, the geographical distribution of its species will be equally interesting.

43. GERANIACEÆ.

This order is well known from the *Geraniums*, or *Cranesbills*, being common in every field in Europe, and the *Pelargoniums*, to which the former name is generally applied, forming favourite flowers in every part of the world. The latter (natives chiefly of the Cape of Good Hope) are also found in New Holland, and may be seen growing every where apparently wild in the island of St. Helena. The genera *Geranium* and *Erodium*, found in most parts of the world where there is moderate temperature, as in the plains of the northern half of the temperate zone and the mountains of tropical countries, are found in the Himalayas, where about fifteen species have been discovered at various heights, as in the mountains above Silhet, in Nepal, and every where in Kemaon, Gurhwal, and Sirmore. *Geranium bicolor* nob. is that which occurs at the lowest elevations, being found in the Kheree Pass. At an elevation of from 5,000 to 7,000 feet, as at Mussooree, *G. Wallichianum* and *Nepalense* are common, with some new species,

as

as *G. heterotrichon* Sm. *pedunculatum*, and *lævigatum*, nob., the last nearly allied to *G. lucidum* of English botany. Mr. Don describes *G. eriostemon* of Fischer, found in Dahuria, as occurring among Dr. Wallich's specimens from Gossainthan. On loftier mountains, as Choor and Urukta, *G. Lindleyanum* and *Choorense* are found, with a pale variety of *G. Nepalense*, which has also been brought me from Cashmere, with a hairy variety of *G. Wallichianum*. *G. Grevilleanum*, Wall. Pl. As. Rar. T. 209, found on Gossainthan, appears to be the same as a species found by Mr. Inglis on the Kherung Pass. A species of *Erodium*, *E. himalayanum*, nob., is also found in the northern portion of the Himalayas, as well as in Cashmere; but is not common, as I only met with it once on the barren hills above Raengurh.

The plants of this family are possessed of but little medical properties. Some of the *Pelargoniums* (which, it may be mentioned, though injured by the rains, generally succeed well in India,) are remarkable for their fragrance; and some of the *Geraniums* for their fœtid qualities. Several of the species have been employed in medicine, from possessing astringent properties; *G. maculatum* is so used in North America, and called *Alum* root.

Geranium Lindleyanum; pilosissimum: caule ramoso adscendente, foliis inferioribus umbellatim dispositis longe petiolatis palmato 7-partitis, lobis multipartitis inciso-dentatis, caulinis oppositis, ramis axillaribus, pedunculis e dichotomia ramorum ramos superantibus, lateralibus terminalibus dimidio brevioribus, omnibus apice breve bibracteolatis bifloris, calycibus pilosis mucronatis, petalis integris.—Tab. 27. (*a. b.*) The flowers, half and full blown. (*c.*) Stamens. (*d.*) Stamens and Petals removed. I have had much pleasure in naming this plant (which I found at Urukta in flower in May) after my friend, Professor Lindley, from whom I have received great assistance during the progress of this work.

44. BALSAMINEÆ.

This order is especially an East-Indian one, only a few species being found in moist places in other parts of the world. Dr. Wallich, in his Catalogue, enumerates forty-seven species of *Impatiens*, and though a few of these may be only varieties, others, as some of the Nepal species, contain evidently two species under one name: the above number will therefore probably remain undiminished. Of these, twenty-two are found in the mountains above Silhet and Pundooa, in Nepal, and Kemaon. In addition to four of these, I have five other species from the mountains to the northward of the Ganges, and along the range as far as Cashmere, whence two more species have been brought me; and analogous to what we have seen to be the resemblance in the flora of Kunawur, on the northern face of the Himalayas to that of Siberia, so do we find one species closely allied to, if not identical with, *I. parviflora*, of Siberia. In Mr. Inglis's collection there is another species, *I. Inglisii*, nob., from Cheeni, also in Kunawur. It is remarkable that of the above forty-seven species, nearly the whole of the remainder, or at least twenty-two species, are found in the peninsula of India. A singular equality of numbers, seeing that we have hitherto found Peninsular and South of India genera confined to the base of the mountains, and if found existing on them, generally, only as single species; but here we have

have them in equal numbers, some of them extending to an elevation of 7,000 feet. This anomaly can only be explained, and a stronger fact could not be adduced in its confirmation, than that the moisture and moderate temperature of the rainy season in the hills (for it is at this season only that they are found) is as favourable to their growth as the heat and moisture of the Peninsula. I have never met with any in the plains of India; but have heard from travellers that they are abundant in Central India, whence we may expect some new species, as well as from the Neelgherries. The peculiarity of the Hill climate has been explained in the introductory chapter and at p. 16, where the moderation and equability of temperature, excess of moisture, and consequent smallness of evaporation during the rainy season, has been shewn to be favourable to the existence of tropical plants. At this season the balsams may be seen apparently unchanged for weeks together, with other plants which delight in a moist atmosphere, as *Orchideæ, Scitamineæ,* a few *Melastomaceæ, Cyrtandraceæ, Begonias,* the beautiful *Platystemma violioides,* and others of which the genera are considered peculiar to a tropical climate; and of so loose, moist, and cellular a texture, as would at any other season in this locality be destroyed in a single day. It may, perhaps, be to this looseness of texture, of which we may suppose a degree of pliability to be characteristic, that we are to ascribe the great number of species, as well as their limited distribution: for we find few of the Peninsular species in Bengal; not many of those from Silhet, in Nepal; and few of the latter in Gurhwal; though of these, *I. Hamiltoniana* and *insignis,* with *I. bicolor* and *pumila,* nob., are common from Jurreepanee to Mussooree, flowering abundantly in the rainy season. A variety of, or one of the species nearly allied to, *I. Balsamina,* is found in Sirmore, and near Simla. *I. speciosa,* one of the most splendid species, was brought me from the interior; and *I. glandulifera,* one of the largest, was produced from Cashmere seed. But the identification of species is difficult in this genus, particularly in the dried state, without a minute examination of all the parts of the flower, and as I am without any specimens of Dr. Wallich's species, I must refer the whole to Professor Henslow, of Cambridge, who has kindly undertaken, and will no doubt, with his usual ability, elaborate my species of the genus *Impatiens,* at the same time with those in Dr. Wallich's Herbarium.

Impatiens bicolor; erecta lævis, apice flexuosa: foliis alternis ovato-acuminatis basi attenuatis petiolatis crenatis, crenis superioribus mucronulatis inferioribus glandulosis, pedunculis axillaribus trifloris, terminalibus multifloris subracemosis, pedicellis elongatis bracteis cordatis suffultis, sepalis lateralibus cordatis, calcare lineari inflexo, flore dimidio breviore capsulis glabris oblongis acuminatis.—Hab. Mussooree and Simla. v. T. 28. fig. 1. (*a.*) The two lateral and the anterior calcarate sepal; (*b.*) the upper sepal; (*c.c.*) the four petals united in pairs; (*d.*) the stamens; (*e.*) the same, with the filaments separating at their base; (*g.*) capsule; (*h.*) the same bursting.

I. glandulifera; erecta, frutescens, ramosissima: foliis ternis lanceolatis acuminatis argute serratis, serris inferioribus, petiolis nodisque glanduliferis, pedunculis axillaribus terminalibusque multifloris racemosis, pedicellis elongatis, calcare brevissimo viridi glanduloso, capsula obovata apice spinulosa basi attenuata.—This gigantic species, obtained from Cashmere seed, is from its size very inadequately represented at Tab. 28. fig. 2, and the leaves are not sufficiently lanceolate. It succeeds well, both in the Saharunpore Botanic Garden and the Mussooree Experimental Nursery.

45. Oxalideæ.

45. OXALIDEÆ.

Mr. Brown, in shewing the relation of *Averrhoa* with *Cnestis*, belonging to the order which he then established of *Connaraceæ* (Tuckey's Congo. p. 432), proposed also the name *Oxalideæ* for the *Sensitivæ* of Batsch, an order composed of *Averrhoa* and *Oxalis*; the former agreeing with the latter in every important point of structure of its flower, and in most respects in that of its seed. To these has been added *Biophytum*, formed of the species composing the natural division of the genus *Oxalis*, having abruptly pinnate leaves and annual stems. Of these four genera, three are found in India; and though the order is composed in De Candolle's Prodromus of 159 species, only four are found in India. *Averrhoa Carambola*, and *Bilimbi*, are common in the gardens of Northern, as they are in those of Southern India. *Oxalis corniculata* belonging to a genus found in most parts of the world, is itself a species of very extensive distribution, being found in Europe, North America, and Mexico, as well as in Japan, and in some of the African islands. It is likewise found in every part of the plains of India, in the cold weather, as well as in both Peninsulas, in the valleys at the foot of the Himalayas, and in the mountains at 7,000 feet of elevation. The Hill specimens do not in any way differ from those found in the plains; though in the latter, the variety with small and crowded numerous leaves approaching *O. pusilla*, is also found. *Biophytum sensitivum* is found as far as 30° N. lat. at the mouth of the Kheree Pass, also on the sandstone range near Allahabad. By Dr. Hamilton it was found near Rajmahl and Monghir. It has also been found in Silhet, Rangoon, and the Indian Peninsula.

Biophytum sensitivum agrees also with *Averrhoa Carambola*, but especially with *A. Bilimbi* "in the foliola when irritated being reflected or dependent, which is likewise "their position, in the state of collapsion or sleep, in all the species of both genera." (Brown, l. c.) The analogy of structure is confirmed by the possession of similar properties. Thus, *Averrhoa Carambola*, and *Bilimbi*, both have acid fruits, which are used as seasoning; and, being accounted refrigerant, also in making sherbets. Of the former there is also a sweet variety; but the latter is so acid as to be only used as a substitute for lemons, or for taking out stains. The different species of *Oxalis* are well known to contain oxalic acid, combined with potass. *O. acetosella*, called in England *wood-sorrel*, well known for its acid leaves and as a substitute for *Rumex acetosella*, is represented in India by *O. corniculata*, which is there called *chooka tiputtee*, or *three-leaved sorrel*, and prescribed as a cooling medicine. The roots of *Oxalis tuberosa* are eaten in Chili, when cooked. Those of *O. crenata*, a plant of Columbia, bearing tubers like small potatoes, is one of those called *Arracacha*, and has been introduced into England as a substitute for that invaluable root; it might be so into India, and be useful wherever the soil and climate are better suited to it than to the potatoe.

46. CONNARACEÆ.

This family, consisting of *Connarus*, Lam., *Cnestis*, Juss., and *Rourea*, of Aublet, or *Robergia*, of Schreber, was separated from *Terebinthaceæ* by Mr. Brown; and as the "insertion

"insertion of stamina in this family may be considered perhaps in all the genera rather as hypogynous than perigynous," they are better placed here than with *Terebinthaceæ*, from which they are distinguished by the want of resinous juice. Mr. Brown considers *Cnestis* to approximate to *Averrhoa*, and *Cnestis*, according to M. Ad. de Jussieu, is allied to *Zanthoxyleæ* through *Brunellia;* though, on the other hand, "*Connarus* can only be distinguished from some leguminosæ, by the radicle of the seed being at the extremity most distant from the hilum."

This is truly an equinoctial family being found within the tropics of the Old and New World; a few species of each of the genera are found in Ceylon, the Peninsula of India, and the forests of Chittagong and Silhet, but do not appear to extend further north.

47. ZYGOPHYLLEÆ.

M. Adrien de Jussieu, in his admirable memoir on the *Rutaceæ*, has treated of the several families composing this great group or class under the names of *Zygophylleæ*, *Ruteæ*, *Diosmeæ*, *Zanthoxyleæ*, and *Simarubeæ*.

The *Zygophylleæ*, allied to *Geraniaceæ*, as well as to *Oxalis*, are found in the warmer parts of the world; *Tribulus* and *Fagonia* existing as single species in the south of Europe, and with *Zygophyllum*, forming a prominent feature in the Flora of the Oriental or Syrian region, extend from Egypt to India, where also they occur as single species. *Fagonia mysorensis* is common in the plains about Delhi, as well as at elevated situations in the southern provinces of India (W. and A.) *Tribulus lanuginosus* spreads also from the northern provinces even to Ceylon. Thence we may trace species of this genus to the Cape of Good Hope and New Holland, as well as to China and Japan, and a few occur in the warm parts of America. It is probable from the nature of the country and the distribution of the genus, that some species of *Zygophyllum* may be found in the extensive space which stretches from Delhi to Surat.

The most important species of this family is *Guaiacum officinale*, which, with its congeners, is found in the West-Indies, and might, without doubt, be successfully cultivated in Bengal. The sudorific properties for which it is celebrated, are also participated in by *Porliera hygrometrica*, though dependent in the former on the presence of a peculiar principle, called *Guaiacine*. Some species of *Tribulus* and *Zygophyllum* are also used medicinally in different countries, but their properties are not very decided. The plants of the latter, however, are said to remain untouched, even in the desert, where the equally thorny *Alhagi maurorum* is greedily eaten by camels; but the seeds of *Zygophyllum coccineum* are said by Delile to be collected by the Arabs, and sold "comme epice aux droguistes du Kaire."

It is remarkable that the genera *Melianthus* and *Biebersteinia*, generally considered as allied to *Zygophylleæ*, should also be found in India, as well as *Balanites*, placed here with doubt. *Biebersteinia*, of which the first species, *B. odora*, was found in the Altai mountains, and the second, *B. multifida*, in Persia, has also been found in

Kunawur, whence *B. odora* was brought me by my plant collectors and also found there by Mr. Inglis; it was at once recognised in my Herbarium by Mr. Brown. The dissections of this interesting plant, represented at Tab. 30, were drawn by Mr. C. Curtis, under the directions of this illustrious botanist. The best generic character has been given by M. Ad. de Jussieu in his memoir on the *Rutaceæ*. The similarity in the appearance of many of the plants of this cold, arid, and frequently saline region, to those found in the equally arid and saline, though hot region about Delhi, was formerly noticed, p. 39. It is interesting to find in the former, a genus allied to *Zygophylleæ*, which are common in the latter; and in both there is an approximation to the Flora of the Oriental region. *Melianthus* was thought peculiar to the Cape of Good Hope, until Dr. Wallich's plant-collectors discovered a decided species of this genus in the lofty mountains of Kemaon.

Balanites Ægyptiaca (*Ximenia*, Auct.) which, though so strongly resembling *Zygophyllum* in having its leaves in pairs, has long since been stated by Mr. Brown not to belong to this order. By M. Delile it is referred to *Aurantiaceæ*, and by the authors of the *Flora Senegambiæ* to *Olacineæ;* with neither of which does it appear to me to be more closely allied than with the order from which it has been removed. It is interesting to find this plant common in the country about Delhi, and in the Doab as far as Allahabad, especially on the banks of the Jumna, as it serves with the other plants mentioned p. 5, to shew an analogy in the Flora of this part of India with that of Egypt, where also this plant is found, as well as in both the interior and on the western coast of Africa. This was first discovered by Dr. Roxburgh, as belonging to the Indian Flora, when he suggested that it should be formed into a new genus, rather than be referred to *Ximenia*, and described it as common on the driest and most barren parts of the Circars; it is found only in similar situations in the north of India, and is one of those plants referred to at p. 5, as shewing the great uniformity of vegetation over a great extent of the plains of India. In the neighbourhood of Delhi, there is also a very distinct variety, if not a new species, with small narrow lanceolate leaves, which in my journal I named *rigidum*, in contradistinction to the other, which I called *arboreum*, referring both with a doubt to *Zygophyllum*, as they were at that time without flowers or fruit. From an officer of rank in the medical service I also received a drawing of a variety with yellow flowers, from the neighbourhood of Cawnpore, which may also be a distinct species. The fact would be interesting, as assisting in ascertaining the native country of the first species, in accordance with Mr. Brown's rule, that a plant would more probably "belong to that country in which all the other species of the same genus were found decidedly indigenous, than to that where it was the only species of the genus known to exist." In the present instance, there can be no doubt about this plant being indigenous in India, whatever it may be in Africa.

M. Silvestre de Sacy, in the learned and invaluable notes attached to his translation of the "*Relation de l'Egypte par Abd-allatif*," has proved that the *lebakh* of Arabian authors is the *Persea* of the ancients; which he however concludes has entirely disappeared

peared from Egypt. M. Delile supposes that *Balanites Ægyptiaca* is the tree:—there is no doubt that in some points it does agree; but the fruit of *Persea*, though astringent before ripening, is described as being afterwards sweet, and good to eat, though not very agreeable. Of the fruit of the *Balanites*, M. Delile himself says, "ils etoient astringens et fermes avant leur maturité: j'en gardai quelques uns, qui se ramolloient et prirent une saveur douce que je ne trouvai point agréable;" and it is difficult to suppose how they could ever become so; as Dr. Roxburgh describes "the pulp as exceedingly bitter, having an offensive greasy smell." I never met with it except in its unripe state; and the only use to which it was applied, is that alluded to by Dr. R. as a firework; the nut being scooped out, by a hole made at one end, is filled with gunpowder, which, when let off, makes a loud report, on account of the denseness and tenacity of the shell. A recent author supposes that this plant produces the myrrh, but for this opinion there does not appear to be any foundation.

48. RUTACEÆ.

This family, in Professor De Candolle's Prodromus, includes the *Ruteæ* and *Diosmeæ* of M. Adrien de Jussieu. The former, called *Rutaceæ* by Dr. Lindley, contains, with some others, the genera *Ruta, Peganum*, and *Cyminosma*. *Peganum* is placed here by M. Ad. de Jussieu, although, as observed by Dr. Lindley, "its stipulate leaves, destitute of pellucid dots, appear to determine its greatest affinity to be with *Zygophylleæ*." *P. Harmala*, the only species of the genus found in the south of Europe and in the Syrian region, also occurs in several parts of India. It has been brought me from between Shahpoor and Bussoulee, on the banks of the Ravee or Hydraotes; it was seen by Dr. Wallich in the Taj Muhul garden at Agra, at which place I have also found it, but near the banks of the river; and it is included in the Flora of the Peninsula. *Lahoree hoormul*, the name by which the seed still used in medicine is now known in Northern India, indicates its probable introduction from the northward. In the *Mukhzun-ool-Udwieh*, *moolee* or *moly* is given as the *Yoonanee* or Greek name, evidently the μολη of Dioscorides, who also mentions that by some it is called *harmala*, —a striking instance of the permanence of some at least of the Asiatic names. *Ruta albiflora*, figured by Dr. Hooker, *Ex. Fl.* t. 79, is common in the Himalayas, at elevations of from 5,000 to 8,000 feet, having been found in Nepal and Kemaon by Dr. Wallich, and by myself in Gurhwal. Another species, *R. angustifolia*, Pers., or a variety of *Ruta Chalepensis*, Lin., called *Sudab*, may be met with in gardens; also introduced on account of its uses in medicine, as the Greek name is said to be *fekhun*, or *ufghanin*, evidently a corruption of πεγανον, owing to the want of the letter P in the Arabic alphabet. The rest of the species of this genus are found, like the *Zygophylleæ*, in the southern parts of Europe, the north of Africa, and the Syrian region, as well as in China and Japan. *Cyminosma*, which is common to the southern parts of India, China, and Cochin-China, forms, with the above and *Aplophyllum* (a genus including

the simple-leaved species of *Ruta*) the small order of *Ruteæ;* so that India possesses representatives of nearly all its genera.

The medical properties of the *Rutaceæ* are owing to a bitter principle, accompanied with essential oil: the latter giving them their strong and peculiar odour, and the other the bitter taste, on which account common rue is considered emmenagogue and anthelmintic. *Ruta angustifolia,* said to be common in Persia, Caubul, and Tinkaboon, is given in India as a substitute for *R. graveolens,* and considered emmenagogue, as well as *Peganum Harmala. R. albiflora* is employed as a stimulant in the hills.

49. DIOSMEÆ.

The *Diosmeæ* M. A. de Jussieu divides into four sections, according to the countries where they are produced, because he finds their fructification correspond with their geographical distribution. 1. European; 2. African, found in dry and sunny places, and characterising the Flora of the Cape; 3. Australasian, of which several in external appearance resemble some from the Cape; and, 4. American, of which the first sub-section contains *Evodia,* to which Dr. Wallich refers some species, and the second nearly corresponds with the *Cuspariæ* of M. De Candolle. The first section, called European,—from the then single genus and species *Dictamnus Fraxinella* having only been found in the southern parts of Europe,—exists also in the northern parts of Asia; as the species or variety, *D. albus,* has been found in Caucasus by Bieberstein, and with *D. fraxinella* by Ledebour, in the Altai mountains. As we have seen in so many other instances a similarity between the vegetation of these regions and that of the Himalayas, so has a species of this genus, allied to *D. altaica* of Fischer, been found to exist in these mountains.

Dictamnus, though used as a medicinal agent, does not, like many of this family, possess any very powerful properties; but the *Diosmas, Bocho* or *Bucku* plants of the Cape, as well as some *Boronias,* &c. containing much essential oil, and noted for their powerful odour, have been employed as stimulants; while the tribe of *Cuspariæ,* containing *Cusparia febrifuga,* noted as an aromatic tonic, as well as species of *Monnieria, Ticorea,* and *Evodia,* used in the cure of intermittent fevers, are accounted powerful tonics. Of these the species would no doubt succeed well in Bengal and the south of India; while the north is suited to the *Diosmeæ* of the Cape and New Holland.

Dictamnus Himalayanus; foliis 6-jugis cum impari, rachi non alato, foliolis ovato-lanceolatis membranaceis, calyci persistenti, petalis subæqualibus, ovario sessili.—Hab. First found by Lieut. J. W. Stephens at Jumnotri; subsequently specimens have been brought me from Kunawur, where it was also found by Mr. Inglis at Mirung. v. Tab. 29. 1. Flower, with some Petals and Stamens removed, to shew the sessile ovarium and declined style. 2. The 5-carpellæ, with the persistent 5-fid calyx. 3. A single carpel opening internally, and terminating at its apex in a kind of hook. 4. The horny endocarp supporting two seeds. 6. A seed removed. 5. The same, cut longitudinally. 7. Embryo, separated from the albumen.

50. ZANTHOXYLEÆ.

The removal of *Zanthoxylum* from *Terebinthaceæ*, rendered necessary that of some other genera, which were placed with and closely allied to it. These form the family or tribe of *Zanthoxyleæ*, which are chiefly found within the tropics of Asia and America, with only a few species in Africa. But as we have species of *Zanthoxylum*, which now includes *Fagara*, extending northwards into the temperate zone, so do we have species of the same genus in China and Japan, and extending in India to Simla in 31° of N. latitude, where *Z. hostile*, differing little from *Z. alatum*, is found. Other species run southwards along the Himalayas to Nepal and Silhet, and then to the Malayan and Indian Peninsulas, whence we may trace them to the African islands on the east of that continent, as well as to the Cape of Good Hope and New Holland. The other genera, of which species are found in India, are *Toddalia* and *Brucea*, the latter about Silhet; but species of the former in the Indian Peninsula, and as far northwards as Nepal, whence Dr. Wallich has figured his *T. floribunda* (Pl. As. Rar. t. 232), nearly allied to *T. aculeata* (*Scopolia*, Roxb.) which is found in the Deyra Doon and lower hills. *Ailanthus excelsa*, belonging to a genus nearly allied to this family, is found at Delhi, along the Jumna, as well as on the Coromandel coast. The other species of this genus are found in China and the Moluccas. Among Dr. Wallich's unpublished drawings, are two species of *Tetradium*, *T. cymosum*, T. 883, and *T. fraxinifolium*, T. 884, probably from the Silhet forests.

The affinity of this order to *Terebinthaceæ* is evident from the genera composing it having formerly been placed there; and both are allied to *Aurantiaceæ*. These the *Zanthoxyleæ* especially resemble, in different parts of their substance being overspread, as remarked by M. Ad. de Jussieu, with vesicles of essential oil, which cover the leaves with transparent dots, and the rind of the fruit with opaque areolæ. To the presence of this essential oil is owing the aromatic pungency for which so many of this tribe are remarkable, and to this being frequently combined with a bitter principle, called *Xanthopicrine* (Fée), is owing their being employed as tonics as well as stimulants. Thus, in North America, as well as in Brazil, species are prescribed as stimulants, and in Japan the capsules of *Z. piperitum* are employed as a substitute for pepper. So, in India, *Z. Budrunga*, *Rhetsa*, *alatum*, and *hostile*, are used, wherever they are indigenous, for the warm spicy pepper-like pungency of their capsules, a property which is participated in by their bark, and other parts. The capsules and seeds of *Z. hostile*, called *tej-bul* by the natives, are employed in Northern India for intoxicating fish, and chewed as a remedy for tooth-ache: they are also given as the *Faghureh* of Avicenna, as *Z. piperitum* and *Avicennæ* are in China and Japan, and are considered an antidote against all poisons. I have no doubt that in many cases they would be of considerable use as a stimulant remedy. The stems and branches are cut as walking-sticks, and compared by General Hardwicke to the herculean clubs afforded by an American species of this genus. Species of *Ptelea* and *Brucea* are possessed of bitter properties. From the

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green parts of *B. Sumatrana,* naturalised in the Calcutta Garden, being simply and intensely bitter, Dr. Roxburgh concludes, that it may be as useful a medicine as Bruce's *Abyssinian Wooginos.* The bark of the root of *Toddalia aculeata* is also said by him to be employed as a cure for the remittent fevers caught in the Hill jungles.

51. SIMARUBEÆ.

This order, intermediate between *Rutaceæ* and *Ochnaceæ,* consisting of but few genera and species, is found chiefly in the equinoctial parts both of the Old and of the New World. The species of *Quassia, Simaruba,* and *Simaba,* are confined to some of the West-India islands, Guiana, and Brazil; but *Samadera* of Gærtner, to which M. Adrien de Jussieu has referred *Vittmannia,* Vahl, and *Niota,* Lam., is found in Madagascar and Java, as well as in Ceylon and the southern parts of India; and on the Martaban coast, whence Dr. Wallich obtained his *Niota lucida.* Pl. As. Rar. 2. T. 168.

In the Himalayas, also, there is a representative of this family in *Nima quassioides* of Dr. Hamilton, referred by Mr. Don to *Simaba,* but considered by M. Adrien de Jussieu as only allied to this family: but from its general appearance, and intensely bitter taste of every part, it is too closely allied to be separated, even though the stamens are pentandrous, as in *Simaruba? excelsa;* the flowers are moreover polygamous, the petals erect and greenish-coloured, with the single ovuled ovaries seated in a gynobase, from the base of which the stamens arise; style separating at top into five stigmas, and towards the base into as many styles, each of which enters the corresponding ovule, about its middle, while the indihiscent drupes enclose seeds, having a membranous integument and short radicle retracted between the large fleshy cotyledons. It was discovered in Nepal by Dr. Hamilton; I have met with it in Gurhwal in valleys, and at moderate elevations within the Himalayas, and have also received it from Turanda, on the banks of the Sutlej, which is in more than 31° of N. latitude.

The *Simarubeæ* are as closely allied in botanical characters, as in the possession of a similar intense but pure bitterness, diffused over every part, owing to the presence of the bitter principle called *quassine.* From the similarity in climate and productions of the countries where they grow, there is no doubt but that all the *Quassias* and *Simarubas* would succeed well in Bengal. But the light-coloured, pure, bitter wood of the Himalayan species, is well calculated alone to supply the place of any of the tribe.

India would appear to be the *Medyhyama,* or central country, botanically, which the natives fancy it to be geographically. Thus, we have seen the southern parts of India, including the Peninsula, Bengal, and the forests of Silhet and Chittagong, supporting a tropical vegetation, which in many respects approximates to the floras of the other equinoctial parts of Asia, as well as of America; while a strip of tropical jungle runs up along the southern or plainward base of the Himalayas, nearly to the most northern limits of Hindoostan. The Himalayas themselves we have seen supporting a different vegetation at different elevations:—Indian at the base and within

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the valleys; European as we ascend; and almost polar when we reach the summits of lofty mountains, which are only for a few months freed from their covering of snow. Intermixed with the Indian and European-like Floras, we have many of the genera, and even species, which were thought peculiar to China, as fully detailed in the account of the Tea-plants, p. 119 to 123, and with these many also of the genera, p. 18, which were considered as existing only in North America. Of these, as well as of the others, we shall find the instances multiply as we proceed. It is less remarkable to find a great resemblance to the Rosaceous Flora of Caubul, for this is a kingdom included within the ramifications of the Hindookhoosh, which is but an extension, and not far removed from the loftiest part of the Himalayan range. The northern face of the Himalayas,—cut off by their lofty and snowy summits from the influence of the tropical rains, enjoying a dry, cold, and rarified atmosphere, with a few months of powerful sun, and every where, a dry and barren soil, as we learn from Messrs. Turner and Saunders, Mr. Moorcroft, and Messrs. Gerard and Herbert,—has a flora bearing the closest resemblance to that of the Altai mountains, and of the south of Siberia, v. p. 40, whether we regard the distribution of families or genera, and even of some species. This should correctly be considered as belonging to the Tatarian rather than to the Himalayan region. At p. 41, it was also mentioned that along with these Altai plants, many were found showing an analogy with the flora of the south of Europe; and others, as *Cuminum cyminum* and *Scutellaria orientalis*, with that of the Oriental region. This, if space allowed, might easily be more fully shewn; but it is unnecessary, as it will be adverted to on a future occasion, as well as in the observations on the distribution of the different families of plants. The fact is interesting at present, in connection with the observation made at p. 41, of the external resemblance between the plants of Kunawur and those of the neighbourhood of Delhi, in consequence, it was presumed, of the great aridity of the soil and climate of both countries. Here also it is curious to observe, we have many of the plants of the Syrian region (v. p. 70) which is characterised by aridity and heat, as that of Tatary is by aridity and cold; but between their floras there is considerable resemblance, and that of India dove-tailing between them, may be said to be flanked on its north-western face by this, as it is on the south-eastern by the flora of the Syrian region. It will be as well, on the present occasion, to allude more fully to the latter fact, in connection with the occurrence of the *Zygophylleæ* in this quarter of India.

In comparing the flora of the northern part of India with that of Egypt, it may be useful to advert to the observations made by Mr. Brown respecting the accordance of the flora of the western coast of Africa with that of India in general, where he remarks that "with the flora of India, that of Congo agrees not only in the proportions of many of its principal families, or in what may be termed the equinoctial relation, but also, to a certain degree, in the more extensive genera of which several of these families consist: and there are even about forty species common to these distant regions;" that this accordance extends over a considerable surface, may be inferred from another observation Mr. Brown makes, which is, that from "16° N. to 6° S. there is remark-

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able uniformity in the vegetation, not only as to the principal natural orders and genera, but even to a considerable extent in the species of which it consists;" and we may consequently have an agreement with the flora of India over nearly the same extent: as we may see by a reference to the flora of Senegal, which Mr. Brown, no doubt, had in view. If we examine the first volume of the *Flora Senegambiæ*,—in which, following the series in De Candolle's Prodromus, forty-five families are treated of, from *Ranunculaceæ* to *Myrtaceæ*,—there are only three of which species are not found in the plains of India. Of these, *Frankeniaceæ* belongs to the flora of the Mediterranean region; and of *Geraniaceæ* and *Simarubeæ* there are species at the foot of the mountains in India. The families consist of 157 genera, of which only forty-six are not found in India: a number which might probably be reduced, if we had leisure to examine the extent of some of the new genera. Among the species, also, in addition to those enumerated by Mr. Brown, there are several found equally in India; of these some probably have been introduced, while the cultivated grains are nearly the same as those of India.

Mr. Brown remarks, that there is a certain degree of resemblance between the vegetation of the banks of the Congo and that of Madagascar, and the isles of France and Bourbon; that the flora of the east coast of Africa is little known; while with that of Abyssinia there was little affinity, though some characteristics of Southern Africa have been found, as *Protea abyssinica*, *Pelargonium abyssinicum*, and *Geisorhiza abyssinica*, but "to the flora of Egypt that of Congo has still less relation, either in the number or proportion of its natural families."

It has been observed, that owing to the great uniformity of temperature over a great extent of Indian territory, many of the same plants spread from the southern to the most northern parts of the plains of India, so that we have many Peninsular plants extending north even as far as Delhi, where also it was observed (p. 6) there is an approximation to the flora of Egypt, as well as to that of the south of Europe. On consideration, it does not appear remarkable, that the western side of the great Gangetic valley should approximate in its flora to that of Egypt, for Cairo and Saharunpore are situated nearly in 30° of N. latitude, whence both India and Egypt stretch southwards; but the Ganges flowing in the same direction, becomes tropical towards its delta, while the Nile, from its northern course, becomes more European in its flora the nearer we approach its mouth. Both rivers, or their branches, in the upper part of their course, traverse or touch upon the desert, which every where crosses Asia and Africa in that belt where the sun's rays, not attempered by the influence of the tropical rains, have the greatest power in drying up the parched and barren soil. In India the desert is found between the Aravalli Mountains, the Jumna, and the Indus; and in Egypt every where beyond the valley of the Nile. From near coincidence in latitude, there is great similarity between the temperature at Saharunpore and at Cairo; but in Egypt, lying open to the Mediterranean, the heat is attempered, which in Saharunpore, from its inland situation, would become more

excessive

excessive than it is, were it not for the accession of the rainy season, which in moderating the temperature, also fertilises the country more effectually, because more generally, even than the overflowing of the Nile does Egypt. There, on the drying up of the inundations, as in India on the cessation of the rains, wheat and barley are sown, and with the exception of clover and lupins, nearly the same crops are cultivated as are mentioned at p. 10 as constituting the cold weather crops of Northern India. These are in both countries gathered in about April; while, analogous to the cultivation of India, the winter harvest of Egypt is immediately followed by the sowing of the summer crops, which depend for their growth solely on irrigation, and consist of rice, maize, sorghum, and the other grains which are enumerated as the rain crops of India.

The arboreous vegetation of Egypt, consisting chiefly of figs, acacias, tamarisks, with the date and doum palms,—to which have been added *Melia azedarach, Cassia fistula, Cordia myxa,* and others,—has great resemblance to that of Northern India; while the fruit-trees grown in Lower Egypt are much the same, with the exception chiefly of the Chinese ones that have been enumerated as growing in the open air at Saharunpore. The species common to equinoctial Africa and India have been mentioned by Mr. Brown (Tuckey's Congo, p. 478). Some of these are found in the most northern parts of the latter. M. Delile has likewise given a list of the species which are common to Egypt and India; and at p. 6 of the present work, some additional species were mentioned common to these two countries, while the existence of analogous species of *Farsetia, Cadaba, Linaria,* has been adverted to in the observations on the different families. To these may be added species of *Echinops, Pergularia, Pennisetum, Cenchrus, Trisetum, Phalaris,* together with such species as *Lycium Europæum, Indigofera paucifolia, Cassia absus, Carthamus oxyacantha, Microlonchus divaricatus, Francœuria crispa.* A single fern is enumerated in the flora of Egypt, so one only is found in the neighbourhood of Delhi. At the foot of the hills and in the mountains, other plants are found, which show the extension of the Oriental flora to the northern parts of India, as *Echenais cirsioides* and *Cotula anthemoides,* found in the Deyra Doon, and *Carduus nutans, Lappa major, Jurinea? tricholepis, Gynactis sinapifolia, Carpesium abrotanoides,* as well as a species of *Pyrethrum, P. Roylei* of M. De Candolle, in the Himalayas.

Interesting as are these facts in a scientific point of view, they are not less so when looked to with regard to their practical application. For, as we have seen a resemblance to the flora and cultivation of India in general on the western coast of Africa, and to those of its northern parts in Egypt, while both these countries have acclimated many of its useful productions, so it will be easy to find in it many places suited to the production of the different articles for which they themselves are noted; and many of these would be doubly valuable, as the places adapted to their growth are those which are the least favourable for the staple articles of Indian commerce.

Thus, *Acacia verek* yielding gum Senegal; and *Pterocarpus erinaceus* the African kino; with *Elais guienensis* the oil palm; *Adansonia digitata; Parkia Africana,* the *Nitta*

or *doura* tree *Sterculia acuminata,* the *Kola;* and a species of *Pentadesma,* called the tallow-tree, might all be introduced into India: while *Khaya Senegalensis, Mammea Africana,* and the African teak, to whatever genus (possibly *Dalbergia*) it may belong, would form additional useful timber trees. *Anona Senegalensis, Chrysobalanus Icaco, Sarcocephalus esculentus, Blighia sapida, Parinarium excelsum, Codarium acutifolium,* the cream-fruit yielded by one of the *Apocyneæ,* and *Safu* by one of the *Amyrideæ,* might form useful additions to the fruits of the warmer parts of India; while *Unona Æthiopica, Monodora Myristica,* and the *Amomum* yielding *Melaguetta* pepper, might be cultivated as drugs; and as Africa has adopted the use of the *Cassava,* and the cultivation of *Voandezia* (*Glycine*) *subterranea,* so might they be introduced as articles of food into India.

Eastward from Egypt and Nubia, we have the southern parts of Arabia, which were at one time supposed to abound in all the riches of the East, but for which we now know she was chiefly indebted to her commerce with India. But coffee, its most valuable indigenous product, if it be not originally a native of Abyssinia, has been most successfully introduced into the opposite coast of Malabar (v. p. 4); and senna of excellent quality is grown both at Tinnivelly and Saharunpore, separated by more than 20° of latitude. The balsam of Gilead and the myrrh-tree, the latter probably, as is the former, a species of *Balsamodendron* (v. *Terebinthaceæ*), might also be cultivated; as well as the best aloes manufactured in many parts of India. This, as well as myrrh, is said by Persian authors to be produced in the island of Socotra.

On the other hand, it would not be difficult in the northern parts to grow cotton as good as the Egyptian,* and at the same time acclimate some of its useful productions: as *Acacia nilotica* and *Seyal,* yielding gums superior to that produced in India; the different kinds of senna, of which one has already been successfully introduced, as well as the date; the doum palm would succeed in every part, as it does in the Peninsula; so would the true sycamore; and Alexandrian clover (*Trifolium Alexandrinum*), (which, as well as *Fenugrec,* is cultivated for food and fodder) would probably succeed better than the European species which I introduced into the Saharunpore Botanic Garden.

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* While this sheet is passing through the press, I have had the pleasure of hearing from my friend, Mr. Charles Groves, now of Liverpool, that lately four bales of cotton from Bombay, grown in one of the Company's experimental gardens, had sold for one shilling a-pound, which was more than three-fourths of the American cotton was selling for. This, he justly observes, connected with the fact of Mr. Hughes continuing to grow his superior Tinnivelly cotton, is sufficient to settle the point of India being capable of producing very superior cottons. He also mentions a fact, which will be new to many, that merchants give about thirty shillings per cwt. for American, and not more than fifteen shillings for East-India rice; so that, if the latter were not protected by a duty of fifteen shillings, it would be entirely driven out of the market. It will not surely be said, that India is incapable of producing the superior kinds of rice! But there is one difficulty, and that is, India being a great consumer, as well as grower, of both rice and cotton; and therefore the best kinds of the former, or large quantities of the latter, may not be sent to England. It is apposite and not uninteresting to mention, that the present intelligent ruler of Egypt, in lately sending an unlimited order for plants to be sent to him from England, particularly specified the useful plants of India!

Garden. The Egyptian wheat also (*Triticum durum*) would be a valuable acquisition, as yielding a very abundant crop upon almost sterile soils; but with these are growing some other plants, which promise to be still more useful, if introduced into India, as the olive and the carob tree. The first, extensively cultivated in the driest and hottest parts of the south of Europe, as well as in Egypt and in Syria, was seen by Mr. Elphinstone near Caubul: it has grown for many years in the open air in the Botanic Garden at Calcutta, and would flourish at Saharunpore, as, according to Delile, "les vignes, les olives, et les roses contribuent à la richesse de Fayoum," which is nearly in the same latitude. The carob-tree (*Ceratonia siliqua*), *khurnoob shamee* of Persian authors, first suggested (as well as the cork-tree) to me by Dr. Lindley, as apparently well suited to the climate of Northern India, would be a particularly valuable acquisition; as, seeking its nourishment under-ground, it is independent of surface irrigation. It would be available in many places in years of scarcity or of famine, and in ordinary times for feeding cattle. That it is very retentive of life we may conclude from a fact mentioned by M. Bové, of a tree supposed to be nearly 300 years old, which was cut down by the French in their invasion of Egypt; thirty years afterwards, Ibrahim Pacha having cleared the ground and sunk wells in the neighbourhood, the return of moisture induced the springing out of some branches, which in three years were from ten to twelve feet in height. The abundance of the produce of the carob—some trees yielding as much as 800 or 900 pounds of fruit or pods—renders these so cheap, that they are eaten by the poorest people, and even given to cattle, mules, asses, and horses, in Egypt, Syria, and the south of Europe. During the Peninsular war, I am informed by Dr. Lindley (who learnt the fact from several officers who had served there), that the horses of the British cavalry were often fed, and thrived upon the seeds or beans, as they were there called, of the carob-trees. (v. also *Loudon Encyc. of Plants*, p. 868.)

But, in fact, the whole of this tract is included in what Mirbel has so well designated as the temperate transition zone, which, commencing at the south of Europe and the north of Africa, extending eastwards, includes Asia Minor, Syria, and the Caucasian regions; whence, as we have seen, some representatives of the flora extend even to the north of India, with which, in many respects, correspond the southern parts of Persia and Beloochistan, and the country northwards towards Mooltan and Caubul. In the northern parts of this zone, as the southern parts of Spain, Italy, and Sicily, and even of France and Greece, the sun is powerful, the heat considerable, and the ground dry and parched up in summer, with but a moderate degree of cold in winter. Many of the productions are such, that we see them extending to the southern parts of the temperate, and some even into the equinoctial zone: as the date, doum, and palmetto palms,—several Asiatic and African mimosas and acacias,—*Melia azedarach, Agave Americana, Yucca aloifolia, Aloe perfoliata, Nerium oleander, Lawsonia inermis, Calotropis gigantea* and *procera;* and with these are cultivated limes, lemons, and oranges, the jujube and pomegranate, with bananas, sugar-cane, sweet potatoes, sorghum, maize, millet, and rice.

But growing with these are many useful plants, of which some might be successfully introduced into India, as the olive and carob trees already mentioned; the laurel and sweet bay, manna ash, pistachio, mastick, and Venice turpentine trees; the species of *Cistus* yielding laudanum, as *C. ladaniferus*, and *creticus; Styrax officinale* yielding *storax;* and the species of *Astragalus*, from which tragacanth is obtained, as *A. verus, gummifer* and *creticus:* to these might be added, sumach, savine, scammony, and colocynth; while the cork-tree covering the hot and arid plains of Spain, might, with the Ilex, Kermes, Dyer's and Barbary oaks, be grown in the north of India, where some of the Himalayan species do not refuse to flourish. The *Cactus opuntia* has been strongly recommended by Colonel Herriott for introduction from the south of Italy to the north of India; and it seems well suited to the climate of the northern provinces; where also *Poterium spinosum*, valued as fodder for cattle, might be a valuable acquisition.

Several of the plants enumerated, as the sumach and pistachio, have already been introduced into the Saharunpore Botanic Garden, where they grow in the open air, with pines, walnuts, poplar, &c. (v. p. 10), and to none of those of the Oriental region did the climate appear unfavourable; it may therefore be suited to others, though it would be unreasonable to expect that it should be equally so to all: but between the mountains and the plains, there is reason to suppose that suitable situations may be found for the greater number, as will be more apparent from the observations on the distribution of the natural orders to which they respectively belong. For the very families which occur in the highest proportions in the Oriental region, are those which exist in the largest numbers in the Author's Herbarium, formed in the plains and mountains of Northern India: as *Leguminosæ, Compositæ, Gramineæ, Cyperaceæ, Labiatæ, Cruciferæ, Rosaceæ, Umbelliferæ, Ranunculaceæ, Caryophylleæ, Boragineæ*, and *Gentianeæ*. In the plains there are numerous species of *Euphorbiaceæ, Malvaceæ*, and *Cucurbitaceæ*.

The extent to which the acclimitation of plants may be carried, or the benefit which may be derived, it is at present difficult to conceive, for not many years have elapsed since true principles have even in England been applied to the subject, where, as my friend Dr. Graham expresses it, "every rare plant was supposed to require heat;" and now the gardens and shrubberies are adorned with the richest varieties, and all intelligent cultivators seek for plants from congenial climates. India, open by sea to the productions of South America, has already possessed herself of such, as the guava, custard-apple, pine-apple, tobacco, maize, capsicum, and others, which appear as much at home as its native productions; but the difficulty of communication on the north, and the nature of the countries and people which intervene, are sufficient to account for the few productions of the Oriental region which have travelled southward. It is fortunate that the Honourable Company's Botanic Garden at Saharunpore, with a nursery in the Hills, is so favourably situated for carrying on the experiments necessary for the acclimitation of the useful plants of this region; which no doubt the present zealous superintendent, Dr. Falconer, will carry into execution, as the means are afforded or opportunities

tunities offer. Such experiments, though they can be extensively or beneficially carried on only when the climate and natural products of a country have been ascertained, are well calculated to convince those who, unacquainted with a subject, are yet inclined to question its utility; and though incapable of appreciating the worth of the information obtained, or the truth or error of the inferences deduced, yet consider themselves fully qualified to pronounce upon their value. But the botanist, contemplating his science in all the bearings with which modern improvements have invested it, in examining the peculiarities of a new vegetation, ascertains also what it is capable of yielding useful to man, either as diet, in medicine, or in the arts; and connecting structure with the climate in which it is found, infers, with almost unerring certainty, for what useful productions of other countries it is particularly adapted: and has thus the gratification of contributing at once towards the perfecting of his science, and pointing to the means for improving the resources of the country for the benefit of which his investigations are, in the first instance, especially intended.

52. OCHNACEÆ.

The plants of this small family, allied to *Simarubeæ*, are found in the hot parts of South America, as well as of Africa, and in the islands of Madagascar and Mauritius; whence we trace them into Ceylon and the Indian Peninsula, and across the ocean to Arabia, which participates with India in many of the same genera. On the eastern side of the Bay of Bengal, we have them running up the Malayan Peninsula to Silhet, where *Ochna squarrosa* is found, as well as at Prome and in the Indian Peninsula; and still higher we have, as frequently noticed, a diminutive species of a tropical genus as we proceed northwards. This, *O. pumila*, Ham., which is probably the same as both *O. nana* and *O. humilis*, is found at Goruckpore; but in gardens, *O. squarrosa* succeeds in the open air as far as Saharunpore. In the Peninsula the species of *Gomphia* prevail with *Ochna*.

The plants of this family possess but little sensible property; but that little is of a bitter and rather astringent nature, so that some of the species are employed as tonics.

53. CORIARIEÆ.

This family, consisting of a single genus, and of but few species, has a very wide distribution, single species occurring in very different parts of the world; as one in the south of Europe and north of Africa, another in New Zealand, a third in Mexico, and a fourth in the Himalayas, with the remaining four species in Peru; so that few inferences can be drawn from their distribution, except that they require a cool climate.

The Himalayan species, *C. Nepalensis*, has been figured by Dr. Wallich in Pl. As. Rar. t. 289; and there is a representation of both the male and female plant in No. 71 of the series of drawings made by the Honourable Company's painters while under my direction. This species, originally found in Nepal, is common at Mussooree, from 5,000 to 7,000 feet of elevation, to which, from its abundance, it has given its own name *Mussooree*.

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M. De Candolle having considered all the floral envelopes as calyx, Professor Lindley remarks, "I do not see upon what principle, either of structure or analogy;" and the inner row of sepals, narrower than the outer, appear to all intents to be petals as much as the others are sepals, as all are modifications of the same substance. In the Himalayan species—which is polygamous, if not diæcious—there are in the male flowers five sepals and ten stamens, with the rudiments of the five pistils; in the female flower there are five sepals, alternating with an inner row of five narrow petals, which again alternate with five imperfect stamens, the whole surrounding five well-developed pistils.

The pseudo-berry, or fruit formed by the junction of the several pistils, is frequently eaten in the hills; though that of the European species is considered poisonous, when taken in any quantity. It is related that several soldiers of the French army in Catalonia were affected by eating them: fifteen became stupified and three died. (v. Lindley and Fée.) *C. myrtifolia,* rich in tannin, is used in Europe by dyers for staining black; and *C. ruscifolia,* in Chili. The stems and leaves of the former are also considered pernicious; those of *C. myrtifolia* have unfortunately in France been employed to adulterate senna-leaves, and have produced fatal consequences, where these have been prescribed. (v. Fée.)

B. CALYCIFLORÆ.

As the foregoing families belong to M. De Candolle's great sub-class of *Thalamifloræ,* so do the following to his *Calyciflorœ:*

54. CELASTRINEÆ.

This order, separated from *Rhamneæ,* with which it was formerly united, may be readily distinguished by its alternate stamens, imbricate calyx, and hypogynous disk. It is related to *Euphorbiaceæ;* hence, in unexamined herbaria, plants of the one order are apt to be referred to the other. By M. Brongniart it is considered to be allied to *Malpighiaceæ,* through *Hippocrateaceæ.*

In *Celastrineæ,* M. De Candolle has included the ILICINEÆ of M. Brongniart, and the STAPHYLEACEÆ of Dr. Lindley; the latter distinguished by their opposite and pinnate stipulate leaves, and indicating an affinity between *Celastrineæ* and *Sapindaceæ.* Of these, the species of *Staphylea* are single species distributed in the south of Europe, in North America, and Peru; one species has also been found in Japan and in the Himalayas. The latter, the *S. Emodi* of Dr. Wallich, was procured by him from Srinuggur; I have found it on Urukta, about 7,000 feet of elevation, also near Burkote, and have had it brought me from near Peer Punjal. *Turpinia,* of which the original species is a native of St. Domingo and the mountains of Mexico, has been ascertained to be identical with the *Dalrymplea* of Dr. Roxburgh, of which the original species, *D.* now *T. pomifera,* was found in Silhet, and the second, *D. Nepalensis,* in Nepal, as well as in the Peninsula. A species of this genus has also, as I learnt from Mr. Arnott, been obtained from near Canton,

Canton, and serves, with numerous others, to show the analogy in vegetation between the southern parts of China and India, as mentioned at p. 122; and with the flora of the latter, the jungly base of Nepal, as we have frequently seen, is almost identical; while the existence of *Staphylea* in Japan, and at moderate elevations in the Himalayas, is an additional instance of their correspondence in vegetation.

Of the *Euonymeæ* or true *Celastrineæ*, *Euonymus* having almost the distribution of *Staphylea*, occurs also in the Himalayas in considerable numbers. Of the eight species enumerated by Dr. Wallich, seven are found to the northward of the Ganges; *E. Hamiltoniana*, in the Deyra Doon, according to Dr. Wallich, and *E. tingens, echinata*, and *vagans*, at moderate elevations, as from 5,000 to 7,000 feet. *E. pendula*, Wall., considered by some botanists to be identical with *E. Japonica*, is found in similar localities; but *E. frigida* and *fimbriata* occur only on such localities as Choor and Urukta, at about 8,000 feet of elevation. *E.* (*lacerus*, Don) *grandiflora*, Wall. Pl. As. Rar. t. 254, is found in Nepal and Kemaon, and *E.? theæfolia* on Chirraponjee. Other species are found on the other mountains of Silhet, and two on those of the Peninsula. This is another of the genera, which shows the analogy in vegetation between Japan and parts of China with the Himalayas.

The species of *Celastrus* found in warm parts of the world, occur also in India, in the Peninsula, and along the foot of hills. The Nepal species, *C. dependens, rufa, stylosa*, and *neglecta*, are probably found in valleys, as I have never seen any of the species in other situations. *C. nutans* occurs in the Deyra Doon and Kheree Pass, and *C. Royleanus*, in the latter, and near the Suen Range. To these, another species, *C. spinosus* nob. *Ic. ined.* t. 73, may he added from similar localities. With *C. nutans* is also found in the Deyra Doon *Elæodendron* (*Nerija*, Roxb.) *dichotomum*, both of which also occur in the most southern parts of India. In addition to these, Dr. Wallich has formed two new genera: *Kurrimia*, allied to *Maytenus*, and *Microtropis*, of Dr. Roxburgh's *Euonymus garcinifolia;* but neither of these extend further north than Silhet.

Of the *Ilicineæ*,—placed here by M. De Candolle, but considered by M. Brongniart more allied to *Ebenaceæ*, among the *Monopetaleæ*,—species of the genus from which the order has been named exist in most parts of the world in mountainous and cool situations; so *Ilex dipyrena* is common at Mussooree, and every where in the Himalayas, bearing very close resemblance to the common holly, especially when covered with its clusters of scarlet berries in November and December. *I. excelsa*, Wall. N. 4328,—which has, however, been also referred to *Cassine* and to *Prinos*,—is also found in Nepal and Kemaon; and at Mussooree another lofty species, *I. serrata*, nob.

The properties of the plants of *Celastrineæ* have not been much investigated, but an acrid principle has been detected, which acts with more or less activity in different species; and the seeds of several yield oil, which is used for burning. That of *Celastrus nutans* is said, in India, to be of a stimulant nature, and used in medicine. The bark of *Euonymus tingens* is in the inside of a beautiful light yellow colour, similar to that of some of the nearly allied genus *Rhamnus;* it is used to mark the *tika* on the forehead of Hindoos;

Hindoos; and might be employed as a dye. I was informed by Sir Charles Grey, on his return from Simla, that it is also considered useful in diseases of the eye. The leaves of *Celastrus edulis,* قات *kat* of the Arabs, cultivated with the coffee, would appear from Forskal's account to be of a stimulating nature. The wood of the several species of *Evonymus* might be used for the same purposes as that of the spindle-tree is in Europe.

Of the *Ilicineæ,* the holly is well known to be employed for making bird-lime, as some of the figs are in India; and the genus is remarkable for containing the *Ilex paraguariensis,* or maté-tree, which produces the famous Paraguay tea, now an article of considerable South American commerce, for which, if it was thought desirable, a suitable locality might no doubt be found within the Indian territories. The *Ilex vomitoria* is considered to be tonic, inebriating, and in larger doses emetic; while *Prinos verticillatus* is accounted in North America a powerful febrifuge.

Euonymus echinata, Wall. v. Fl. Ind. ed. Wall. 2. p. 410. Hooker Bot. Mag. t. 2,767. Tab. 31. f. 1. (*a.*) The flowers; (*b.*) the same reversed; (*c.*) capsule cut transversely; (*d.*) the seed enveloped in the arillus; (*e.f.*) the same with the latter opened.

55. RHAMNEÆ.

The true *Rhamneæ* are, like the *Celastrineæ,* allied to *Euphorbiaceæ.* M. Brongniart remarks, that if we consider the insertion of stamens the most important distinction of plants, they will come among polypetalous orders with perigynous stamens, nearest to *Pomaceæ;* but if this be left out of consideration, they will be found to have many characters in common with *Byttneriaceæ.*

Rhamneæ are found in almost every part of the globe within the temperate and equinoctial zones, and the different genera affect respectively cool and warm situations. Thus *Zizyphus* is found chiefly in the latter, from the equator to the north of Africa and Syria, and southwards to the Cape of Good Hope; every where in the plains of India, and also in the Himalayas, but only within the valleys. *Z. flexuosa,* which Dr. Wallich describes from the neighbourhood of Gossainthan, I have also received from the foot of mountains towards Cashmere; but in the valleys of Gurhwal and Sirmore, *Z. acuminata* is found, as well as *Z. mauritiana?* Near Kheree there is *Z. œnoplia,* with a new species, *Z. bhunder;* but in the plains of N. India, *Z. jujuba* is the most common species. Near Delhi, and on the banks of the Jumna, *Z. œnoplia* is found, as well as *Z. napeca,* Roxb. In the mountainous country from Sherghatty to Roghonautpore, *Z.* (*latifolia,* Roxb.) *rugosa* and *xylopyra* are common with some new species, as *Z. ruminata,* Ham., and *Mirzaporiensis,* nob. *Gouania,* a genus found in the West-Indies and South America, extends in India from the Peninsula to the Deyra Doon, where *G. leptostachya* is found, with another Peninsular plant, *Ventilago maderaspatana.* Dr. Wallich has also a *Gouania nepalensis;* and *G. lanceolata* is common about Hurdwar, near Saharunpore, and also at Delhi, according to Dr. Wallich. *Ceanothus,* as formerly constituted, is another genus found in warm parts of the world, but as now restricted, chiefly in Mexico and North America. *Ceanothus,* now *Colubrina Asiatica,* is found in the Indian and Malayan Peninsulas;

sulas; and *Scutia indica*, which includes *Ceanothus zeylanicus* and *circumscissus*, is not mentioned out of the former. Dr. Wallich has, however, two Nepal species, *C. nepalensis* and *C. triquetra*; the latter, with the exception of the emarginate petals, agreeing with the character of *Scutia*, extends from Kemaon to the Deyra Doon and to Mussooree, at 6,500 feet of elevation, as well as to many parts of the hills. *C. venosus*, nob., is found at Nagkanda. *Hovenia dulcis* is common to India, China, and the Himalayas, and is certainly indigenous in the latter, as I have found it wild in the woods about Mussooree, at 6,500 feet of elevation. *Berchemia* and *Sageretia*, genera common to China and North America, with species of the latter, also in South America, are both found in India and at the foot of the Himalayas. *B. parviflora* in the Peninsula; *B. flavescens* towards Gossainthan; *B. floribunda*, in Nepal and Kemaon; and *B. laxa*, of which the fruit is that of the genus, is found in the low and sheltered valley of Sahunsadhara, as well as in the Kheree Pass. *Sageretia oppositifolia* and *ramosa*, are found in Nepal; of these the former extends to the Deyra Doon. *Paliurus*, found in Syria and the south of Europe, has also a species, *P. virgatus*, Don. Bot. Mag. t. 2,535, in Nepal, where *Rhamnus*, a genus of very wide distribution, has also a representative. This, the *R. virgatus* of Dr. Roxburgh, is common in both Kemaon and Gurhwal. At Mussooree, it is found at 6,500 feet of elevation; where also *R. rupestris*, nob., is common; while another new species, *R. purpureus*, is found at Simla, and on the sides of Choor.

The berries of one species of *Rhamnus*, or buckthorn, have long been known from their cathartic nature: this property is participated in by those of other species, as well as by their inner bark. The berries of *R. catharticus*, *infectorius*, *saxatilis*, and *amygdalinus*, known as French and Turkey berries, *graines d'Avignon* and *graines jaunes*, also furnish a colour, which varies from yellow to green. This M. Brongniart supposes is owing rather to different degrees of ripeness than to essential differences in nature; it is probable, therefore, that the Himalayan species, especially *R. virgatus*, so common everywhere, and so loaded with berries, might form an effectual substitute, and be useful as a dye in the country, or serve as an additional article of commerce. The fruit of *Zizyphus*, on the contrary, is of an edible nature, frequently sub-acid, pleasant-tasted, and nourishing. This is an anomaly not unfrequently presented, M. Brongniart remarks, by the fleshy part of the fruit, when every other part of two plants may agree in possessing the same properties, as for instance, the peach and almond. *Z. vulgaris*, or jujube, introduced from Syria, is cultivated in the south of Europe for its pleasant-tasted fruit; the long-famed *Z. lotus*, in Africa, and *Z. spina christi*, in Syria, afford edible fruit in their respective countries; so in India and China, *Z. jujuba*, *nitida*, *napeca*, Roxb., and other species, yield a fruit, which is much eaten by the natives of these countries. The first with round fruit is the most common species in the jungles of Northern India, but in the gardens there is a variety or distinct species, with oblong fruit, which attains a considerable size, and when grafted, yields a very pleasant-tasted fruit, called *ber*, which may be styled the Indian jujube. In Persian works, *berree* and *jharree* are said to be its Hindoostanee; *kinar* and *khial* its Persian; *nebbek* and *sidr* its Arabic

 names;

names; the two latter, as we learn from several authors, are in Arabia and Africa applied to *Z. lotus* and *Z. spinachristi*. The fruit of the wild kind is dried and powdered, as was done with the *lotus* of the *Lotophagi*: this powder, in Arabic, is called *suvekoon-nebbek;* in Persian, *arud-i-kinar;* and in Hindee, *ber-choonee*. This kind bears a kind of lac, in Northern India called *beree-ke-lakh*, which is used for dyeing leather, cotton, and silk. Some of the species of this order are said to possess astringent leaves, and some are remarkable for the denseness and goodness of their wood.

56. SAMYDEÆ.

This order is placed in *Dichlamydeæ* by M. De Candolle, though the flowers of all the species are apetalous; it ought therefore to be removed to *Monochlamydeæ*, to preserve the principle of arrangement, as it is not particularly allied to the families near which it is placed; plants belonging to it may be easily distinguished by their leaves having a mixture of round and linear pellucid dots. They are found only in the warm parts of the world, as in the West-India Islands, Mexico, and South America; in Asia, we have them in Java, Ceylon, and Penang, extending into the Peninsula of India, and from Silhet up to the banks of the Jumna. The distribution of the Indian species is, however, difficult to ascertain, as the leaves of each vary so much at different ages, and the specimens in the East-India Herbarium show them generally only at one age, and without fruit.

Casearia vareca, Roxb., seems to be confined to Goalpara and Silhet. *C. cheela*, nob., an *C. piscidia?* Hb. Ham., is found with *C. tomentosa* and *C. pauciflora*, nob., in the Doon and valleys within the hills. Another species, with smooth leaves, is found in the valleys, near the Choor, *C. alnifolia*, nob., an *C. Hamiltonii*, Wall. In the central range, on the line of the great military road, *C. canziala*, Hb. Ham., referred by Dr. Wallich to *C. ovata*, is common.

The leaves of some of the species are said to be astringent, but of one species are eaten by the natives of India, according to Dr. Roxburgh.

57. HOMALINEÆ.

Of the *Homalineæ*, found only in warm parts of the world, species of *Blackwellia* are alone found in India. This genus, found in the African islands of Mauritius and Madagascar, as well as in Java, extends upwards along the Malayan Peninsula, and the tropical jungle at the base of the Himalaya, as far as Nepal, where *B. nepalensis* is found; but which I have not met with further north.

58. CHAILLETIACEÆ.

Of this small order, found in Guiana, Sierra Leone, Madagascar, and the island of Timor, there are no indications in India, as No. 4,038 and 7,443 of the East-Indian Herbarium, referred here by Mr. Brown, are only found in the Malayan Peninsula.

59. AQUILARINEÆ.

This order, consisting of but few genera and species, and these found chiefly in the Indo-chinese territories, hardly admits of notice in the present work, though one species extends northwards as far as the forests of Silhet, were it not for the opportunity of publishing a drawing of Dr. Hamilton's, from the collection of the East-India Company, of the tree which yields one at least of the kinds of *Agallochum* of the ancients. This has long been traced to India, Malacca, Siam, and Cochin-china. Loureiro is confident that all the kinds of true aloes-wood, especially the most valuable, called *Calambac*, was produced by his *Aloexylum Agallochum*, which he places in the Linnean class and order, *Decandria Monogynia*, and which De Candolle refers to the natural family of *Leguminosæ*. This tree grows in the lofty mountains of Cochin-china, called Champava, in 13° of N. latitude, near the great river *Lavum* (Mei-kong?) which flows between Cochin-china and the Laos. From the positive testimony of Loureiro, as well as from the information obtained from the Siamese by my late friend, Mr. Finlayson, when at Chantibond, that the *Calambac* and *Agila*-wood were produced by totally different trees, it is more than probable that the *Aloexylum* of Loureiro produces one, perhaps the most valuable, kind of *Agallochum*. But it is remarkable, that in both trees, the fragrance is asserted to be the effect of disease; but as Mr. Finlayson says, "the opinion may well be called in question," especially, as in examining the structure of sound agila-wood under the microscope, the cells may be observed filled with the fragrant resinous secretion. *Excæcaria Agallochum*, of the natural order of *Euphorbiaceæ*, is another tree, which, on the authority of Rumphius, is said to produce a kind of aloes-wood. M. Fée, who has seen a genuine specimen of the wood of this tree, states that its fragrance cannot be compared with that of the *Agallochum* of Loureiro, which, moreover, does not present on its transverse section, the mouths of the ducts which are so conspicuous in the wood of *Excæcaria*.

A third kind of *Agallochum* or aloes-wood, and that which is the best known has long been imported by Europeans from Malacca and the kingdom of Siam. Of this, no doubt, the Malay name *agila*, has given origin to the terms aquila and eagle-wood, particularly as the Portuguese, the first direct importers, called it *pao-d'agila*. The Sanscrit name *agura* is very similar to the Malayan, and has been converted in India into *aggur*, *ugoor*, and *uggur*. The Arabic names are said to vary from *agalugen* and *ayaloogi* to *ulfakh* and *unjugion*. In Persian works on Materia Medica, three kinds are described under the names of, 1. *Aod-i-sumooduree*. 2. *Aod-i-hindee*. 3. *Aod-i-chinee*. In the bazars, in making a collection of the articles of the Indian Materia Medica, I obtained three kinds. 1. *Aod-i-hindee*. 2. A kind obtained by commerce from Surat, which, however, does not appear to differ essentially from the third kind, *Aod-i-kimaree*. This is probably the *Al-cemericum* (this word differing only in having the Arabic article as a prefix) mentioned by Aboo-Hanifa, as quoted by Serapion in Mathiolus (Comment. in Diosc.) and which has probably been derived from the name of some place, as we

learn from Malte Brun, that " on the frontier of Pegu, there is said to be a considerable town, called *Cambouri* (in other works, probably, the same place is called Kamar) the seat of a great commerce in eagle-wood, ivory, and rhinoceros' horns, and from this comes the finest varnish." (*Mod. Trav.*, Birmah and Siam, p. 300.) In Persian works, it is stated, that the Greek name, more particularly applied to *aod-i-kimaree*, of this *incense-wood, aod-i-bukhoor* is *agallokhee*, which is no doubt intended for the αγολλοχον of Diosc. 1. c. 21.

Having ascertained the native names, and the article now in use, to which the translators into Arabic applied the Greek name, it remains to identify the tree which produces the Malayan and Indian *Agallochum*. M. Sonnerat, in his second voyage to India, obtained specimens of a tree which was supposed to afford the true *Bois d'Aigle*. Of this he presented a branch to Lamarck without fructification, but accompanied by a small drawing of the flower and fruit, which are those probably figured at T. 376 of the Illustrations, and from which most probably the generic character was drawn up. This, M. Lamarck, under the description of *Bois d'Aloes, Agallochum officinarum*. Bauh. Pin. 393, says has great resemblance to the *Agallochum secundarium* of Rumphius, Hort. Amb. 2, t. 10, as well as to the *Sinkoo* of Kæmpfer, 903, and has called it *Garo de Malacca, Aquilaria Malaccensis*. *A. ovata* Cav. diss. 7, p. 377, t. 224.

Dr. Roxburgh, in describing his *Aquilaria Agallocha*, states, that it is an immense tree, a native of the mountainous parts east and south of Silhet, in about the latitude of 24° to 25° N., which flowers in April, and ripens its seed in August, and that it affords the real *Calambac* or *Agallochum* of the ancients; adding, there seems more reason to conclude that it was carried to China from our eastern frontier, than to suppose it was carried from Cochin-china, where it was always in great demand. Small quantities are sometimes imported into Calcutta by Siam from the eastward; but such is always deemed inferior to that of Silhet. From Aboo-Hanifa, it is also stated, *l. c.* " Agallochum verum India mittit præstantissimum." Thriving plants, Dr. Roxburgh further states, " of the *Garo de Malacca*, received from that place, are now in the Botanic Garden, and so exactly like plants of the same age and size of our species, that they cannot be distinguished;" but as the Malacca plant had not then flowered, Dr. Roxburgh was unable to determine whether they corresponded in every respect; until then, he says, we may be allowed to consider the above *A. ovata* as another species of the genus.

Dr. Buchanan Hamilton, in his investigation of the eastern frontier of Bengal, also met with this plant near Goalpara, v. Wall. Cat. 7,250. *c.*, which he considered to be the *Agallochum officinarum*, as this name is affixed both to his specimens and drawing. Dr. Wallich also obtained specimens of the same tree from Silhet, by means of his plant collectors, v. Cat. 7,250. *a.*; and I am informed by Dr. Lindley, that he also was decidedly of opinion, that it produces the eagle or aloe-wood of commerce, an opinion of the more value, as Dr. Wallich had opportunities of visiting the countries eastward of Bengal. The specimens of this plant having been distributed to different botanists

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by the liberality of the East-India Company, Dr. Lindley had an opportunity of examining the fructification, of which he has given the most correct description in his valuable *Introd. to the Natural System*, p. 77, and has with his usual liberality favoured me with the dissections which accompany the figure from Dr. Hamilton's drawings.

It is much to be regretted, that Mr. Finlayson, in his visit to Siam, was unable to obtain specimens of the tree producing the agila-wood, as he would not probably have referred even in his unrevised journal, to both Roxburgh and Loureiro for the botanical descriptions of the plant, as there is no doubt, from microscopical examination of the wood, that the several kinds of *Agallochum* must be the produce of different genera. But it is remarkable how nearly the plant which affords the *Calambac* of Cochin-china approaches in its locality to that from which the agila-wood of Chantibond is obtained, as the latter is nearly in the latitude, and (taking the Mei-kong as the great river alluded to) also in the longitude assigned by Loureiro to the *Calambac* (v. Supra ;) and " the agila-wood of Chantibond is reckoned among the best, and only equalled by that of Cochin-china." (Finl. p. 258.) It is there called *nuga-mai* and *mai-hoam*, also *kisna*, Macul. Dict. of Commerce, where it is stated that it is produced in the greatest quantity and perfection in the countries and islands on the east coast of the Gulf of Siam.

Mr. Finlayson informs us, that the consumption of this highly-odoriferous substance is very considerable, even in Siam, but the greatest part is exported to China. The consumption in the latter is extensive, though used chiefly in a very economical mode: the wood being reduced to a fine powder, and mixed with a gummy substance, is laid over a small slip of soft wood, about the size of a bull-rush, so as to form a pretty thick coating. These are lighted in their temples, and give out a feeble but grateful perfume. We are informed by M.M. Merat and Delens, that the aloe or eagle-wood was burned as incense by Napoleon in the imperial palace.

In conclusion, it may be stated that I agree with Mr. Finlayson in considering that there does not appear sufficient foundation for the hearsay opinion of the odoriferous principle of agila-wood being the effect of disease. Pieces of apparently the most sound wood display the cells gorged with the fragrant resin, which is most probably deposited in the largest quantities in the internal central wood, the amount of which may therefore depend upon age and a favourable soil; but this can only be ascertained by observation on living trees. Should this explanation be correct, the result would be to prove the practicability of cultivating this tree more extensively on our eastern frontier with an assurance of a favourable result, and prove the utility of minute observations of a scientific nature, even by the practical deductions to which they lead.

Aquilaria Agallocha ; Roxb. Fl. Ind. 2. p. 422. Wall. Cat. 7250. v. Tab. 36. f. 1.—(*a.*) A branch in flower. (*b.*) Ditto with unripe fruit from Dr. Hamilton's drawings. (*c.*) An expanded flower, shewing the downy surface of the calyx, and its five reflexed segments; together with the ten woolly scales which arise from its orifice, and the stamens which alternate with them. (*d.*) The same, cut open, the pistil being abstracted. From this it is seen that the inside of the calyx is lined with the ten scaly woolly processes, which are free at their upper extremity, as shewn at fig. *c.* but which adhere to the

the calyx throughout the remainder of their length; alternating with them, and forming an inner series, are the ten stamens, the filaments of which adhere to the sides of the calyx, and separate the bases of the scales by elevated naked lines; the anthers originate nearly from the sinus of the faucial scales, a very short portion only of the filaments being free. (*e.*) A section of the pistil. The stigma is an orbicular fungous body, slightly depressed in the middle, and very like that of some *Thymelææ*; it communicates, by means of a very short style, with the ovary, which is woolly and one-celled, (two-celled in Roxb.); its ventral suture projects into its cavity in the form of a thin plate, from each side of which hangs a suspended ovule. (*f.*) Represents one of these ovules, which has a plano-convex figure, and is extended into a thin membrane along the whole of the convex side which is next the placenta; it is produced downwards into a taper horn, at the point of which it is to be presumed is the foramen; upwards it is gradually rounded off.—I am indebted to my friend, Dr. Lindley, for this description, as well as for the drawings of his dissections.

60. TEREBINTHACEÆ.

The *Terebinthaceæ* of Jussieu have been divided by modern botanists into several orders, such as *Anacardieæ, Sumachinæ, Spondiaceæ, Burseraceæ, Amyrideæ,* and *Connaraceæ.* The last appearing to be closely allied to *Oxalideæ,* has been already mentioned, and the remainder being so closely related to one another, and participating in many of the same properties, and having much the same geographical distribution, it is most convenient to treat of them as one whole, whether this be considered as an order containing several tribes, or as a class where these will be elevated to the rank of separate families.

The genera of *Terebinthaceæ,* peculiar to India, are *Semecarpus, Buchanania, Boswellia, Odina, Sabia, Pygeum, Syndesmis, Holigarna,* and *Melanorrhæa.* Of these the four last are confined to southern parts, as the forests of Silhet and the Malayan Peninsula, while all the others are found in the most northern parts of India, at the foot of, and at moderate elevations on the Himalayas; *Sabia* alone is found at a considerable height, with species of *Rhus,* which we know extends northwards to the south of Europe, and southwards to the Cape of Good Hope; it is also found in China, and in North as well as in South America. Being thus a genus of considerable distribution, it is not confined to the Himalayas, but occurs also in the Peninsula of India, of which one of the species, *R. Mysorensis,* extends up to the neighbourhood of Delhi. *Mangifera* and *Garuga* are likewise genera found in northern parts, whence they extend southwards, the former to the island of Mauritius, and the latter to that of Madagascar. *Protium* and *Canarium,* confined to the southern parts of India, extend into the Indian Archipelago, and the latter into China. *Balsamodendron* is common to Arabia, Abyssinia, and India; while *Anacardium, Spondias, Icica,* and *Amyris?* are common to South America, and to both the West and East Indies. The last is mentioned with doubt, as most of Dr. Roxburgh's species have been removed to other genera.

The species of these genera, which show themselves in the most northern parts, as in the Deyra and Kyarda valleys and lower hills, are *Semecarpus cuneifolium,* very closely allied to *S. Anacardium, Buchanania latifolia, Odina Wodier, Spondias mangifera, Boswellia glabra,* and *Garuga pinnata.* The mangoe attains its full size, and ripens excellent fruit in the latitude of Saharunpore and at Kirana. The tree thrives as high as

4,000

4,000 feet at Nahn, but does not ripen its fruit. I know not how much further north it extends, but have heard that the fruit does not ripen at Lahore. The species which have been mentioned, are those which are found in most parts of India, in the jungly tract along the foot of the Himalayas, in the forests of the central range of mountains, as well as in those of the Peninsulas. In the forests of Silhet and Chittagong, other species are prevalent, as *Holigarna racemosa* and *longifolia*, *Melanorrhæa usitata*, species of *Canarium*, *Bursera serrata*, Wall., (*Schinus niara* and *Benghalensis*, of Hb. Ham.) referred by W. and A. to *Icica*, *Balsamodendron commiphora*, and *Pygeum acuminatum*. Species of *Syndesmis* have as yet only been found in Tavoy and Penang; *Anacardium occidentale* occurs only in the islands, but is cultivated in the Peninsula, where species of *Protium* are alone found.

Sabia, Colebr., is one of the new genera which is found in Silhet and Nepal, extending northwards to the vicinity of the Ruenka lake, and also to the valleys on the sides of Urukta. This would be the only plant of the order at any considerable elevation in these mountains, if it was not for the prevalence of the genus *Rhus*, of which several species are found here, and are very common. *R. parviflora*, Roxb., is that which is found at the lowest elevations. *R. velutina*, Wall., is so nearly allied to *R. cotinus*, that some of its smooth-leaved varieties might be referred to it; of which Caucasus is at present the most southern-known distribution. *R. kakrasingee*, nob., (*R. acuminata*, D. C.?) which, by Dr. Wallich, has been united with *R. succedanea;* and of which the horn-like excrescences, formed probably in consequence of the deposition of the ova of some insect, have long formed a famed article of Hindoo medicine, is found in the Deyra Doon, and every where in the hills, at moderate elevations.

The other species are closely allied to those found in Japan. Thus, *R. vernicifera*, D. C. includes both the Japan plant, *sitz* of Kæmpfer, and Dr. Wallich's *R. juglandifolia*, found in Nepal, Kemaon, and every where in Gurhwal. *R. Buckiamela*, Roxb., is so closely allied to the Java and Japan *R. semi-alata*, as to have been united with it by D. C., though it has been again separated by Dr. Wallich.

The different groups or families into which the *Terebinthaceæ* have been divided, have a considerable resemblance in the nature of their products. These have been shortly summed up in the excellent work of M. Fée, as consisting, 1st, of fixed oil in the almonds of the seeds; 2d, essential oil, which is combined with resin in the turpentine of the pistacias: 3d, resin, which flows naturally, or from artificial openings made in the trunks of the greater number of species; 4th, gum, which is seldom found pure, but frequently combined with the resin, as in myrrh, &c.

The *Burseraceæ* include the plants yielding the most valuable products, which have long been articles of great commercial importance. Thus, the *Balsamodendron* (*Amyris*) *Gileadense*, or balsam of Gilead-tree, known in the East by the name of *Balessan*, has long been accounted one of the riches of Arabia, whence, or from Abyssinia, its native country, according to Bruce, it was at an early period taken into Syria. It has also been introduced into the Botanic Garden at Calcutta, as well as into the Peninsula of India.

India. *B. Opobalsamum*, to which M. Kunth more particularly refers the *Balessan* of Bruce, and the figure of *Prosper Alpinus*, is perhaps only a variety of the former, affording a similar product. *B.* (*Amyris*, Forsk.) *Kataf* and *Kafal*, are also nearly allied, if not identical species; both are natives of Arabia, and both give out a most fragrant balsamic odour. The wood of *B. kafal* is an article of considerable commerce, according to Forskal, and is that probably which is given in Indian bazars as the *aod-i-balessan*. Forskal also mentions that he had heard of two other trees, which are like these; one the *shujrut-ul-murr*, or myrrh-tree, and the other called *khudush*.

The myrrh-tree, which for so many ages has remained unknown, appears at last to have been identified by Messrs. Ehrenberg and Hemprich, naturalists of Berlin, who collected some myrrh off the plant itself in Arabia, near Gison. This shrub belongs also to the genus *Balsamodendron*, and has been called *B. myrrha*. It is figured by Nees Von Esenbeck, *officinaler pflanzen* 17 *leifer*, and is said to have been found growing with *Acacias*, *Euphorbias*, and *Moringas*. In Persian works, *myrrh* is said to be the produce of Africa and the island of Socotra, as well as of Arabia. By Mr. Bruce the myrrh-tree is described as growing behind Azab, along the coast towards the straits of Babelmandel. Though it would be desirable to have the information confirmed respecting the tree yielding myrrh, yet it is not in consequence of its not explaining the production of East-India myrrh, as hinted by Messrs. Merat and De Lens, for "the Abyssinian myrrh," as stated by my friend, Dr. Thomson, "comes to us through the East-Indies, "while that produced in Arabia is brought by the way of Turkey." But it is very difficult to ascertain the exports or imports of any of the eastern ports; for in the lists of the former, printed for the use of European merchants, we frequently see articles which we know have been previously imported in Arab ships from a variety of places.

Though there does not appear any reason for supposing that myrrh is produced in any part of India, yet there is a substance having the closest resemblance to it, which is imported into and known in Europe as Indian myrrh. This is also said very closely to resemble, if indeed it at all differs from *Bdellium*: it is probable, therefore, that it is what in India is known by the name of *googul* (*mooql* of the Arabians), as it forms the *Bdellium* of commerce, and resembles an inferior kind of myrrh, as indeed *Bdellium* is frequently described to be. That it is also the *Bdellium* of the ancients would appear from the Persian authors giving *budleyoon* and *madikoon* as the Greek names of *mooql*, Hindee *googul*, evidently the βδελλιον and μαδελκον of Dioscorides. The tree which yields the *googul* has not yet been ascertained, but in the Saharunpore Botanic Garden there is a small tree called by this name, which I was informed was said to produce the drug of that name. As this had never flowered, I regret having deferred inquiring into its history, but believe it had been introduced from Nujeebabad. This, however, is unimportant, as I am well satisfied from the general character of the plant, and especially its bark separating in strips, like the birch, that this must be the *Amyris Commiphora* of Dr. Roxburgh. (Fl. Ind. 2. p. 244.) *A. agallocha* (Cal. Cat. p. 28) of which he gives *googula* as the native name. The characters of this species agree in

every

every respect with those of the new genus, *Balsamodendron*, to which it has been referred by Messrs. Wight and Arnott; it serves to show the analogy between the flora of India, Arabia, and Abyssinia, as well as the similarity in the products of plants of the same genus in these different countries. This Indian species is described by Dr. Roxburgh as being found in Silhet, Assam, and the districts E. and N.E. of Bengal; flowering in the Calcutta Botanic Garden in February and March, but seldom ripening its seed. The whole plant, especially when any part is bruised, diffuses a grateful fragrance, like that of the finest myrrh; so that Dr. R. was induced to think it might be the plant yielding that drug, but seems to have abandoned the idea, in consequence of the evaporation of the exuded juice, and his being able to obtain only a small quantity of a gummy matter, which he observes, certainly resembled myrrh, both in smell and appearance. But this, considering that the trees were young, as they did not ripen their seed, must be considered rather as favourable, than conclusive against their producing any kind of gum-resin. The *googul* which I obtained in the bazars was said to come from the hills, at the foot of which this tree is found; the subject might therefore be traced out by those favourably situated for the purpose. The name *googil* is also applied, according to Dr. Ainslie, by the Tellingoos of the Coromandel coast, to the resin which exudes from *Boswellia glabra*.

There is, however, a substance, famed in ancient and used in modern times, produced also by this group, and known as *Olibanum* or *Thus*, *looban* and *koondur* of the natives of India. Under the latter name, it is described by Avicenna, evidently referring to the λιβανος of Dioscorides, who mentions both an Arabian and an Indian kind. The latter Mr. Colebrooke has proved to be the produce of *Boswellia serrata*, Roxb., (*B. thurifera*, Colebr.), *salai* or *saleh* of the Hindoos, common in Central India and Bundlecund, where I have seen it, especially about the Bisrumgunge ghaut. It is probably also produced by *B. glabra*, which has the same native name, and though extending to a more northern latitude, is distributed over many of the same localities. It is common in the low hills above Mohun Chowkee, where I have myself collected off the trunk of the trees some very clear, pure, and fragrant resin, which burns rapidly away with a bright light, diffusing a pleasant odour. To this kind, according to Dr. Ainslie, the term *googul* is applied by the Tellingoos. The resin of both species is employed as incense in India, and both might be much more extensively collected than they at present are, as there is reason to believe that Central India alone furnishes the greatest portion of the Indian Olibanum of commerce; as it is chiefly exported from Bombay. From the affinity in vegetation between parts of Arabia, Persia, and India, it is not improbable but the genus *Boswellia* may extend into those countries, and afford that which is known as Arabian Olibanum. *Canarium Benghalense* is another plant of this tribe, which, according to Dr. Roxburgh, exudes an excellent clear amber-coloured resin, not unlike copal. In America, as in India, several valuable resins, as *Elemi*, *Carana*, *Chibou*, and two or three kinds of *Tacamahaca*, are afforded by plants of this tribe.

In the group of *Anacardieæ* we have the well-known *Pistacia vera*, *Terebinthus*, and

Lentiscus, yielding respectively *Pistachio nuts, Chio turpentine,* and *Mastic,* products which are all well known in India; the last, called *koondur roomee,* may be translated Turkish Olibanum. *P. Terebinthus* seems to extend into Arabia, where it is called *butum,* as well as into Persia, as it is there called *sukkur.* Mr. Elphinstone informs us, that some of the hills in Caubul produce mastic, and that the pistachio grows wild in Hindoo-koosh. From Caubul, or, as I was informed, from Bokhara, the almond, as well as its pericarp, is imported into India, together with a kind of gall, called *gool-i-pista,* stated, (as in *P. Terebinthus,*) to be formed on, and a resin called *aluk-ool-unbat,* produced by, the pistachio-tree. This may be substituted for that of *P. Terebinthus,* and is probably what is alluded to by Kæmpfer, *Am. Ex.* p. 414. *P. Atlantica,* called *tum* by the Africans, is said by Desfontaines to afford a resin like mastic, which is used for the same purposes. This, therefore, might probably be introduced into the North of India, if the climate should be found too hot for the other species. Several, however, of this group afford useful products in India. Thus, *Buchanania latifolia* affords edible nuts. The mangoe is known for its delicious fruit; inferior kinds are, however, disagreeable to many, on account of the terebinthinate taste and smell of the skin. Besides its well-known uses as a condiment, the unripe fruit is cut into slices and dried—to be used as an acid when the fresh fruit is not procurable. A gum-resin exudes from the bark, as well as from that of *Odina wodier.* The latter is so abundant as to form an article of commerce. It is called, in Northern India, *jhingun ke gond* and *kenni ke gond.* The latter name, or nearly the same, *kinneh ke gond,* is given by Dr. Ainslie as the Hindoostanee of *Galbanum.* A gall is also produced on the leaf and fruit of *Odina wodier,* formed by the deposition of the ova of a species of *Aphis.*

Some of the *Anacardieæ* are, however, more remarkable for the acrid nature of their juices, which, on drying, become black, and are used as varnishes; as that of the *Anacardium occidentale,* or cashew-nut; so also of *Semecarpus anacardium,* or marking-nut. The variety of this, or species, *S. cuneifolium,* found in Northern India, is also used for marking cotton, and in native medicine. This resinous balsam is insoluble in water, and only miscible with alcohol when this has been previously alcalized, *Roxb.* Dr. B. Hamilton informs us, that the juice procured from *Holigarna longifolia,* is used in Malabar for varnishing shields. *Melanorrhœa usitata* of Dr. Wallich, Pl. As. Rar. t. 11 and 12, is the *theet-see,* or varnishing-tree of the Burmese, found at Prome, Martaban, Moulmein, and Tavoy. Dr. W. identified this with the *Kheu,* or varnish-tree of Munnipore, on the N.E. of Silhet, where it grows with saul and teak, *Shorea robusta* and *Tectona grandis,* as well as the wood oil-tree (*Dipterocarpus*) in the valley of Kubbur, elevated 500 feet above the plains of Bengal in about 25° N. lat. This tree abounds in a thick and viscid, greyish-brown fluid, which turns black soon after coming into contact with the air. Though the natives of the country seem to touch it with impunity, its contact is frequently followed by painful and deleterious effects. It is used for paying boats, and for varnishing vessels intended to hold liquids, also for gilding, and as a kind of ink (v. Wall. l. c. p. 11 and 12.) Dr. Wallich also mentions the

the *Augia* of Loureiro producing a varnish used in China and Siam; and also the *Stagmaria verniciflua* of the Malayan Islands, *Arbor vernicis* of Rumphius, according to whom, as Mr. Jack observes, it is the tree which yields the so much-celebrated Japan lacquer or varnish, as well as that of Siam and Tonquin, which becomes black and hard, and being acrid causes excoriations and blisters. Loureiro represents the varnish of the two last countries as being the produce of a different tree. The former has unaccountably been referred to *Terminalia* by Lamarck, and called *T. vernix:* its properties might thus be adduced as an exception in the family where it is placed, though strictly in accordance with those of the family to which it naturally belongs.

The *Sumachineæ* exude resin; the bark, as well as the leaves and fruit of several species is astringent, on which account they are employed in the preparation of leather. The genus *Rhus* includes some true poisons, as *R. venenata, perniciosa, radicans,* and *Toxicodendron;* and though most are inodorous, others, as *R. suaveolens* and *aromatica,* exhale a pleasant odour; while some of the species have acid berries, as *R. coriaria, Bucki-amela,* and *Schinus molle.* Thus, *Rhus Cotinus,* or *Red sumach,* has wood, called *young fustick,* which is astringent, as well as the berries; and *R. Coriaria,* known in India by the same name as in Europe, is a powerful astringent, chiefly employed in tanning leather, but also in Indian medicine. The seed of *R. parviflora, tuntereek,* is frequently substituted in India for that of the sumach. *R. glabra* is considered a febrifuge. *Rhus vernix,* a Japanese tree, exudes a whitish resinous juice, which soon becomes black in the air. *R. succedanea* and *vernicifera,* both common to the Himalayas and Japan, are said in the latter to yield a similar product. Species of other genera, as of *Schinus,* contain a resinous matter.

The *Spondiaceæ* contain but few plants, and these have sapid and eatable fruit, which, in the West-Indies, are called *hog-plums;* so, in India, *Spondias mangifera,* called *amra,* produces a fruit, which is eaten when ripe, and pickled before ripening. The tree is said to exude a mild insipid gum.

From the preceding observations, it is evident that the *Terebinthaceæ* are one of the most important families for the number and value of their products. India contains so many of them, that it is perhaps immaterial to acclimate those of other countries, though from the nature of the climates in which these chiefly grow, there is no doubt of the success which would attend the attempt. It is more important, perhaps, to diffuse those which already exist over as wide an extent as practicable; and ascertain the properties of others. The species of *Rhus* being alone found at any elevation, might no doubt be introduced into English shrubberies. The mangoe even, which, as is well known, has been ripened by Lord Powis, might be more extensively cultivated than, from its usual arboreous nature, is supposed possible: for by grafting and transplanting, the ordinary growth is much impeded, and shrubs of less than four feet in height have borne in the Saharunpore Garden above a dozen mangoes. It would be necessary only to imitate the climate, by giving a green-house cold in winter; rapidly raising the heat in February and March, and continuing it till May or June, or about the time of the

accession of the rains, when the addition of moisture to the heat is indicated; as the mangoes only perfectly ripen, after the atmosphere has become moist in the rains.

Odina Wodier; Roxb. Fl. Ind. 11. p. 293. v. Tab. 31. fig. 2. Flowering branch of a male plant. (*a. b.*) Male flowers. (*c. d.*) A fertile flower. (*e.*) The fruit. (*f.*) Leaves expanding after the flowers. As a full description has been given by Dr. Roxburgh of this plant, it is necessary only to mention that it is common every where in the hilly parts of India, and produces a useful resin, as mentioned in the text.

61. MORINGEÆ.

This order, consisting of only a single genus, and but few species, has been separated from *Leguminosæ* by Mr. Brown, on account of its compound unilocular ovarium, with 3 parietal placentæ, and simple unilocular antheræ. *Moringa pterygosperma,* of which *M. polygona* is supposed to be a variety, is common in the Peninsula, and most parts of India. I have seen it in a wild state in the jungle which skirts the Himalaya, even in the most northern parts. *M. aptera* appears to be confined to Arabia and Egypt, and though mentioned as belonging to India, I have not been able to trace it to any part of that country. This species is supposed to be the true *Ban* of the Arabians, and its seeds to have formed the *Ben-nuts,* of old writers, from which the *Ben-oil* was expressed, formerly more famed than it is at present. In India, the Arabian synonyme *Ban,* is applied both to the *bukayun, Melia bukayun,* and to the *Sohunjna,* or *Moringa pterygosperma;* from the seeds of which, both in the northern and southern parts of India, an oil is procured, which is described as not becoming rancid. Being inodorous, it is now chiefly employed for retaining the aroma of delicate flowers, and though aperient, is seldom used as medicine. The flowers, leaves, and tender seed-vessels, are eaten by the natives of India in their curries; and the roots are universally known to European residents in India, as a substitute for the horse-radish. They are remarkable for their pungent and stimulant nature, and are employed for the latter property by the natives in medicine.

62. LEGUMINOSÆ.

The *Leguminosæ* form one of the most important orders of the vegetable kingdom, whether we consider their numbers, their diversity of form, or their important uses, as food, medicine, or in the arts. In consequence of the irritability of the leaves of many of the species and their collapsion during sleep, they have been considered by some authors as the most highly organized, and therefore placed at the head of the vegetable kingdom. They may be almost universally recognised (*Detarium* is the only exception) by the form of fruit from which they are named. They form in almost every country a considerable portion of the flora. In the present collection they amount to 300 species, which is about $\frac{1}{12}$ of the whole. The hill specimens being to those found in the plains in the proportion nearly of 92 to 208.

Mr. Brown has divided the *Leguminosæ* into the three orders of *Mimoseæ, Cæsalpineæ,* and *Papilionaceæ,* which he considers belong to one class, and which he is still of opinion it is expedient to preserve. They certainly form very natural groups, the two first

first agreeing in a great measure in their geographical distribution. M. De Candolle considers them only as portions of the extensive order of *Leguminosæ*, which he divides into two great divisions, one containing all the plants in which the radicle of the embryo is straight; this includes the *Mimoseæ* and *Cesalpineæ;* and the second, those in which the radicle is bent back upon the cotyledons. These consist almost entirely of the *Papilionaceæ*, which have been further subdivided into two sections; the first called *Phyllolobeæ*, which in germination push their cotyledons above ground, and contain the tribes of *Sophoreæ, Loteæ,* and *Hedysareæ;* the second, M. De Candolle calls *Sarcolobeæ*, which retain their cotyledons under ground, and consist of the tribes of *Vicieæ, Phaseoleæ*, and *Dalbergieæ;* of these the *Vicieæ* and *Phaseoleæ* contain almost all the pulses which are cultivated as food for man or animals; while the *Phyllolobeæ* include but few of which the seed is fitted for food, though the subtribe of *Trifolieæ* contains the clovers and other plants cultivated as green fodder.

The MIMOSEÆ, instead of the irregularity which distinguishes the greater portion of the *Leguminosæ*, have their parts of fructification disposed with the utmost symmetry, their sepals and petals, except in *Parkia*, are valvate in æstivation, and their stamens hypogynous. The plants belonging to this order are chiefly confined to the warm parts of the world, but spread southwards to the Cape of Good Hope and New Holland, and northwards to Japan and the neighbourhood of the Caspian Sea.

The genera common in every part of India, are nearly the same as those of which species are found in America; as *Entada, Mimosa, Inga, Desmanthus, Acacia, Adenanthera,* and *Prosopis*, and with the exception of the two last, also in Africa. As a species of *Mimosa* ascends the sides of the Andes, so an *Acacia, A. mollis,* Wall. t. 177, of which there are two highly ornamental varieties, is found as high as 6,000 feet on the Himalayas, in 30° of N. latitude. There is also a species in Nepal, which, according to M. De Candolle, is closely allied, if it be at all different from *A. Nemu* of Japan. Of these genera the species are most prevalent in the Malayan and Indian Peninsulas, in the forests of Silhet, and in those of the Rajmahl hills; and to such places the genera *Entada, Desmanthus,* and *Adenanthera,* are principally confined, though the first has its best-known species, *E. Pursætha,* extending even to Nepal. But species of these, as well as of several American genera, succeed in the most northern parts of India. The genus *Mimosa,* of which *M. pudica* is perfectly naturalized in India, has a species, *M. rubicaulis,* extending as far north as the Deyra Doon and lower range of hills, where are also found *Acacia Catechu, farnesiana, stipulata* (which appears to be the same as *Smithiana*), and *speciosa* (*Serissa,* Roxb.) The last is so like the Egyptian *A. Lebbek,* that on seeing the latter at St. Helena, I took it at first for the Seriss, a tree I had been daily in the habit of seeing for a number of years. The most remarkable instance of a southern plant spreading to these northern latitudes along the tract of forest, is *Acacia elata,* which was found by Dr. Wallich at the mouth of the Irrawady, and which, on examining, in company with Dr. Graham, was found to be identical with specimens collected by myself in the Deyra Doon, where it forms a lofty tree. In the more

open

open country near Saharunpore, *A. arabica,* with *farnesiana,* are common, as every where in India, with *A. alliacea,* in the hedges. In the dry Bangur land, between Saharunpore and Delhi, *Acacia modesta* and *Prosopis spicigera,* are found; and near the latter city, *Desmanthus cinerea,* belonging to the section *Dicrostachys* of D. C., formed into a genus by Messrs. Wight and Arnott, and of which the other species are found in Abyssinia and Senegal. To the neighbourhood of Delhi also extend *A. leucophæa* and *catechuoides;* and *Inga dulcis* flourishes in gardens within that city. From Central India I received a new species, *A. nervosa,* through the kindness of Captain Jenkins, from the neighbourhood of Nagpore. The resemblance to the flora of Africa, which has been indicated, is confirmed by the occurrence in India of two species of Mr. Brown's genus, *Parkia,* as to this belong Dr. Roxburgh's *Acacia biglobosa* and *pedunculata. A. arabica, bubool,* and *Prosopis spicigera jhand,* extend north into the country between the Beas and Ravee (*Burnes' Travels.*)

With the exception of the fruit, in which some anomalies are presented here as in other families, the *Mimoseæ* offer great uniformity in the properties of the different species. Several afford gum as an exudation, secrete an astringent bark, and form excellent timber. Thus, on the western coast of Africa, *Acacia verek* yields gum-Senegal; in Nubia, *A. nilotica* and *Seyal,* gum-arabic; and in New Holland, *A. decurrens* affords a substitute for these, as *A. arabica, farnesiana,* and *speciosa* do in India. The bark of *A. arabica* or *bubool* of the Hindoos, is considered in India a valuable tonic and astringent, and, abounding in tannin, is extensively used in tanning leather. *A. nilotica* is so used in Nubia, and *A. Adansonii,* yielding a reddish gum, in Senegambia; *Acacia* bark is exported from New South Wales, and might be so from many parts of India. Owing to the transference of this astringent matter into the woody tissue, the old high-coloured wood of some species is used for making the astringent extract, known under the name of *catechu.* It is probable that other plants may be used for obtaining an extract similar to this, as we learn from Dr. Ainslie that the kinds called *cuttacumboo* and *cashcuttie,* are manufactured in the Peninsula from the *Areca catechu;* but the greater portion of that which is used in or exported from India, is manufactured from the *Khuer* or *Acacia catechu,* as Mr. Kerr and Dr. B. Hamilton have described its manufacture from this plant in Canara and Behar. In Northern India the *Kutt* manufacturers move to different parts of the country in different seasons, erect temporary huts in the jungles, and selecting trees fit for their purpose, cut the inner wood into small chips. These they put into small earthen pots, which are arranged in a double row along a fire-place built of mud (*choola*); water is then poured in until the whole are covered; after a considerable portion has boiled away, the clear liquor is strained into one of the neighbouring pots, and a fresh supply of material is put into the first, and the operation repeated until the extract in the general receiver is of sufficient consistence to be poured into clay moulds, which, in the Kheree Pass and Doon, where I have seen the process, are generally of a quadrangular form. This *catechu* is usually of a pale red colour, and is considered there of the best quality. By the manufacturers it is conveyed to Saharun-

pore

pore and Moradabad, whence it follows the course of commerce down the Ganges, and meets that from Nepal, so that both may be exported from Calcutta. Another astringent product of a plant of this tribe is procurable in the bazars of India, and this, is remarkable, as only known by the old name *akakia;* it is described by Persian authors, as it was by Dioscorides and Avicenna, as being the expressed juice of the fruit of the tree which yields gum-arabic, *Sumugh arabee.*

The denseness and tenacity of the timber afforded by some of the species is considerable, that of *A. arabica* and *farnesiana* being used for making wheels and tent-pegs; that of other species attains a large size, as of *A. kalkora* and *A. speciosa;* the latter is dark-coloured and close-enough grained for making furniture. *A. elata, xylocarpa, Sundra, odoratissima, stipulacea,* and *cinerea,* all yield it of good quality.

Some of the species of this tribe are remarkable for the seeds being covered with edible fleshy pulp, as *Acacia Kæringa* and *Inga dulcis,* in India; also, *I. fæculifera* and *Mimosa fagifolia* in America; while the saponaceous legumes of *Acacia concinna* form a considerable article of commerce, and the seeds of *Entada Pursætha,* called *gela,* are used by the natives for washing the hair. The bark of some species, as of *A. ferruginea* and *leucophæa,* added to *jaggery* water, is distilled as an intoxicating liquor. The seeds of *Parkia Africana* (*Inga biglobosa,* Palis. de Beauv.) well known as produced by the doura-tree, are roasted in Africa as coffee; so, in India, Dr. Roxburgh's *Mimosa pedunculata,* which he approximated to his *M. biglobosa,* thinking the latter identical with the African species, is eaten by the Malays, who are fond of the seeds, as well as of the mealy matter which surrounds them; the former tasting like garlic.

The Cæsalpineæ, or Lomentaceæ, distinguished by Mr. Brown as comprehending "all the genera having perigynous stamina, a corolla whose æstivation is not valvular, and which, though generally irregular, is never papilionaceous. To these characters may be added the straight embryo, in which they agree with *Mimoseæ,* but differ from all the *Papilionaceæ,* except *Arachis* and *Cercis.*"

The *Cæsalpineæ,* like the *Mimoseæ,* chiefly inhabit the warm parts, both of the new and of the old world, with a like extension to both the north and the south, but with an addition in the former direction of one or two species in the south of Europe. Several genera are peculiar to either the old or the new world, and a few are common to both. Of the former, those which exist in or are confined to India, are *Humboldtia, Hardwickia, Jonesia, Cynometra,* and *Mezoneurum;* but none of these extend beyond the southern parts. *Amherstia nobilis,* the most splendid of the many magnificent objects of the vegetable kingdom, was found by Mr. Crawford and Dr. Wallich growing close to a kind of monastery, near Martaban, about 17° of N. latitude. Some splendid dried specimens have since been sent to Dr. Lindley by Mr. Griffith from the woods near Pogoon.

The genera *Guilandina, Cæsalpinia, Poinciana, Tamarindus, Cassia, Bauhinia,* and *Outea,* are common to India and America, and all, with the exception of the last, which is only found in the Calcutta Garden (Lin. Trans. v. 12), occur in every part of India. Of these, such species as *Tamarindus indica, Cassia fistula, Poinciana pulcherrima,*

Guilandina

Guilandina Bonduc, Cæsalpinia sepiaria, and *Bauhinia variegata,* found every where in the plains, are those which have been so completely naturalized, as to appear indigenous to America; in the same way that *Parkinsonia aculeata* has from thence been introduced into India, and is now found growing in some places where there are no other shrubs or trees. In the forest tract at the foot of the mountains, *Cassia fistula* may, in the month of March, be seen in luxuriant flower, and more ornamental even than the laburnum, which in general appearance it a good deal resembles; and in the Kheree Pass, *Bauhinia purpurea* and *parviflora,* with *B. racemosa.* The last hang in elegant festoons from the tops of lofty trees, which one is at a loss to conceive, how, from the distance of its root from the stem, it could ever have ascended; but occasionally a half-killed tree displays the mode of its progress, and indicates the destruction it must have created in the forest. Another species of the same genus, *B. emarginata,* may be seen on the sides of the Himalayas, above Rajpore; and in the neighbourhood of Nahn, a species of *Cassia, C. suffruticosa,* does not refuse to thrive. At still greater elevations, as at Mussooree, we have only herbaceous species of this genus, of the section *Chamæcrista,* as *C. Wallichiana* and *amœna;* but this is only during the rainy season, at which time the latter makes its appearance also in the neighbourhood of Saharunpore, showing that water, the great equalizer of temperature, causes an approximation even in such dissimilar climates as that of Saharunpore and the hills. In the open plains, *Cassia tora* is common, as well as *kusounda* of the natives, which comes very near *C. purpurea,* Roxb., as well as *C. sophora,* with which it has been united in the East-Indian Herbarium, No. 5,317, but is a distinct species, though closely allied to it, and not at all different from *C. occidentalis,* common in the West-Indies. *C. tomentosa,* another American species, found at Santa Fé de Bagota, is said by Messrs. Wight and Arnott also to be found on the Neelgherries.

The affinity with the African Flora has been indicated under the *Mimoseæ:* it is further proved by the occurrence in India of the African genus *Pterolobium;* indeed the same species, *P. lacerans,* the famous Kantuffa of Abyssinia, described by Mr. Bruce, appears to be equally common in the Peninsula of India. Other species also, as *Cassia tora, occidentalis,* and *absus,* are mentioned in the "Flora Senegambiæ." It is remarkable, that *C. absus,* which is extremely common in the Deyra Doon, as well as in the plains of India, is mentioned by M. Delile in the *Centurie de Plantes d'Afrique,* p. 25, as the "*chychm* des droguistes d'Egypte," brought by the caravans from Darfour; the powdered seeds being used as an application in cases of chronic ophthalmia; they are employed for the same purpose in India, and are known by nearly the same name: *Chaksoo* being the Hindoostanee; *chushmak* and *chushmeezuk* are given in works on Materia Medica, as the Persian; *kushmeezuk, tushmeezuk* (perhaps the *tasmarach* of Avicenna), and *hub-oo-souda* or Soudan-seed, as the Arabic names; and *chushm,* as the Syrian. To these is, moreover added, *akakalis,* as a Greek name. This is no doubt intended for the ακακαλις of Dioscorides l. c. 119, who describes it as a plant of Egypt. I was induced, on procuring the plant from seed bought in the bazar, and

sown

sown in the Botanic Garden of Saharunpore, to call it *Cassia acacalis,* in a catalogue which however was never prepared for publication. (Journ. Asiat. Soc., 1. p. 452.)

The family or group of *Cæsalpineæ* contains a number of trees and plants, which are highly valued for their products, though there is not among these that general resemblance which we have so frequently seen characterising the products obtained from plants of the same natural order. Among these, however, are some of the most ornamental of the vegetable kingdom, as the splendid *Amherstia nobilis, Cassia fistula, Jonesia Asoca, Poinciana pulcherrima,* and several *Bauhinias,* many of which are remarkable for their size as climbers, as well as for the singular arrangement of their woody fibre. Several of this tribe are valued for their red-coloured wood, as *Hæmatoxylum campechianum,* affording log-wood; *Cæsalpinia echinata,* and *C. crista,* Brazil-wood. In India a similar product, *bukkum* or sapan-wood, is yielded by *C. sappan,* growing only in the southern parts, but indicating where the South American species might be most successfully cultivated. *Adenanthera pavonina,* common in the forests of Southern India, also yields a wood of a deep red colour, used as a dye, and for various economical purposes; this is called *rukta-chundun,* or red sandal-wood, a name which is also applied to the wood of *Pterocarpus santalinus,* another of the *Leguminosæ.* The red colour is generally an indication of astringent and tonic properties in the products of plants; the latter, unaccompanied however by the red colour, is found in a remarkable degree in a plant closely allied to the *Cæsalpinias.* This is *Guilandina bonduc, Kutkurenja* of the natives, *Akutmookt,* or اکتمکت of Avicenna; and, there is some reason for supposing, one of the kinds of *eagle-stone* of the ancients. The seeds I have found a powerfully effective and cheap remedy in the cure of the intermittents, with which the natives of India are so frequently attacked. The bark of a kind of *Bauhinia,* called *kobdar,* is described as being astringent; that of *B. variegata,* and also of *Cassia auriculata,* are, according to Dr. Roxburgh, used by the natives in tanning and dyeing leather, as well as in medicine. Some of the tribe yield good timber, others, as *Bauhinia racemosa* and *parviflora,* have bark employed in making rope. An oil is expressed from the seeds of some, as *Cæsalpinia oleosperma;* others exude a mild gum, like *Mimoseæ,* and some other plants, which have at the same time an astringent bark. A brownish-coloured gum is said by Dr. Roxburgh to be afforded by his *Bauhinia retusa.* It is also collected from *B. emarginata,* in the Deyra Doon, and called *sem-ke-gond.*

Some of the American plants of this tribe yield products with more decided properties; such as *Copaifera officinalis,* yielding balsam copaiva. Dr. Roxburgh inquires, whether the nearly-allied *Hardwickia binata* may not produce a similar product? *Hymenæa Courbaril* affords the resin called *anime.* The Mexican tree which yields the true copal is not so well known, but supposed to be allied to the last. The copal of the East-Indian market is the produce of Vateria Indica, p. 107. A fragrant resinous principle is secreted by *Aloexylum agallochum.* Some of the species yield acid edible fruit, as the tamarind-tree, of which both the red and common kinds are known in India. The kernel of the seeds, like those of the mangoe, are eaten in times

times of scarcity. The *Ceratonia siliqua*, or carob-tree, *khurnoob shamee*, as yielding an edible fruit, and the seeds affording food for cattle, has been recommended (p. 163) to be introduced into the North of India. Both the tamarind and carob are slightly aperient, as is the sweetish secretion which surrounds the seeds in the long legume of *Cassia fistula*, much used in Indian medicine. The *Cassias* are better known for the purgative properties of the officinal species than for any others; a property participated in by the leaves of other species of the genus, as *C. marilandica, occidentalis* and *tora*. Some of the species, with strong and disagreeable odour, as *C. sophora, occidentalis*, and *obtusa*, are employed in curing various cutaneous affections. *C. alata* is called in India *dad-murdun*, which may be translated *herpes-killer*. The seeds of the same species were sent to Dr. Roxburgh from the West-Indies under the name of *Cassia herpetica*.

The most valuable and extensively-used of the products of the plants of this tribe are the different kinds of senna, produced by two species of *Cassia*, according to some, but by four or five species, according to other botanists, of the section *Senna*, or genus of some authors. The sennas of commerce are imported into Europe chiefly from Alexandria and the East-Indies. Though it is difficult to assign the different commercial varieties to the species which produce them, yet the present state of our knowledge appears to justify the following statement.

Cassia obovata, or the blunt-leaved senna, is found in Lower and Upper Egypt and Nubia; in Central Africa, in the *Wady Gherurbi*, according to Dr. Oudney; and on the western and northern coasts of that continent. From these it must have been introduced into Syria and Italy, whence it has obtained the names of *Aleppo* and *Italian Senna*. From Egypt and the eastern coast of Africa, it is probably introduced into the Peninsula of India, as it is said by Dr. Ainslie to be alone used there by the Indian practitioners; but a nearly allied species, *C. obtusa*, Roxb., is common "on the high, dry, uncultivated lands of Mysore, where the leaves are used as a substitute for senna." Roxb. Fl. Ind. 2. p. 344.

The *Alexandrian Senna* is produced by the *Cassia acutifolia* of Delile, Fl. Æg. t. 27. f. 1, which differs little in botanical characters from, and indeed has been united with, *C. lanceolata*, of Forskal, by M. De Candolle; and this name is given to it by Nectoux, (Voy. dans la Haute Egypte, 19. pl. 11.) This species, first met with about Philæ and Syene in Upper Egypt, is also found in Nubia and Sennaar, and brought by the Arabs to Esneh, whence it is conveyed down the Nile to Boulac, where five parts are mixed with three parts of the leaves of *C. obovata*, and two parts of *Cynanchum Argel*, Delile, to form the senna of commerce. To this species is nearly allied the *Cassia ovata* of Messrs. Merat and Delens, called *Séné de Tripoli*, from the place of its growth.

Cassia lanceolata of Forskal, described by him as found at Surdud, and also at Mor in the northern parts of Arabia, also about Mocha, and the district of Abuarish, is that which from its place of exportation is called *suna mukkee*, Senna of Mecca. Some portion is conveyed into Egypt, according to both Forskal and Delile, but the greater portion is exported to India, and finds its way into the interior by means of the ports of

Surat

Surat and Bombay, those of the Peninsula, as well as by Calcutta. A considerable portion is, however, re-exported to Europe, together with some probably cultivated in the country.

Dr. Ainslie informs us (Mat. Ind. 1. p. 391. 1826) "that Mr. G. Hughes, of Palamcottah, a few years ago succeeded perfectly in cultivating the true senna of Arabia, in the southern part of the Indian Peninsula." This has now become a regular Indian export, and is well known in the London market, where it brings a high price, under the name of Hughes' Tinnevelly senna. Dr. Thomson, in his *Elem. of Mat. Med.* 2. p. 307, states, that "though not adopted into general use in Great Britain, it is milder in its operation than the Alexandrian drug; is as certain a purgative, and operates without griping." Dr. Christison, however, informs me, that the principal chemist in Edinburgh purchases this in much larger quantities than any other kind of senna. It is no doubt the produce of *C. lanceolata,* though the leaves, from the more tropical climate, may become larger and more elongated, and have therefore given rise to the species, *C. elongata,* of Lemaire Lisancour (v. Fée) formed of the *Séné de l'Inde.*

Having had my attention turned to the Materia Medica of India at the request of the Medical Board of Bengal, I procured some senna from the Saharunpore Bazar, there called *suna mukkee,* which I found consisted entirely of lance-shaped leaves. The seeds picked out of this senna were sown in the garden, and a very exact representation of one of the plants procured, is given in plate 37. This agrees, as might be expected, with Forskal's description of his *Cassia lanceolata;* as it is probable that the *suna mukkee* originally found its way into Northern India by means of the extensive commerce which takes place between Surat and Delhi. But from its cheapness I was led to believe that it must be cultivated in the country, and on inquiry was informed that it was so, somewhere in the Agra and Muttra district; but I was never able to prove the fact. This senna corresponds in every essential particular with that cultivated at Tinnevelly, but the leaves, as might be expected from the more northern latitude of Saharunpore, are smaller; in this respect they agree with some plants procured from seed sent to the Saharunpore Garden by the Hon. Sir Charles Metcalfe; but with the place of growth of which I am unacquainted, though probably Arabia or the Indian Peninsula.

The ripened seeds of the first crop were sown in the following year, and a large quantity of leaves being obtained, were dried and prescribed in the Saharunpore Hospital with very satisfactory results. A sample having been sent to the Medical Board, were submitted to experiment by Mr. Twining in the General Hospital at Calcutta. After prescribing it in forty-five cases, both in powder and infusion, Mr. T. says, "From these trials, I am disposed to consider the senna now under trial, equal to the best I have ever seen," (v. Trans. Med. and Physic. Soc. v. p. 433); and the Medical Board, in communicating the result, desired to assure me that it was as gratifying to them as it must be to me.

These facts are adduced to show that the northern, as the southern, and therefore all the vast intermediate space of India, is equally fitted for the growth of the best senna.

That it repays the cost is evident from Mr. Hughes continuing to grow it; that it would do so in every part of India, I feel confident from its success at Saharunpore. It was sown there in March; again at the commencement, and also at the conclusion of the rains; those first sown were cut down two and three times, and always threw out a profusion of new branches, so that several crops were obtained from the same plant during one season. In a more southern climate this might also have been done with those last sown, as the vegetation seemed stopped only by the accession of the cold weather. A recent author says, "Celui de l'Inde n'est qu'un séné en quelque façon de passage, dont ou n'aura peut-être plus dans quelques années." But it is to be hoped that many intelligent cultivators will rival Mr. Hughes, and setting the natives an example, enable India to contribute a larger proportion than she at present does, of the four millions of pounds which are imported into Europe.

The Papilionaceæ, named from the peculiar irregularity of the corolla, are distinguished, as well as the small tribe of *Swartzieæ*, by the radicle being bent back upon the cotyledons. They have a calyx with distinct lobes, and stamens with perigynous insertion.

The plants of the tribe *Sophoreæ* are few in number in India, and scattered over a wide extent of territory. *Virgilia*, a genus of which one species is found in N. America, three at the Cape of Good Hope, and one in Abyssinia, has one, *V. aurea*, in the Peninsula of India, found near Courtallum: Messrs. Wight and Arnott mention that they do not perceive any difference between the Indian plant and that from European gardens, which was introduced from Abyssinia.

Sophora tomentosa is common to the Caribbee Islands and to the Peninsula of India, the islands of Ceylon, Penang, and Mauritius; *S. glauca* is found on the Neelgherrie Mountains. *Ormosia*, a genus found in South America and the Caribbee Islands, has also two species in the forests of Silhet; and another, *S. glauca*, in Nepal, figured by Dr. Wallich at t. 125 of his splendid work. In Silhet, also, is found Dr. Roxburgh's *Podalyria bracteata*, which, as suggested by Mr. Brown, does not belong to this genus (*Congo*, p. 430), and has by Dr. Graham been formed into a new one called *Dalhousiea*, in honour of the Countess of Dalhousie, who, in addition to extensive collections of plants from different parts of the world, has brought home one of the most beautifully dried collections that I have seen from the Himalayas, made during a residence of many months at Simla. But none of the above genera extend to the northern parts of India, though these are not without some of the *Sophoreæ*. In the Deyra Doon and the neighbourhood of Suhunsudhara is found a species of *Edwardsia*, of which the only other species inhabit the islands of New Zealand, Sandwich, and Bourbon. The Indian species *Edwardsia* (*Sophora*, Wall. 5335) *mollis*, is figured at tab. 33. fig. 2. from drawings made from flourishing plants introduced into the Saharunpore Botanic Garden. To this species must also be referred the specimens marked B of *S. Houghiana*, Wall. 5336, sent by Dr. Govan from Sirmore, which is no doubt the same plant in a more advanced state, as the leaves vary much at different ages. At elevations of 8,000 and 10,000 feet,

feet, another of this tribe is found, which is well known from having become perfectly naturalized in English gardens. This is *Anagyris nepalensis*, which has also been referred to *Baptisia* and *Thermopsis*, as well as to *Virgilia* and *Podalyria;* so that it would not appear very closely allied to any, and render eligible the adoption of the genus *Piptanthus*, made for it by Mr. Salisbury. The success attending the introduction of this into English gardens, would seem to insure that of many others from the same altitude, and especially of the still more ornamental plant of the same tribe *Thermopsis* (*Anagyris*? Wall. 5341) *barbata*, "superb sort of lupine" of Mr. Fraser, (*Himal., Mount.* p. 159), figured at t. 33. fig. 1, where may be seen only one of the numerous annual flower-stalks which arise from one root. This being sunk in the ground, is protected from the great vicissitudes of temperature, and would therefore be independent of the numerous changes of an English spring. I met with it on Urrukta and Kedarkanta, and have received it from Doda on the road to Cashmere, as well from Shalkur in Hungarung. It was gathered by Mr. Inglis on the Broang Pass.

The plants of this tribe, though in general highly ornamental, are not remarkable for any useful properties, with the exception of *Myrospermum peruiferum, pubescens*, and *Toluifera*, the balsams of Peru and Tolu trees, which, however, are anomalous in their characters as in their properties, and therefore Dr. Lindley proposes to remove them from this order, and place them in or near *Amyrideæ*, to which they are allied. For the cultivation of these, suitable localities might probably be found in Travancore; perhaps also in Silhet.

The remainder of the family of *Papilionaceæ* are very generally diffused over every part of India, both in the mountains and the plains, though the same tribes do not affect these two very different localities. For in the latter, with the genera *Heylandia, Crotalaria*, and *Rothia*, of the tribe *Genisteæ*, we have of *Clitorieæ, Psoralea, Indigofera, Clitoria, Pueraria*, and *Glycine;* of *Galegeæ, Tephrosia, Agati*, and *Sesbania;* of *Hedysareæ, Zornia, Æschynomone, Smithia, Uraria, Desmodium, Dicerma, Flemingia, Alhagi*, and *Alysicarpus;* of *Phaseoleæ, Abrus, Rhynchosia, Phaseolus, Dolichos, Lablab, Psophocarpus, Canavalia, Mucuna, Cantharospermum, Cajanus, Erythrina*, and *Butea;* and of *Dalbergieæ, Pongamia, Dalbergia*, and *Pterocarpus*. Some genera are entirely confined to the Peninsula, as *Pycnospora, Stylosanthes, Lourea, Eleiotis, Nomismia, Soja*, and *Cylista*, with some new genera, which have been formed by Messrs. Wight and Arnott. Of some of the above genera, a few species extend into the mountains as high as 6,000 or 7,000 feet of elevation, as we have seen to be the case with species of other tropical genera; the annuals, or those with annual stems, are, however, found chiefly in the rainy season. Of these may be enumerated species of *Indigofera, Smithia, Uraria, Desmodium, Flemingia, Pyrrhotrichia, Cyrtotropis, Phaseolus, Parochetus*, and *Cajanus*.

In the mountains, including this general term, both the northern and southern face of the Himalayas, we have of *Genisteæ*, species of the genera *Cytisus*, and *Ononis;*—of *Trifolieæ: Medicago, Trifolium, Trigonella, Melilotus, Lotus*, and *Podolotus;*—of *Galegeæ: Caragana*, and *Colutea;*—of *Astragaleæ: Astragalus, Oxytropis*, and *Guldenstadtia;*—of *Hedysareæ:*

Hedysareæ : Oxyramphis, and *Lespedeza ;*—and of *Vicieæ : Cicer, Vicia, Ervum, Pisum, Lathyrus,* and *Orobus.*

As we have seen species of the genera which are most prevalent in the plains of India, extending into the Himalayas, so do some of those which find a congenial climate in the latter, spread into the former, and flourish at a season when the obliquity of the sun's rays allows the plains to be cooled down to a temperature, which approximates to that of the summer of the mountains, and of European latitudes. Most of these are found only in a cultivated state, forming a portion of the cold-weather crops, mentioned at p. 10: others exist in fields, and in the neighbourhood of cultivation. The *Trifolieæ* belong to the genera *Medicago, Trigonella,* and *Melilotus,* and the *Vicieæ* to *Cicer, Faba, Vicia, Ervum, Pisum,* and *Lathyrus.* Of some of these, the species *Medicago lupulina, Melilotus parviflora, Vicia cracca,* the variety *angustifolia,* of *V. sativa, Ervum hirsutum* and *Lathyrus aphaca* have been so perfectly naturalized, as to be as common as any other plants during the cold weather for three or four hundred miles of Northern India. But as these, if introduced, must have been so with the *Cerealia,* and cultivated *Leguminosæ,* and as the native country of the former is still undetermined, they have an equal right to be included with them in the Flora of any country where they mutually occur.

The occurrence of such plants, however, indicates the nature of the climate, as well as the possibility of cultivating their valuable congeners ; and, in fact, the cold-weather cultivation of Northern India, consists, in addition to the *Cerealia,* of *Leguminosæ* belonging to the tribes *Trifolieæ* and *Vicieæ.* Of the former, *Medicago sativa,* lucern, *Trigonella fænum græcum, methee,* are cultivated as fodder, and the latter for its use as a vegetable ; while *Trigonella incisa,* nob. *cheenee, Melilotus leucantha,* and *Ervum hirsutum, gegla,* growing spontaneously, are given as fodder to cattle ; as pulse, both the red and white varieties of *Cicer arietinum, chuna* and *kaboolee chuna,* the gram of Europeans, are cultivated ; also *Faba vulgaris, bakla, Ervum lens, mussooree; Vicia sativa, khandee, Lathyrus sativus* and *Pisum arvense,* both called *muttur;* and a variety of the latter, with serrate leaves, named *urra-muttur.*

To complete a view of the Leguminous cultivation of the plains, it is necessary to notice the plants cultivated during the rainy season. These belong almost entirely to the tribe *Phaseoleæ,* of which we have in the fields *Phaseolus radiatus,* Roxb., called *mash* and *oorud; P. mungo,* Roxb., *huree moong ; P. aureus,* Hb. Ham., *moong ; P. aconitifolius, moth ; P. cuneatus,* nob., *bangur ke moth ;* with varieties of *Dolichos catjang,* two called *lobia* and one *sontha ;* also *Cajanus flavus,* called *urhur ;* and of the *Trifolieæ, Cyamopsis psoraloides. P. Max, kalee moong,* is also mentioned by Dr. Roxburgh, and *P. calcaratus* is cultivated in the Peninsula. In the gardens are cultivated in the same season, *Dolichos sinensis, Lablab vulgaris* and *cultratus, Canavalia gladiata, Mucuna capitata,* with other species, and many varieties of all. *Phaseolus lunatus* is commonly called country French beans. *P. vulgaris* is said also to be common, but the only plants I ever found which corresponded with the European plants were from Cashmere, and these differed

differed so much in their nature from the Indian *Phaseoleæ*, as to be cultivable only in the cold weather; and were the only ones of the tribe which succeeded well in the Mussooree Experimental Garden. That many of the same species and varieties of the *Phaseoleæ*, are cultivated in the southern as in the northern parts of India, and that there is considerable uniformity in their characters, is evident from my specimens of cultivated *Phaseoleæ*, named from Dr. Roxburgh's MS. descriptions, corresponding in every respect with those contained in his Herbarium, as I ascertained in company with Dr. Graham. *Arachis hypogæa*, from China or Africa, is also cultivated in India.

Hence we may also expect, as in other families, to find many of the plants of Bengal, and Southern India, extending to Northern India: accordingly in the Deyra Doon and Kheree jungle we have such plants as *Crotalaria tetragona, retusa* and *sericea, Psoralea corylifolia, Pueraria tuberosa, Dumasia villosa, Smithia sensitiva, Mucuna pruriens* and *monosperma, Desmodium gyrans, Dicerma pulchella*, and *Uraria lagopus;* with shrubs and trees like *Tephrosia candida, Butea superba, Erythrina spathacea?, Pongamia glabra, Dalbergia ougeinensis* and *Sissoo. Pterocarpus*, a genus which occurs chiefly in the southern parts of India, is mentioned by Dr. Govan as occurring about Nahn, but I was never fortunate enough to meet with it. At Saharunpore and in the open plains there are such plants as *Heylandia latebrosa, Indigofera enneaphylla, Sesbania Ægyptiaca* and *aculeata, Agati grandiflora, Butea frondosa, Æschynomene aspera* and *aculeata, Uraria picta*, with several species of *Alysicarpus*.

The neighbourhood of Delhi, and the arid banks of the Jumna, as we have frequently seen, enjoy a peculiarity of vegetation, which approximates their flora to that of the drier parts of the peninsula, as among the plants found may be enumerated *Indigofera cordifolia* and *trita, Rhynchosia medicaginea* and *microphylla, Tephrosia diffusa* and *purpurea*. The existence also of *Alhagi maurorum*, with *Indigofera paucifolia*, and a species of *Crotalaria, C. Burhia*, Hb. Ham., (*C. arida*, nob.) nearly allied to *C. Thebaica*, shews the relation which has frequently been pointed out in the flora of this part of India to that of Egypt.

The greater proportion, however, of the species of the genera which have been enumerated, as well as those of *Galactia, Ormocarpum, Stylosanthes, Lourea*, and *Eleiotis*, are found, as might be expected, in the southern parts of India; for the great majority, as *Crotalaria, Psoralea, Indigofera, Clitoria, Galactia, Glycine, Tephrosia, Sesbania, Zornia, Stylosanthes, Æschynomone, Uraria? Desmodium, Rhynchosia, Phaseolus, Dolichos, Erythrina*, and *Pterocarpus*, are common to India, with the equinoctial parts, both of Africa and America; in each a few species of some of the genera extend northwards, as we have seen them do in India, whenever local circumstances produce a climate favourable for the growth of tropical plants. A progress which may be restrained either by the intervention of an ocean or a mountain range, and in both cases by reducing the temperature, or in the latter by preventing the progress of the tropical rains; so that tropical vegetation may be indicated on the map by a series of undulating or zig-zag lines, in the same way as has been done by the illustrious Humboldt for the lines of

equal

equal temperature. Though the genera are numerous, which are common to the equinoctial parts of Asia, Africa, and America, yet a few have only been found in the two first, as *Cyamopsis, Ormocarpum, Alhagi, Alysicarpus, Cylista,* and *Dalbergia,* while others exist only in Asia and America, as *Mucuna, Collæa, and Canavalia.*

The genera which have been enumerated as occurring in the Himalayas, are, on the contrary, in general common to these mountains, as well as to Siberia and Europe, the Oriental and Mediterranean regions. *Caragana, Oxytropis,* and *Guldenstadtia,* exist in Siberia and the Himalayas, *Colutea* in the latter and Europe; while *Cicer,* found in the Oriental region, Arabia, and Egypt, occurs also on the northern face of the Himalayas; but *Trifolium, Phaca, Lespedeza, Vicia, Lathyrus,* and *Orobus,* occur in most of the above regions, as well as in the Himalayas, and the cool ports of America.

Some of the species, moreover, are not to be distinguished from those occurring in Europe and the Oriental region, which has been elsewhere shown to send many of its plants thus far southwards. Thus we have *Ononis procurrens, Trifolium pratense* and *repens, Medicago sativa,* and *Lathyrus pratensis,* in Cashmere; the two last are also found in Kunawur, with *Medicago lupulina* and *falcata, Vicia sylvatica,* and *Cicer soongoricum,* and a nearly allied species, *C. microphyllum,* nob. In the Himalayas we have *Ervum tetraspermum, Orobus luteus,* and *Cytisus flaccidus,* closely allied to *C. argenteus.* The numerous species of *Astragalus* and *Oxytropis* approximate the flora of the Himalayas and of Kunawur, to that of Siberia and of the Altai Mountains; and though few of the species can be identified with those of Pallas or Ledebour, which I have examined in the collections of Mr. Lambert and Professor Lindley, yet there is a great resemblance between many of them. A representative even of the North American flora is not wanting, for specimens of *Desmodium nudiflorum,* collected by myself in the Himalayas, are pronounced by Dr. Boott not to differ from those collected by himself in the United States of America, while several species of *Lespedeza* bear a close resemblance to those from the same country. *L. juncea,* or, at least a species referred to and scarcely to be distinguished from it, is found in these mountains, as well as in China and Japan.

The existence of a few genera of a tropical nature has been already indicated at moderate elevations, and in the rainy season. Thus, *Crotalaria anthylloides* is found at Mussooree and Nepal, in the Peninsula and Ceylon, Java, and Canton; also *C. alata,* of the section *Alatæ;* to which also belongs a species found on the Andes. *Smithia ciliata, Parochetus oxalifolia, Cantharospermum paucifolium,* and *Rhynchosia suaveolens,* may be enumerated as occurring in these mountains in the rainy season, together with *Phaseolus angustifolius* and *scaber,* belonging to a genus, of which some species travel further north than any other of the tribe *Phaseoleæ.* It is probable that both the red and white varieties of *P. vulgaris* were introduced into Europe from Caubul, Cashmere, or the neighbouring countries, as the seeds of both were brought me from the latter, and they can only be successfully cultivated in a lower temperature than other species of the genus. In addition to these, there are a few shrubby species of *Indigofera* and *Desmodium,* which extend as high as 6,000 feet. Among these,

D. tiliæfolium,

D. tiliæfolium, nutans, and *multiflorum,* with *I. heterantha* and *violacea,* may be mentioned as the most ornamental. At lower elevations, a species, which I have called *I. Arghawan,* from its native name, is highly ornamental, from the luxuriance with which it flowers before the leaves make their appearance. I know not whether it is to this plant, that the same name is applied by Mr. Elphinstone, and described as being highly ornamental in the neighbourhood of Caubul.

In the hills, as in the plains, the cultivated *Leguminosæ* belong to different tribes in the different seasons of the year; thus the field-pea, called *kullae* in Sirmore, is cultivated in the summer months, and *Dolichos uniflorus, koolut* and *koolthee,* horse gram of Europeans in the Peninsula, in the rainy season; *Phaseolus torosus, seeta mas,* in Nepal; and in the Deyra Doon and lower hills, *Cajanus bicolor,* whether a variety or distinct species, is called *tor* by the natives, and distinguished from the *urhur.* In Cashmere, besides the French bean, other *Phaseoleæ* are cultivated, as well as *Fenugrec:* cattle are fed on lucern and clover, which are, however, only found, as far as I have been able to learn, in a wild state. Lieut. Burnes mentions clover at Peshawur and Gundamuk; also that artificial grasses are cultivated at Caubul, and trefoil at Bokhara.

Among the *Mimoseæ* and *Cæsalpineæ* we have seen that, with some anomalies, there is considerable uniformity in the properties of the plants of these tribes or orders; but in the *Papilionaceæ,* which form so considerable a proportion of the *Leguminosæ,* indeed of the vegetable kingdom, we find that with some striking conformities to the law of uniformity of properties with structure, there are yet considerable exceptions; but those which agree in habit, as the herbaceous species of a tribe, generally also correspond in properties, even when discrepancies present themselves among the arborescent or shrubby species.

Thus, if we examine the European *Papilionaceæ,* to which the Himalayan, as well as those which flourish in the cold weather in the plains of India, correspond in form; we shall find that the *Vicieæ* are cultivated in many countries; their seeds being useful as pulse, their stalks as fodder. The *Trifolieæ* afford bland and nourishing food, much relished by cattle, and are therefore much cultivated in different countries. The true *Hedysareæ* and *Astragaleæ,* though not cultivated, are greedily cropped by cattle in Europe; and as has been mentioned at p. 41, *Astragalus Webbianus,* with other species, forms the principal nourishment of the numerous herds of cattle which are driven in the summer months by the Tartar shepherds to the bleak, elevated, and apparently barren districts of Kunawur and Hungarung. As much the same climate, as well as similar species of *Astragali,* extend to the Altais and Siberia, we may conclude, that there also they afford food to numerous cattle. The shrubby species, as *A. verus, gummifer, creticus,* and *aristatus,* and perhaps others of the section *Tragacantha,* yield the peculiar gum of that name, which may perhaps also be secreted by some, though it has not yet been traced to any, of the Himalayan species; but with these, the officinal species would no doubt thrive, if it was expedient to introduce them. It would appear, however, a more important matter to teach the natives of the mountains to grow the easier cultivated

Trifolieæ, which would be useful for their cattle as winter fodder, now supplied by the leaves of trees stacked for that purpose.

But as these are not indigenous in the plains, and only suited for the cold weather cultivation of Northern India, it is desirable to ascertain whether there may not be other plants suited as fodder for cattle, and profitable for cultivation. For though it is not the custom of the natives of India, with the exception of barley, to cultivate any green food for cattle, which, in addition to the precarious pasturage of Indian plains, generally get only *bhoosa* or chopped straw, and the cut stems, called *kurbee,* of the *Jooar,* or *Sorghum vulgare;* yet in an extended and improved system of farming, it would no doubt be desirable to have crops yielding green food suited to the climate. For this purpose the *Gramineæ* and *Leguminosæ* appear the most likely to be useful: of the latter, some of the *Genisteæ, Hedysareæ,* and *Phaseoleæ,* being best suited to the climate, are most eligible for experiments. Of the first, I was informed that cattle were occasionally fed on the green parts of *Crotalaria juncea;* but as this plant, extensively cultivated, is valuable on account of its fibrous bark, some other species might, perhaps, equally well answer the purpose. Of the *Hedysareæ, Alhagi Maurorum* affords, in the most desert places, food grateful to the camel. Dr. Roxburgh states, that his *Hedysarum quinqueangulatum* and *auriculatum,* both included in *Desmodium diffusum* by Messrs. Wight and Arnott, are greedily eaten by cattle, and might be advantageously cultivated. I tried the *Cichorium Intybus,* which is much liked, both by horses and cows; it succeeded well in the Saharunpore Garden. *Indigofera enneaphylla* is also eaten by cattle, and might be useful in a sandy country, with *Desmodium triflorum,* in binding the soil.

The *Phaseoleæ,* extensively cultivated both in gardens and fields, are frequently objectionable as fodder, in consequence of the numerous hairs with which they are covered; but on this account, the pods of *Mucuna pruriens* are useful in medicine: *Phaseolus radiatus* is, however, eaten by cattle, and other useful exceptions might be found by attention being turned to the subject. Of this tribe it may be mentioned that lupins (*L. albus*), much cultivated in Arabia and Egypt, are not so in Northern India, though corresponding in general in the nature of its cultivation, but they may be procured in the bazars under the name *toormus,* corrupted from ϑερμος. A variety of *Dolichos catjang,* called *lobia,* is referred to as the λοβια of the Greeks.

Edible matter is furnished by the roots of some of this family, as *Dolichos bulbosus,* and the tuberose species of that genus, as well as of *Apios, Lathyrus,* and *Pueraria.* Saccharine matter is secreted by the roots of the liquorice, alpine trefoil, and *Abrus precatorius;* and a kind of manna by *Alhagi maurorum.* This is the *tooruñjbeen* of Arabian authors (quite a distinct substance from *shirkhisht*); the plant is by them called *haj,* to which the article being prefixed, has made the *Alhagi* of botanists. It is one of the plants, called *ooshturkhar,* or camel's thorn, but is in India known by the name of *juwansa,* and is so common every where as to be frequently employed in making *tattees.* I have met with it from Delhi all along the banks of the Jumna, as well as of the Ganges,

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in Upper India. It was found by Dr. Hamilton at the Seetakoond, or hot spring near Monghir, probably in his progress to Nepal; and is therefore called *Manna nepalensium* by Mr. Don. I am unable to discover any difference between the Indian and Egyptian plants, of the latter I possess specimens collected by M. Bové, and am disposed to think that both these, with *A. camelorum*, may be only varieties of one species. No manna is collected in India, Arabia, or Egypt, and the climate of Persia and Bokhara seem alone suited for its due secretion. In the latter it is much used as a substitute for sugar. It is imported into India from Caubul and Khorasan.

The preceding are pretty uniform in their nature, as they chiefly secrete mucilage, fecula, and saccharine matter; but some of the *Sarcolobeæ*, as well as several *Phyllolobeæ*, have more pernicious properties, as some are said to be poisonous; and a few to have a narcotic principle, as *Phaseolus radiatus* in its roots. The leaves of several shrubby species are purgative, as those of *Colutea arborescens* and *orientalis*, used for adulterating senna, especially that procured from *Cassia obovata;* so also are those of species of *Genista, Cytisus, Robinia, Coronilla*, and *Clitoria*.

In a commercial point of view, Indigo is probably the most important product of this family, and a striking instance of the important results attendant on the proper application of science and skill; for Bengal indigo, a few years ago nearly unknown, and little valued, now brings the highest prices, and almost to the exclusión of every other kind in the English market. As the manufacture is so well understood, it need only be mentioned that as the lower provinces are favourable to the growth of the plant, and the manufacture of indigo, so the upper provinces, not so well adapted for the latter, are particularly so for the ripening of the seed, which is yearly sent down to the lower provinces; and this probably prevents the deterioration of the plant so frequently found to ensue on the continued cultivation of the same seed in the same place. Though *Indigofera tinctoria* is the most commonly cultivated species, indigo may also be obtained from other species, as *I. cærulea* in India, *I. anil* and *caroliniana*, in America, and *I. argentea* in Egypt.

Dr. Roxburgh informs us, that from wounds and natural fissures in *Butea frondosa* and also in *B. superba*, a red juice issues, which hardens into a brittle ruby-coloured gum-resin, not used by the natives, though strongly and simply astringent; but in the northern provinces, it is employed by them for this property, and called *kumurkus* and *dhak ke gond*, also *kuni; an kino?* The flowers called *teesoo* and *keesoo* yield a beautiful dye, and the roots form strong rope.

Of the *Dalbergieæ, Pterocarpus erinaceus* yields African kino, so, in India, *P. Marsupium*, a native of the Circar mountains, exudes a red juice, which hardens into a strong, simply astringent, brittle gum-resin of a dark red colour, very like that of *Butea frondosa*, according to Dr. Roxburgh. *P. Draco* is said to yield dragon's blood, *dum-ool-ukhwain; P. santalinus* affords one kind of Saunders-wood, and *P. dalbergioides*, excellent timber, like the generality of this tribe, as *Dalbergia Ougeinensis, latifolia*, and *Sissoo*. The last, indeed, is one of the most valuable of the Indian timber-trees, and, in

conjunction with the saul (*Shorea robusta*) more extensively used than any other in Northern India; but, like every other, subject to be speedily destroyed by the unceasing ravages of the white ant. It would be important to ascertain whether timber and vegetable matter might not be defended from these destroying hordes by the same process as employed by Mr. Kyan in so effectually preserving from the dry rot, and of which so luminous an account was given by Dr. Faraday in his lecture, and subsequently in the *Quarterly Review*. When in India, it was my intention to have prosecuted a series of experiments on the subject. I commenced by dissolving corrosive sublimate and assafœtida in strong spirits (articles, all of which are procurable in every bazar), and poured the solution into any place where the white ants were beginning to make their appearance. The process was so effectual, that they were always driven away from the point attacked, and my servants were afterwards in the habit of resorting to the same measure whenever occasion required. I regret that my avocations did not allow me leisure to pursue the subject; but I commend it to my ingenious friend, Mr. James Prinsep.*

In conclusion, I have to express my obligations in examining this extensive family to Dr. Wight, who compared and named many of those of Indian forms; some of which, especially those from near Delhi, he found to be identical with his own from the Peninsula of India; to Dr. Graham, Professor of Botany in the University of Edinburgh, for the kindness with which he went through the whole of Dr. Wallich's and my collection of *Leguminosæ*. Finally, to Mr. Bentham for the following valuable account with which he has favoured me of the new species of the tribes *Loteæ* and *Vicieæ*.

Edwardsia mollis; foliolis 25-29 suboppositis subcoriaceis ellipticis emarginatis subglabris, junioribus oblongis obovatisve adpresse sericeis, carina alis vexilloque subæquali.—*Sophora mollis.* Wall. Cat. Herb. Ind. n. 5335.—*S. Houghiana.* Wall. l.c. n. 5336, B. v. Tab. 34. f. 2.—(*b. c. d.*) standard, alæ, and petals of carina;—(*e.*) stamens and pistil, with the oblique calyx;—(*f.*) moniliform legume, with the persistent stamens;—(*g.*) the same cut transversely, to show the four wings;—(*h. i.*) the seed.

This shrub, found about the hills in the Deyra Doon, and about Sahunsadhara, is remarkable for the showiness of its inflorescence, as this makes its appearance before the leaves are fully expanded.

Thermopsis barbata; sericeo-tomentosa; foliis sessilibus inferioribus simplicibus 3-4 verticillatis, superioribus trifoliolatis, stipulis foliolis æqualibus, omnibus oblongo-lanceolatis verticillatim dispositis, racemi floribus geminis ternisve, pedicellis calyce longioribus.—*Anagyris? barbata.* Grah. Wall. Cat. n. 5341. Tab. 34. f. 1.—(*c. d. e.*) petals;—(*f.*) calyx cut open, with stamens and pistil;—(*g.*) a legume of unusual (*h.*) of the ordinary form;—(*i.*) the seed;—(*k. l.*) the same, with the testa removed;—(*m.*) the embryo.

This plant, remarkable for its showy nature, is also so for the variableness of its leaves; these being frequently, as represented in the plate, but sometimes the whorl is composed of six leaflets, which might be formed either by two sessile and opposite leaves, or by the addition of a leaflet between the pair of leaf-like stipules: sometimes the whorl is composed of four leaflets, which must in this case be considered simple leaves. The bracteæ also are remarkable, as forming by their union a calyx-like involucre.

HIMALAYAN

* While this is passing through the press, I have seen (14th March 1835) specimens at the Royal Institution of Oak and Deal, which had been sent to and have returned from India, with a certificate from Mr. Kyd, stating that both had been freely exposed in such situations, as where timber is never known to escape the depredations of white ants; but neither piece had been touched, and both were returned sound and uninjured. It is hardly possible to calculate the benefit of which this may be productive. It remains to be ascertained whether the preparation ("*ruskupoor*") procurable in India, is equally efficacious; as well as to ascertain the Indian woods, in which the chemical combination is most complete and effectual in resisting the destructive powers of the white ant; powers, second only, if second indeed they be, to the dry rot.

HIMALAYAN LEGUMINOSÆ

Of European and Siberian Forms. By G. Bentham, Esq.

Tribus 1. Loteæ. DC. Prod. 2. 115.

Subtribus 1. Genisteæ. DC. l.c. 153.

I. Cytisus. DC. Prod. 2. 153.

Sect. Lotoides. DC. Prod. 2. 166.

1. *C. flaccidus* (*Royle*), caulibus decumbentibus, foliis calycibus leguminibusque adpresse sericeis, foliis breviter petiolatis trifoliolatis, foliolis oblongo-ellipticis mucronulatis, floribus 3-4 terminalibus, corollis glabris calyces vix excedentibus.—Glycine? flaccida Wall. Cat. Herb. Ind. n. 5517.—Vix a *C. argenteo* differt petiolis vix stipulo longioribus, foliolis majoribus, corollis minoribus glabris. Folia caules et legumina interdum dense sericeo-villosa (*C. lanuginosus*, Royle, MSS.)

Hab. Mussooree and Suen Range.

II. Ononis. Linn.—DC. Prod. 158.

1. *O. procurrens*, Wallr.—DC. Prod. 2. 162.

Hab. Cashmere.

Subtribus II.—Trifolieæ. DC. Prod. 2. 171.

III. Medicago. Linn.—DC. l.c.

1. *M. lupulina*, Linn.—Ser. in DC. Prod. 2. 172.—Wall. l.c. n. 5944.

Hab. Oude and Nepal. *Wall.*—Plains of Northern India. *Royle.*—Chinee in Kunawur. *R. Inglis*, Esq.

2. *M. falcata*, Linn.—Ser. in DC. Prod 2. 172. var. floribus cæruleis.—Legumina falcata minime cochleata, caules prostrati.—Wall. l.c. n. 5945. C.D.

Hab. Ludak. *Wall.*—Lippa in Kunawur. *Royle.*

3. *M. sativa*, Linn. Ser. in DC. Prod. 2. 173. *Wall.* l. c. n. 5945. A.B.

Hab. Herb. Madras. Hb. Ham. a Patna. *Wall.*—Cultivated in N. India. Wild on Peer Punjal and in Cashmere. *Royle.*—Tazeegong in Kunawur. *R. Inglis*, Esq.

4. *M. denticulata*, Willd—var. β. vulgaris Benth. Cat. Pyr. 103.—Wall. l.c. n. 5946.

Hab. Oude. *Wallich.*

IV. Trigonella. Linn.—Ser. in DC. Prod. 2. 181.

Sect. Fœnum Græcum. Ser. in DC. Prod. 2. 182.

1. *T. Fœnum Græcum*, Linn.—Ser. in l.c.—Wall. l.c. n. 5984.

Hab. Hb. Madras. Hb. Ham. Puraniya and Rampore, Wall. *Methee* of the natives, cultivated in India and Cashmere, *Royle.*

Sect. Buceras Ser. in l.c.

2. *T. incisa* (Royle) diffusa; foliolis obovato-vel truncato-cuneatis inciso-dentatis, stipulis semisagittatis basi subdentatis, umbellis pedunculatis 1-4-floris, floribus erectis subsessilibus, leguminibus arcuatis longis linearibus reticulato-venosis.—Valde affinis *T. polyceratæ* et *T. pinnatifidæ*, differt umbellis pedunculatis.

Hab. *Cheeni* of the natives, indigenous in the cultivated fields of Northern India, used as fodder for cattle.

Sect. Falcatula, Ser. in DC. Prod. 2. 184.

3. *T. gracilis* (Benth.) glabra; caulibus prostratis, ramis filiformibus, foliolis ovato-subrotundis parvis, stipulis lato-lanceolatis subdentatis, pedunculis folio longioribus mucronatis subumbellatim 2-4-floris, floribus pedicellatis nutantibus, leguminibus latis subfalcatis compressis venosis. —A *T. hybrida* differt foliis parvis, pedunculis elongatis, floribus multo minoribus approximatis et habitu.

Hab. Mussooree and Cashmere.

4. *T. Emodi* (Benth.) adscendens, glabra vel apice pubescens; foliolis ovatis obovatisve basi angustatis, stipulis semisagittatis lineari-lanceolatis vix dentatis, pedunculis folio sublongioribus muticis racemoso-plurifloris, floribus pedicellatis nutantibus, leguminibus latis subfalcatis compressis venosis.—*Melilotus Emodi.* Wall. Cat. Herb. Ind. n. 5941. Statura fere *T. corniculatæ*, sed flores pauciores laxiores multo minores. Legumina *T. gracilis?* sed in exemplaribus suppetentibus immatura.

Hab. Gossainthan and Kemaon. *Wall.*—*Metha* of the inhabitants of the hills. Banks of Jumna and near Shalma. *Royle.*

5. *T. obcordata* (Wall. Cat. Herb. Ind. n. 5986) diffusa glabra; foliolis cuneato-obcordatis, stipulis late semisagittatis incisis, pedunculis folio brevioribus mucronatis umbellatim plurifloris, floribus minutis pedicellatis nutantibus, leguminibus linearibus compressis subfalcatis.—Flores in sectione minimi, legumina fere *T. corniculatæ* sed multo minora. Cum hac commixtum est in herbario Indico exemplar ad *T. occultam Del.* forte referendum, vel *T. obcordatæ* exemplar monstruosum?

Hab. Hb. Ham. a Tikari. *Wall.*

6. *T. fimbriata* (Royle) diffusa; ramis apice pubescentibus, foliolis obovatis fimbriato-dentatis, stipulis lanceolato-semisagittatis subdentatis, pedunculis folio vix longioribus racemoso-multifloris muticis, floribus densis pedicellatis nutantibus elongatis.—Affinis *T. esculentæ;* diversa habitu, foliis fimbriatis, racemis brevibus densis et floribus majoribus angustioribus. Legumina non vidi.

Hab. Rogee in Kunawur, Bussoulee on the road to, and Kioonthul in Cashmere.

7. *T. esculenta*, Willd.—Ser. in DC. Prod. 2. 185.—Wall. l.c. n. 5985.

Hab. Hb. Roxb. Hb. Ham. ex Olipur. Ludak, from seeds sent by Mr. Moorcroft.

V. Melilotus. Tourn.—Ser. in DC. Prod. 2. 186.

1. *M leucantha* Koch.—Ser. in DC. Prod. 2. 187.—Wall. l.c. n. 5942.

Hab. Hb. Hm. from Puraniya and Banks of the Rapty. Silhet and Rampore. *Wall.*—Saharunpore, *Royle.*

2. *M. parviflora*, Desf.—Ser. in l.c.—Wall. l.c. n. 5943. A.B.

Hab. Hb. Ham. from Hilsa. *Wall.*—*Metha* of the plains of Northern India, where it is extremely common in the cold weather. *Royle.*

3. *M. Italica*, Lam.—Ser. in DC. Prod. 2. 188.—Wall. l.c. n. 5943 D.

Hab. Hb. Madras. *Wall.*—Grown in the Saharunpore Botanic Garden from seed bought in the bazar. *Royle.*

VI. Trifolium. Linn.—Ser. in DC. Prod. 2. 189.

Sect. Eutriphyllum. Ser. in DC. Prod. 2. 192.

1. *T. pratense*,

1. *T. pratense*, Linn.—Ser. in DC. Prod. 2. 195.

Hab. Cashmere.

Sect. Trifoliastrum. Ser. in DC. Prod. 2. 198.

2. *T. repens*, Linn.—Ser. in DC. Prod. 2 198.

Hab. Cashmere.

VII. Lotus, Linn.—Ser. in DC. Prod. 2. 209.

1. *L. corniculatus*, Linn.—Ser. in DC. 2. 214.—*L. bracteatus*, Wall. Cat. Herb. Ind. 5939.

Hab. Nepal and Kemaon. *Wall.*—Himalaya passim. Cashmere and Kunawur. *Royle.*

VIII. Podolotus, *Royle.*

Calyx ovato-tubulosus, obscure bilabiatus. Alæ vexillum subæquantes, carina subrostrata. Stamina diadelpha vel decimo basi cum cæteris connexo. Stigma capitatum, obliquum. Legumen stipitatum, lineare, rectum, subteres. —Habitus et folia *Hosackiæ*, corolla *Loti*, ab utroque genere legumine stipitato diversum.

1. *P. hosackioides* (Royle)—Herba procumbens, multicaulis, ramosa, glabra. Folia impari-pinnata, 7-8-juga. Stipulæ parvæ, scariosæ. Foliola obovata vel oblonga, obtusa. Pedunculi axillares, folio sublongiores, ebracteati, umbellatim 2-3-flori. Calyces pedicellati, glabri, submembranacei. Flores magnitudine *Loti angustissimi.*

Hab. Mussooree, and common in the Himalayas.

Subtribus III.—Galegeæ. DC. Prod. 2. 243.

IX. Caragana, Lam.—DC. Prod. 2. 268.

1. *C. Moorcroftiana* (Benth.) foliolis sub-5-jugis ovali-oblongis villosis, petiolis foliolo terminatis, ramulis sterilibus stipulisque spinescentibus, calycibus villosis breviter dentatis.—Flores 6-10 ad apices ramulorum brevium foliatorum racemosi.—*Astragalus Moorcroftianus*, Wall. Cat. Herb. Ind. n. 5933.

Hab. Luddak. *Moorcroft.*

2. *C. brevispina* (Royle) foliolis 4-5-jugis ovali-oblongis obovatisve subtus pubescentibus, petiolis brevissime stipulisque spinescentibus, pedunculis folio brevioribus apice subumbellatim 4-5-floris, calycibus pubescentibus, dentibus tubo brevioribus.

Hab. Bumpta on the shoulders of Urrukta.

3. *C. Gerardiana* (Royle) foliolis 4-5-jugis ovali-oblongis villosis, petiolis pilosis apice spinescentibus, stipulis scariosis, calycibus villosissimis, dentibus tubo brevioribus.—Flores ad axillas solitarii? Legumina intus extusque villosissima. *Astragalus Gerardianus.* Graham in Wall. l.c. n. 5938.

Hab. Sirmore. *Gerard. Furze* from Neetee. *Webb.* v. T. 34. f. 1. *a.* calyx; *b.* one of the alæ of corolla; *c.* Stamens, diadelphous, 9 and 1, and pistil; *e. f.* transverse sections of legume; *g.* seed.

4. *C. polyacantha* (Royle) foliolis 5-6-jugis late-obovatis villosis, petiolis rufo-villosis stipulisque spinescentibus, pedunculis solitariis? calycibus villosis dentibus tubum subæquantibus.—*Astragalus polyacanthus.* Wall. l.c. n. 5934.

Hab. Kemaon versus Emodum. *Wallich.*

5. *C. spinosissima* (Benth.) foliolis 3-4-jugis parvis ovatis villosissimis, petiolis spinescentibus, stipulis scariosis, floribus sessilibus subfasciculatis, calycibus elongatis nigro-villosis, dentibus brevissimis.—*Astragalus spinosissimus.* Wall. l.c. n. 5935.

Hab. Bhote. *Wallich.*

6. *C. versicolor* (Benth.) foliolis bijugis approximatis cuneato-linearibus glabris, petiolis foliola superantibus stipulisque spinescentibus, pedicellis solitariis calyce parum longioribus, calycibus basi vix gibbis, legumine glabro.—*Genista versicolor.* Wall. l.c. n. 5922. v. Tab. 34. f. 2. *a.* Stamens. 9 and 1; the latter is distinct, and not united with the former, as in the figure; *b.* calyx and pistil; *c.* transverse section of legume. Dr. Wallich's name has inadvertently been written under the figure, though the plant belongs to this genus.

Hab. A. *Tartaric Furze.* Tartariæ Chinensis confinibus. *Webb.*—B. *Tartaric Furze* e Ludak b. Moorcroft.—C. *Tartaric Furze, Dama* of the natives, eaten by all animals; the flower varies in colour. *Gerard.* Wall. l. c. n. 5922. —Tagla. *R. Inglis*, Esq.—Chango in Hungarung. *Royle.*

X. Colutea, R Br. DC. Prod. 2. 270.

1. *C. Nepalensis* (Sims) foliis subfasciculatis, foliolis obovatis retusis glaucis, pedunculis folia æquantibus 3-5-floris, vexilli gibbis minimis, carina apice obtusa appendiculata, leguminibus apice vix hiantibus.—A *C. cruenta* differt carina forma et floribus multo majoribus. Habitus *C. Alepicæ.* Legumina fere *C. arborescentis* nec coriacea.—*Ic. Bot. Mag.* t. 2622. *Bot. Reg.* t. 1727.

Hab. Lippa in Kunawur. *Royle.* In Horto Societatis Horticult. Londinensis colitur ex seminibus Nepalensibus.

Subtribus IV.—Astragaleæ. DC Prod. 2. 273.

XI. Oxytropis. DC. Prod. 2. 275.

1. *O. floribunda.* Ledeb. Fl. Alt. 3. 283?—var. caulibus brevibus, floribus paucis.

Hab. Pungee and Chango in Kunawur and Hungarung.

2. *O. mollis* (Royle) subacaulis; foliolis numerosis ovatis sericeis, scapis folio longioribus, floribus paucis laxe spicatis, bracteis calyce brevioribus, leguminibus suberectis ovatis turgidis acuminatis junioribus calycibusque nigro-villosis.—Affinis *O. longirostræ* et *O. sylvaticæ.*

Hab. Chaogaon in Kunawur.

3. *O. chiliophylla* (Royle) caulibus cæspitosis brevissimis dense lanatis, stipulis magnis imbricatis, foliolis tri-quaternatim verticillatis lanato-sericeis, scapis folia æquantibus, floribus capitatis, calycibus cylindraceis nigro-villosis, dentibus lanceolatis.—Affinis *O. lanatæ.*

Hab. Shalkur.

XII. Astragalus, Linn.—DC. Prod. 2. 281.

Sect. 1. Hypoglottidei. DC. l.c.

1. *A. strictus* (Graham) caule adscendente? subglabro, stipulis basi concretis oppositifoliis, foliolis 8-10-jugis oblongis canescentibus, pedunculis folio sublongioribus, bracteis minimis, calycibus campanulatis nigro-pubescentibus, corollis calyce duplo longioribus.—Affinis *A. hypoglottidei*, differt præcipue floribus laxioribus dimidio minoribus.—Wall. Cat. Herb. Ind. n. 5924.

Hab. In montibus Sillet. *Wallich.*

2. *A. leucocephalus* (Graham) subacaulis vel diffuso-procumbens, sericeo-villosus; stipulis concretis oppositifoliis, foliolis 15-20-jugis ovali-oblongis, pedunculis folio longioribus, spicis capitatis, bracteis tubum calycis æquantibus calycibusque sericeo-villosis, leguminibus villosis calyce inclusis—Affinis præcedenti. Capitula densa cano-villosa fere *A. glauci.* Flores albi. Variat foliis capitulisque plus minusve villosis. Wall. l.c. n. 5923. v. Tab. 33. f. 2.

Hab. In Deyra Doon et Rikeekes. *Wallich.* Mussooree and passim in hills. *Royle.*

Sect. 2. Onobrychioidei. D.C. Prod. 2. 286.

3. *A. Maxwellii* (Royle) erectus?; stipulis liberis membranaceis lineari-lanceolatis, foliolis 10-12-jugis oblongis cano-

cano-pubescentibus, pedunculis folio longioribus, racemis densis multifloris, floribus pendulis, calycibus nigro-pubescentibus, dentibus bracteisque subulatis, leguminibus oblongis acuminatis reflexis rectis pubescentibns.—Flores purpurascentes videntur magnitudine *A. falcati.*

Hab. Chandow Pass; discovered by the late Lieut. Maxwell.

4. *A. pycnorhizus* (Wall.) diffusus, glaber; stipulis parvis liberis ?, foliolis 4-6-jugis late-obovatis, pedunculis folio longioribus 1-2-floris, corollæ vexillo lato patente, leguminibus ovatis turgidis longitudinaliter sulcatis glabris.—Species distinctissima: an hujus loci ?—Wall. l.c. n. 5927.

Hab. In Emodo ad Gossainthan. *Wallich.*

Sect. 3. Annulares. DC. Prod. 2. 289.

5. *A. Amherstianus* (Royle) diffusus, subsericeo-hispidus; foliolis 7-8-jugis parvis oblongis villosissimis, pedunculis paucifloris folio multo brevioribus, leguminibus cylindricis incurvis adpresse hispidis.—Habitus *Sesameorum.* Affinis *A. hispidulo*, DC. sed multo minor leguminibus brevioribus.

Hab. The only specimens I have seen, are in the collection formed by Lady Sarah Amherst at Simla.

Sect. 4. Bucerates, DC. Prod. 2. 290.

6. *A. hamosus*, Linn. DC. l.c.

Hab. Grown in the Saharunpore Botanic Garden, from seed bought in the bazar under the name of *ukleel-ool-mulik*, or King's crown.

Sect. 5. Synochreati, DC. Prod. 2. 291 (Legumina membranacea inflata vel compressa.)

7. *A. peduncularis* (Royle) erectus cano-tomentosus; foliolis 15-20-jugis oblongis subtus sericeis, stipulis lanceolatis basi concretis oppositifoliis, pedunculis longissimis erectis rigidis, floribus racemosis pendulis, leguminibus oblongis reflexis turgidis acuminatis cano-pubescentibus.—Habitus *A. asperi* et *A. falcati.*

Hab. Pungee in Kunawur.

8. *A. stipulatus*, Don.—DC. Prod. 2. 292.—Wall. l.c. n. 5928.

Hab. Nepalia. *Wallich.*

Sect. 6. Galegiformes, DC. Prod. 2. 294.

9. *A. rotundifolius* (Royle) erectus glaber; stipulis maximis foliaceis glaucis, foliolis 6-10-jugis elliptico-subrotundis glaucis, pedunculis folio longioribus, floribus racemosis pendulis, corollis calyce duplo longioribus, leguminibus stipitatis oblongis plano-compressis utrinque mucronatis. Legumina pollicaria.—Wall. l.c. n. 5929. B.C.

Hab. Oude et Deyra Doon. *Wall.*—Lippa in Kunawur. *Royle.*

10. *A. graveolens* (Hamilt.) erectus glaber; stipulis maximis foliaceis glaucis, foliolis 8-10-jugis ovali-ellipticis obovatisve, pedunculis folio longioribus, floribus laxe racemosis, corollis calyce vix dimidio longioribus, leguminibus stipitatis elongatis compressis ?—Legumina nondum matura sesquipollicaria. Flores dimidio minores quam in præcedente.—Wall. l.c. n. 5929. A.

Hab. Ad ripas Rapti. *Hamilton.*

11. *A. podocarpus* (Graham) erectus glaber; stipulis lanceolatis membranaceis liberis, foliolis 10-13-jugis oblongo-ellipticis, pedunculis folium æquantibus, floribus racemosis, leguminibus stipitatis oblongis turgidis utrinque acuminatis.—Legumina 1-¼ pollicaria. Wall. l.c. n. 5930.

Hab. Kemaon versus Emodum. *Wallich.*

12. *A. concretus* (Benth.) caule erecto glabro, stipulis lanceolatis membranaceis concretis, foliolis 8-12-jugis oblongo-ellipticis pubescentibus, pedunculis folium æquantibus, floribus racemosis, leguminibus stipitatis oblongis turgidis utrinque acuminatis.—Præcedenti simillimus. Legumina dimidio fere minora. An huc ob legumina stipitata; an ad *Synochreatos* ob stipula concreta referendus? —*A. vicioides*, Graham. Wall. l.c. n. 5931. non Ledeb.

Hab. Emodo ad Gossainthan. *Wallich.*

13. *A. chlorostachys.* Lindl. Trans. Soc. Hort. Lond. 7. 249.—*A. Govanianus*, Graham. Wall. l.c. n. 5925.

Hab. Sirmore. *Govan.*—Urrukta and Nagkanda; Deolee in Cashmere. *Royle.*

14. *A. sesbanoides* (Royle) erectus glaber vel leviter strigoso-pubescens; foliolis 15-20-jugis parvis ovatis, pedunculis folio longioribus, floribus racemosis, leguminibus pendulis ovatis molliter villosis.—Species elegantissima habitu affinis *A. vicioidi Ledeb.* et *A. melilotoidi?* Legumina vix 4-5 lin. longa, dentes calycini brevissimi glanduloso-villosi.

Hab. Mussooree.

15. *A. trichocarpus* (Graham) erectus strigoso-pubescens; foliolis 12-15-jugis oblongis basi cuneatis, pedunculis folio vix longioribus racemosis, leguminibus pendulis villosis. —Præcedenti valde affinis sed foliolorum forma distinctus videtur.—Wall. l.c. n. 5926.

Hab. Sirmore. *Govan.*

Sect. 7. Tragacanthæ. DC. Prod. 2. 295.

16. *A. strobiliferus* (Royle) floribus axillaribus sessilibus aggregatis, calycibus 5-partitis, laciniis subulatis lanatis corolla brevioribus, stipulis glabris foliolis 5-6-jugis oblongo-linearibus villosis, caule leguminibusque lanatis.—Affinis *A. cretico* et *A. siculo.*

Hab. Kanum in Kunawur.

17. *A. polyacanthus* (Royle) glaber; pedunculis brevissimis subbifloris, calycibus cylindraceis 5-dentatis, foliolis 10-12-jugis parvis obovatis glabris, leguminibus oblongis acuminatis turgidis calyce subduplo longioribus.—Affinis *A. poterio.* Variat leguminibus glabris villosisve.

Hab. Soongnum in Kunawur.

18. *A. Grahamianus* (Royle) pedunculis 2-3-floris folio brevioribus, calycibus cylindraceis 5-dentatis pubescentibus, foliolis 5-6-jugis oblongis glabris vel pubescentibus, leguminibus ovatis turgidis pubescentibus calyces æquantibus.—v. Tab. 36. f. 2.—*a.* calyx. *f.** stigma. *h.* pollen.

Hab. Hills surrounding Cashmere.

19. *A. multiceps* (Wall.) caule villoso, pedunculis brevibus 1-7-floris, calycibus subinflato-cylindraceis 5-dentatis pubescentibus, foliolis 5-6-jugis obovatis oblongisve subsericeo-villosis, leguminibus ovatis turgidis villosis calyces vix æquantibus. Wall. l.c. n. 5237.

Hab. Sirmore. *Wallich.*—Shalkur in Hungarung. *Royle.*

Sect. 8. Caprini. DC. Prod. 2. 301.

20. *A. Webbianus* (Grah.) subcaulescens glaber vel vix pilosiusculus, foliolis 25-31 parvis obovatis distantibus subcarnosis, dentibus calycinis longis lanceolato-subulatis bracteisque subpilosis, corollis glabris.—Affinis *A. Schanginiano*, differt glabritie, foliolis parvis et petiolis subincuratis. Wall. l.c. n. 5936.

Hab. Inter rupes Sutlej. *Wallich.*—Much eaten by goats, called *kuner* by the Bhoteas. *Webb.*—Nako in Hungarung. *Royle.*

21. *A. Candolleanus* (Royle) subcaulescens, hirsutus; foliolis

foliolis 21-31 obovatis obtusis emarginatisve, pedunculis brevissimis paucifloris, calycis dentibus tubo dimidio brevioribus. Ab *A. Buchtormiensi* vix differt nisi caulibus elongatis et petiolis subpersistentibus. Foliola minora.

Hab. Rogee in Kunawur.

22. *A rhizanthus* (Royle) acaulis, subsericeo-pilosus; foliolis 21-31 late-ovatis subrotundis sæpius obliquis, floribus dense aggregatis subsessilibus, calycis elongati hirsuti dentibus tubo brevioribus, leguminibus oblongis acuminatis hirsutissimis.—Hæc etiam *A. Buchtormiensi* affinis, at floribus numerosis majoribus et foliolorum forma diversa.

Hab. Lippa, Chango and Leeo in Kunawur.

XIII. Guldenstadtia, Fisch. DC. Prod. 2. 307.

1. *G. cuneata* (Benth.) subacaulis vel diffusa incana; foliolis 16-17 cuneiformibus retusis pedunculis unifloris.

Hab. Shalkur in Hungarung. *Royle.*

Tribus II.—Vicieæ. DC. Prod. 2. 353.

XIV. Cicer, Linn.—DC. Prod. 2. 354.

1. *C. arietinum*, Linn. DC. l.c.—Variat flore purpurascente vel albo, caule foliisque pubescentibus vel glabris.

Hab. Both varieties are cultivated in Northern India; the red is called *lal chuna*, the white *kaboolee chuna.*

2. *C. songaricum*, Steph. DC. l.c.

Hab. The only specimen is in the Herbarium presented to Mr. Brown by Mr. Inglis, found by him at Chinee in Kunawur.

3. *C. microphyllum* (Royle) foliis omnibus vel superioribus abrupte pinnatis apice cirrhiferis, cirrhis subsimplicibus, foliolis parvis cuneato-rotundatis obcordatisve serratis superioribus minoribus, stipulis parvis ovatis dentatis, calycis basi gibbosi laciniis alis brevioribus.—Valde affinis *C. songarico* sed ramosior, humilior, gracilior; foliola numerosa stipul subæqualibus. Folia 2-4 pollicaria, foliola alterna. Pedunculus brevis bracteatus uniflorus. Flores minores videntur quam in *C. songarico*, calyce minus gibboso.

Hab. Shalkur in Hungarung.

XV. Vicia, Linn.—Genus adhuc lege minime naturali divisum et circumscriptum.

* Floribus subsessilibus.

1. *V. Faba*, Linn.—Faba vulgaris Mœnch.—Ser. in DC. Prod. 2. 354. Species a *V. Narbonensi* generice non separanda.

Hab. Cultivated in the cold weather in N. India—*bakla* of the natives.

2. *V. sativa*, Linn. var. angustifolia. Ser. in DC. Prod. 2. 361.

Hab. Cultivated in N. India—grain eaten by the natives, called *khandee.*

* * Pedunculis elongatis multifloris.

3. *V. dumetorum*, Linn.—Ser. in DC. Prod. 2. 355.

Hab. Taranda in Kunawur.

4. *V. sylvatica*, Linn.—Ser. in l.c.—Foliola parum angustiora quam in varietate vulgari sed eadem species videtur.

Hab. Kanum and Pungee in Kunawur; also in Cashmere.

5. *V. tenera*, Wall. Cat. Herb. Ind. n. 5928—a *V. sylvatica* differt pedunculis folio brevioribus, at omnino eadem ac *V. Americana* et verosimiliter cum illa *V. sylvaticæ* mera varietas.

Hab. Silhet, Kemaon and Sirmore. *Wall.*—Suen, Mussooree, and Kedarkanta. *Royle.*

6. *V. rigidula* (Royle) villoso-pubescens; caule tetraquetro, cirrhis simplicibus 2-3-fidisve foliolis (8-12) ellipticis submucronatis costatis viridibus, stipulis semisagittatis integris dentatisve, pedunculis folium superantibus multifloris, alis vexillum subæquantibus carinam parum superantibus, stylo versus apicem subtus puberulo, leguminibus glabris pendulis. —*V. amœnæ* affinis et forsan cum illa Orobisque nonnullis, Lathyris plurijugis congener.

Hab. Rogee in Kunawur. *Royle*—Kunawur. *R. Inglis*, Esq.

7. *V. cracca*, Linn.—Ser. in DC. Prod. 2.

Hab. Common in fields in N. India during the cold weather, called *ankara.*

XVI. Ervum, Linn.—Ser. in DC. Prod. 2. 366.

1. *E. Lens*, Linn.—Ser. in l.c.—Variat caule foliisque glabris vel villosis.

Hab. Cultivated in the cold weather in N. India—*mussooree* of the natives—*adus* of the Arabs.

2. *E. hirsutum*, Linn —Ser. in l.c.

Hab. Extremely common in wheat-fields in N. India, where it is called *gegla.*

3. *E. tetraspermum*, Linn.—Ser. in l.c.

Hab. Himalayas.

XVII. Pisum, Linn.—Ser. in DC. Prod. 2. 368.

1. *P. sativum*, Linn.—Ser. in l.c.

Hab. Cultivated in Northern India, but probably introduced by Europeans.

2. *P. arvense*, Linn.—Ser. in l.c.

Hab. Cultivated in the Himalayas, also in the plains of N. India, and wild in the Khadir of the Jumna near Delhi; *urra muttur* of the natives, called *kullae* in the hills.

XVIII. Lathyrus, Linn.—Ser. in DC. Prod. 2. 369.

1. *L. ovatus* (Royle) pubescens; caule tetragono non alato, cirrhis subtrifidis, foliolis 2-3-jugis ovatis (magnis), stipulis semisagittatis foliolo minoribus, pedunculis plurifloris folio longioribus, vexillo amplo patente.—Valde affinis *L. altaico* sed pubescens, foliola paucijuga duplo majora. Flores duplo majores.

Hab. Boodurwar valley on road to Cashmere.

2. *L. pratensis*, Linn.—Ser. in DC. Prod. 2. 370—cum varietate elatiore pubescente floribus majoribus.

Hab. In Boodurwar and Cashmere; the larger variety at Rogee, in Kunawur.

3. *L. Aphaca*, Linn.—Ser. in DC. Prod. 2. 372.—Wall. l.c. n. 5952.

Hab. Hb. Ham. e Puraniya. *Wall.*—Common near banks of rivulets in Northern India. *Royle.*

4. *L. angulatus*, Linn.—Ser. in l.c.

Hab. Found among grass both in the hills and plains.

5. *L. sativus*, Linn.—Ser. in DC. Prod. 2. 373. Wall. l.c. n. 5953.

Hab. Hb. Madras e Courtallum. *Wall.* Cultivated in N. India—*muttur* of the natives.

XIX. Orobus, Linn.—Ser. in DC. Prod. 2. 376.

1. *O. luteus*, Linn.—Ser. in DC. Prod. 2. 378.—*O. Emodi.* Wall. l.c. n. 5948.

Hab. Sirmore and Kemaon. *Wall.*—Urukta, Choor, Nagkanda, Boodurwar, and Shalimar, in Cashmere. *Royle.*

Parochetus oxalidifolia; foliolis obovatis retusis integerrimis.—*P. major.* Wall. Cat. Herb. Ind. n. 5525.—*P. communis.* l. c. n. 5972.—Tab. 35. f. 1.—(*a.*) standard ;—(*b.*) alæ ;—(*c.*) carina of corolla ;—(*e.*) quadrifid calyx, upper lip bidentate, and pistil with single stamen ;—(*d.*) nine united stamens ;—(*f.*) half of legume, with seven seeds.

This genus has been referred by Mr. Don to the *Phaseoleæ*, but Mr. Bentham is of opinion that it has greater affinity to the *Trifolieæ*, with which it certainly agrees in habit, while the parts of fructification present no discrepancies. The species was at first referred to *P. communis*, as on referring to the E. I. Herbarium, no difference could be perceived between it and *P. major.* n. 5525, which appeared to be only a variety of *P. communis.* n. 5972. The latter name, as the more general and applicable, was therefore adopted ; but Mr. Don has since shown me the original specimens, of which the leaflets are clearly *dentato-serrate*, of his *P. communis;* and as *P. major* is described with crenate leaves, this species, the most nearly allied to it and which I have never seen except with the most completely entire leaves, must be considered distinct, unless specimens, showing the regular gradations, can be found.

Smithia ciliata; caule erecto, calycis labiis reticulato-venosis dentato-ciliatis.—Tab. 35. f. 2.—(*a.*) calyx and bracteæ, with young legume ;—(*b.*) ripe fruit.

This plant brought me from near Kedarkanta, is easily distinguished from *S. sensitiva*, found in the Deyra Doon, by its habit, the form of the leaves, and its calyx. I am indebted to my friend, W. Saunders, Esq. for the drawing.

Uraria lagopus; DC. Prod. 2. p. 324. Wall. Ic. ined. 577—*U. lagopodioides.* Wall. Cat. Herb. Ind. n. 5676.—An *Doodia alopecuroides?* Roxb. Fl. Ind. 3. p. 368.—*Uraria lagopoides.* T. 33. f. 1.

Though this species varies a good deal in the form of its leaves, there is no doubt of its being the same plant as n. 5676 of Dr. Wallich's Catalogue, there named *U. lagopodioides*, and in consequence so named by me in the figure T. 33. f. 1. though in my own Catalogue it had been referred to *U. lagopus*, DC. ; so in the E. I. Herbarium, the specimens are marked *U. lagopus*, as in Dr. W.'s drawing referred to. This cannot be *Doodia lagopodioides*, Roxb., as that is described as being " prostrate and rooting at the joints ;" but may very probably be *D. alopecuroides*, from which it differs little in character, and is found in the same parts of the country, that having been sent by General Hardwicke from the northern parts of India, and this found by myself in the Kheree Pass, Deyra Doon, and Suen Range.

Cassia lanceolata.—Forskal Catal. Arab. p. cxi. n. 270. Descrip. Plant. p. 85.

In conformity with the opinion of many botanists, this species has been considered as distinct from *C. acutifolia* of Delile, though the two are united by M. De Candolle, and are certainly very nearly allied to one another. The latter, called *C. lanceolata*, Lam., by Nectoux, is considered by M. Delile to be the same as his *C. acutifolia*, and may be distinguished by its suffruticose habit, shorter, ovate-lanceolate acute leaves, long-linear stipules, and by the shorter, less membranous legumes. The *Cassia lanceolata*, Forsk., or that grown from the seed of *Suna-mukee*, though an annual, may with care be made to live throughout the year, and thus assume a suffruticose habit. The leaves are truly lanceolate, but differ in length in the lower and upper parts of the stem, but the sessile glands on which so much stress has been laid, do not appear to be a constant character, as I have very seldom seen them. The figure will give a correct idea of the form of the thin and membranous legume. Tab. 37.—(*a.*) A flower ; —(*b.*) the same, with the calyx and corolla removed ;—(*d. e.*) sepals and petals separated ;—(*f. g.*) fertile stamens ;—(*e.*) abortive ditto ;—(*h.*) pistil ;—(*i. k.*) legume ;—(*l. m. n.*) seed and embryo.

63. ROSACEÆ.

The *Rosaceæ*, like the *Leguminosæ*, have been divided by some botanists into several orders, which are by others considered only tribes of that under consideration. As the multiplication of families renders advisable the retaining together as many as possible in one group, whether this be called a class or order, I have preferred following M. De Candolle, in considering them together, instead of separating the *Chrysobalaneæ*, *Amygdaleæ*, and *Pomaceæ*, from the *Sanguisorbeæ*, *Spiræaceæ*, *Dryadeæ*, and *Roseæ;* particularly as they correspond in many points of structure, geographical distribution, and, with

with the exception of the secretion of prussic acid by the *Amygdaleæ*, also in properties.

The *Chrysobalaneæ*, most entitled to rank as an order from differences in structure, differ also from the true *Rosaceæ* in geographical distribution (*Br. Congo*, p. 434), as they are chiefly found in the tropical parts of Africa and America; and though the order was not supposed to exist in Asia, Dr. Wallich has discovered species of *Parinarium* at Singapore, and an arborescent plant of this tribe, Cat. n. 7507, in Silhet. But a *Chrysobalaneous* plant is found much further north, as we have seen to be the case with plants of other tropical families. This is *Prinsepia utilis* of the present work, which is common on the driest and most barren-looking schistose rocks, as in the neighbourhood of Muttiana, in N. lat. 31½°, and at elevations of 5,000 and 6,000 feet, where its seeds yield by expression a useful oil.

The *Rosaceæ* are, however, chiefly confined to the cool parts of the northern hemisphere, being found in the plains of high latitudes, and in the mountains of more southern regions. Though roses, peaches, and some of the apple-tribe, are found in the gardens, we do not meet with any of the *Rosaceæ* in the plains of India, with the exception of *Rubus*, found however only in hilly places in the southern parts of India, and a single *Potentilla*. This is *P. denticulosa*, DC. which does not differ from *P. supina*, Linn.; it is common in the plains of N. India in the cold weather, and at elevations of 4,000 and 5,000 feet in the Himalayas. Messrs. Wight and Arnott mention, that it is found on the Neelgherries. I have also had it from Cheeni and from Lower Kunawur, whence it extends to the Caspian Steppes, and into Europe and also North America.

Two other species of *Potentilla* are found on the Neelgherries, with a *Cotoneaster*, *Fragaria*, and species of *Rubus* and *Photinia*. Of this last genus, species are also found in the mountains above Silhet and Pundua, and extending further north, with a species of *Eriobotrya*, in Nepal; making these genera common to the Himalayas and to China. A *Raphiolepis* is also mentioned in India, but it does not appear to extend beyond China or Cochin-china. A species of *Eriobotrya* is said to be found in Persia.

In addition to these, in the northern as in the southern parts of the Himalayas, there are numerous species of *Rosaceæ* belonging to such genera as are found in Europe, Siberia, the Altai Mountains, China, Japan, and North America; and from Caucasus to the Hindoo Khoosh, on the ramifications of which and in the valleys they include, some, as the *Pomaceæ* and *Amygdaleæ* appear to have their favourite resort. The genera, of which species are found in the Himalayas, are *Amygdalus*, *Persica*, *Armeniaca*, *Prunus*, *Cerasus*, *Spiræa*, *Neillia*, *Geum*, *Sieversia*, *Rubus*, *Dalibarda*, *Fragaria*, *Potentilla*, *Sibbaldia*, *Agrimonia*, *Sanguisorba*, *Rosa*, *Cratægus*, *Cotoneaster*, *Cydonia*, and of *Pyrus*, species of the sections *Pyrophorum*, *Malus*, and *Sorbus*. Of these, *Neillia* is alone peculiar to these mountains. *Sieversia* is interesting, as found on the Alps, in Kamtschatka, in Melville Island, and in the Himalayas, on such lofty mountains as Choor, Kedarkanta, and Gossainthan; and *Dalibarda*, in these mountains in North America, and the Straits of Magalhaens. Though the *Rosaceæ* are chiefly confined to the

the northern hemisphere, yet the southern is not without them, as a *Geum* is found in the last-mentioned straits; a *Fragaria* and *Rubus* in the Andes and Peru; a *Cratægus* and *Potentilla* in Chili; and though not to the south of the line, a *Geum, Rubus,* and *Amygdalus,* in Mexico; and a *Cerasus* in the West-Indies, appearing to indicate that where any similarity of climate exists, representatives of genera and families may be found, of which the greater numbers exist in very distant regions.

With respect to species which, independent of those yielding the well-known fruits, are common to these mountains, and other parts of the world, *Pyrus baccata* may be mentioned, which, common in Siberia, was procured by Dr. Wallich from Kemaon, and found by myself on Kedarkanta. Of the *Spiræas,* one is near, if not identical with, *S. callosa,* of Thunb.; *S. chamædrifolia,* Linn. and *S. Kamtschatika,* Pall., allied to *S. Ulmaria,* found in Siberia, are also so in these mountains. *S. triternata* approaches *S. Aruncus,* and *S. Lindleyana* is like *S. sorbifolia.* *Agrimonia Nepalensis* resembles *A. Eupatorium.* The *Potentillas* are thirty-one in number: of these twenty-one are in Dr. Wallich's, and twenty-three in the author's collection; of the latter six are new, (*P. insignis* and *Candolleana,* nob., with those figured Tab. 40 and 41) and three are Siberian species. Many are highly ornamental, as may be seen by those already introduced, as well as by those figured in the present work, which would succeed equally well in England. *P. cathaclines, multifida,* and *bifurca,* are the three Siberian species found in Kunawur. *Sibbaldia procumbens* is common to Europe, Siberia, America, and the Himalayas.

Nothing can be more ornamental than the double white rose of Northern India and the Deyra Doon, *R. Lyellii, kooza* of the natives; nor than *R. Brunonis,* allied to *R. moschata,* Linn., common in the valleys, or the banks of streams within the mountains, ascending to the tops of lofty trees, especially alders, and hanging down in elegant racemes. On more lofty and drier situations, as the passes of Kunawur, *R. Webbiana,* allied to the Scotch rose, is common; *R. macrophylla* is the most common species on the southern face of the mountains; but on Choor, Urrukta, and such situations, *R. sericea,* Lindl. (*R. tetrapetala,* nob., p. 23), is remarkable in always having four (as *P. Tormentilla* among the *Potentillas*) instead of five, the usual number of petals. In the plains, though so extensively cultivated, no species of rose appears to be indigenous. *R. Damascena, goolab* and *sud-burg* of the natives, *wurd* of the Arabs, is that most highly esteemed, and cultivated in Northern India for making rose-water, and the *atter* of roses. The latter is, however, only extensively distilled at Ghazipore, probably from this species, as it is in Persia; though it is difficult to ascertain whether the same species be cultivated for these purposes in Cashmere. Some of the species of *Rubus,* as in Europe, ripen their fruit early in the season, and others towards autumn. *R. fruticosus* is found in Cashmere. *R. rotundifolius, zurd-anchoo* of the Hill-people, affords a grateful fruit in April and May, but *R. lasiocarpus, kul-anchoo,* not until the rains. *R. concolor* comes the nearest to the raspberry, and is not found except on lofty mountains, as Dhunoultee, Choor, and Kedarkanta. In addition to these, a species of strawberry,

Fragaria nubicola, Wall., very closely allied to *F. collina,* affords a grateful fruit in May, on such places as Phagoo, Mhasoo, Bhoke, &c.

With exception of the *Amygdaleæ,* which secrete hydrocyanic acid, none of the *Rosaceæ* are possessed of deleterious properties, but many are remarkable for producing the most delicious fruits, both in Europe and Asia. Of most of these, the native country is not well ascertained; but in Europe, we point to the S.E., and in India to the N.W., as their native country. Thus, in India—Caubul, and Cashmere; and in Europe, —Pontus and Armenia, are considered as the native countries of the same fruits, which the ancients generally named from the places whence they were procured. Thus we have *Cerasus* and *Persica, Armeniaca* and *Cydonia mala.* In India, however, the languages being more analogous, they adopt the names of the countries more to the northward. But as none of these fruits have been found wild in the plains of these Asiatic countries, we must look to the mountains which run along their whole extent, as their probable native sites, especially as we shall there find most of the fruits alluded to, if not wild, yet in a high state of perfection, with new species of the genera to which they belong.

Thus, the almond, peach, nectarine, apricot, plum, and cherry, with the apple, pear, and quince, are all found either in a wild or cultivated state on the ramifications of Taurus and Caucasus, Hindookhoosh and the Himalayas, or on the valleys included within them. Most of them are enumerated by Forster and Moorcroft, as being abundant in Cashmere, whence I introduced them into the Mussooree Nursery. Mr. Elphinstone and Lieut. Burnes inform us, they abound in Peshawur and Caubul; and by the latter, the peach, apricot, cherry, plum, pear, apple, and quince, are represented as abundant at Bokhara, and other places on the north of the Hindookhoosh: in Kunawur, on the north of the Himalaya, we have the apricot, peach, plum, and apple.

The Almond, which, though flowering, does not ripen its fruit in N. India, and of which both the sweet and bitter kinds are known and imported into the northern parts from Ghoorbund, and into the southern parts of India by the Persian Gulf, is so extensively cultivated in the south of Europe, in Syria, and Barbary, that it is probable its native country may be further north than others of the tribe, and therefore the north of Africa, as generally supposed; though it may also be found in the mountains of Asia.

The Peach, introduced into Europe from Persia, a country in which the fruit is very fine, and where both the free and cling-stone varieties are known, and called *kulloo* and *kardee,* the general name for peach, being Persian *aroo;* and Arabic *khookh.* They ripen well, and are of a fine flavour in Peshawur; also, in the north of India, with the well-flavoured flat peach from China. With care, it succeeds also in the elevated land of Mysore; it is found wild in different parts of the Himalayas, as about Mussooree, at elevations of 5,000 and 6,000 feet. In the district of Bissehur there is a distinct kind, called *bhemee* by the natives, *Persica saligna,* nob., which though small, is juicy and very sweet. The Nectarine is found in gardens in Northern India, where it is called *shuft-aloo,* and *moondla* (smooth) *aroo,* though it does not perfectly ripen its fruit, nor is it known from whence it was introduced, though probably from Caubul.

The

The Apricot is very abundant round almost every village in the Himalayas, rendering it difficult to ascertain whether it be ever found wild, as the trees remain the only vestiges of deserted villages. It has been supposed to be a native of the Oases of Egypt, in consequence of its name *burkook* being probably the original of the old term apricoke and *Præcocia;* but as that is its name in the Arabic language which prevails, like the apricot, over a great extent of the Oriental region, the same name is likely to be every where applied to it. At Caubul it is said to be preserved in fourteen different ways, with and without the stones, or the kernel left, or an almond substituted (*Burnes*). It is generally brought in this state into N. India, under the name *khoobanee;* the Arabic name is *mishmish;* in Bokhara, where they are particularly fine, they are called *bakurkhanee.* In the Himalayas the fruit is called *zurd-aloo, chooloo,* and *chinaroo:* in Kunawur the fruit is dried on the tops of their houses, and when pounded, mixed with their meal. It is chiefly cultivated on account of the beautiful oil which is expressed from the kernels. These may also be found in the bazars, under the name of *badamkohee,* or hill-almonds. The oil has a slight smell of hydrocyanic acid, and must resemble that from almonds, especially the bitter kind, or that obtained from *Prunus brigantiaca.*

Specimens of the Cherry or *aloo-baloo,* which I obtained from Cashmere, appear to Dr. Lindley not to differ from the common species, which therefore is probably that met with at Caubul, perhaps also at Bokhara. The fruit of *Cerasus Puddum,* common in the Himalayas, is not edible, but is employed for making a well-flavoured cherry-brandy, though not distilled like the *kirschenwasser;* the bark *pudmak* is used in medicine, as is that of species of cherry in the United States and Mexico. *Cerasus undulata* and *capricida,* the last so called from the leaves being poisonous to goats; and *C. cornuta,* remarkable for its pod-like monstrosity, are handsome and showy trees growing on lofty mountains, and worthy of introduction into England.

The Plum is known in India in a dried state, under the name of *aloo-bokhara,* though chiefly cultivated about Ghuzni. It was seen by Lieut. Burnes, both at Koondooz and Bokhara, whence it may originally have been introduced into the kingdom of Caubul. Specimens of the plants from Cashmere appear to Dr. Lindley to be a new species, —*Prunus Bokhariensis,* nob. To this kind, *kokamalis* (κοκκυμηλεα) is applied as the Greek name in Persian works on Materia Medica. From Irki, near Sabathoo, a small, yellow, thin-skinned and very juicy sweet plum was introduced into the Saharunpore Garden, and which, though I considered to be a new species (*P. aloocha*), is very like a variety of the common plum. It is this, probably, which is called *greengage* by travellers. Mr. Moorcroft also mentions a plum in Ludak, *Cerasus tomentosa,* Wall. Cat. N. 715. *Prunus triflora,* Roxb., is a plum now common in gardens in India, which Dr. Roxburgh states was originally introduced from China. The peach, apricot, cherry, and plum, all exude gum in Northern India.

Of the *Pomaceæ,* the Quince-plants, introduced from Cashmere, do not differ from those already in India, *Cydonia vulgaris,* Pers. The seeds *bihee dana,* being mucilaginous

ginous and used in medicine, are imported from Caubul and Cashmere into Northern, and by the Persian Gulf into Southern India.

Of Pears, that of Samurcund is most noted; they are plentiful at Caubul, and excellent at Peshawur, and are brought into India by the northern merchants from Cashmere and Boodurwar. In the gardens of India, the only kind known is one introduced from China, *Pyrus sinica*, or Sand-pear, which more nearly resembles the baking-pear than any other I know. *P. Pashia*, Ham. (*P. variolosa*, Wall.), or wild pear-tree of the hills, attains a great size; but the fruit is not edible, until it becomes somewhat decayed. *P. lanata* and *crenata*, are other species of this genus, which are found at higher elevations, the first affords an edible fruit, called *paltoo*.

Apples alone of the tribe succeed well in the southern parts of India, as they are stated to be excellent at Bangalore and in Tirhoot, and, though small, of a good quality in most parts of Northern India. As an instance of the difficulty attendant on the introduction of European plants into N. India it may be mentioned, that an apple-tree from Liverpool, in consequence of being the only one which survived, cost upwards of £70 before it was planted in the nursery at Mussooree, where, however, it was thriving along with the fruit-trees introduced from Cashmere. The apple is grown in some of the villages of the Himalaya, as well as in Kunawur. They are remarkably fine at Peshawur and Caubul, and are brought down to India from Boodurwar and Cashmere. On the northern face of the mountains they are grown both at Balkh and Bokhara, and are remarkably fine at the former.

PRINSEPIA.

Calyx basi cyathiformis obtuse et inæqualiter 5-fidus imbricatus. *Petala* 5 rotundata breve unguiculata calycis fauci inserta. *Stamina* 30-40 pluri-serialia subæqualia infra petala inserta. *Antheræ* biloculares, loculis discretis. *Germen* liberum 1-loculare. *Stylus* terminalis. *Stigma* orbiculare capitatum. *Bacca* ovata cortice coriaceo, lateraliter ob semen unum abortivum stylo persistente appendiculatum. *Semen* magnum baccæ conforme, cotyledonibus crassis testa fusca striata inclusum.

I have had much pleasure in dedicating this Chrysobalaneous genus to my friend, Mr. James Prinsep, Secretary of the Asiatic Society of Bengal, who, though not a botanist, contributes most essentially to the progress and right understanding of an important branch of the science, the Geography of Plants, by his researches into the meteorology of India. He is moreover well entitled to the honour by the zeal with which, in a debilitating climate, he promotes the different branches of science, besides those in which he himself excels, by giving the gratuitous aid of his varied talents, in editing and publishing at his own risk, the "Journal of the Asiatic Society of Bengal," a publication filled with original communications on all branches of science by contributors in India. This I have done with the liberal consent of my friend, Dr. Lindley, who previously possessed this plant from Dr. Wallich, though it is not enumerated in the latter's Catalogue.

P. utilis. Tab. 38. fig. 1.—(*a.*) Flower seen from above;—(*c.*) the same reversed;—(*d.*) petals separated;—(*b.*) branch with fruit;—(*e.*) berry cut transversely;—(*f.*) seed enclosed in its testa;—(*g.*) embryo.—This shrub may be easily recognised in the Himalayas, where it is called *bhekhul*, and common in the most barren places (v. *supra*) by the thorny nature of its abortive branches, rising like the few flowered racemes from the axillæ of the leaves. Early in the season it is conspicuous for the abundance of its inflorescence, and later for that of the purple-coloured berries with which it is loaded. The leaves are alternate, either single or 2-3-fascicled, coriaceous, petioled, lanceolate, serrate, younger ones entire. Bractes membranous, lanceolate, dentate-ciliate. The seeds by expression yield a useful oil.

Cerasus

Cerasus cornuta; (Wall.) foliis oblongis ellipticis, basi cordatis apice acuminatis reticulato-venosis serratis lævibus, petiolis sæpe glandulosis, racemis elongatis foliosis multifloris foliis æqualibus vel longioribus, fructibus ovato-subrotundis. Wall. Cat. Herb. Ind. n. 716.—Tab. 38. fig. 2.—(*a.*) A flower; —(*b.*) the same opened;—(*c.*) seen from below;—(*d.*) branch in fruit;—(*e.*) A drupe cut transversely; —(*f.*) the hollow pod-like monstrosity which forms instead of the fruit, as sometimes on the common plum, as represented by M. De Candolle.—(Mem. sur les Legumineuses, p. 139. t. 3. fig. 1.)

This species is nearly allied to *C. undulata*, Ser. and *C. Lindleyana*, Wall., and forms a lofty tree on Choor, at Simla and Dhunoultee.

Sieversia elata; aristis nudis, foliis radicalibus interrupte lyrato-pinnatisectis lobis lateralibus subcuneiformibus dentatis, terminali ovato maximo subtrilobato dentato, caulinis oblongis pinnatifidis stipulisque acute dentatis, caulibus erectis, floribus magnis racemoso-paniculatis, laciniis calycinis integris, accessoriis multo minoribus, petalis obcordatis calyce duplo-longioribus.—*Geum elatum.* Wall. Cat. n. 711. var. β. *humile*, caule unifloro foliisque minoribus. *S. humilis.* Royle. MSS.—Tab. 39. fig. 1.—(*a.*) hairy achenium approaching maturity, with naked persistent continuous style;—(*b.*) achenium cut vertically, displaying the erect seed.

Hab. Sirmore and Kemaon. *Wallich.*—Kedarkanta. var β. Shalma.

Dalibarda calycina; DC. Prod. 2. p. 568.—*Rubus calycinus.* Wall. Don Prod. Fl. Nep. p. 235. Wall. Cat. Herb. Ind. n. 737.—Tab. 39. fig. 2.—(*a.*) Flower with (*b.*) the petals separated, displaying the hairy dentate calyx tubular below, and numerous pistils;—(*c.*) two stamens;—(*d.*) ripe achenia enclosed in the calyx, of which a part has been cut away;—(*e.*) a single achenium;—(*g.*) the same, with the style and one side cut away to shew the pendulous seed;—(*f.*) embryo.

This plant has been figured from the collection of drawings made under Dr. Wallich's superintendence, and lent by the Hon. the Court of Directors, as mentioned at p. 3. It is mentioned (Fl. Nep. l. c.) as found on Gossainthan, and is interesting as belonging to a genus, of which one species is found in North America, and the other at the Straits of Magalhaens; I have preferred following M. De Candolle, in placing this in *Dalibarda*, rather than continuing it in *Rubus*, not only as sufficiently distinguished, but also as more interesting, in showing that the result of the subdivision of large into new genera or sections, is not always to restrict these to a particular part of the world, as seen both in this genus, and in *Sieversia.*

Potentilla Cautleyana; sericeo-pilosa; caule adscendente paucifloro, foliis radicalibus caulinisque inferioribus petiolatis, superioribus sessilibus, omnibus ternato-palmatis, lobis ovalibus serratis, stipulis parvis subintegris, laciniis calycinis acutis, petalis magnis obcordatis calyce duplo-longioribus.—v. Tab. 40. fig. 1.

This species, found at Lippa, in Kunawur, I have named after my friend, Lieut. Proby Cautley, of the Bengal artillery, Superintendant of the Doab Canal, to whose zeal in the prosecution of Natural History, I have been indebted for many interesting specimens in the *Tria Regna*, as well as for the drawings illustrating the Fossil Remains, Tab. 2. fig. 4—15, discovered by him at the foot of the Himalaya during his researches in his favourite subject of Geology.

P. pteropoda; sericeo-tomentosa; foliis radicalibus longe petiolatis circumscriptione flabelliformibus, lobis oblongis cuneatis apice dentatis, stipulis longissimis petiolo (cui fere æqualibus) adnatis, caulibus foliis æqualibus vel paulo longioribus uni-v-paucifloris, petalis magnis obcordatis, laciniis calycinis acutis dimidio brevioribus, carpellis ovatis, receptaculo villoso.—v. Tab. 40. f. 2.

Hab. Mountains surrounding Cashmere.

P. Saundersiana; niveo-tomentosa; caule ramoso multifloro, foliis radicalibus quinatim, caulinis ternatim palmato-sectis pectinatim-dentatis omnibus petiolatis, stipulis latis submembranaceis accretis subvaginantibus, floribus longe pedunculatis, petalis obcordatis, laciniis calycinis lanceolatis acutis petalis subæqualibus, carpellis oblongis lævibus.—v. Tab. 41. fig. 1.

Hab. This species, found at Lippa, in Kunawur, I have named after my friend, Mr. Wilson Saunders, who, during only a short residence in India, made a large collection of the plants and insects of that country, and now applies himself with equal zeal to Botany and Entomology.

P. Inglisii; radice crassa, caulibus cæspitosis, foliis ternato-quinato etiamque septeno-palmatim sectis, segmentis oblongis obtusis integerrimis petiolisque lanatis, stipulis longis membranaceis petiolo adnatis,

adnatis, pedunculis filiformibus unifloris apice bracteatis, petalis rotundatis, segmentis calycinis corollæ æqualibus, receptaculis villosis.—Tab. 41. f. 3.

Hab. The specimens of this plant were brought me from Soongnum, in Kunawur, and were found by Mr. Inglis, after whom I have named it, at Shipkee, in Hungarung.

P. microphylla. Don Prod. Fl. Nep. p. 231. DC. Prod. 2. p. 583. Wall. Cat. n. 1010. Tab. 41. f. 2.

Hab. Found on Kedarkanta and the Chandow Pass; also on Gossainthan.

Sibbaldia purpurea; polygama; caule procumbente stipulis petiolisque persistentibus squamato, foliis quinato-palmatim sectis, segmentis cuneatis bi-v.-tridentatis sericeo-pilosis, petalis obovatis calyce longioribus. Tab. 40. fig. 3.

(*a.*) A male flower seen from above, with a disk in place of pistils: this is coloured too dark;—(*b.*) a flower seen from below;—(*c.*) corymb of fertile flowers in an advanced state;—(*d.*) one detached;—(*f.*) opened out;—(*g.*) a seed.

Rosa sericea; (Lindley) floribus tetrapetalis.—Lindley, Ros. 105. DC. Prod. 2. p. 613. Wall. Cat. 695. Ic. ined. n. 973.—*Rosa tetrapetala.* Royle. p. 23.—Tab. 42. fig. 1.

(*a.*) Corolla seen from below;—(*b.*) ripe fruit;—(*c.*) with the upper part of calyx removed;—(*d.*) a seed;—(*e.*) the same cut transversely;—(*f.*) embryo.

Rosa Webbiana; (Wall.) aculeis rectis pugioniformibus inæqualibus confertis, setis nullis, foliolis basi cuneatis simpliciter serratis, calycis tubo oblongo, sepalis pedunculisque glanduloso-scabris. Wall. Cat. Herb. Ind. n. 682.

Hab. This species was found at Lippa, in Kunawur, and on the Kherung Pass, by Mr. Inglis. It was originally sent to Dr. Wallich by Captain Webb, from Kemaon. It approaches *Rosa spinosissima*, but differs in the want of *setæ*, and in a tendency to convert the upper leaves into true bractes; also in the dark colour of its stem contrasting so strongly with the white thorns.

64. GRANATEÆ.

This order, consists of but a single genus, *Punica*, of which the pomegranate, the only species, has been known from the earliest period as one of the valuable products of Western Asia, whence it has extended into the south of Europe, and may now be found from thence to India, as well as in the northern parts of Africa. Lieut. Burnes describes the pomegranates as forming quite a wood in Mazenderan, whence the dried seeds are exported for medicinal use; and mentions that the famous pomegranates without seeds are grown in the rich gardens, called *Balabagh*, lying under the snowy hills near the Caubul river. Mr. Forster describes them as delicious about Hadgiabad, as they are indeed in most parts of Persia, *Journ.* p. 169. Though grown in most parts of India, large quantities of a superior quality are yearly brought down by the northern merchants from Caubul, Cashmere, and Boodurwar. *Punica* might be retained in *Myrtaceæ.*

In the Himalayas the pomegranate may be seen growing wild and also near villages. The fruit, though small, is brought down for sale to Saharunpore; it is called *darmee;* and the rind *naspal,* being very astringent, is used in medicine, as well as in dyeing. The employment by the natives of India of the bark of the root for the expulsion of tape-worm being now well known, since the subject was communicated by Drs. Hamilton and Fleming, is a remarkable instance of the oblivion into which even a valuable medicine may fall, as this property was well known to Dioscorides. 1. c. 154. The natives give *buloositon* and *rooman* as the Greek names of the Pomegranate.

65. MEMECYLEÆ.

65. MEMECYLEÆ.

This small order, allied to both the preceding and the following, is also so to *Melastomaceæ* and to *Myrtaceæ*, and is only found in the hot parts of India and along the Malayan Peninsula. One or two species of *Memecylon* occur as far north as Silhet, and *M. grande* at Monghir. *M. edule*, found in the Peninsula, Silhet, and Penang, is supposed by Dr. Roxburgh to be the *M. tinctoria* of Wildenow, as its leaves form an ingredient in the dyes of the Coromandel. The ripe berries, though somewhat astringent, are eaten by the natives. (Roxb.)

66. COMBRETACEÆ.

This is another of the families found equally in all the equinoctial parts of the world, and of which a few species spread to the most northern parts of India, and the valleys of the Himalaya. The genera *Terminalia, Conocarpus, Poivrea,* and *Combretum,* of which species are found in India, are common to the tropical parts of Asia, Africa, and America; but *Pentaptera, Getonia,* and *Lumnitzera,* are confined to India, with *Quisqualis* in the Malayan Peninsula and Java.

To the few species previously known in India of some of these genera, several have been added, especially of *Combretum* from Silhet, the Burmese territories, and Malayan Peninsula; but those found in the forest at the foot of the mountains in the most northern parts, occur also in the southern parts of India, as *Terminalia Bellerica* and *Chebula,* the latter nearly allied to *T. citrina; Pentaptera tomentosa,* which differs little from *P. glabra, Poivrea Roxburghi, Conocarpus latifolia,* and *Combretum nanum.* Many of these are found in the Malayan Peninsula, in Silhet, at the entrance into Nepal, and along the foot of the Himalayas in the Deyra and Kyarda Doons. *Getonia nutans* and *floribunda, Quisqualis indica, Lumnitzera racemosa,* are confined to southern parts; the last in the Delta of the Ganges, and the salt marshes in the southern provinces of Malabar. *Conocarpus myrtifolia,* Wall., 4017, appears to be the only species peculiar to the upper provinces, and this was found by Dr. Hamilton on the banks of the Jumna, where I also met with it in coming down that river: it may have spread from Central India. The species of *Conocarpus* have been divided by M. De Candolle into three sections, American, African, and Indian; the last called *Anogeissus* is adopted as a genus by Dr. Wallich. It cannot, however, be now considered as peculiar to India, as an undoubted species of the same genus or section is figured at t. 65 of the *Flora Senegambiæ.*

The *Combretaceæ* yield several products, and some medicines, as myrobolans, which, if valued according to the time they have been in use, would rank with those of considerable importance. Several of the tribe, as species of *Terminalia* and *Pentaptera,* yield excellent timber (v. Roxb. Fl. Ind. 11. p. 429—444); but astringency is the principle most generally diffused, as the bark of *Terminalia Urjan* is used in medicine for this property, and in dyeing black in India, as that of *Bucida Buceras* is in Jamaica, and of

Terminalia benzoin in the Isle of France. The galls found on the leaves of *T. Chebula* by Dr. Roxburgh are powerfully astringent, and used in dyeing yellow and black. So the ripe fruit of *T. Bellerica* is reckoned astringent, and *T. moluccana* is like it. That of *T. Chebula* in an unripe state, and of different ages (v. Fleming, As. Res. xi. p. 182. 8vo.), has long been known under the name of black, yellow, and chebulic (*kaboolee* from Cabool) myrobolans, and considered gently laxative. The fruit of *T. citrina,* as well as of *T. angustifolia* and *T. gangetica,* is like that of *T. Chebula,* and employed for the same purposes. The kernels of *T. Catappa* have the same name, *badam,* applied to them, as to those of the common almond; they are eaten as such, and are very palatable. I have seen the tree as far north as Allahabad, in gardens. The kernels of *T. moluccana,* and those of *T. Bellerica,* are also eaten. From the latter a gum exudes, as from *Combretum alternifolium* in S. America. A milky juice is described as flowing from *T. benzoin,* Linn. f., which, being fragrant on drying, and resembling *benzoin,* is used in churches in the Mauritius as a kind of incense.

Conocarpus latifolia; Roxb. Fl. Ind. vol. ii. p. 442. Wight and Arnott, Prod. Fl. Ind. Penins. 1. p. 316. *Anogeissus latifolia.* Wall. Cat. Herb. Ind. n. 4014.—Tab. 45.—(*a.*) Head of flowers;—(*b.*) a single flower separated;—(*c.*) the same, with the upper part of the calyx opened, showing the insertion of the stamens, the filiform part of the calyx contracting above the base, which embraces the ovary;—(*d.*) carpels imbricated in a head;—(*e.*) a single carpel with its two wings, and terminated by the indurated tube of calyx and the style.

This species, common in the southern, is also found in the northern parts of India, as in the Kheree Pass, where it is called *baklee.* It clearly belongs to the same section as the African *Anogeissus leiocarpa.* v. Tent. Fl. Senegamb. p. 279. t. 65.

67. RHIZOPHOREÆ.

The mangrove tribe, so common on the equinoctial shores, both of the Old and the New World, and which are so remarkable for their seed germinating while yet attached to the branch, as well as for the adventitious roots which serve as supports to the trunk, hardly admit of notice in this work, were it not that *Carallia lucida,* one of the family, is mentioned by Dr. Wallich as having been procured from Kemaon, as well as from Silhet, Chittagong, and the Malayan Peninsula, and the lower regions of the Circar mountains. This is another instance of a tropical plant travelling far north along the tract of forest.

In the Delta of the Ganges, and near Chittagong, *Rhizophora* (*Bruguiera.* Lam.) *gymnorrhiza,* is found, as well as *R. Candel,* whence both extend to the shores of the Indian Peninsula. The wood of several plants of this tribe is described as being hard and durable.

68. ONAGRARIÆ.

This family, as constituted by De Candolle, contains several tribes, some of which have been separated as distinct orders; but as the tribes *Jussieæ* and *Onagreæ* are still retained, there is a want of uniformity in its geographical distribution. *Epilobium,* found in the cool parts of the world, and in mountainous situations, is like so many other genera of the same distribution, common in the Himalayas, with *Circæa,* found

also

also in Europe and America; while *Jussiæa*, of the tribe which is named after it, and found in most hot countries of the world, has species (*I. repens* and *villosa*) common every where in the plains of India, with a species of *Ludwigia* (*L. jussiæoides*); *L. diffusa* is found in the Doon, the other species of this genus occur in Pegu, Java, and Mauritius. *Trapa*, as we have seen to be the case with other aquatic genera, extends over a great extent of latitude, being common every where in the waters of India and China, as well as of Cashmere, of Europe, and Siberia.

Thirteen species of *Epilobium* have been found in the Himalayas. Of these, *E. spicatum* and *parviflorum* are also European. *E. sericeum* comes near *E. hirsutum*; *E. læve*, nob., near *E. montanum*. *E. Himalense*, *Herbertianum*, *decussatum*, and *laxum*, are the other species not previously published. Two species of *Circæa* have been enumerated by Dr. Wallich; of these, *C. repens*, found in Nepal and on Choor, comes near *C. lutetiana*, while that referred with doubt to *C. intermedia*, Ehr. varies much in the form of its leaves, some being almost round, and others like those of *C. alpina*. This is also found on Choor and at Mussooree. A third species is figured in this work from the neighbourhood of Kotgurh.

Few of the plants of this family are possessed of any properties which render them useful, but the tribe of *Hydrocaryes*, formed occasionally into an order so called, are remarkable for the size of their seeds, and the quantity of fecula which they contain rendering them useful as food for man; hence *Trapa bicornis* is extensively cultivated in the lakes of China, and the nuts of *T. bispinosa*, called *Singhara*, are sold in all the bazars in India; and a species, called by the same name, forms a considerable portion of the food of the inhabitants of Cashmere, as we learn from Mr. Forster, that it yields the government £12,000 of revenue; and Mr. Moorcroft mentions nearly the same sum, as Runjeet Sing's share, from 96,000 to 128,000 ass-loads of this nut yielded by the lake of Ooller.

Epilobium laxum; caulibus laxis quadrilineatis, foliis inferioribus oppositis decussatis, superioribus alternis, omnibus breve petiolatis ovatis oblongis acuminatis basi cordatis semi-amplexicaulibus undulati serrulatis pilosis venosis, floribus axillaribus subsessilibus, petalis emarginatis, stigmate capitato.—Tab. 43. f. 2.

Hab. Mussooree.

Circæa cordata; caule rigido erecto pubescente, foliis cordatis acuminatis repando-denticulatis pubescentibus, capsulis rotundis.—Tab. 43. fig. 1.—(*a.*) A flower seen laterally, *b.* from above; insertion of stamens alternating with that of petals;—(*c.*) bilobed petals;—(*d.*) anther seen in front and from behind;—(*e.*) pollen;—(*f.*) filiform style and emarginate stigma;—(*g.*) hispid capsule;—(*h.*) the same opened;—(*i.*) the seed.

Hab. Neighbourhood of Kotgurh in the rainy season.

69. HALORAGEÆ.

This being an aquatic family, does not by its distribution indicate differences of climate, as its plants are found in streams and wet situations in various parts of the world. Thus, *Hippuris* is common to Europe and America, and has been found at Unalaschka, but not in India. *Callitriche* is common to India and Europe; *Myriophyllum* to both these

these and to America. *Serpicula** is common to India and Africa, being found in the Mauritius, the Cape of Good Hope, and the Indian Peninsula; *Haloragis* in the last, as well as in New Holland.

70. CERATOPHYLLEÆ.

This, like the former order, being aquatic, is distributed over a wide extent, and species of the genus from which the order is named, are found both in Europe and India. *C. muricatum,* an Egyptian plant, is also found in India; as well as *C. tuberculatum,* Cham., considered with doubt to be the *C. verticillatum,* Roxb., which is found in the pools about Calcutta.

71. LYTHRARIÆ.

The *Lythrariæ,* called also *Salicariæ,* are divided into tribes, which differ in their geographical distribution; the *Lagerstræmiæ* being tropical, as *Lagerstræmia* occurs in India, China, and the Islands: *Fatioa* appears to be only a variety of *L. parviflora.* The true *Salicarieæ,* like other tribes containing aquatic plants, or those delighting in moist situations, are distributed over a wide extent, and very different climates; thus, *Rotala, Pemphis,* and *Ameletia,* are exclusively Indian, extending from the islands of the Indian Ocean up to the Peninsula and Bengal, and the last as far as Nepal. *Lawsonia* exists in a cultivated state in most parts of the Oriental Region. *Grislea* is found in India, China, and S. America, and *Ammania* in the warm parts of both hemispheres.

Lythrum, found in Europe, America, and New Holland, exists also in the Himalayas, the species figured t. 46, being indigenous in Cashmere. This is closely allied to *L. virgatum* and *Salicaria;* the latter remarkable for being found in New Holland, as well as in Europe.

The

* The authors of the *Prod. Fl. Indiæ Penins.,* in their observations on this genus, have remarked "that this genus must not be confounded with the other *Serpicula* in Wallich's list, n. 5048," although they have been considered the same by me, and referred to the same natural order. Considering that the plant alluded to, has been described by Dr. Roxburgh in the *Flora Indica,* vol. iii. 1832, under both *Serpicula* and *Vallisneria,* that in making an Index, I had nothing further to do than to follow my author, as well as the labour and difficulty in a short space of time of indexing a Catalogue of nearly 8,000 plants, not one of which I had examined, it would be unnecessary to notice the above criticism, were it not for the opportunity of explaining the circumstances under which the Index was made. Immediately on my arrival from India, and when Dr. Wallich was on the eve of departure, and much pressed for time, I offered to Index his Catalogue, though there was little time for even the mechanical part of the undertaking, much less for consultation; and, therefore, though I had arranged most of the published Indian plants, and my own collections in their natural orders, the only work which could be consulted, when the memory failed, was that of *Bartling,* "*Ordines Naturales.*" It was intended, however, to have arranged the families and genera with the number of species under each, in a regular, instead of an alphabetical series, when many errors would necessarily have been corrected. The design, though commenced, was abandoned, chiefly on account of the want of time; but independent of this, the difficulties were sufficiently great of ascertaining the plants referred to under the different numbers, as is evident from one of the authors of the above work, even when writing on the subject, having no suspicion that his new genus, *Bhesa,* was the *Kurrimia* of Dr. Wallich, partly because, as he himself states, the latter had placed his *Itea macrophylla* under *K? macrophylla,* Cat. n. 7200.—*Arnott, Jameson's Journal.* No. 34. p. 261.

The species which extend furthest north are, *Lagerstræmia Reginæ* and *parviflora*, *Grislea tomentosa* and *Ammania rotundifolia*, at the foot of the hills in the Deyra Doon. *Ammania octandra* and *vesicatoria*, are found at Saharunpore in the rainy season; and further south, *A. indica*, *multifida* and *pentandra*.

Astringency is the property remarked in many of the *Lythrariæ*, and is that ascribed in India to the flowers of *Grislea tomentosa* (*Lythrum? Hunteri*) called *dhaee*, of which the bright red flowers, somewhat resembling those of a *Fuchsia*, are used in dyeing; the leaves of *Lawsonia inermis*, much cultivated on the north of the Jumna, *hinna* of the Arabs, *mhendee* of the Hindoos, is used with catechu in India, as every where in the Oriental region, by the women in staining their fingers of an orange hue. The leaves of *Ammania vesicatoria* are so acrid, that it frequently receives from the natives the same name, *soorujhal*, as *Ranunculus sceleratus*; it is used in rapidly raising blisters.

Lythrum Cashmerianum; foliis oppositis lanceolatis basi cordatis sessilibus apice subalternantibus marginibus venisque brevissime pilosis, floribus breve pedunculatis 3-5 in axillis bractearum fasciculatis. Tab. 44. fig. 1.—(*a.*) Flower;—(*b.*) the same seen from below;—(*c.*) opened;—(*d.*) capsule;—(*e.*) cut transversely;—(*f.*) vertically;—(*g.*) a seed.

Hab. Shores of the lake of Cashmere.

72. TAMARISCINEÆ.

This order, composed of the genus *Tamarix*, and a few genera which have been separated from it, is placed here by M. De Candolle, on account of being allied to *Lythrariæ* and *Onagrariæ*, and is referred by Dr. Lindley to the neighbourhood of *Frankeniaceæ*, near which its hypogynous stamens ought to place it.

The plants of the genus *Tamarix* are distributed over a wide extent of territory in the Old World, from 10° to 50° and 55° of N. latitude in Europe and Siberia, and from the Canaries and Senegambia on the west, to China on the east: they differ as much in their localities as in their latitudes, being found on the shores of the ocean, or the banks of rivers, as the Ganges and Nile, as well in the arid and sandy parts of Northern India and the Punjab, as in the cold and elevated climates of Tibet and Siberia; but in these the soil is saline. The genus *Myricaria*, existing in Europe, Siberia and Dahuria, is found also in Kunawur, and the elevated country crossed by Mr. Moorcroft in his journey to Manasarowur.

Respecting the distribution of the species of *Tamarix* there is yet some uncertainty. Dr. Roxburgh has described two as common in India, *T. indica* and *dioica*; the former, found on the banks of the Ganges, Jumna, and other rivers, as well as the coast of Coromandel, has been referred by some authors to *T. gallica*, with which it is, no doubt, closely allied; and if identical, an additional instance of the great extent over which a species may spread when growing in the vicinity of water. *T. dioica*, to which the same name *jhuo* is applied, is most common in Northern India on the banks of rivers; and *T. Furas*, Ham., in the drier parts of the Doab, and in the neighbourhood of Delhi. This species is closely allied to *T. articulata*, Vahl, as I have ascertained, by comparison with specimens collected by M. Bové, in Egypt. It is the *T. orientalis* of Forskal, found

found by him in Arabia. The Arabic name, *asul* or *atul*, is applied to *Furas* (فراس) in India, as to *T. orientalis*, in Arabia and Egypt. With *T. indica* and *dioica*, *T.* (*Trichaurus*, W. and A.) *ericoides*, is found in the Peninsula.

Myricaria, a genus of which one species extends from Europe to the Caucasus, and others are found in Siberia and Dahuria, has also two species in the Himalayas: *M. bracteata*, Tab. 44. f. 2, found in the vicinity of Cashmere; and *M. elegans*, nob., at Lippa, in Kunawur, where the climate has been shown to be Tataric, and the soil saline.

Bitterness and astringency are the properties ascribed to the *Tamariscineæ*, and hence the occasional employment of the European species as a tonic, and as a substitute for hops in making beer in Denmark. In India, also, the twigs of *T. indica* and *dioica*, are considered astringent; but the plants are more valued on account of the galls which are formed on these, and on *T. Furas*, as on *T. orientalis* in Egypt, and which being highly astringent, are now, as in former times, used in medicine and dyeing. Those formed on *T. Furas* are called *sumrut-ool-asul* or *chotee-mue;* and of the jhuo, *sumrut-ool-toorfa* or *buree-mue*. They are chiefly imported from Mooltan, but I have found them on the *Furas* in Delhi. The ashes of *T. gallica* and *Africana*, when growing near the sea, contain a large proportion of sulphate of soda, so that they may be profitably burnt to obtain this salt; its abundance explains the utility of some of these plants as diuretics. It would be interesting to ascertain the quantity contained in the ashes of plants grown in the saline country to the westward of the Jumna. A product very different from any of these is the *manna* produced by a species of *Tamarisk*. This has been ascertained by Ehrenberg to be produced by the puncture of *Coccus maniparus*, on a variety of *T. gallica*, growing on Mount Sinai. The manna has long been known by the name of Arabian, to distinguish it from Persian manna, the produce of *Alhagi Maurorum*, the *toorunjbeen*, (v. p. 194) of Arabian authors. This is called *Guzunjbeen*, from *Guz* or *Kuz*, one of the names of *T. gallica*, or a species of *Tamarisk*.

Myricaria bracteata; caule angulato striato, foliis lineari-lanceolatis sessilibus subpatentibus, spicis terminalibus solitariis, bracteis deciduis latis cordatis membranaceis pedicello longioribus.—Tab. 44. f. 2. (*a.*) Flower seen from below, with a scale attached to the pedicel;—(*b.*) the same, with the petals separated, and the monadelphous stamens opened out;—(*c.*) capsule with one side removed, showing the three placentæ, one inserted into the base of each valve.

M. elegans; caule rotundo striato, foliis alternis oblongis ovatis patentibus basi attenuatis, racemis paniculatis lateralibus, bracteis ovatis acuminatis pedicello subæqualibus.—*M. Davuricæ* affinis ex descriptione Ledeb. vol. iii. p. 224.

73. MELASTOMACEÆ.

This is one of the most natural families, and, with a few exceptions, a strictly tropical one, which is very prevalent in, but not confined to the New World, as though 650 species have been found there, no less than 150 species have been discovered in Asia, but as yet only twelve in Africa. Of the genera, eighty-three in number, only ten occur in Asia; those, of which species are found in India, are, *Osbeckia*, *Melastoma*, *Oxyspora*, *Sonerila*, *Sarcopyramis*, *Triplectrum*, and *Pternandra*. Of these, the five last have

have not been found in other quarters of the world, but the two first are common to Asia, Africa, and America. Of most, the greater proportion of the species are confined to the southern parts of India; but as a few species escape to the northward of the tropics, both in America and China, so in India, from the powerful influence of a local climate, several species, with *Melastoma malabathricum*, are found at the foot of the Himalayas in Silhet, and in diminished numbers in Nepal. Of these may be mentioned, *Melastoma Wallichii*, *Osbeckia ternifolia* and *Nepalensis*, *Oxyspora paniculata*, *Sarcopyramis Nepalensis*, and *Sonerila maculata*. Some species extend still further north, as *Osbeckia stellata* and *angustifolia*, in the valleys near Mussooree, and on the banks of the Giree. *Sonerila tenera*, discovered by Dr. Wallich in Tavoy, was found by myself in the Deyra Doon. Though so frequently mentioned, it cannot be too often repeated, that it is only during the rainy season that these tropical plants make their appearance: and the figure in Tab. 45 is an instance of their diminished size, when found in these northern situations.

Sonerila tenera; pilosula ubique setis longis intermixtis; caule exiguo tenero, foliis submembranaceis oblongis ellipticis obtusis trinerviis ciliatis, racemis terminalibus lateralibusque.—Tab. 45. f. 2. (*a.*) Flower;—(*b.*) the same, with petals and stamens separated;—(*c.*) capsule;—(*d.*) cut transversely; (*e.*) longitudinally, showing the seeds attached to the axis, "exactly as in *Osbeckia chinensis*. Gært. Carp. 2. t. 106;" as Dr. Roxburgh remarks, in describing his *Sonerila maculata*. Fl. Ind. ed. Wall. 1. p. 121.

74. ALANGIEÆ.

This small order may almost be said to be confined to the East-Indies, as both its genera, *Alangium* and *Marlea* (*Stylidium*, Lour.) are common in the southern parts of India, whence they extend along the Malayan Peninsula to Cochin-china, and northwards along the forest-clad base of the Himalaya. *Marlea begonifolia* extends beyond 30° of N. latitude, while *Alangium decapetalum* spreads from the Central Range up the western bank of the Ganges to Allahabad, and the banks of the Jumna. This is common in the Peninsula with *A. hexapetalum*, said to afford good wood and edible fruit.

75. PHILADELPHEÆ.

This order, nearly as small as the former, affects a very different locality, but serves to show the analogy in the vegetation of very distant countries. The genus *Philadelphus* was known only as existing in the South of Europe and North America, until Dr. Wallich discovered a new species in the Himalayas. This is formed of two varieties, which he at one time considered two distinct species, *P. tomentosus*, which is probably only a more advanced state of *P. triflorus*, having the appearance of the figure at T. 46. This is common in Sirmore and Kemaon, at elevations of 6,000 and 7,000 feet, and *P. tomentosus* was procured by Dr. Wallich from Gossainthan. *Deutzia* is one of the new genera found by Thunberg in Japan, and which, on identifying in the Himalaya, first led me to perceive the affinity of its flora to that of that island; new species have been discovered by Bunge in the north of China in addition to the three enumerated by

by Dr. Wallich from the Himalayas, *D. staminea, Brunoniana,* and *corymbosa,* the first figured in *Pl. Asiat. Rar.* 191, and the last in T. 46. p. 2. of the present work. The last is found at the highest elevations, as on Acharanda and Urrukta, and the others are common about Mussooree, and every where in the mountains at similar elevations. All appear to be suited to the open air of English shrubberies.

Philadelphus tomentosus; (Wall.) foliis oppositis petiolatis ovato-lanceolatis acuminatis serrato-denticulatis subquintuplinerviis tomentosis vel glabriusculis subtus nervis pilosis, ramis oppositis floriferis, floribus inferioribus axillaribus solitariis superioribus terminalibus trifloris racemosis, calycis lobis acuminatis, stylo medio quadrifido staminibus æquali. Wall. Cat. Herb. Ind. n. 3653.—Tab. 46. f. 1.

Deutzia corymbosa; (Brown.) foliis ovatis acuminatis denticulato-serrulatis sublævibus, corymbis lateralibus terminalibusque longe pedunculatis multifloris, calycis laciniis minimis, stylis 3-v-5 longis medio dentatis.—*D. corymbosa* (Brown.) Wall. Cat. Herb. Ind. n. 3652.—Tab. 46. f. 2.—(*a.*) Flower seen from above;—(*b.*) from below.

76. MYRTACEÆ.

The *Myrtaceæ* are well known for the elegance of their appearance in tropical countries, and from their representative, the common myrtle in temperate climes, but though many occur in, they are not confined within the tropics; as several genera and many species are found in Australia and New Zealand, as well as at the Cape of Good Hope; so, in India, they extend to its most northerly parts along the foot of the Himalaya. The genus *Myrtus,* in addition to its extension north, spreads south as far as the Straits of Magalhaens, and as well as in the cold parts of Peru, occurs in India on the Neelgherries. The other genera, of which species are found in India, are *Psidium, Sizygium,* and *Eugenia,* common to America and Asia; *Jambosa,* found in the latter and Africa; with *Sonneratia* and *Careya* peculiar to India and its islands.

The species of *Sonneratia* are found only in the Peninsula and the Delta of the Ganges. *Barringtonia acutangula, sumundur-phul* of the natives, existing naturally at Chittagong, is found growing in a clump of trees at Saharunpore (probably introduced) near the late Mr. Grindall's house; but *Careya arborea,* found in Martaban, and Tenasserim, extends naturally as far north as the Jumna, along the foot of the Himalaya, with species of *Sizygium,* as *S. Jambolana,* a variety called *jumawa; S. Panialla;* and another species, allied to the first, which occurs still further north in the Suen range, *S. venulosum,* nob.

The *Myrtaceæ* are chiefly remarkable for secreting volatile oil, which gives an aromatic fragrance to the leaves and other parts of many species, rendering these useful as condiments; they also secrete tannin, hence the employment of some as astringents; others yield edible fruit, as the guava and the different kinds of rose-apple, which are, however, seldom unaccompanied by a degree of aromatic principle, which renders them agreeable to some, but disagreeable to others.

Though naturally growing more to the southward, some of this tribe succeed well in the gardens of Northern India, as *Jambosa vulgaris, Psidium pyriferum* and *pomiferum, Sizygium Jambolana,* and what is remarkable, *Melaleuca Cajeputi,* though a native of the Moluccas. This is probably owing to the quantity of essential oil it contains, as

well

well as to the looseness of its bark, which separating, like that of the birch, renders more difficult the transmission inwards of the cold during the winter season.

But as this is the species stated by Mr. Jack to be more fragrant than any other, and that from which the *Cajeputi* (*Kayapootee*) oil is distilled, it is probable that it might be successfully cultivated in many parts of India, as it succeeds in the open air so far north as Saharunpore. So would also, in southern parts, *Myrtus Pimenta*, or allspice, now cultivated in Jamaica, but of which the trees flourish in the Calcutta garden. The *Clove-tree*, or *Caryophyllus aromaticus*, is a native of the Moluccas, but more difficult to be grown in other countries: it is however cultivated in Cayenne, as well as in the Isle of Bourbon. Ceylon, and the southern parts of the Indian, as well as of the Malayan Peninsula, appear the only parts of the British territories suited to the purpose, though the tree grows freely in the Calcutta garden. It is remarkable that Persian authors give *kurphullon* as the Greek name of cloves. Myrtle berries are still used in Indian medicine, and imported from the north; *Myrtus tomentosa* yields edible berries on the Neelgherries, as the common myrtle does in Syria. The union of astringency with aromatic principles accounts for the employment of some of this tribe in New Holland as substitutes for tea: while *Eucalyptus resinifera* yields a kino remarkable for its astringency; this principle pervades even the edible fruit of *Sizygium Jambolana*, as well as every part of the tree, of which the leaves and bark are used in Indian medicine.

Many of this tribe yield excellent wood, as species of *Eugenia* and *Sizygium*, as well as the New Holland *Eucalypti*, which would succeed well in Northern India, with many other of the plants of that region.

77. CUCURBITACEÆ.

This order, known in Europe from its products forming a luxury, rather than a necessary of life, includes, in tropical countries, an important group of plants, as they afford to the inhabitants a considerable portion of their food. They are chiefly remarkable for the power of adapting themselves to the different situations where they may be grown. Thus we hear of their affording large and juicy fruit in the midst of the Indian desert, where water is 300 feet from the surface (*Elphinstone*), and they are equally grown in the dry season on the sandy islands of Indian rivers; but excess of moisture does not appear to be injurious, as the great majority are successfully cultivated in the rainy season; and Mr. Moorcroft describes an extensive cultivation of melons and cucumbers on the beds of weeds, which float on the lakes of Cashmere; they are similarly cultivated in Persia and in China (v. *Hort. Trans.* 2d Ser. vol. 1. p. 468. and *Staunton's Embassy*). Being chiefly annuals, which a few months suffice to bring to perfection, we find them succeeding in the summer temperature of northern climates, and thus extending from the Line to 55° or 60° of northern latitude, and southwards to the Cape of Good Hope. Their place in the natural series is uncertain; but in habit they are very unlike those near which they are at present placed.

The *Cucurbitaceæ* are common every where in India, both in a wild and cultivated state, belonging to the genera *Zanonia, Lagenaria,* which hardly differs sufficiently to be separated from *Cucurbita, Benincasa, Cucumis, Luffa, Bryonia, Sicyos, Momordica, Trichosanthes,* and *Herpetospermum;* the last, with *Zanonia,* and the new genus *Coccinia,* formed by Messrs. Wight and Arnott of *Bryonia grandis,* are peculiar to India. Most of the others are found in the tropical parts, both of Africa and America, though they chiefly prevail in India, and in many parts of the Oriental Region.

From the similarity of temperature which prevails over all India during the warm and rainy seasons, we find nearly the same species every where; but as most are found in a cultivated state or afford edible food, they will be enumerated below with those which afford useful medicines. Some of the species may be seen in the most arid places, others in the densest jungles; planted at the foot of a tree they emulate the vine in ascending its branches, and near a hut, they soon cover its thatch with a coating of green: they form a principal portion of the culture of Indian gardens: the farmer even rears them in the neighbourhood of his wells.

From the descriptions of Dr. Roxburgh, and his drawings, as well as those of the late General Hardwicke, and from finding my specimens collected in Northern India corresponding in a great degree with those contained in the East-Indian Herbarium, I have no doubt that considerable certainty has been attained respecting the Indian species, though they still require the labours of a monographist, who would study their habits in a living state and at different ages.

As indications of the vegetation of different parts it may be mentioned, that the species of *Zanonia* and *Sicyos* are confined to the forests of Nepal and Silhet, and those of *Herpetospermum* to the latter. From these, *Trichosanthes palmata* extends along the tract of forest to the Deyra Doon, where are also found the bitter variety of *Lagenaria vulgaris,* called *toombee, Momordica Balsamina, Bryonia cissioides* and *laciniosa;* the last I have also received from Cashmere. Some of the above occur also in the valleys at the foot of the hills, with *Cucumis Hardwickii,* nob. The only species I have found in the interior of the mountains, are *Bryonia scabrella* and *Nepalensis,* with a new species of *Cucumis, C. Himalensis,* nob., from Simla, and also from Lieut. Maxwell, from near the Broang Pass. In the open plains, as near Saharunpore and Delhi, we have *Cucumis pseudo-Colocynthis* very abundant, as *C. Colocynthis* is described to be in parts of Africa; also *C. pubescens, Bryonia rostrata, Momordica humilis, Luffa tenera* and *Coccinia Indica,* which indeed is common every where.

From the great size of the fruit, and the quantity of bland nutritious matter they contain, several of this tribe are cultivated in every part of India, either in field or garden cultivation; as *Lagenaria vulgaris, al-kuddoo,* of which the variety *toomba* is used for making the stringed musical instrument, called *sitar; Cucurbita Pepo, meetha kuddoo; C. Citrullus, turbooz;* a variety of this called *tentsee; Benincasa cerifera, petha; Cucumis Melo, khurbooza; C. Momordica, phoot; C. sativus, kheera; C. utilissimus, kukree; Luffa pentandra, acutangula, clavata* and *racemosa;* the two first called *ghia* and *kalee tori;*

Momordica

Momordica Charantia, kurella; M. muricata and *dioica, Trichosanthes anguina, chuchinda; T. dioica, pulwul;* and *T. cucumerina, junglee chuchinda.* To these, the native names by which they are known in the northern provinces, have been attached; the synonymes may be ascertained from the works of Drs. Roxburgh and Ainslie. Of many of the above, the seeds are used medicinally, and yield oil, as of *al-kuddoo, tentsee, khurbooza,* and *phoot,* forming a few of the cooling seeds of the Indian, as some did of the ancient Materia Medica. Those of *Cucumis Momordica* are described by Dr. Roxburgh as being ground into a kind of meal, and the fruit of *Cucumis utilissimus* as particularly valuable for long voyages, in consequence of being easily preserved good for several months. The fruit of other species, though not cultivated, is eaten in India; as of *Bryonia rostrata* and *umbellata, Trichosanthes cucumerina, Cucumis pubescens,* which is highly valued, as it becomes aromatic on ripening. The root also of some species is edible, as of *Momordica dioica* and *Bryonia umbellata.* The useful species of other countries might easily be introduced, if required. The vegetable marrow, a variety of *Cucurbita ovifera,* however, seems the only one particularly desirable. But the mode of cultivating cucumbers, melons, &c. on beds of floating weeds, as practised in Cashmere, and described by Mr. Moorcroft (*Journ. Geog. Soc.* 2. p. 258), might be taken advantage of in India, where pieces of water, covered with masses of aquatic plants floating on their surface, are abundant, and might thus be made to yield a fruitful crop.

It is generally well known, that along with the bland, there exists a bitter principle in the fruit of many species of this family, as in the rind of the cucumber and the melon. In many, however, this predominates to such an extent, that they become intensely bitter, and are used as purgatives, as the colocynth, squirting cucumber, and bryony, in Europe; all which also form, or are supposed to form, articles of the Indian Materia Medica. So the African bryony has the same properties as the European; and in India, with the true colocynth, we have a nearly allied species, which I have called *C. pseudo-Colocynthis,* substituted for, and indeed from similarity of appearance and effects, considered in Northern India to be the true colocynth. Another species, *C. Hardwickii,* nob., from its bitterness, is called *puharee indrayun,* or hill colocynth. So also the wild and bitter variety of *Lagenaria vulgaris,* called *toombee,* and used for making Fukeers' bottles, is considered poisonous. Indeed I was informed by Nanoo, a very respectable and intelligent native doctor, attached to the jail hospital at Saharunpore, that he had seen a case of poisoning from eating of the bitter pulp of *toombee,* in which the symptoms were those of cholera. *Luffa amara* also, according to Dr. Roxburgh, is bitter in every part, and violently emetic and cathartic; so *L. tenera,* nob., *kurwee tori,* is used in native medicine, and *L. Bindal* is considered in Northern India a powerful drastic in cases of dropsy; *L. graveolens* has a heavy disagreeable smell. To these may be added, *Trichosanthes laciniosa, amara, incisa,* and *palmata,* all of which are used in Indian medicine. The roots of *T. cordata* were at one time, Dr. Roxburgh informs us, sent to England, either as a substitute for, or as the real Columbo.

Cucumis pubescens. (Wild).—Prod. Floræ Penins. Ind. Or. 1. p. 342. *C. maderaspatanus.* Roxb. Fl. Ind. 3. p. 723. Wall. Cat. 6734. partly. v. Tab. 47. fig. 1.

This plant, common about Saharunpore, is esteemed by the natives for its fruit, which becomes aromatic on ripening, hence (*C. aromatica,* nob.), but it is too closely allied to be separated from *C. pubescens,* which itself resembles *C. turbinatus* and *C. trigonus,* so nearly as only to be distinguished, according to Dr. Roxburgh, by the fruit, "which is about the size of a partridge's egg, downy, maculated, and without any tendency to be three-sided." (Roxb. Fl. Ind. 3. p. 723).

C. Hardwickii; stems slender, climbing, very scabrous with white, frequently, hair-bearing glands, leaves cordate-acuminate, somewhat 5-lobed, or 5-angled, angles acute, upper surface very hairy, under less so, margins undulately crenate, minutely toothed, male flowers one or two together, female solitary, calyx of each very hairy; fruit oval, oblong, rounded at both ends, from 2-3 inches long, and about half as broad, marked with narrow white stripes; flesh very bitter. v. Tab. 47. fig. 3. *a.* the fruit.

Hab. Found at the foot of the mountains, and called *puharee indrayun,* or hill colocynth. In the figure of this plant, in the late General Hardwicke's collection of drawings, vol. 8. Tab. 23, the same native name is written, as I myself obtained so many years afterwards. In affixing the name of the original discoverer to this plant, I pay but a feeble testimony of my respect for the memory of one, who so meritoriously spent a long life in the advancement of every branch of the Natural History of India.

C. pseudo-Colocynthis; stems slender, prostrate and radicating, very scabrous; leaves scabrous on both sides, with white glandlike hair-bearing tubercles, 5-lobed, lobes as well as the angles rounded, the former slightly toothed, the terminal one broader, cuneate, subdivided into three smaller lobules; male flowers generally solitary, as are the female, long peduncled. Calyx, tube oblong hispid, segments narrow, linear, and pointed. Fruit oblong and smooth, marked with eight broad stripes; flesh very bitter. v. Tab. 47. fig. 2. *b.* transverse section of fruit.

Hab. Plains of Northern India, where it is called *Indrayun* and *Bisloombha,* it may be distinguished from *P. Colocynthis,* by its oblong, not round fruit, as well as by the obtuseness of the lobes which in that species are acute, and the leaves more divided, as I have ascertained by comparison with the Linnean specimen. This is very well represented in the Medical Botany of Messrs. Stephenson and Churchill from a plant grown in the Chelsea Garden from seed sent from the Mediterranean region.

78. PAPAYACEÆ.

This small order contains only the genus *Carica,* which is confined to the tropical parts of S. America; whence *C. Papaya,* the Papaw-tree, has been introduced into India, and is cultivated as a fruit in all the southern parts. The frost in the northern provinces is in some years so severe, as in a single night to destroy large trees of this loose-textured plant. Botanists have considered the genus *Carica* allied to both *Cucurbitaceæ* and *Urticeæ.* The natives of India have, in addition to the former, seen an affinity to the *Euphorbiaceæ* in its resemblance to the castor-oil plant, and have given it in the northern provinces the expressive name of *Urun-khurbooza,* or ricinus-like melon.

The fruit of the *Papaya* is esteemed by many people in the East; but it is not so generally known that its unripe fruit and seeds are vermifuge, and that newly-killed meat hung up under its shade, and poultry fed on its leaves and fruit, are said to be made tender in a short time. (Hooker Bot. Mag. 2898).

79. PASSIFLOREÆ.

The different kinds of *Passiflora,* or passion-flower, which form the type of this order, are well known for the elegance and splendour of their appearance. They were long supposed to be confined to South America and the West-Indies, but the progress of discovery has ascertained the existence of species of this genus at Singapore and Penang,

Penang, as well as of *P. Leschenaultii* on the Neelgherries, and of *P. Nepalensis*, figured by Dr. Wallich, in Tent. Fl. Nep. t. 11. in Nepal. One species of this genus extends as far south, however, as New Zealand, though the genus *Disemma* prevails in New Holland. *Tacsonia* is confined to South America, though a doubtful species, *T. pubescens* is mentioned as existing *in India Orientali*. *Modecca*, according to our present knowledge, is restricted to the East-Indies, Burma, Java, and the northern coast of New Holland. The species enumerated by Dr. Wallich were found at Prome, in Silhet, and the Peninsula of India.

Several of the edible species of *Passiflora* have been introduced into India by the Calcutta Botanic Garden, and a few as far north as Saharunpore. Many others might be successfully cultivated in every part of India, and would form useful and ornamental additions to the gardens.

80. PORTULACEÆ.

The *Portulaceæ* form a small order allied to the *Caryophylleæ*, but, unlike them, are found chiefly in the hot parts of the world, with a few species extending into Europe and North America, and others to the Cape of Good Hope and New Holland. A few species are found every where in the plains of India, belonging to the genera *Trianthema* and *Portulacca*, with a species of *Talinum*, *T. cuneifolium*? in Nepal, and *T. indicum*, which appears to be the same as *T. strictum*, in the Indian and Malayan Peninsulas. The latter genus is chiefly found in the New World, with a species in Arabia: the two other genera have the distribution of the family in the Old World, and are also found in America. The same species, as *Trianthema obcordata*, *crystallina* and *decandra*, and a pentandrous variety of the last, if it be not a distinct species, with *Portulacca oleracea* and *P. quadrifida*, are found in the northern, as in the most southern parts of India, and the Malayan Peninsula. In the fort of Toghlukabad, near Delhi, I found a species which appears distinct from any, *P. geniculata*, nob., but it may be only a variety of Dr. Roxburgh's *P. quadrifida*, a species found in Arabia and Egypt, as well as in India. The fleshy bland leaves of the common Purslane render it useful as a pot-herb in the countries where it is found; in India it is even cultivated for this purpose; *P. meridiana* and *Trianthema obcordata* are also so used; as is *Claytonia perfoliata* in America.

81. PARONYCHIEÆ.

The *Paronychieæ* of M. De Candolle, called also *Illecebreæ*, are divided into several tribes, some of which are considered Orders; as *Scleranthеæ*, *Queriaceæ*, and *Minuartieæ*. They are allied to *Portulaceæ*, and like these to *Caryophylleæ* and *Amaranthaceæ*. They are found chiefly in dry, barren, and sandy places in the south of Europe, and north of Africa, and southwards at the Cape of Good Hope and in New Holland; a few are found in Siberia, and in both North and South America. Though a few species only are found in India, these exist nearly every where, as *Polycarpæa corymbosa* from Ceylon to Saharunpore and westwards to the shores of the Red Sea. *P. spadicea* is confined to the Peninsula; and *Hapalosia Læflingiæ*, Wall., the *Læflingia Indica* of authors, is common

common every where. *Drymaria* (*cordata*, W. and A.) *extensa*, belonging to a genus which is placed both in this order and in the tribe *Alsineæ* of *Caryophylleæ* (v. p. 78), extends from the Peninsula up to the Deyra Doon. The above were the only genera known to exist in the plains of India; but *Illecebrum*, found in moist places in Europe, has a species in Kunawur, which I have called *I. erectum*, though it can scarcely be distinguished from *I. verticillatum;* and *Herniaria*, having the distribution of the order, has a species in Cashmere, *H. Cashmeriana*, nob., nearly allied to *H. incana*.

82. CRASSULACEÆ.

The *Crassulaceæ*, named also *Sempervivæ* and *Succulentæ*, are found in various parts of the world, but in the greatest numbers north and south of the tropics. From the peculiarity of their absorbing surface, they are enabled to obtain nourishment from the driest atmosphere, and probably, to check its excess in the most moist; for we find them both within the tropics, and attached to barren rocks in the driest parts of India, as of the Cape of Good Hope. *Bryophyllum*, so remarkable for the rooting property of its leaves, introduced from the Moluccas and the south of India, succeeds in the gardens of N. India. *Kalanchoe*, found in Egypt, Arabia, and Sierra Leone, has a species, *K. varians*, in the Deyra Doon and lower hills; with *K. laciniata*, and two or three other species in the Peninsula of India. *Sedum* and *Tillæa?*, found chiefly in the cold parts both of the Old and of the New World, and *Umbilicus*, confined to the former, have been discovered in the Himalayas. Of these, the species of *Sedum* are about twenty in number, with flowers of various colours, as red, blue, white, and yellow; some fixed to rocks; others, as *S. sinuatum* and *linearifolium*, growing on the moss-covered bark of trees; a few are confined in their locality: others spread along the whole extent of the mountains with which we are acquainted, as *S. Himalayanum*, from Nepal to Cashmere, and *S. multicaule*, *rubrum* and *azureum*, if the same as *S. Gerardianum*, from the latter to Sirmore and Kemaon. In the arid country of Kunawur, two species have been discovered, *S. Moorcroftianum*, Wall., and *S. capitatum*, nob. *Umbilicus spathulatus*, nob., Ic. ined. 144. f. 1. (*Sedum adenotrichum*, Wall.?) is common on the Mussooree and Suen Ranges, and *Tillæa? pentandra*, Ic. ined. 142, found in the same situations, occurs also on Kedarkanta and in Cashmere.

The *Crassulaceæ*, like several other of the families near which they are placed, possess little medicinal properties, though a few were included in the older systems of Materia Medica.

Sedum linearifolium; caulibus suffructiculosis epiphytis, ramis floriferis rosulato-confertis, foliis alternis numerosis lineari-lanceolatis integris vel minime denticulatis, floribus terminalibus solitariis v. 2-3 corymbosis, petalis albis oblongis apice acuminatis.—Tab. 48. f. 1.

Hab. On moss-covered trunks of trees at Mussooree in the rainy season, the flowers are generally solitary, and the leaves entire, as represented in the figure.

S. azureum; caule simplici? foliis cordato-ovatis lævibus suboppositis, floribus corymbosis, petalis azureis oblongis acutis.—Tab. 48. f. 2.

Hab. Peerpunjal. *S. Gerardianum;* if a variety of this is found at Simla and on Kedarkanta.

S. coccineum;

S. coccineum; radice crassa, caulibus numerosis rosulato-confertis, foliis subimbricatis linearibus integris, corymbis terminalibus paucifloris, petalis oblongis obtusis calyceque rubris.—Tab. 48. f. 3.

Hab. Boodurwar, near Cashmere.

83. FICOIDEÆ.

This order, allied to *Crassulaceæ*, as well as to *Chenopodeæ* and *Alsineæ*, and composed chiefly of succulent plants, is found in hot and sandy parts of the world, from the south of Europe to the Cape of Good Hope and Van Diemen's Land. The genus *Mesembryanthemum*, out of upwards of 300 species, has only three, in Egypt and Arabia, of which one extends to the south of Europe. *Sesuvium*, found on the sea-coast, in the hot parts both of the Old and of the New World, has a species, *S. repens*, near Tranquebar, in the Peninsula of India, and on the opposite coast near Moulmein. *Glinus lotoides* and *dictamnoides*, which hardly differ from one another, are found in every part of India, and the genus in the south of Europe, north of Africa, Arabia, and Egypt.

The succulent leaves of *Tetragonia expansa*, used as a pot-herb in New Zealand, have been introduced into England, and might be so into India. *Mesembryanthemum edule* and *Sesuvium Portulacastrum* are used for the same purpose. Other species of *Mesembryanthemum* yield soda, as *M. geniculiflorum* and *nodiflorum*, *ghasool* of Forskal, which are probably the plants referred to under this name in Persian works on Materia Medica. It is not known what plants are burnt for the purpose of obtaining the soda, *Sujjee muttee*, exported from the shores of the lakes of Western India.

84. CACTEÆ.

Of nearly 200 species of this family at present known, all appear to be natives of America, though Dr. Roxburgh has a *Cactus Indicus*, which he considers to be a native of India, as well as a *C. Chinensis*, from China; *Opuntia vulgaris* has become so common, as to appear a native of the south of Europe. This, growing in the most arid situations, and affording a grateful fruit in the hottest weather, has appeared to Colonel Herriott, and he is joined in this opinion by the late Mr. Haworth, from the similarity of climate and other circumstances, well suited to the north of India, where it would no doubt succeed well, and be a valuable acquisition in place of the *Cactus* now grown there, useful only for hedges.

This species, Dr. Roxburgh thirty years ago described as new and common in the Peninsula of India. Dr. Ainslie states, that this "species of *Opuntia* is indigenous in India, and is what the wild cochineal insect, when introduced, fed on so voraciously, as almost to have rendered the plant extinct on the Coromandel coast." It is equally common in the north of India, and has there a Sanscrit name, *nagphuni*, applied to it, as in the more southern parts; but Professor H. H. Wilson informs me, that he is unable to say whether rightfully or not. Messrs. Wight and Arnott consider it, from an examination of a drawing of Dr. Wight's, to be the *Opuntia Dillenii*, figured in the *Botanical Register*, t. 255. The Indian plant is certainly like this, but my specimens are insufficient for a comparison. If introduced, it must have been so, long previous to the

the introduction of the different kinds of *Opuntia* by Dr. Anderson into Madras, as it was at that time common in every part of the Peninsula of India.

The luxuriant existence over so great an extent of India of a species of *Opuntia*, whether indigenous or not, suggests the introduction and extended culture of Cochineal, notwithstanding that this has already been tried and failed. But it may be observed, that so little was known respecting the kind of insect introduced, the mode of treating it, or the climate best adapted for it, that the experiment can hardly be considered a fair one. Many years ago, Dr. Anderson, of the Madras medical service, introduced several of the useful species of *Opuntia*, which he cultivated in his garden. Captain Nelson, an officer of the Indian army, on his return from England, stopping at Rio Janeiro, obtained some of the *Opuntia* with cochineal insects on it, which he brought to Calcutta, and sent to the Botanic Garden, whence they were distributed to different parts of the country. But so little seems to have been known, whether the *grana fina* or *grana sylvestra* insect had been introduced, that it was inferred to be the latter, as Dr. Ainslie states, "from its preferring the *Cactus Indica*, and refusing to feed either on *C. cochenillifer* or *Tuna*." Dr. Fontana, in an interesting communication, published in the *Asiatic Annual Register* for 1799, and reprinted in *Tennant's Indian Recreations*, mentions both the Manilla and Chinese Opuntias, but states that the insects thrived best on the species indigenous to Bengal. The cultivation was extended, and the quality improved, as in 1795 only five rupees a seer, but in 1797 seven rupees a seer were given for Bengal cochineal, when Mexican was selling at about 16-20 rupees. The Bengal Sylvestris, Dr. F. states, contains only from 9-16 to 10-16 parts of the colouring matter contained in the Mexican. The cultivation, however, was subsequently given up, probably on account of the decreased price of cochineal, and the more profitable cultivation of indigo; but latterly it seems again to have been resumed, as I have seen some good specimens of cochineal made in Bengal.

It is not intended by the above notices to recommend the resumption of a cultivation, which has been tried, and appears to have failed, but only that as the experiment is inconclusive, in consequence of the *grana fina* insect not having been introduced, and the *sylvestra* only into the southern parts of India, it seems worthy of repetition under more favourable circumstances, and in situations not so well adapted for the staple articles of Indian commerce, especially as in these, the *Cactus* thrives particularly well.*

85. Grossularieæ.

* The cochineal, *Coccus Cacti*, is chiefly cultivated with any care in Mexico, where the *grana fina* is sown on the plants about the 10th of October, on the return of the fine weather, the females having been kept under cover during the rains. The *grana sylvestra* is gathered from insects in a wild state; but cochineal is also imported from Georgia and South Carolina, and some of the West-India islands. It has also been tried in Peru, Hayti, and Brazil. The imports are from 220,000 to 330,000 lbs., and have been as high as 700,000 lbs., but the price at present is low, and kept down by the importation of large quantities (600,000 lbs.) of lac, the produce of another species of *Coccus*, *C. lacciferus*, peculiar to India. A demand, however, exists for it in Central Asia, as we learn from Lieut. Burnes they give at Herat thirty-two rupees a-seer, for some which they import from

85. GROSSULARIEÆ.

Currants and gooseberries are so familiarly known, that every one may form a correct idea of this order, which contains only species of the genus *Ribes*, to which both of the above belong. The species are found in the temperate and cold parts both of the Old and New World, as well in the northern as in the southern hemisphere. We therefore find them, as we have done species of so many other genera of a similar distribution, every where along the Himalayas; though as yet only three species have been discovered. Of these, *R. glaciale*, found on Gossainthan, as well as on Choor and Manma, at elevations of from 8,000 to 10,000 feet, is nearly allied to *R. petræum*. *R. acuminatum* is found in similar situations, as well as eastwards in Kemaon and Nepal. The gooseberry, or a species so nearly allied to it, as to have been referred to it by Dr. Wallich, but which I have called *Ribes Himalensis*, is found on Buddrinath; near the almost inaccessible sources of the Ganges; and in Kunawur, as mentioned at p. 32 and 35. The Himalayan species secrete acid and jelly, but less saccharine matter than their European congeners, owing partly to want of culture, and partly to the shortness of the season between their flowering and the accession of the rains; also, perhaps, to distinctness of species; but the European kinds would succeed at elevations, where little snow falls in winter, and where, from the earlier development of vegetation, sufficient time would be gained for the ripening of the fruit.

86. SAXIFRAGEÆ.

The *Saxifrageæ*, as constituted by De Candolle, contain several tribes, which by other botanists are considered as distinct orders; such as *Cunoniaceæ*, *Baueraceæ*, *Escallonieæ*, *Hydrangeæ*, and *Saxifrageæ*. Of these, *Hydrangeæ*, though polypetalous, are sometimes, from the resemblance in habit to *Viburnum*, referred to *Caprifoliaceæ*. *Adamia* (Pl. As. Rar. t. 213) is a genus peculiar to Nepal; but *Hydrangea*, found all along these mountains, is also so in North America, China, and Japan, as well as in the mountains of Peru. *H. altissima* (Tent. Fl. Nep. t. 50), climbs lofty trees, and is common, as well as *H. vestita* (*asper*, Don), which is trigynous.

Of *Escallonieæ*, *Itea* is found in the Khassia mountains, and as far north as the Deyra Doon. *I. macrophylla*, found in the former situation, was first described by Dr. Wallich in the *Flora Indica*, but is referred in his Catalogue to *Kurrimia*, probably from their being some plant like it in habit; as Mr. Arnott mentions that it clearly resembles *I. chinensis*. (Hook and Arnott in Bot. of Beechey's Voyage, p. 189, t. 39.) In the Deyra

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from Bokhara and Yarkund, probably the Kermes produced in Russia and Tatary. A kind is also produced (v. p. 85) on the roots of a plant in the marshes near Herat; as is the scarlet grain of Poland, *Coccus polonicus*, on the roots of *Scleranthus perennis* in the north-east of Europe. The *Kermes*, or *Coccus Ilicis*, produced on the *Quercus Ilex* and *Quercus cocciferus*, growing in the south of Europe, has yielded a crimson dye from the earliest ages. The Persian name, *kirm*, a worm, indicates that the Asiatics were acquainted with its true nature, when in Europe it was thought to be the seed of a plant. The French, with their characteristic quickness, have introduced the Cochineal into Algiers, with other tropical products.

Deyra Doon a very distinct species is found, *I. nutans*, nob. (*Ic. ined.* 146), resembling *I. virginica* in habit, and in having terminal spike-like racemes, of which the capsule separates on ripening into two distinct carpels. In *I. macrophylla* the spikes are axillary, and 2 to 3-fascicled. (v. Wall. *Ic. ined.* 156.) The other species of the genus are found in China and North America.

The true *Saxifrages* are well known from being so common in the mountains and fields of European countries. They are found in other cold parts of the world, as both Northern Asia and America, the mountains of South America, and the Straits of Magalhaens, as well as on the Himalayan mountains. The genera found in the latter are *Saxifraga, Chrysosplenium,* and *Parnassia,* common in both Europe and North America, *Tiarella,* found in the latter only, with *Astilbe,* peculiar to these mountains; *A. rivularis,* Don (*Spiræa triternata,* Wall. 706) occurs in Nepal, and also at Mussooree.

Of the *Saxifrages, S. ciliata* and *ligulata* are allied to *S. crassifolia ; S. odontophylla,* and *S. lanuginosa,* nob. to *S. granulata* and *Sibirica. S. stenophylla,* t. 50, from Peerpunjal, is so like specimens of *S. flagellaris,* from Melville Island, as only to be distinguished on a close inspection. *S. mucronulata* (*spinulosa,* t. 50. f. 2), with *S. aciculata,* nob., allied to *S. Brunonis,* and *S. brachypoda* (*glandulosa,* Wall.), belonging to the same group, are found on Choor and Kedarkanta, where the climate, from the shortness of the season after the melting of the snow and the power of the sun, has been compared to that of polar regions, p. 20. *S. imbricata,* t. 49. f. 1, is one of the singular forms found in Kunawur.

S. parnassifolia, Don, which varies so much, as apparently to include both *S. diversifolia* and *Moorcroftiana,* resembles, in one of its varieties, *Parnassia,* very closely in foliage. This genus, referred here by Mr. Brown and Dr. Lindley, has a species, *P. nubicola,* common every where in these mountains, the rest of the genus being found in Europe, Eastern Siberia, and North America. *Vahlia,* referred here by De Candolle, but still continued in *Onagrariæ* by Bartling, is the only genus which displays the anomaly of growing only in hot parts of the world, as Egypt, Senegambia, and the Cape; and in India, in Tranquebar.

Saxifraga imbricata ; caulibus numerosis dense cæspitosis foliosis, foliis minimis undique arctissime imbricatis ovatis oblongis crassis apice subtriquetris puncto terminali marginibus ciliato-serratis, floribus solitariis terminalibus, sepalis glanduloso-ciliatis, petalis obovatis unguiculatis trinerviis sepalis longioribus. Tab. 49. fig. 1.

Hab. Kunawur.

Saxifraga ramulosa ; Wall. Cat. N. 446. Ser. in DC. Prod. 4. p. 21.—Tab. 49. f. 3.

Though it agrees in so many respects, I have hesitated in referring this plant to *S. ramulosa,* described by M. Seringe from imperfect specimens; in consequence of its more diffuse habit, the branches being frequently terminated by solitary flowers, and the leaves being smaller and more obtuse; but these differences are not greater than those observed in the varieties of *S. cæsia,* to which this species is most closely allied.

S. ciliata. Tab. 49. fig. 2.

I have had some difficulty in naming this plant, as the published descriptions, as well as the distributed specimens of Wall. Cat. 4492. and figures of *S. ligulata,* to which it is most nearly allied, do not correspond with one another; indeed, two distinct species pass under that name. Dr. Wallich (*As. Res.* xiii.

Res. xiii. p. 398) describes *S. ligulata* with leaves "basi angustata,—crenato-dentata, dentibus crenisque ciliis longis—uti omnes plantæ partes lævia, carnosa, ad lentem punctata." "Scapus crassus apice semel bisve furcatus." "Flores congesti in paniculam terminalem compactam subracemosam nudam leviter nutantem." Calyx profunde quinquefidus laciniæ leviter ciliatæ—a plant corresponding in every respect with this description, except in the leaves being less ciliate, I have found growing in Choor, Simla, and Kedarkanta, and with which the specimens in the East-India Herbarium, 4492. 2. from Buddrinath, correspond, as well as the figure in Loddiges' Botanical Cabinet, t. 747.

The plant, *S. ciliata*, figured in Plate 49. fig. 2. is found on the Mussooree and Suen Range, at lower elevations than *S. ligulata*. The leaves are ovate and obtuse at both ends, extremely hairy on both, but especially the under surface, and along the nerves; the peduncle is slender, the inflorescence an erect, but lax spreading panicle; the calyx gamosepalous, and cup-shaped at the base, and consequently less deeply divided than in *S. ligulata*, with the laciniæ entire, and not ciliate, and the petals more unguiculate.

S. stenophylla; Tab. 50. f. 1.

This species so closely resembles *S. flagellaris* from Greenland and Melville Island, that it might be considered a modification of that species, and almost the same words used in describing both; but this may be distinguished by the sepals being narrow and lanceolar, the lower leaves acute and not obovate, and by its being more sparingly covered with glandular hairs. It grows on Peerpunjal.

S. mucronulata; caule simplici paucifloro, stolonibus capillaribus rosulatis, foliis inferioribus rosulatis, caulinis alternis, omnibus trinerviis lanceolatis basi attenuatis apice spinuloso-mucronatis margine glanduloso-ciliatis, petalis oblongis ovatis 5-nerviis, sepalis acutis trinerviis marginibus glanduloso-ciliatis, stigmatibus crassis.—*S. spinulosa*, Tab. 50. f. 2. *a.* Flower with the petals *c.* separated, and half of the stamens *d.* cut off; *e.* pistil; *b.* sepal magnified. Having observed since the publication of Plate 50, that there is already a *S. spinulosa*, DC. Prod. p 47, I have been obliged to substitute the present for the name first imposed.

Parnassia nubicola; (Wall. Cat. N. 1246) stigmatibus tribus, nectariis trisetis staminibus breviribus, foliis radicalibus ovatis 7-nerviis, caulino breve-petiolato cordato-ovato, omnibus subtus ferrugineis; petalis obovatis subcrenatis unguiculatis basi ciliatis. Tab. 50. fig. 3. *a.* Flower with the petals, and *b.* the stamens separated, shewing the angled scape and pentangular lower adherent half of the calyx; *d.* fertile, *e.* abortive stamens; *f.* germen with the calyx and stamens attached above its middle; *g.* transverse section of the trilocular 3-valved capsule.

87. UMBELLIFERÆ.

The *Umbelliferæ*, from their peculiarity of habit and inflorescence form one of the most natural of families, and of which almost any individual may be recognized at a glance; but in proportion to this facility of recognition, is the difficulty of ascertaining the genus to which any particular plant may belong. Indeed so great a resemblance is there between these, that it has even been said that the whole order might be considered only as one huge genus. But as this, to say the least, would be inconvenient, and as the difficulty is great of forming natural genera, different parts have been selected by different botanists for generic distinctions; the result, therefore, has frequently been to form very artificial groups, and to transfer plants from one to another, and to cause a frequent change of name. This is no doubt owing in part to many plants having been referred to genera from imperfect specimens, and also to our more perfect knowledge, in consequence of more careful dissection of all the parts of a plant. From the labours, however, of Hoffmann and Lagasca, Koch, and De Candolle, considerable precision has now been attained in the characters of the genera, though they may perhaps justly be considered as being too much subdivided. The

The distribution of the *Umbelliferæ* also was so imperfectly known, that they were long supposed to be chiefly confined to the northern parts of the northern hemisphere; but more extended observation, has shewn that they affect a moderate temperature, and chiefly prevail in the temperate zone: something less than one-third of those known are found in the southern hemisphere, and about four times as many in the Old World, as in America.

Considering, therefore, that the *Umbelliferæ* flourish in a moderate temperature, we cannot look for them in the plains of India; and accordingly we find that Dr. Roxburgh has only described seven wild and six cultivated species in his *Flora Indica*. Messrs. Wight and Arnott, in addition to the latter, have described twenty species, some found also in Bengal, but others from the mountains of the Peninsula. But a great accession is observable in the numbers, immediately we turn our attention to the Himalayas, where every kind of temperature suited to the growth of plants may be found. In Dr. Wallich's Catalogue we have sixty-six species enumerated, among which most of Dr. Roxburgh's are included; in the author's collection there are not less than ninety species, of which several are new, and others the same as Dr. Wallich's. The total of the whole is 127 species for the Indian Flora, of which eleven are found in the plains and at the foot of the hills, seven only in a cultivated state, and the remainder in the mountains, with the exception of a few in the Peninsula.

The genera, to which these Indian and Himalayan *Umbelliferæ* belong, are *Hydrocotyle, Eryngium, Œnanthe,* and *Daucus,* found in most parts of the world; *Ptychotis, Athamantha,* and *Torilis,* existing in the south of Europe and in the Oriental region. *Falcaria? Carum, Bunium, Pimpinella, Bupleurum, Livisticum, Selinum, Archangelica, Palimbia, Peucedanum, Heracleum, Pastinaca,* and *Pleurospermum,* which are chiefly found in Europe, and eastwards in the Caucasus and Siberia, with a few spreading southwards into the Mediterranean region. To these may be added, *Sanicula, Helosciadium, Sium, Seseli, Cnidium, Ligusticum,* and *Chærophyllum,* found in these countries, as well as in North America. The genus *Osmorhiza,* also, which was thought to be restricted to the latter, has been found in the Himalayas, and not only the genus, but one of the same species, *O. brevistylis* exists in these two widely-separated localities. *Hydrocotyle asiatica* and *Coriandrum sativum,* as remarked by M. De Candolle, are also found widely distributed; the first being found in Asia, Africa, and America; and the second, common in Europe and the Oriental region, as well as in India, has also a variety, or very nearly allied species in Mexico. Some of the above genera, as *Sanicula, Helosciadium, Apium,* and *Ligusticum,* are also found in South America; and others, as *Fœniculum, Seseli, Cnidium,* and *Peucedanum,* at the Cape of Good Hope.

Those, of which species are found in the plains and warm parts of India, as the bases of mountains, are the new genera *Dasyloma,* extending from Bengal to Northern India; and *Ozodia,* confined to the Peninsula; also species of *Hydrocotyle; Ptychotis sylvestris,* nob., found in the Khadir lands of the Saharunpore district; *Bupleurum tenue,* in the Kheree Pass; *Œnanthe stolonifera,* in Bengal; *Ammi? indicum* and *daucifolium* (Wall. Cat.

Cat. 7208 and 7209), of which I do not possess specimens; *Cnidium diffusum*, and *Seseli Indicum*, in the plains of Southern India.

The new genera which have been detected in the Himalayas, are *Eriocycla, Trachydium, Cortia, Tordyliopsis, Pycnocycla, Vicatia, Hymenolæna*, and *Hymenidium*. Of these, the two last are found only on such lofty mountains as Gossainthan, Choor, and Kedarkanta, as well as on Peerpunjal, whence also I have received the specimens of *Trachydium*. *Prangos* has only been discovered in the plains of Tatary, and *Ferula* in the mountains of Persia and Caubul.

The remaining *Umbelliferæ*, which are known in India are those found only in a cultivated state; but this from so remote a period as to have become perfectly naturalized, and known to the natives, as well as to have names given to them in the languages of different parts of the country; some also have not as yet been found in other parts of the world; as *Ptychotis Ajowan*, known every where by the name *Ajwain*, slightly varied in different districts; *Fœniculum Panmorium*, called *sonf* in Northern, and *panmuhooree* in Southern India; *Anethum Sowa*, Arabic *shubit*, Hindoostanee *soya; Cuminum Cyminum*, called *kumoon* and *zeera suffed; Apium graveolens*, known only by the Arabic name *kurufs*; *Ptychotis* (*Pimpinella?*) *involucrata*, called *aneeson* in Northern India, but *chanoo* and *radhooni* in Bengal: it is used by Europeans as a substitute for parsley. *Daucus Carota, gajur;* to which Dr. Roxburgh assigns *gringana* and *gargara* as Sanscrit, though Dr. Carey finds no authority for these names; and *Coriandrum sativum*, Wall. Cat. 594, (marked by mistake *Cuminum Cyminum*, which is N. 7263 of the Catalogue,) cultivated probably in every part of India, as it is included among the Mysore exports by Dr. Buchanan, and has several names assigned it by Dr. Ainslie, but is omitted in the *Prod. Fl. Indiæ Penins.* It is known in the north of India, as in Bengal, by the name *dhunya; kushneez* is assigned as the Persian; and *kuzeereh* as the Arabic name. In addition to these, *Ptychotis sylvestris*, nob., called *arub ajwain*, is used as a carminative by the natives; and a kind of carraway, *zeera seeah*, *Carum nigrum*, nob., is imported from Kunawur.

Having frequently seen that the Persian works in use in India apply what they call *Yoonanee*, or Greek names, to many of the plants and medicines in use there, it is interesting to ascertain, whether, in a family so numerous in species, and of which so many are mentioned in the writings of the ancients, these are applied with sufficient discrimination, and at the same time, correspondence with the results obtained in Europe, as to warrant reliance being placed on their determinations in other cases. The results of this investigation appear very satisfactory: as, for instance, commencing with those best known in both countries, Coriander (κόριον) has *korioon*, and Cumin has *kumoon*, assigned as their Greek names. Celery, known in India only by the name under which it is described in Avicenna, *kurufs*, has *salioon* and *osaliyoon*, evident corruptions of σελινον and ελαιοσελινον. In Persian works, the Arabic name *razeeanuj*, the Persian *badian*, Hindoostanee *sonf*, Greek *marithon*, are applied to *Fœniculum Panmorium*, a species so like *F. vulgare* (μαραθρον), as considered scarcely to differ, by Messrs. Wight and

and Arnott. Ανισον is applied in Europe to the *Anise, Pimpinella Anisum ;* and *aneeson* in Northern India, to the plant every where employed, as a substitute for parsley. This was referred by Dr. Roxburgh to the genus *Apium,* but subsequently removed by M. De Candolle to *Ptychotis.* M. Lagasca, in looking over my collection of *Umbelliferæ,* considered it more nearly allied to *Pimpinella ;* and Messrs. Wight and Arnott have also referred it to that genus, though it is anomalous in some of its characters. Finally, Dr. Roxburgh, in describing *Ligusticum Ajowan,* states, he cannot conceive that this famous Indian plant, aromatic in smell, pungent in taste, used both by natives and Europeans for culinary and medicinal purposes, can be unknown to European botanists. To *Ajwain,* Persian authors assign *nankhwah* as the Arabic name. This is the نانخواه of Avicenna, written *nanachua* and *nanachue* in the marginal translation of *Ammi,* in the Latin edition of his works; which names are quoted under *Ammi* by Mathiolus, in his Commentaries on Dioscorides. But in Persian works on Materia Medica, *Aammi* is also given as the Greek synonyme of *nankhwah,* that is, of *Ajwain,* which Dr. Roxburgh justly supposed could not be unknown to Europeans. This has been referred by M. De Candolle to the genus *Ptychotis,* which brings it near *P. copticum,* called at one time *Ammi copticum:* the *Ammi* itself is called *Cuminum Æthiopicum* and *regium ;* the latter name is translated by *kumoon mullookee,* and is given as a synonyme of *nankhwah* in Persian authors.

In addition to these, other names, a little varied, might be mentioned, as *dokus, kirvia, kokalus, kirdmane, seesaron, seesalioon, kunniyoon,* and *koofiyoon,* intended for κωνειον. The seeds of *Prangos pabularia,* have the name *fiturasulioon* applied to them in the bazars of Northern India, though there is no proof they constituted the *Petroselinum* of the ancients. From the locality and uses of Prangos ; being described by Mr. Moorcroft as growing in the neighbourhood of Draz, on the northern face of the mountains, and affording abundant and excellent fodder for cattle, which it fattens in a short space of time, it corresponds more nearly with the *Silphium* of some of the ancients. This is described by Arrian as growing only with pines on Paropamisus, where it was browsed on by numerous flocks of sheep and cattle. It has been generally supposed to be the assa-fœtida plant. Lieut. Burnes, crossing in the direction of Alexander's route, found this in the same situation, greedily cropped by sheep, and even eaten by his fellow-travellers (as is also mentioned by Kinnier) ; and he supposes it to be, the *Silphium* of Alexander's historians. Heeren applies the greater portion of the remarks which remain of Ctesias respecting the Indians to the high land of Tatary, where grew the *Silphium,* grazed on by innumerable flocks of sheep and goats (*Pol. and Com. de l'Antiq.* 1. p. 372), in the country where cochineal was found (v. p. 224), and whence even now comes the finest wool. In the same country the *Prangos* is found, forming a nourishing and abundant fodder for cattle. As after the first sowing this requires little care or culture, it would no doubt be a valuable acquisition in climates for which it is suited, though of these we have not at present any precise notions. It would, probably, succeed in Kunawur, at the Cape of Good Hope, and also in some of the Australian settlements.

The

The order of *Umbelliferæ*, so natural in structure, is likewise so in the possession in a considerable degree of similar properties. The seeds abound most in essential oil, and are hence frequently warm and carminative—as those of anise, carraway, dill, cumin, coriander; but the diffusion of a portion in the herbaceous parts renders agreeable, as culinary articles, fennel, parsley, celery, and others. A remarkable anomaly, however, occurs on the herbaceous parts of many of this tribe being of a poisonous nature, so that we cannot place great reliance on their generally innocuous nature.

Many have tuberous roots, which are eaten by the natives of different countries, as species of *Bunium* and *Chærophyllum* are in Europe; and, in the Himalayas, a species of the latter genus, called *sham*, *C. tuberosum*, nob. In Santa Fé and the Caraccas, *Aracacha esculenta* is highly valued as a substitute for potatoes, and might be introduced into India. In others, saccharine matter and mucilage abound without any excess of essential oil, so that they form a grateful food: as the carrot, parsnip, skirret, and *Pastinaca Sekakul* in Persia. If essential oil abounds as well as mucilage, and the former changes to resin, and the latter to gum, we have a series of gum-resins, which exude from incisions in the stem, or from the top of the root (Fée), as *Assafœtida*, *Galbanum*, *Sagapenum*, *Ammoniacum*, and *Opoponax* all of which are employed in Indian medicine, and have, with the exception of the first, Greek names assigned them.

Having obtained in the bazars two species of seed, as those of the assafœtida plant, and seeing others in Dr. Lindley's possession from Beloochistan, it is probable that more than one species of *Ferula* yields this gum resin in the different parts of Persia, Caubul, and Bokhara. *Ammoniacum*, called *ooshk* and *ooshak*, is produced by *Dorema Ammoniacum* of Mr. D. Don (*Lin. Trans.* xvi. p. 599), in the province of Irak, where the plains are dry, gravelly, and exposed to an ardent sun. *Galbanum*, in Persian works, has *barzud* given as the Arabic, *bireeja* as the Hindoostanee, with *khulyan* and *metonioon* as the Greek names (evident corruptions of χαλβανη and μετωπυον, owing to errors in the reading of the diacritical points); *kinneh* and *nafeel* are stated to be the names of the plant, which is described as being jointed, thorny, and fragrant. Neither its locality nor nature are well known, but it is probable, as suggested by Mr. Don, that the plant named by him *Galbanum officinale*, from some seed found on the drug, may be a native of some remote and inaccessible parts of Syria; perhaps of some of the northern parts of Persia, or of Arabia. *Sagapenum*, *sugbeenuj* of the Arabs, and to which *sugafiyoon* is assigned as the Greek name in Persian authors, is probably a product of Arabia, as it is imported thence into India, and into England from Alexandria; it is supposed to be produced by *Ferula Persica*, but the subject is well worthy of investigation by travellers. *Opoponax*, called *juwasheer*, and said to be produced by *Pastinaca Opoponax*, is also imported into India from Arabia, and into Europe from Asia Minor. Dr. Lindley has some seed, called *hooshee*, sent by Mrs. Macneil from the Hills of Beloochistan, which he informs me, appears to be *Opoponax*. Some of the above, as Sagapenum, requiring a hot climate and arid soil, would succeed well in the north-western frontier of India, while others, as the Assafœtida, might find a congenial soil and climate in the mountains.

NOTES

NOTES UPON SOME OF THE HIMALAYAN UMBELLIFERÆ,

By JOHN LINDLEY, Ph.D.,
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Eryngium planum. L.

In Cashmere; quite the same as the European plant. It is also found in the Altai.

Carum gracile; foliis pinnatis, foliolis palmato-pinnatifidis: laciniis linearibus obtusis bilobis trilobisve involucro utroque subnullo.

Hab. Nako in Kunawur. Differs from *C. Carui* in its much less-divided leaflets, more slender and delicate appearance, and in the umbels rarely having more than four or five rays.

Dasyloma latifolium; umbellis pedunculatis, fructu exacte oblongo calycis dentibus coronato, foliolis ovatis serratis basi cuneatis integris.

Hab. Choor Mountain. A much larger plant than either of the other species, and at once distinguished by the form of the fruit, which in *D. glaucum* is pyriform.

ERIOCYCLA.

Umbellæ compositæ, generales longiradiatæ partiales capitatæ. Involucra et involucella depauperata. Fructus sect. transv. ellipticus, densissimè lanatus, a latere compressus, stylis brevibus suberectis coronatus. Mericarpia jugis 5, acutis, sub lana absconditis, lateralibus marginantibus. Valleculæ 1-vittatæ, commissura 2-vittata. Semen teres.

Very near *Soranthus*, from which, however, it is readily distinguished by its woolly fruit, which, although minute, has strong ribs beneath the wool, and by there being only two *vittæ* to the *commissure*. It also wants the long-diverging styles of *Soranthus*.

Sp. 1. *Eriocycla nuda.* Tab. 51. f. 2.—*a.* A single flower magnified to shew the peculiar form of the petals. *b.* A ripe fruit. *c.* The same, cut transversely, to shew the juga and vittæ.

Hab. Rarung in Kunawur.

TRACHYDIUM.

Umbellæ simplices v. compositæ; involucris polyphyllis foliaceis multifidis: foliolis basi membranaceis connatis. Styli recurvi. Fructus a latere compressus. Mericarpia jugis 5 inflatis carnosis valleculisque verrucosis, lateralibus sejunctis. Valleculæ 1-3-vittatæ, commissura bivittata. Semen facie depressum, a pericarpio ferè liberum.

A remarkable genus belonging to the multivittate *Seselineæ*, and distinguished at first sight by its simple, or occasionally compound umbels and succulent warted fruit. Its nearest affinity is with *Athamanta* and *Ligusticum*.

Sp. 1. *Trachydium Roylei.*

Hab. Peer Punjal.

Levisticum argutum; foliis bipinnatis, foliolis ovato-lanceolatis inciso-serratis acutissimis.

Hab. Mussooree.

Archangelica Roylei; caule juniore pubescente, foliis bipinnatis, foliolis rhombeis pinnatifidis inciso-serratis, involucelli foliolis subulatis umbellulæ æqualibus.

Hab. Urukta. A very distinct species, most nearly allied to *A. Gmelini.*

Heracleum canescens; foliis pinnatis subtus præsertim et caule villosis, foliolis ternatim sectis: laciniis ovatis duplicato-serratis, umbellæ radiis pilosis, involucelli foliolis acuminatis radiis æquantibus.

Hab. Mussooree. Next *H. candicans.*

Heracleum cinereum; foliis ternatis et caule cinereo-pubescentibus foliolis tripartitis cordatis duplicato-serratis subtrilobis, involucelli foliolis setaceis radiis æqualibus, fructibus obovatis: vittis linearibus.

Hab. Mussooree. Priori affine; utriusque statura pedalis.

PYCNOCYCLA.

Umbellæ compositæ, densissime capitatæ ideoque quasi simplices, polygamæ. Involucra et involucella depauperata. Calycis dentes acuminati. Petala lanata, quasi biloba, acumine angustissimo recto inflexo. Styli longissimi pilosi suberecti. Flores masculi plures unicum centralem hermaphroditum circumstantes: pedicellis cylindraceis incrassatis fructum mentientibus et suprategentibus. Fructus pubescens, teres, rostratus. Mericarpia jugis primariis filiformibus: lateralibus commissuralibus. Valleculæ trivittatæ commissura bivittata. Albumen involutum.

This remarkable genus partakes of the characters of both the *Caucalineæ* and *Scandicineæ* of De Candolle. Its numerous vittæ refer it to the former; from all the known genera of which it however differs, in having no trace of secondary juga. With several *Scandicineæ*, especially *Chærophyllum*, it accords in the surface and form of its fruit; but it differs in the great number of vittæ. From all of both tribes, its remarkable dense umbels, which, although in reality compound, appear as if simple, distinguish it at first sight.

Sp. 1. *Pycnocycla glauca.* Tab. 51. f. a—g.

Pycnocycla glauca.—a. A partial umbel, with the male flowers in the circumference, and the female in the centre. *b. c.* Front and back views of a male flower. *d.* A partial umbel in the state of fruit, with the permanent thickened peduncles of the male flowers surrounding the ripened females. *e.* A ripe fruit separated. *f.* The upper end of the latter shewing the calyx and permanent styles. *g.* A transverse section of the latter. *h.* The same magnified, shewing the form of the albumen, the juga, and the vittæ.

Hab. Banks of Sutlej.

Chærophyllum reflexum; caule sparsim pilis longis debilibus munito, foliis supradecompositis pilosiusculis lobis multifidis laciniis acuminatis, umbellis multiradiatis exinvolucratis, involucellis oligophyllis cum pedicellis florum masculorum defloratorum reflexis, fructibus ovatis elongatis glabris, carpophoro ensiformi.

Differs from *C. villosum* of Wallich, in its differently formed fruit, many-rayed umbels, and more finely cut leaves. Stands next *Ch. bulbosum.*

Hab. Kedarkanta and Nagkanda.

Chærophyllum acuminatum; caule inferne petiolisque sparsim villosis, foliis biternatis, foliolis lanceolatis acuminatis grosse serratis basi pinnatifidis.

Hab. Choor. Next *Ch. aromaticum.*

Osmorhiza brevistylis, DC.

Hab. Turanda in Kunawur. I cannot distinguish this from the North American species; which occurs on the west side of the rocky mountains, and which it may therefore be presumed will be found in the Flora of Northern China.

Osmorrhiza laxa (Royle) stylis subclaviformibus angulo acuto divergentibus latitudinem fructus subæquantibus, caule laxo, umbellis nutantibus. Tab. 52. f. 1.

Hab. Sirmore in the Himalayan Mountains.

Pleurospermum cicutarium; valleculis fructus univittatis, jugis lateralibus margine incrassatis, foliis supradecompositis, foliolis pectinatis: laciniis acuminatis.

Hab. Choor and Simla.

HYMENOLÆNA. DC.

This genus, as it stands in De Candolle's Prodromus, contains plants with three essentially different kinds of fruit. The mass of the species probably agrees with *Hymenolæna Benthami* and *Angelicoides*, although what specimens I have seen are in too imperfect a state to enable any one to form a fixed opinion upon the subject. But *H. obtusiuscula* does not appear to differ from *Ligusticum*, to which Dr. Wallich had referred it, as it certainly has the albumen and vittæ of that genus; and *H. Brunonis*, the albumen of which is not involute, forms a genus scarcely differing from *Cnidium*, except in its remarkably membranous involucra.

Of what are probably genuine *Hymenolænas*, Mr. Royle's Herbarium contains the following new species:

1. *Hymenolæna latifolia;* foliis pinnatis, foliolis subrotundo-ovatis grossè serratis, involucri foliolis spatulatis semi-coloratis parum divisis: involucelli membranaceis obovatis indivisis costâ herbaceâ.

Hab. Peer Punjal.

2. *Hymenolæna Govaniana;* (Wall.) foliis pinnatis, foliolis pinnatifidis: laciniis lineari-oblongis subtrilobis serratis, involucri foliolis foliaceis multifidis radiis umbellæ multo brevioribus vix coloratis, involucelli rhomboideis stellatis semifoliaceis acute tridentatis. Tab. 52. f. 2.

Hab. Kedarkanta and Peer Punjal.

N.B. These two last species are nearly related to *Cnidium cuneatum* of Ledebour, which is probably an Altai form of *Hymenolæna*.

3. *Hymenolæna stellata;* subacaulis v. parum caulescens, foliis pinnatis, foliolis subrotundis 3-5-partitis incisis: laciniis mucronatis, involucri foliolis foliaceis margine tantum membranaceis involucelli stellatis apice foliaceis subbipinnatifidis mucronatis membranaceo-alatis.

Selinum stellatum. *Don Prod. Fl. Nep.* 185. *DC. Prod.* 3. 165. β. foliolis involucellisque altiùs incisis.

Hab. Lippa and Soongnum in Kunawur.

HYMENIDIUM.

Calycis margo obsoletus. Fructus sectione transversali subteres. Mericarpia jugis 5 subæqualibus alatis, ala membranacea, lateralibus marginantibus; stylis longis recurvis coronata. Valleculæ 1-vittatæ. Commissura 4-vittata. Semen semiteres. Albumen hinc planum.—Herbæ perennes, foliis supradecompositis. Involucra, et involucella membranaceo-marginata; hæc floribus longiora.

1. *Hymenidium Brunonis.*

Hymenolæna Brunonis. *DC. Prod.* 4. 245.

Hab. Cashmere and Choor Mountain.

2. *Hymenidium? densiflorum;* foliorum laciniis linearibus: ultimis 2-3-fidis acuminatis, involucri foliolis lanceolato-rhomboideis 5-fidis involucelli tridentatis membranaceis acutis.

Hab. Cashmere, Choor, and Kedarkanta.

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88. ARALIACEÆ.

The *Araliaceæ* of Jussieu, to which has been added *Hedera*, long confounded with *Caprifoliaceæ*, has its genera distributed through both tropical and European countries, and is found both at the base and at considerable elevations in the Himalayas. In the Peninsula of India, and in the districts of Chittagong and Silhet, are found species of *Gilibertia*, *Hedera*, and *Paratropis;* of these, the two last, with *Panax*, extend to Nepal, where also is found the new genus *Torricellia*, allied to *Hedera*. From this to the sides of the hills in the Deyra Doon, extends *Panax fragrans*, Roxb., forming a small tree, of from sixteen to twenty feet in height: *P. decomposita*, found on Gossainthan, occurs also at Mussooree. Of the genus *Hedera*, the Ivy, or a variety with yellow fruit, is the most common species, and may be seen clinging to the rock and clasping the oak; affording, from its pleasing associations, glad recognition to the European traveller. There are several species of the genus in Silhet and Nepal; but *H. æsculifolia* and *terebinthacea* (*Aralia digitata*, Roxb., referred to *Paratropis* by Wight and Arn.), with *Hedera parasitica*, Don, are found as far north and the last as high as Mussooree.

The plants of this family are not possessed of very decided medical properties, though the *Ginseng*, produced by *Panax quinquefolium*, has been more celebrated than plants of

greater value. This plant, produced in the mountains of Chinese Tatary, between 39° and 47°, was recognized from the description in Canada and Virginia, whence it is now exported to China. Subsequently the same plant, or a species so closely allied to it, that Dr. Wallich has called it *Panax pseudo-Ginseng* (Pl. As. Rar. t. 137), was discovered by him on Sheopore, at an elevation of 9,000 to 10,000 feet: an additional instance of the existence of similar plants in the mountains of China, North America, and the Himalayas. Though the *Ginseng* is of little value as a medicine, being chiefly composed of gum and starch; yet as it is highly esteemed, and always in demand in China, it might be desirable to introduce its cultivation into Nepal, and the British portion of the Himalayas, for export to China. *Aralia nudicaulis* is used in North America as a substitute for sarsaparilla; and *A. racemosa* and *umbellifera*, the latter exuding a gum resin, are also admitted into the American Materia Medica. The ivy, formerly more used than in the present day, is still retained in the Indian Materia Medica, though the hukeems do not know that the article is so much within their reach: it is one of the kinds of *lublab*, to which *kussoos* (evidently κισσος Diosc.) is assigned as the Greek name. It exudes a gum resin or peculiar principle, called *Hederine*, and the leaves are irritating.

89. HAMAMELIDEÆ.

The small order of *Hamamelideæ*, composed of few genera, and these of but few species, is remarkable especially for their extensive distribution. Of the genus *Hamamelis*, one species is found in China, a second in Peru, and the third in North America. The only species of the new genus *Bucklandia* (Wall. Cat. N. 7414) referred here by Mr. Brown, is from Silhet, whence were procured the organic remains first discovered in India: much to the northward of those described by Dr. Buckland from the banks of the Irrawadi.

90. CORNEÆ.

This small order, of which the principal genus has hitherto been placed with *Hedera* as a section of *Caprifoliaceæ*, is by M. De Candolle separated from it, and formed into a small order, of which *Cornus* is the principal genus. This, found in the colder parts of the northern hemisphere, comes as far south as Mexico, in America, and from Europe into Asia as far south as Silhet, along the Himalayan mountains. The species peculiar to these occur along the whole range, as they were procured by Dr. Wallich from Silhet and Nepal, and by myself in Sirmore. *Cornus oblonga* is found at the lowest elevations, being common in the Deyra Doon, and *C. macrophylla*, with *C. nervosa*, nob., at Mussooree, and similar heights. At such, and still higher elevations, is also found *Benthamia fragifera*, Lindl. (*Cornus capitata*, Wall.), which has been introduced into, and is likely to succeed in England, (Hort. Trans. 2d Series, vol. 1), where *C. macrophylla* would also be a desirable acquisition.

Though the fruit of *Cornus* is little valued, that of *Benthamia* is eaten in the hills, and the wood of both genera is esteemed, as is that of the first in Europe for its hardness

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and tenacity, and use for wedges, mill-cogs, &c., as well as for making gunpowder. An oil may also be expressed from the seeds of some species. It would be useful to ascertain whether the Himalayan species may be employed for the above purposes, as also whether they possess any medical properties, like *Cornus florida,* and other species, used as a substitute for Peruvian bark in North America.

91. LORANTHACEÆ.

The plants of all the previous orders have had truly polypetalous corollas; these now become monopetalous: the present order is included in the *Epicorollæ Corisantheræ* of Jussieu, though not arranged with the *Corolliflorœ* of M. De Candolle, in consequence of the petals frequently continuing more or less disunited.

As we have seen the ivy in the *Araliaceæ* extending into northern climates, so in this parasitical order, the misletoe has a like distribution, and is as familiarly known in northern regions, though the mass of the species exist in the tropical parts both of Asia and America. Thus we find the genus *Loranthus* in considerable numbers on trees in every part of the plains of India; not less than ninety being found in that country and the Malayan Peninsula, though *L. bicolor* is the most common species. Some few ascend the mountains; several occur in Nepal. Of these, *L. pulverulentus* and *vestitus* are found as high as Mussooree; and *L. ligustrinus* and *cordifolius* lower down on the mountain side. Of *Viscum,* also, there are several species, of which some are found on trees in Bengal and Silhet, though I have only met with them in mountainous situations, as *V. dichotomum,* near both Simla and Hurdwar; *V. stellulatum,* near the former and Ruengurh, and *V. verticilliflorum,* nob., nearly allied to *V. Wightianum,* Wall., at Mussooree, on the oak. *V. elongatum,* D.C. (*opuntioides,* Wall.) is found in the Peninsula, and on the hills of the Central Range; apparently the same species may also be seen in Colonel Sykes's collection from the west of India. Dr. Wight gives the Dindygul hills as the locality of some of the Peninsular species. *Schœpfia,* found in the West-Indies and the Andes of Peru, has a species, *S. fragrans,* Wall. (*Tent. Fl. Nep.* t. 9), extending from Bechiaco to the great valley of Nepal, and another, *S. acuminata,* in the Pundua mountains.

92. CAPRIFOLIACEÆ.

The *Caprifoliaceæ,* as constituted by M. De Candolle, are composed of the tribes *Sambuceæ* and *Lonicereæ*: and are found in cold and mountainous parts, chiefly of the northern hemisphere. Nearly all the genera occur at different elevations, and are common in every part of the Himalayas. Of these, the elegant genus *Leycesteria* is alone peculiar to these mountains; and the only known species, *L. formosa,* is common in Nepal and Kemaon, as well as in Sirmore, at elevations of from 6,000 to 7,000 feet. *Abelia,* named by Mr. Brown in honour of Dr. Abel, by whom the first-known species was discovered in the Chinese province of Kiangsee, has also been detected in the Himalayas; and the second species, *A. triflora* (Wall. Pl. As. Rar. t. 15), has also been described by Mr. Brown (l.c. p. 15). It was obtained by Dr. Wallich from the loftier

mountains of Kemaon, and is common at Mussooree, at an elevation of from 6,000 to 7,000 feet. It is a highly fragrant and very ornamental species, and therefore well worthy of introduction into England. *Triosteum,* long considered as confined to North America, has also been discovered in the Himalayas by Dr. Wallich, who found *T. Himalayanum,* on Gossainthan, in Nepal.

Sambucus, Viburnum, and *Lonicera,* most abundant in species, are found in many parts of the world, as Europe and both Northern Asia and North America, whence they extend to Mexico, and in Asia along the Caucasus to the Himalayas, and eastwards to Siberia and China. Of *Sambucus* and *Viburnum,* species are likewise found in the Andes: the former also in New Holland, and the latter on the Neelgherries and Penang. *Lonicera* is mentioned in the mountains of Northern Africa, as well as in those of Java.

We have seen that a genus of this family is common to China and the Himalayas, but we have some species even of another genus common to them both, as well as to Japan, as *Lonicera confusa, longifolia,* and *Chinensis.* The other species of *Lonicera* found in these mountains, are *L. diversifolia,* the most common, of which *L. Royleana* (Wall. Cat. 478), is only a variety; those found on loftier situations, as from 8,000 to 9,000 feet, are *L. Webbiana, Govaniana, angustifolia,* and *sericea,* nob., and on still loftier mountains, as Kedarkanta, *L. obovata,* nob. Dr. Wallich's *L. acuminata, glabrata,* and *lanceolata* are confined to Nepal; and the new species, *L. elliptica, glauca,* and *depressa,* are found in Kunawur, and closely resemble some of the species figured by Ledebour from the Altai. *L. bracteata,* nob., is a singular species found on Shalma, which is so closely allied, that it might almost be referred to *Leycesteria,* between which and *Lonicera* it thus forms a link.

Both the common and dwarf elder, *Sambucus nigra* and *ebulus,* have been traced from Europe to the Caucasus; in the Himalayas we have a representative of this genus in *S. adnata,* obtained by Dr. Wallich from Gossainthan, and by myself from the mountains of Cashmere. The species of *Viburnum,* which are most common in these mountains, are *V. cotinifolium,* Ham. (*polycarpum,* Wall.), *V. Mullaha,* Ham. (*stellulatum,* Wall.), and *V. punctatum.* These are common at Simla, Mussooree, and similar elevations, as well as in Kemaon and Nepal, where they were originally discovered: a few species extend southwards even into the Burmese territories. The species found at the loftiest elevations, and which comes into flower early in the season, before the leaves have made their appearance, and before the snow has completely melted away on such mountains as Choor and Kedarkanta, is *V. nervosum,* Ham. (An *V. erubescens* and *grandiflorum?* Wall.) This, from its long tubular corolla, differs apparently so much from the rest of the genus, as to have been at first taken, by M. Jacquemont, for a *Daphne.*

The plants of this family are not possessed of any very decided properties, though both the berries and the leaves of the elder are much used in Europe. The leaves of some of this family are said to be slightly purgative, and the bark of others to be astringent. The fruit of one species of *Viburnum* (*V. Mullaha*) is eaten in the mountains, and

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the young shoots and leaves of *Lonicera diversifolia*, called *dandoo*, are used in medicine by the Hill people.

Lonicera bracteata; foliis ovato-lanceolatis, superioribus oblongo-lanceolatis acutis, omnibus breve petiolatis pilosis, pedunculis bifloris axillaribus solitariis foliis subæquantibus, floribus nutantibus bracteis late foliaceis, corollæ tubo basi æquali, baccis concretis oblongis junioribus glanduloso pilosis. v. Tab. 53. f. 2.—*a.* Flower-buds half concealed by the bracts; *b.* bracts spread out, and the flowers removed; *c.* corolla with the petals and stamens; *d.* stamens; *e.* berry surmounted by calyx.

Hab. Shalma. The tumid joints and the branches proceeding from the centre of scaly buds, are remarkable in this plant, as well as the fructification. This should refer it to *Xylosteum*, distinguished from *Caprifolium* by Mr. Brown, but both genera have been merged in *Lonicera* by M. De Candolle.

93. RUBIACEÆ.

The great family of *Rubiaceæ* is by some botanists separated into the two orders of *Stellatæ* and *Cinchonaceæ;* which are certainly very closely allied to one another, but the separation is in some respects advisable, as they differ much in geographical distribution: the *Cinchonaceæ* being found in warm, and the *Stellatæ* in cool climates, chiefly of the northern hemisphere. Of these, species of *Asperula, Rubia,* and *Galium,* extend from Europe along the Caucasus to the Himalayas; the two last occur also in both North and South America, *Rubia* at the Cape, and *Galium* in New Holland: the former extends also to the Burmese territories, and is found on the mountains of Java; *Galium* alone of the tribe occurs in the mountains of the Peninsula. The species of this genus which occur in the Himalayas and Kunawur, are numerous, and have a close resemblance to their European and Siberian congeners. *Rubia cordifolia* (*Munjista,* Roxb.), occurs in Siberia, Japan, and the Himalayas. *R. aculeata* is a new species from Kunawur, as is *Asperula glauca,* allied to *A. cynanchica,* from the same region.

The plants of this tribe possess a slight degree of astringency; on which account some were and are still used in medicine. Of these, *Galium* is referred to in Persian works under the name *galion.* *Rubia tinctorum,* or madder, is the best known for a property (redness of the roots) possessed by many of this family, which renders them valuable as dyes. For this, *R. cordifolia* (*R. Munjista,* Roxb.) is used as a substitute in the East, and forms even an article of the export commerce to Europe, under the name of *Munjeeth;* for this *Fooh* is given as the Arabic, and *rodeen* (ερυθροδανον?) as the Greek name. *R. angustissima,* from Tong dong, has also highly-coloured roots.

The remainder of the *Rubiaceæ* have by Dr. Lindley been denominated *Cinchonaceæ* from the most important genus, and may be treated of together, as they chiefly occur in the tropical parts of the world, and have a northern or southern extension only according to local peculiarities of climate. *Putoria* occurs in the north of Africa and south of Europe, A *Hedyotis* in Carolina, and *Pinckneya pubens* in Georgia; *Burchelia,* a *Gardenia, Oldenlandia,* and others, occur at the Cape of Good Hope; *Psychotria,* and a few others, in New Holland; but the most southern is *Nertiera depressa,* found in the Straits of Magalhaens. They abound in the warm parts of Asia, Africa, and America, as well as in the tropical islands. They also prevail on the Andes of Peru and the mountains of Mexico; so are they found in India, on the Neelgherries, and

other

other mountains of the Peninsula, but especially on those of Silhet, whence they extend northwards to Nepal, and along the foot of the mountains as far as the banks of the Jumna. A few also ascend them, to elevations even in this northern latitude, of 5,000 and 6,000 feet.

The genera, which are chiefly prevalent in India, and more especially in its southern parts, are *Nauclea, Hymenodictyon, Mussænda, Gardenia, Randia, Cupia,* DC., *Stylocoryne, Petunga, Wendlandia, Ophiorrhiza, Argostemma, Dentella, Hedyotis, Oldenlandia, Morinda, Vangueria, Guettarda, Pæderia, Canthium, Ixora, Pavetta, Grumilea, Coffea, Psychotria, Geophila, Cephalanthus, Borreria, Spermacoce, Knoxia,* and *Putoria.* Of many of these, the greater number of the Indian species occur in the forests of Silhet (where are also found *Myrioneuron, Pleotheca, Androtropis,* and *Horsfieldia*), and other southern districts, but the numbers increase as we approach the line; where, as of *Urophyllum* and *Uncaria* in Penang, &c. the greater number of species exist, with one or two only spreading north. Some of the above genera are common to India and Africa, as *Grumilea, Kohautia, Nauclea;* others to the former and South America, as *Mussænda, Morinda, Geophila, Cephalanthus,* and others; while several are common to the three. Some are peculiar to the mountains, as *Menestoria,* DC., *Hymenopogon,* Wall., and a few new genera to the Peninsula of India. (v. Prod. Fl. Ind. Penins.)

The species of these genera, which have the most northern extension, being common in the Doons and Kheree Pass and jungle, are *Nauclea cordifolia* and *parvifolia, Hymenodictyon thyrsiflorum, Wendlandia cinerea, exserta* and *puberula, Randia uliginosa, longispina* and *dumetorum, Pavetta tomentosa* and *Ophiorrhiza Mungos,* with some species of *Hedyotis, Oldenlandia,* and *Spermacoce.* Of these, some may be seen in the hot valleys in the interior of the hills, with *Kohautia* (*Hedyotis,* Wall.) *gracilis. Coffea Bengalensis* ascends elevations of 3,000 feet, and still higher a stunted species of *Gardenia,* (*G. tetrasperma?*) as well as *Spermadictyon suaveolens* and *Leptodermis lanceolata,* which do not appear to me to be generically distinct.

During the moisture of the rainy season, some herbaceous *Rubiaceæ* make their appearance at 6,000 and 7,000 feet of elevation, as species of *Oldenlandia, Hedyotis calycina, Borreria pusilla, Argostemma sarmentosum* and *verticillatum, Ophiorrhiza rugosa, Knoxia mollis;* and on trees we find *Hymenopogon parasitica,* which is also found with *Luculia gratissima,* on the mountains of Silhet; where species of *Hymenodictyon* (*Cinchona,* Roxb.) occur at their feet, and afford a set of interesting facts, as these are all nearly allied to the valuable medicinal genus *Cinchona.*

The *Stellatæ* we have seen are noted for astringency, and for yielding colouring matter; both these principles are afforded by the *Cinchonaceæ.* With respect to the last, as *Rubia cordifolia,* or the *Munjeeth,* yields a red dye in the hills, so *Morinda multiflora* and *tinctoria,* called *aal* and *ach,* are cultivated in the plains of Northern and Central India, and *Oldenlandia umbellata* in the Peninsula, for the red dye they respectively yield; so that India is, in its different parts, supplied with a similar principle by plants of this family. *Morinda citrifolia, angustifolia, umbellata* and *ternifolia,* are also similarly used in India,

as

as *M. Royoc* is in the West-Indies. *Rondeletia tinctoria, Hydrophylax maritima,* and others, all possess similar properties.

Many of the herbaceous exotics secrete the peculiar principle, called *emetine;* as *Cephaelis Ipecacuanha,* which yields the *brown* or *true Ipecacuanha,* and grows in the moist and shaded forests of Brazil and New Granada. *Psychotria emetica,* a small undershrub, found in Peru and New Granada, affords the *striated* Ipecacuanha; *P. herbacea* supplies a substitute, as does *Richardsonia Brasiliensis;* also *R. rosea* and *scabra,* and *Spermacoce ferruginea* and *Poaya:* showing the possession of similar properties by so many plants of the same natural family.

In India, *Randia* (*Posoqueria,* Roxb.) *dumetorum,* called *muenphul,* with the Arabic synonyme of *jouz-ool-kue,* or emetic fruit, is used as an emetic by the natives of India. The fruit bruised and thrown into water, is said by Dr. Roxburgh to poison fish; and Dr. Ainslie states, that an infusion of the bark of the root is given as a nauseating medicine in the south of India. *Pæderia fœtida* is also used there as an emetic.

In some of these emetic, as in the dyeing roots, there are traces of tannin, a principle found in abundance in some of the arborescent *Cinchonaceæ.* Thus, *Nauclea Gambir,* a native of the Malayan Peninsula and Indian Archipelago, yields the very astringent principle, called *gambeer,* which in many parts of the East, is used for the same purposes as *Catechu,* and is thought by some European authors to be the true *Kino.*

Tannin, it is well known, exists in abundance in the bark of the several species of the genus *Cinchona.* These also secrete the peculiar alcaloids, called *quinia* and *cinchonia,* principles not contained in the *Exostemmas,* once united with the *Cinchonas,* but which also differ from them in having their stamens projecting beyond the corolla; some of them, indeed, instead of tonics, act as emetics. But others of this family, from the possession of astringent properties, are employed as substitutes for Peruvian bark, as *Pinckneya pubens* in Carolina, *Portlandia hexandra* in French Guiana, *Rondeletia febrifuga* in Sierra Leone; so also *Macrocnemum corymbosum, Guettarda coccinea, Antirrhæa verticillata, Morinda Royoc,* and others.

In India, *Hymenodictyon excelsum,* referred by Dr. Roxburgh to the genus *Cinchona* itself, has the inner coats of the bark bitter and astringent, and is used by the natives in medicine for the latter property, as well as for tanning leather. I know not if the other species of this genus are possessed of similar properties.

The true *Cinchonas* extend, in Peru and Columbia, from the Line to 10° of N. and S. latitude, at elevations of from 3,000 to 8,000 feet on ramifications of the Andes, flowering from June to August. But the spurious species now referred to other genera, though extending further north, all require a warmer climate, since they are found at lower elevations; as the species of *Buena,* in Peru and Brazil; of *Remigea,* in Brazil; of *Exostemma,* in Peru, Brazil, Mexico, and the West-India Islands; and of *Hymenodictyon,* at the foot of mountains in India. Though the extent of distribution of the true *Cinchonas* has been pretty well ascertained, there is yet considerable obscurity respecting the species which yield the different officinal barks, owing partly to incomplete investigation, but

but chiefly to the natives uniting them according to physical properties, which vary even upon the same tree, according to age and exposure.

The pale barks are generally considered to be produced by *Cinchona Condaminea, scrobiculata* and *lancifolia:* the yellow barks by *C. purpurea* and *C. pubescens,* which includes *C. cordifolia* Mutis.; and it is said even by the older branches of *C. lancifolia,* as well as other trees, which in their young state yield pale bark. The red barks are produced by *C. magnifolia,* which includes *C. oblongifolia;* but other species may also supply it. Of these, and many others, there are specimens in the splendid collection of the genus *Cinchona,* made in the neighbourhood of Loxa and Santa Fé, in 1805, now in the possession of Dr. A. T. Thomson, Professor of Materia Medica in the London University.

These *Cinchonas* occupy a belt of 20° of latitude, at elevations varying from 3,600 to 9,000 feet on the Andes, and the principal species from 6,000 feet to the latter height, where the mean temperature of the year is about 59° and 62°, or equivalent to that of the Canaries and of Rome; but where the thermometer often sinks to the freezing point, though snow does not fall below 9,000 feet of elevation. There would apparently be no difficulty in finding suitable localities for the several species of this very important genus in India, where the seasons are similar, and the southern parts equally covered by mountains: as the Neelgherries, between 10° and 11° of N. latitude, and 8,000 feet high, with a range of the thermometer of 43°, a mean temperature of about 53°, and where no snow falls (v. p. 30.), or perhaps on the mountains of Chittagong and Silhet, as on Chirrapoonjee, in lat. 25° elevated 4286 feet, with a range of the thermometer of from 12° to 20° below that in the plains of Bengal (v. *Journ. As. Soc.* vol. 3.), and where *Luculia* (*Cinchona,* Wall.) *gratissima* is found in great luxuriance.

Humboldt has remarked it as singular, that Condamine should have made the first and the last attempt to transport young *Cinchona* plants to Europe, which, after being conveyed for 1200 leagues down the river Amazons, and living for eight months, were destroyed by a wave, which washed over the boat near the mouth of the river to the north of Para. M. Feé has more recently recommended (*Cours d'Hist. Nat. Pharm.* vol. ii. p. 252) the investigation of the subject to his government, and the introduction of the *Cinchona* into the French colonies.

The coffee, *boon,* and *kuehwa* of the Arabs, said by them to be the produce of Yemen, is a remarkable instance of a plant restricted in its distribution, becoming one of the most extensively-diffused of those which afford valuable articles of commerce, increasing the resources of the countries where it is grown, and improving the revenues of those into which it is introduced. From Arabia, the coffee-plant was first introduced into Batavia, whence it was spread into the islands of the Indian Archipelago. The offsets of a plant presented to Louis XIV. from the hot-houses of Amsterdam, were transported to Martinique; thence they have been diffused to the other West-India islands, a great part of S. America, and the southern states of N. America. It is cultivated also on the western coast of Africa, the Cape of Good Hope, and the islands of Bourbon and Mauritius.

It

It has already been stated (p. 4), that the coffee of the Malabar coast is remarkably fine, as is that of some other parts of the Peninsula, as of Bangalore and Coimbatore. It succeeded well, and the plants bore abundantly under the shade of the teak plantation in the Calcutta Botanic Garden; but the subsequent cultivation in Bengal has been pronounced a failure, though I have heard that it has succeeded in the vicinity of Dacca. The reasons assigned for the former, want of shade and too powerful a sun, do not appear to be satisfactory; for the sun cannot be more powerful than in many places where coffee is cultivated, and Bengal is not likely to be the only country where shade is unattainable. However much ignorance may sneer at principles, attention to the physiology of vegetation, and of this, as connected with the nicer peculiarities of climate (v. p. 88), would probably afford a more satisfactory explanation; and as success and failure are not accidental, a scientific explanation might suggest a practical remedy. A rich soil and moist climate are said, both in Java and the West-Indies, to produce luxuriant vegetation, and a coarse-flavoured, though sufficiently abundant crop of berries. But the finest Mocha coffee is, we know, produced in a very dry climate, and arid soil, on the slope of mountainous situations. The plants grow freely, and bear a few fruit in the open air as far north as 30° of latitude in the Botanic Garden at Saharunpore; but we know that a low temperature, though only during the winter months, is unfavourable to the cultivation of coffee, and therefore not to be attempted in the open country of the northern provinces of India. But it would be an interesting point to ascertain how far north the coffee might be successfully cultivated in India. The Rajmahl hills would probably afford some suitable localities, perhaps also those of Silhet and Assam, at low elevations; and certainly along the Burmese coast and Malayan peninsula, the cultivation might be indefinitely extended.

Kohautia coccinea; caule folioso teretiusculo sub lente brevissime piloso, foliis lineari-lanceolatis, stipulis membranaceis petiolis jungentibus fimbriatis, floribus ex dichotomia et di-trichotome corymbosis sessilibus vel breve pedunculatis, corollæ lobis obovatis acutis. Tab. 53. f. 1. (*a.*) Flower seen from above, (*b.*) from below. (*c.*) Corolla opened. (*d.*) Capsule. (*e.*) Transverse section of capsule.

Hab. Budraj.

94. VALERIANEÆ.

The *Valerianeæ* form a small order found in temperate climes in different parts of the world, as in the northern parts of the northern hemisphere, the mountains of South America, and the Straits of Magalhaens. They proceed along Caucasus to the Himalayas, where they are found at different elevations, as well as on the mountains of the Peninsula. They are absent from the plains of India; but one species, *Valeriana villosa,* descends to the Deyra Doon.

The genera peculiar to these mountains are *Triplostegia* and *Nardostachys,* the latter allied to *Patrinia,* which is found in Siberia, Dahuria, and Japan; but *Valeriana* is the most numerous in species. These extend from Silhet to Sirmore, and from that to Cashmere. *V. Hardwickii, villosa,* and *elata,* are the most common species, *V. lanceolata* and *bracteata* are two new species from the southern face of the Himalayas, and *V. acuminata* and *pusilla* from Kunawur, and *V. striata* from Cashmere.

 The

The annual plants of this order are without odour, and some are even eaten as sallads, but many of the perennial species secrete in their roots a volatile oil, which renders them useful as perfumes, or as stimulant medicines, as *Valeriana officinalis, Phu,* and *dioica. V. celtica* is exported from the mountains of Austria to Egypt, whence it is spread into both Africa and Asia, being valued for its fragrance and use in perfuming their baths. So also in India, the roots of *Jatamansi,* no doubt the *Spikenard* of the ancients, and produced by a plant of this order, are brought down in large quantities from the Himalayas to the plains, whence they are distributed over every part of India, being highly esteemed as a perfume, and for their uses in medicine.

Notwithstanding the proofs adduced by Sir Wm. Jones, it has been said that the grounds are insufficient on which the *Jatamansi* of the Hindoos has been considered to be the Spikenard of the ancients. Having followed the course pointed out by that eminent Orientalist, without taking exactly the same steps, it is not uninteresting to state, that I arrived at precisely the same results.

Dioscorides (l. 1. c. 6.) describes three kinds of *Nard;* of the first and principal of which, there are two varieties, *Syrian* and *Indian;* the latter is also called *Gangites,* from the river Ganges, near which, flowing by a mountain, it is produced. The second kind is called "Celtic," and the third "Mountain Nard." On consulting Avicenna, we are referred from ناردين *Narden* to سنبل *Sunbul,* pronounced *Sumbul,* and in the Latin translation from *Nardum* to *Spica,* under which the Roman, the Mountain, the Indian and Syrian kinds are mentioned; and *Senbel,* misprinted *Seubel,* is given as the synonimous Arabic name. This proves, as stated by Sir Wm. Jones, that *Sumbul,* in Persian dictionaries, translated, "the Hyacinth,—the Spikenard, to which the hair of a mistress is compared—an ear of corn, &c.," was always considered by Arabian authors as synonimous with the *Nardos* of the Greeks. On consulting the Persian works on Materia Medica in use in India, and especially the *Mukhzun-ool-Udwieh,* we are referred from *Narden,* in the Index, to *Sumbul,* in the body of the work.

Under this name, however, four separate articles are described—1st, *Sumbul-hindee;* 2d, *Sumbul-roomee,* called also *Sumbul-ukletee,* and *Narden-ukletee,* evidently the ναρδος κελτικη of Dioscorides, said also to be called *Sumbul-italioon,* that is, the Nard which grows in Italy; the 3d kind is *Sumbul-jibullee,* or Mountain Nard (ναρδος ορεινη); and, 4th, *Sumbul farsee,* which is a bulbous plant, and probably a kind of hyacinth. *Polianthes tuberosa* is described as being one of the kinds of Persian Sumbul. But the first alone is that with which we have at present any concern. The synonimes of it, given by Persian authors, are, Arabic, *sunbul-ool-teeb,* or fragrant nard; Greek, *narden;* Latin, *nardoom;* Hindee, *balchur* and *jatamasee.* The last is the Sanscrit name, and that which was given to Sir Wm. Jones, as the equivalent of *sumbul-hindee,* and which, he informs us, like other Sanscrit names applied to the same article, has reference to its resemblance to locks of hair.

The *Sumbul-hindee* is described as a plant without flower or fruit, like the tail of an ermine, in length exceeding that of the finger, but rather less in thickness. Several

are

are said to be clustered together on one root, of a bright blackish colour, and of a very fragrant and strong odour. It is said to grow in the mountains of Caubul, India, and Bengal.

The proofs and reasoning of Sir Wm. Jones appearing to me so satisfactory, and plants of what was said to be the *Jatamansi*, having been procured from the hills, which flowered at Gyah, and were figured and described *As. Res.* vol. ii. and iv., I considered the subject as perfectly settled. But one day accidentally asking Huree Sing, an intelligent and respectable native at the head of the establishment of the Saharunpore Botanic Garden, whether a plant (*Valeriana villosa*) in the Conservatory was not like the *Jatamansi;* he replied in the negative, and pointed to a *Plantago*, with lanceolate leaves, as that which most nearly resembled it.

Understanding that the *Jatamansi*, better known in Northern India by the name *bal-chur*, was yearly brought down in considerable quantities from the mountains, I procured at the end of the rainy season several pounds of the fresh dug-up root from Nagul, a village five miles N.E. of Deyra, and one of the commercial entrepôts situated at the foot of the mountains. The roots obtained exactly resembled those sold in the Saharunpore bazar as *Jatamansi;* some of them were planted in the Botanic Garden, and others in the Hill Nursery at Mussooree. One of the former which vegetated during the cold weather, is represented at Plate 54. f. 1. From the mountain specimen in flower, f. 2. it is evident that though belonging to the same natural order, *Valerianeæ*, as the plant figured by Dr. Roxburgh (*As. Res.* vol. iv.), the true *Jatamansi* is more nearly allied to the Siberian genus *Patrinia*. It is remarkable that the Φυ of Dioscorides, *Valeriana Dioscoridis* of Sibthorp, فو *foo* of the Arabians, is translated in the Persian *bekh-i-sumbel*, root of Sumbul.

It is evident that, either by accident or design, a wrong plant was sent from Bootan, and figured and described in the Asiatic Researches, at a time when it was not possible to detect the imposture, as it was long before we had free access to the hills. Previous to my inquiries, though I was unacquainted with the fact, the error had been detected, and the true plant sent home by Dr. Wallich. This was described by Mr. D. Don for his *Prod. Floræ Nepalensis*, and figured by Mr. Lambert (*App. to Illustr. of the Genus Cinchona*), where the additional corroborative fact is stated of Spikenard bought as such in a chemist's shop in London (and of which a figure is given) corresponding exactly with the roots of the Nepal plant, and both with the roots represented in Plate 54, and all with the descriptions of the Arabians; also with the figure of *Nardum* in the edition of Dioscorides by Ruellius, and with that given by Clusius.

The localities also agree with those assigned by Dioscorides and Ptolemy to the Indian Nard, as the latter, as quoted by Sir Wm. Jones, mentions *Rangamritica*, or *Rangamati*, and the borders of the country now called Bootan. The remoteness of these, indeed, has alone prevented the earlier ascertainment of the true plant. In the part of the Himalayas with which I am best acquainted, it is only found on such lofty mountains as Kedarkanta (v. p. 22), and Shalma, where it is for six months

 covered

covered with snow, and like many plants of a similar locality furnished with permanent hair-like fibres. The latter situation I have not visited, but it is situated between the Ganges and Jumna, about fifteen miles from both, and about twenty and thirty in a direct line from Jumnotri and Gungotri. It must be elevated at least 9,000 feet, as the plants found with the *Jatamansi*, as *Betula Bhojputtra*, *Rhododendron anthopogon*, *Anagyris Nepalensis*, *Thermopsis barbata*, *Rheum Emodi*, *Rosa sericea*, *Pæonia Emodi*, *Aconitum heterophyllum*, *Primula Stuartii*, with species of *Podophyllum*, *Trillium*, and *Fritillaria*, are not found at lower elevations. Garcia ab Horto is therefore in error in assigning *Chittor* and *Mandou* in the Deccan, as its places of growth, as it is quite impossible for this plant to exist in any part of Central India. But Garcia, indeed, though aware of the fact of the natives being acquainted with the Greek and Latin names of the nard, seems, as well as others, to have confounded with it the *Azkhur*, called also "the Arabian perfume," "Grass of Mecca," and "Camel's hay," to which the natives give *Sikhoonus* (σχινος Diosc. 1. c. 16.) as the Greek name, and which is afforded by one, if not more, species of *Andropogon* (v. *Gramineæ*), found in the localities he assigns to the Spikenard.

With respect to the objection that the fragrance of the *Jatamansi* is not such as to warrant the probability of its having been so highly esteemed by the ancients, it might be sufficient to reply, that it is both incorrect and unphilosophical to infer the tastes of another time and country from those of the age and place we live in. But in the present instance, however disagreeable soever it may be to some, there is no doubt that the *Jatamansi* is highly esteemed in the present day throughout the East, both as a perfume, and a stimulant medicine. Indeed, from the number of complaints enumerated in Persian authors for which it is said to be a cure, this root might lay claim to the title of a true *Panpharmacon;* and with respect to the fragrance, I consider that of the true *Jatamansi* to be far from disagreeable. But even if this were not so, it would be just as reasonable to disbelieve, that it might be so to others, as it would be not to credit an account of the mysteries of the Eastern toilet, because at variance with our ideas of grace and elegance; or disbelieve the relations of a traveller, who, in describing an Indian beauty, "armed for conquest," might mention, that with the rose, jessamine, and sweet-scented keora at command, her presence was yet most readily recognised by the strong smell of the oil of cocoa-nut.

Nardostachys Jatamansi. DC. Coll. Mem. vii. t. 1. Prod. vol. iv. p. 264.—*Valeriana Jatamansi.* Jones and Roxburgh in As. Res. excl. descr. et ic. Don in Lamb. Cinch. p. 180. ic.—*Patrinia Jatamansi.* Don. Prod. Fl. Nep. p. 159.—*Nardus indica*, &c. veterum. Tab. 54. f. 1. and 2. v. supra. p. 243.—(*a.*) Flower enlarged—seen from above; (*b.*) from below; (*d.*) capsule surmounted by calyx; (*e.*) transverse section of capsule, with one fertile and two abortive cells.

Hab. Gossainthan, Shalma, Kedarkanta, and probably other lofty mountains of the Himalaya.

95. DIPSACEÆ.

The *Dipsaceæ*, allied on one hand to *Valerianeæ*, and on the other to *Synanthereæ*, avoid, like the former, great extremes of temperature, and are, like them, most abundant in temperate climes, but only of the Old World; as in Europe and parts of Siberia, on Caucasus,

Caucasus, and in Persia, as well as in the Oriental region, and both North and South Africa.

Though some plants of these regions spread to the south, we find the *Dipsaceæ* absent from the plains of India, but common in the Himalayas at moderate elevations, where we know there is moderation of temperature. The genera found in these mountains are *Morina, Dipsacus,* and *Scabiosa;* on the Neelgherries also a species of *Dipsacus* (*D. Leschenaultii*) is found.

Morina, found in Persia and the Oriental region, extends in the Himalayas from Peerpunjal to Gossainthan. *M. nana, polyphylla,* and *longifolia,* being found in the latter situation; but the last only has an extensive distribution, as it is found at Mussooree and on Choor, as well as on the mountains of Cashmere. *M. Wallichiana* is most common at Mussooree; and *M. Coulteriana,* nob., which approaches *M. persica,* is found in Kunawur. Only a single species of *Scabiosa* (*S. Candolleana*) has been discovered to the southward of Cashmere; but from that valley was obtained *S. speciosa,* Tab. 55, as well as *S. stellarifolia,* nob., allied to *S. Columbaria.* The species of *Dipsacus, D. strictus* and *inermis,* found in Nepal, spread also to Sirmore, where other new species (*D. levis* and *auriculatus,* nob.), are found, as well as one from Jumboo, near Cashmere. The plants of this family have little sensible or medical properties, and have none ascribed to them in these mountains. *Dipsacus Fullonum* retains its place in the Indian Materia Medica, under the name *dunsakoos.*

Morina Wallichiana; foliis pinnatifidis, lobis spinescentibus, superioribus caule corollaque molliter villosis, calycis lobis integerrimis vel brevissime emarginatis. Tab. 55. f. 1.—(*e.*) Pistil with the two lobed calyx surmounting, and the toothed involucel surrounding the germen; one of the teeth is generally much longer than the others. (*f*) Flower seen from behind, with the involucel opened.

Hab. This plant, which is nearly allied to *Morina Persica,* is found on Mussooree, with *M. longifolia,* of which a leaf has been accidentally introduced into the same plate. I have named this species in compliment to my friend, Dr. Wallich, to whom Indian Botany is so deeply indebted for its present advanced state. The name may serve also to commemorate the "Wallichius, vir ornatissimus," who sent several exotic fruits to Clusius, and which the latter has described in his Exot. lib. 11. c. xxi.

M. Coulteriana; foliis oblongis angustis sinuato-pinnatipartitis lobis duris spinescentibus, calycis lobis bifidis, segmentis acutis.

Hab. Kunawur. I have named this species in honour of Dr. Coulter, who has so ably elucidated the order to which it belongs, and who intended to have described for this work the Himalayan *Dipsaceæ,* but has been obliged by indisposition to decline the task for the present.

Scabiosa speciosa; caule suffruticoso, foliis ovato-lanceolatis basi auriculatis caule involucroque pilosis, corollis 5-fidis radiantibus, involucelli basi elongata villosissima, foveolis villis occultatis, corona 16-nervia integra patula, calycis limbo sessili, setis 5 nigris scabris corollæ tubo æqualibus. Tab. 55. f. 2.—(*a.*) Flower of the ray; (*b.*) of the centre; (*c. d.*) pistils with calyx.

Hab. Cashmere.

96. SYNANTHEREÆ.

This great family of plants, better known by the name, objectionable on account of its incorrectness, *Compositæ,* is like the *Umbelliferæ,* numerous in species, which resemble each other so closely, as to have caused the same plant to have been referred by different botanists to different genera. More attention, however, having been paid to their true

true structure, greater precision has now been introduced into generic characters, and these, the valuable work of Lessing—"*Synopsis Generum Compositarum*," has presented in a convenient form. Yet the difficulty is so great, of referring the plants of so large a family to their true genera, that I should have despaired of being able in a short time to give a satisfactory account of the Himalayan and Indian *Compositæ*, especially with respect to their geographical distribution, had it not been for the kind assistance of Mr. Don, Dr. Lindley, and especially of Professor De Candolle, who has named the greater portion, and will describe the new species in the forthcoming volume of his Prodromus.

The *Synanthereæ*, though very generally diffused throughout the world, are not very numerous in the plains of India, Dr. Roxburgh having only described sixty-one species, some of them from the Peninsula, where Dr. Wight collected 111 species; in this number are included the majority of Dr. Roxburgh's species, and several from the Neelgherries and other Peninsular mountains. Dr. Wallich has enumerated in his Catalogue, 426 species collected over a wide extent, both of plain and mountain surface. The author's collection within more confined limits, but with equal diversity of surface, contains 238 species. These, in their distribution, confirm all the results which have been obtained in other families, with respect to the great correspondence between climate and the vegetation it supports.

Thus the *Cynareæ* (*Cynarocephalæ*, Auct.), which, with the exception of the subtribe of Cape *Arctodieæ*, occur chiefly in Europe and the northern half of the temperate zone and the Mediterranean and Oriental regions, are found in the Himalayas, and in the plains of the north-western provinces of India, which have been elsewhere shown to correspond in other respects with the vegetation of these regions. Thus, in the Himalayas, we have species of the genera *Serratula, Cnicus, Centaurea, Lappa, Carduus,* and *Saussurea*, with the new genera *Dolomiæa*, DC. allied to the last, as well as *Aplotaxis*, DC., of which numerous species are found in these mountains, and one in Siberia. Of species, *Carduus nutans*, from Muttiana, Choor, and Kedarkanta, as well as from Boodurwar, appears to be identical with the European plant. *Lappa Himalayana* closely resembles *L. major*. *Centaurea pulchra*, DC., I have only obtained from Cashmere: it is cultivated in the Peninsula, probably from the same source. An approximation to the Oriental flower is seen in the existence of species of *Echinops*, as *E. nivea* and *cornigera*, of *Jurinea*, *J? Tricholepis*, DC., on the Suen Range; of a *Cirsium*, *C. verutum*, Don, on Thanna Toongra; and of *Echanais cirsioides*, DC. in the Deyra Doon. From Dokree, in Kunawur, another species of *Cirsium*, or of *Cousinia*, was obtained, which also shows the alliance of this region with the Oriental.

This is still more decidedly the case in the plains of Northern India, for the only plants of this tribe found there belong to genera, of which species are also found in the Mediterranean and Oriental regions, as *Microlonchus divaricatus*, common about Saharunpore and the Doab, and the banks of the Jumna. *Cirsium Wallichii*, found in similar situations, as well as *Echinops echinatus*, only in the latter. *Tricholepis* is an

Indian

Indian genus, allied to *Cirsium;* it is found in the Himalayas, in the plains, and in the Peninsula; while *Carthamus oxyacantha,* referred by Mr. Don to *Kentrophyllum,* is also found on the western banks of the Jumna, as well as by Bieberstein, near the junction of the Kur and Aras rivers, and near the eastern base of Caucasus.

In a cultivated state may be every where found *Carthamus tinctorius,* in the cold season; but in the west of India, Colonel Sykes informs me, only *C. flavescens,* common also in Armenia. In gardens may be seen, in the same season, *Amberboa odorata* (*Centaurea moschata,* Auct.) introduced from Cashmere, as well as *Calendula officinalis* and *Cynara Scolymus,* or the artichoke, which, though introduced by Europeans, is also known by the Arabic name *hurshuf.*

So the *Cichoraceæ,* which chiefly prevail in Europe, the Mediterranean region, and the temperate parts of Asia, occur in the Himalayas in considerable numbers; but only a few species are found in the plains of India, and these only during the cold season, as species of *Lactuca* (*Prenanthes,* Roxb.), and *Sonchus oleraceus, arvensis,* and *eriopus,* chiefly in the northern parts. *Lactuca sativa* is found in gardens, and known by the name *kahoo;* while *Cichorium Intybus* appears also to have been introduced in consequence of its uses in medicine, as it is known by the Arabic name *hindba,* to which *sarus* (σερις) is given as the Greek synonyme, and *kasnee* كاسني as the Hindoostanee; hence called *Cichorium Cosnia* by Dr. Hamilton.

But in the Himalayas, we have species of *Leontodon, Tragopogon, Scorzonera, Picris, Lactuca, Chondrilla, Taraxacum, Crepis, Sonchus, Hieracium,* and *Mulgedium.* The last most numerous in species, some of which are highly ornamental, is also found in America, as well as *Leontodon* and *Lactuca. Scorzonera* and *Crepis* are only found in Kunawur, and a species of *Picris, P. hispida,* Don, on Peerpunjal; but a European species, *P. hieracioides,* is also found in the Himalaya, in Nepal, and in the Peninsula of India. *Hieracium Sabaudum,* Lin., a native of the south of Europe, is also found in Cashmere; and in the Himalayas, other species, nearly allied to *H. umbellatum* and *murorum.*

The tribe of *Mutisiaceæ,* containing nearly forty genera, was long considered as being confined to South America and the Cape of Good Hope. But as we have frequently seen in many of the families, as the *Rosaceæ,* which prevail in greatest numbers in the Old, but have yet their representatives in the New World, so the tribe *Mutisiaceæ,* so numerous in Asia and Africa, exists only as isolated species in the Himalaya. Thus, *Leucomeris spectabilis* of Mr. Don, found in Nepal, and common in the Kheree Pass, has been referred by Lessing to the South American genus *Gochnatia,* and *Chaptalia maxima* of the same author, he has referred to *Onoseris,* having the same locality; but the North American *Chaptalia* is represented by *C. gossypina,* figured in this work, and so closely resembling *C. tomentosa,* as scarcely to be separated from that genus. It is found at Mussooree, and similar elevations throughout Gurhwal and Sirmore, affording the Hill-people a tomentum on the under surface and petioles of its leaves, which they employ as tinder and amadou, as well as, it is said, for making a fine kind of cloth. To this tribe also belong *Liatris latifolia* and *cordata* of Mr. Don, formed into a new genus

genus by M. De Candolle : these are found in Nepal, as well as at Mussooree and Simla. *Dicoma* also, which was only known to exist at the Cape of Good Hope and on the banks of the Senegal, has a species, *D. lanuginosa,* which extends from the Peninsula of India up to Delhi, and the arid country on the western bank of the Jumna.

The remainder of the *Compositæ,* consisting of numerous genera and species, are included by Jussieu under the general term, indeed order, *Corymbiferæ.* By Lessing, these are divided into the tribes *Vernoniaceæ, Eupatoriaceæ, Asteroideæ, Senecionideæ,* and *Nassauviaceæ.* The last found only in America; but of all the others, there are numerous species both in the plains and mountains of India. These it will suit better the purposes of this work, to consider with respect to their geographical distribution, than according to the tribes to which they belong.

Taking therefore into consideration, first, those which prevail in the plains of India, we have of genera peculiar to the country, and of those of which species extend into the Indian islands, *Decaneurum, Poloa, Vicoa, Cæsulia, Cyathocline, Sphæropsis, Blumea, Blainvillea, Ramtilla, Glossocardia, Emilia,* and *Pluchea;* and as in other tropic-like countries, both of the Old and New World, species of *Eclipta* and of *Bidens.* Of genera common to Africa and India, species are found of *Epaltes,* Cass. (*Ethulia,* Gært.) *Sphæranthus* and *Grangea;* and of those common to the latter and America, species of *Vernonia, Elephantopus, Ageratum, Adenostemma, Siegesbeckia, Xanthium, Spilanthes,* and *Myriogyne. Wedelia* is found in the south of India and Nepal, as well as in America and Polynesia. A few species also are found of genera, which exist in every part of the world, as of *Gnaphalium, Erigeron* and *Conyza;* and at the foot of the mountains, species of *Senecio* and *Artemisia.* The country in the neighbourhood of Delhi and the western bank of the Jumna in general, we have frequently seen has considerable affinity to the Flora of Egypt and of the Oriental region, an affinity of which these tribes afford a few additional instances in the prevalence here of *Francœuria crispa, Cotula anthemoides,* and of species of *Filago, Xanthium,* and *Pulicaria.* The Egyptian plant, to which the name *Grangea Maderaspatana* has been applied, M. De Candolle considers to be different from the Indian.

The general uniformity we have seen to characterize the plains of India over a wide extent of surface, is exemplified in this family as in others, by the prevalence in northern as in the most southern parts of the same plants, such as *Vernonia cinerea, Elephantopus scaber, Sphæranthus mollis, Vicoa indica, Cæsulia axillaris, Grangea Maderaspatana, Cyathocline lyrata, Emilia sonchifolia, Blumea Wightiana* and *oxyodonta, Myriogyne minuta, Gnaphalium indicum,* and others.

In a cultivated state, but perfectly naturalized, we may find in Indian gardens in every part of India, *Callistephus chinensis,* from China; *Chrysanthemum indicum,* probably from the same country, if not from Cashmere, whence I have myself received it; *Matricaria suaveolens,* from the Oriental region; *Helianthus annuus* and *tuberosus,* with *Tagetes erecta* and *patula,* from America. The greater portion of these have become so widely diffused, and such universal favourites with the natives of India, not prone to adopt

novelties,

novelties, and having names assigned them in the different dialects, that it renders extremely difficult the ascertainment of truly indigenous species.

In the Himalayas, as we have frequently seen, moderation of temperature, the result of elevation, supports a vegetation which is analogous to that of other cool parts of the world. This is fully exemplified in this, as in every other family, with the same exceptions as we have elsewhere seen, of a more tropical vegetation the nearer we approach their bases. Thus we have of genera found almost every where in temperate parts of the world, species of *Senecio, Conyza, Artemisia, Tanacetum, Gnaphalium,* and *Helichrysum;* of those found in Europe, Asia, and America, *Solidago, Diplopappus, Aster, Stenactis, Erigeron,* and *Inula;* and of genera restricted to Europe and the northern parts of Asia, *Tussilago, Doronicum, Bupthalmum, Pyrethrum, Achillea,* and *Carpesium;* with *Ligularia,* found also in Africa; *Eupatorium,* and *Mikania* in America chiefly; *Antennaria,* confined to Europe and the arctic zone; and the new genus *Leptocoma.* On the Neelgherries occur the new genera *Monosis* and *Notonia,* as well as species of *Doronicum, Senecio, Helichrysum,* and *Aster.* (v. Wight. *Contrib. to Botany of India.*)

The species which are remarkable as occurring in the Himalayas, as well as in other parts of the world, are *Tussilago Farfara, Senecio Jacobæa,* found there and in Europe; *S. chrysanthemifolius* in the south of Europe and in Kunawur; *S. asplenifolius,* in my collection from Cashmere, Mr. Don informs me is not to be distinguished from specimens of the same species collected by Pallas on Caucasus. *Carpesium abrotonoides,* a plant of the Oriental region, is also found on Choor. Some of the species of *Aster* very closely resemble *A. alpinus,* and *Antennaria leontopodina,* referred by Mr. Don to *Leontopodium,* is certainly very like this genus. Some of the species of *Inula, Ligularia* and others, as well as those represented in the present work, are highly ornamental

A resemblance to the Flora of China has frequently been noticed: it is observable here also, as *Bidens Chinensis,* found in that country, occurs also at Mussooree; and the genus *Glossogyne* is common to India and China. With these it was not to be expected that we should also find some African plants; but *Dicrocephala* occurs at the Cape, in the Peninsula of India, and the Himalayas. *D. latifolia,* DC., and *gracilis,* DC., being found at Simla and Mussooree, and at the latter, *D. grangeæfolia,* DC.: a species which M. DC. remarks, confirms the relation between this genus and *Grangea. Gynactis synapifolia,* DC., found at Jurreepanee, he observes, he has reason to believe occurs also on the banks of the Senegal. Finally, *Sclerocarpus Africanus,* which has already been mentioned on the authority of Mr. Don, as occurring at Simla, as well as in Africa, is also found at Mussooree in these mountains. The hill species of *Ethulia* have all been referred to the new genus *Myriactis.*

Numerous as are the *Compositæ,* natural as they are in structure, few of them are of much importance as medicinal agents, and still fewer of any value as articles of diet, but there is considerable resemblance in the properties of the plants belonging to the different tribes. Thus the *Cichoraceæ* abound in a milky and bitter tasted juice, which is frequently of a narcotic nature. The lettuce is considered narcotic in India as in

Europe, and the inspissated juice called Lactucarium, yielded more particularly by *Lactuca virosa* and *sylvestris*, is said to combine a narcotic with a diuretic power. The latter property is also ascribed to the *Taraxacum*, which as considered useful in liver complaints, it is interesting to find is so easily procurable all along the Indian frontier. As the lettuce and endive are eaten in Europe, so is *Tragopogon gracilis* in the Himalayas, but without being blanched. The roots of Succory, from which the Indian Kasnee does not appear to differ, are used as a substitute for coffee, and the herbage is grateful to cattle, on which account it is sometimes cultivated as fodder, and succeeds well in northern India. Cattle also eat *Sonchus oleraceus* and *Lactuca runcinata* in India. But the only plant which affords any quantity of nutritious food is *Helianthus tuberosus*, or Jerusalem artichoke, which succeeds well in every part of India; its herbage also is esteemed as fodder, and yields, on being burnt, abundance of potash.

But bitterness is the property which is most conspicuous and uniform in the *Compositæ;* hence many of them have been employed as tonics and in larger doses, or where the proportion of essential oil is greater, as local stimulants, as the different kinds of *Artemisia*, Camomile, Coltsfoot, Tansy, Golden rod, Achillea, and others, of most of which we have seen there are analogous species in the Himalayas. In India some species of *Artemisia* are accounted highly valuable from their bitter and tonic properties, as *Artemisia indica*, called *dona* and *murwa*, *A. vulgaris*, *nag-downa*, for which *A. parviflora* is substituted in northern India, and *artemasia* given as its Greek name; *A. Doonense* is given as *ufsunteen* or *absinthium*. *A. chinensis*, and it is said also *A. vulgaris*, yield the tomentum which is used as moxa and amadou, and for which that of *Chaptalia gossypina* would no doubt be an excellent substitute. *Matricaria suaveolens* is substituted for camomile, and *atnamees* (anthemis), given as the Greek synonime of *buboona*. Some species of *Artemisia* have long been celebrated as anthelmintics; in India *Vernonia anthelmintica* is specially used for this purpose. Others of this family, as *Ptarmica* and *Arnica*, have been employed as sternutatories; but nothing can be more effectual than *Myriogyne minuta* (*Artemisia sternutatoria*, Roxb.); of which the latter specific name is a translation of the Hindee *nukh chinkhnee*. *Sphæranthus mollis*, which from its sensible properties was supposed would be useful in medicine, is used in N. India, and called *khamadroos*, being considered the χαμαιδρις of the Greeks. Several have been considered sudorific; and *Eupatorium Ayapana*, which is quite at home in the Calcutta Botanic Garden, is one of the most powerful, and has been strongly recommended for introduction as a regular article of the Materia Medica. Some of the *Compositæ* secrete an acrid principle, especially in their roots, as *Anthemis Pyrethrum*, known in Indian medicine by the name *akurkura*. The roots of some species of *Spilanthes* are said to be possessed of similar properties. The *Arniceæ* alone act with violence on the system, and some, as *Arnica montana* and *Doronicum Pardalianches*, combine so much acrid with the bitter principle as to be highly deleterious and poisonous. Many plants we have seen of different families, whatever other principles they may secrete in other parts, lay up a store of oil in the kernels of their seeds; so it is with many of

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this family, and this in so large a quantity as to allow of their being cultivated for the oil they yield, as the sun-flower; the *Ramtilla oleifera,* in Bengal, and *Carthamus tinctorius* in every part of India; this last, however, is also cultivated on account of its flowers, which are well-known in commerce under the name of Bastard Saffron.

Specimens of most of the Plants of this family in the Author's Herbarium having been sent to Professor De Candolle, that celebrated Botanist had the kindness to name the greater portion, and favour the author with a letter referring by numbers to those which had been retained. The Plants referred to and figured in this work have been named in conformity to this list, with the exception of those to which the Professor's initials have not been attached. The generic and specific characters will be published in the 5th volume of his justly celebrated Prodromus.

1. *Echinops nivea.* D.C. in lit. Wall. Cat. N. 2986.—Tab. 56. fig. 1.

Hab. Mussooree and Suen ranges. Sireenugur. *Wall.*

2. *Dolomiæa macrocephala,* D.C. in lit. and Archives de Botanique 2. p. 330. *Carduus macrocephalus,* Wallich, Cat. N. 2904. *Saussurea religiosa,* nob. p. 26.—Tab. 57. *a.* The united anthers rising from the corolla, of which the limb has been removed; *b.* a single anther, with each lobe terminating in an extended ciliate base; *c.* a floret; *d.* the same, with the corolla removed, and the quadrangular achenium separated.

Hab. This plant has been formed into a new genus by M. De Candolle, in consequence of differing from *Saussurea,* to which it is most nearly allied in its pappus. It is used by the inhabitants of the hills as a kind of incense in their religious ceremonies, and is by them called *googlan;* hence *Saussurea* (*Googlana MS.S.*) *religiosa* nob. It is found on Kedarkanta, Peerpunjal, and at Lippa in Kunawur. It was sent to Dr. Wallich from Gossainthan and Kêmaon.

3. *Cyathidium taraxacifolium,* Lindley. *Aplotaxis taraxacifolia,* D.C. in lit. *Saussurea? taraxacifolia,* Wall. Cat. N. 2914.—Tab. 56. fig. 2. *a.* a floret with its cup-like, awned, external pappus; *b.* the pappus; and *c.* an anther, both highly magnified, the latter terminating in a long villous prolongation; *d.* part of a style with the stigmas.

Hab. This species has been separated from *Aplotaxis* by my friend Dr. Lindley on account of the cup-like outer pappus with its short bristles. It grows on Choor and Kedarkanta, and was sent to Dr. Wallich from Sirmore by Dr. Govan.

4. *Aplotaxis gnaphaloides.* D.C. in lit.—Tab. 59. fig. 1.

Hab. Soongnum in Kunawur.

5. *Chaptalia gossypina,* nob. p. 18. and 247.—Tab. 59. fig. 2. *a. b.* florets; *c.* anther; *d.* stigmas.

Hab. Owing to some mistake in the numbering I was unable to find this plant named in the letter with which I was favoured by Professor De Candolle. Mr. Don referred it to the genus *Chaptalia,* and it certainly bears great resemblance to *C. tomentosa.* It is, I believe, *Onoseris lanuginosa.* Wall. Cat. N. 2929. *Chaptalia maxima,* Don, has been referred to the same South American genus. It is found at Mussooree, &c. v. p. 247.

6. *Aster angustifolius.* Lindl. MS.S.—Tab. 58. fig. 1.

Hab. Cashmere.

7. *Callimeris flexuosa.*—Tab. 58. fig. 2. *a.* achenium.

Hab. Suen, Mussooree, and Cashmere.

8. *Galatilla juncea.* Lindl. MS.S.—Tab. 58. fig. 3.

Hab. Saharunpore Botanic Garden from Himalayan seed.

The three last plants have been examined and described with others of the section to which they belong by Dr. Lindley for Professor De Candolle.

9. *Corvisartia indica,* D.C. in lit.—Tab. 60. fig. 1. *a.* quadrangular achenium; *b.* base of the corol, with the bulbous base of the style; *c.* anther.

Hab. Peerpunjal and Cashmere.

10. *Ligularia arnicoides,* D.C. in lit.—Tab. 60. fig. 2. *a.* achenium; *b.* stigmas.

Hab. Kedarkanta, Broang and Chandow Passes.

11. *Mulgedium macrorhizum.*—Tab. 61. fig. 1. a. b. achenium; c. stigmas.

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Hab. Mussooree and Kedarkanta.

12. *Mulgedium sagittatum.*—Tab. 61. fig. 2. a. anther; b. stigmas; c. achenium.

Hab. Kedarkanta and banks of the Rawee and Buspa Rivers.

97. LOBELIACEÆ.

This order, allied to *Cichoraceæ* by its irregular split corollas, cohering anthers, and milky juice, is only considered a tribe of *Campanulaceæ* by Mr. Brown, but, unlike that order, delights more in southern than in northern latitudes, though the Indian species are chiefly found in mountainous situations. They are numerous in South America and the West Indies, as well as at the Cape of Good Hope, in New Holland, and in the Island of Java. A few species extend into China, Japan, Europe, and North America. In India we find them on the mountains of the Peninsula, as *L. excelsa,* attaining an elevation of ten and twelve feet on the Neelgherries. A species extends to the Western Ghauts explored by Col. Sykes; *L. zeylanica* is found in Silhet and on the mountains of the central range; *L. stipularis* is common to the Indian and Malayan Peninsulas, extending along the foot of the mountains to Nepal and Kemaon, and existing at Mussooree in a diminutive state; *L. rosea* and *begonifolia* are found in the former as well as on the mountains of Pundooa; and *L. pyramidalis,* which Dr. Wallich describes as being found in Silhet, as well as in both low and lofty situations in Nepal, extends north as far as Shalma.

The *Lobeliaceæ* are remarkable for the acridity of their milky juice, on which account some are of a deleterious nature, as *L. Tupa* in Chili, and *L. longiflora* in the West Indies. Others are employed as medicinal agents, as *L. syphilitica* and *cardinalis;* and *L. inflata* in North America as an emetic and sudorific; *L. Caoutchouc* is so named by the inhabitants of Popayan from the tenacity of its juice. It would be desirable to ascertain if the Indian species are possessed of any useful properties. *L. pyramidalis, excelsa,* and others are highly ornamental, and well worthy of introduction into the gardens of England.

98. CAMPANULACEÆ.

M. Alphonse De Candolle, in his Monograph on the *Campanuleæ,* which, for comprehensiveness of views combined with minuteness of detail, is quite a model for such kinds of work, treats of this order as a tribe of a more general one, which embraces the foregoing and two following orders. *Campanulaceæ* are well known from the different species of Bell-flower being so common in European fields and gardens. Indeed, they prevail chiefly in the temperate regions of both hemispheres, as in the Oriental and Mediterranean regions, the mountains of Europe, Caucasus, and the Altai, the frontiers of China and Siberia, N. America, the Cape of Good Hope, and New Holland; a few species in South America, St. Helena, and Senegambia, in the Burmese territories, and the islands of the Indian Archipelago. Of the three hundred and eleven species belonging to this order, only thirteen are found in intratropical countries, or as M. A. de Candolle expresses their distribution in a general way, one-half of the whole

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are found in Europe and temperate Asia; a fourth of the remainder at the Cape of Good Hope; and the rest dispersed throughout the other parts of the world. Dr. Wallich's Himalayan species are fourteen in number: to these must be added seven new ones in the author's collection, and probably many more remain to be discovered in the unexplored portions of the Himalaya.

M. A. De Candolle has made the interesting remark, that with only a single exception, all the species belonging to genera which open their capsules by lateral pores, as *Campanula* and its allies, are found in the northern hemisphere; while those which, like *Wahlenbergia* and the genera grouped round it, open their capsules at the apex, chiefly inhabit the southern hemisphere. Thus in the Himalayas we have several species of *Campanula*, and one of *Symphandra* (*S. stylosa*, nob.), of which the other species are found in Crete and Caucasus. The former genus we have seen is common in the plains and mountains of the northern hemisphere; some of its species found in these mountains are allied to their northern congeners, as *Campanula aristata* from Peer Punjal to *C. linifolia*, and *C. sylvatica* to this and to *C. rotundifolia*, while *C. latifolia* is found in these mountains as well as in Europe, Caucasus, and Siberia. *C. canescens*, which differs considerably in habit, is the only species found both in the mountains and the plains of India; *C. Cashmeriana, nervosa, evolvulacea*, and *anagalloides*, are the other new species; *C. carnosa*, Wall. (*Wahlenbergia ovata*, Don) is removed from the order by M. A. De Candolle.

Of those chiefly inhabiting the southern hemisphere we have a species of *Cephalostigma* on the banks of the Irrawady; the two other species of the genus being found on the banks of the Senegal. A *Wahlenbergia* (*W. dehiscens*) is found in Silhet, and another, *W. agrestis*, in Nepal, where, we know according to locality other tropic-like plants exist; both these belong to the same section of the genus, as all the Bengal, Cape, and Australasian species. *W. cervicina* is found in Egypt, as well as in Western Africa. *Codonopsis*, of Dr. Wallich, is a new genus peculiar to these mountains, allied on one hand to *Canarina*, found only in the Canary Islands, and on the other to *Campanumæa*, discovered by M. Blume in Java. Of this I have been fortunate enough to obtain two new species, *C. rotundifolia* and *ovata*, both figured in this work. *Codonopsis thalactrifolia* of Dr. Wallich, *Glosocomia tenera* of Mr. Don, has been reunited to this genus by Mr. Bentham, for the reasons assigned in the following communication, in which he has also favoured me with specific characters of the two first species.

Codonopsis ovata; ramis sterilibus brevibus filiformibus opposite-foliosis, floriferis erectis alterne-paucifoliatis apice nudis unifloris, foliis subsessilibus ovatis basi cordatis pubescentibus, calyce 5-fido, corolla tubulosa ampla, antheris glabris muticis.—Tab. 69, fig. 3 (*a*) a flower with part of the calyx and corolla removed; (*b*) capsule, (*c*) vertical, (*d*) transverse section, and (*e*) the valves of the same.

Hab. Cashmere. *Royle.*

Codonopsis thalictrifolia (Wall. in Roxb. Fl. Ind. p. 106) ramis sterilibus brevibus filiformibus opposite-foliosis, floriferis erectis alterne-paucifoliatis apice nudis unifloris, foliis minimis petiolatis reniformibus puberulis, calyce 5-fido, corolla tubulosa ampla, antheris extus villosis apice mucronulatis. *Glosocomia tenera.* Don. Prod. Fl. Nepal, p. 158.

Hab. Gossainthan. *Wallich.*

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"On a close examination I do not find in either of these plants (which are very closely allied to each other in habit and character), those peculiarities which have been described by Dr. Wallich and Mr. Don, and which induced M. A. De Candolle, in his excellent and elaborate monograph of *Campanuleæ*, to exclude the *C. thalictrifolia* not only from the genus, but from the order altogether. The leaves of the slender sterile shoots, which are in fact simple and opposite, have been mistaken for the leaflets of a compound leaf, as mentioned by Mr. Don, and the supposed free ovarium proves also to have been an illusion. The whole of the part which contains the ovula is perfectly adherent, and the apparently free part is but a conical apex, dehiscent indeed at the maturity of the fruit in three septiferous valves (as in other Codonopsides), but containing no placentæ, and therefore forming more properly a part of the style, than of the ovarium. The irregularity of the calyx and corolla is but very slight and often scarcely perceptible, and the character derived from the hairy and mucronate anthers is of no importance, and moreover exists in one only of the above two species, which certainly cannot be separated from each other."

The following are the other *Campanulaceæ* figured in this work, of which, as well as of the other new species, specimens have been sent to M. A. De Candolle.

Codonopsis rotundifolia; caule ascendente volubili, foliis alternis quandoque oppositis membranaceis læviter pilosis subtus glaucescentibus rotundatis crenatis, corolla campanulata pallide cœrulea.—Tab. 62. fig. 2. (*a*). corolla spread out; (*b*). flower with the corolla removed; (*c*). transverse section of capsule; (*d*). a flower in which the calyx and corolla are divided into six lobes.

Hab. This new and very distinct species of *Codonopsis* belongs to M. A. De Candolle's first section and is allied to both *C. viridis* and *purpurea*. The stamens alternate with the lobes of the corolla, and the filaments are only a little broader at the base. The flower, with the senary division of its parts, is interesting, as showing the alliance of this genus with *Canarina*, near which it has been placed by M. A. De Candolle.

Campanula Cashmeriana; caule ascendente velutino-pubescente, foliis caulinis sessilibus oblongo-ovatis subcrenatis integrisve, ramis axillaribus floribus erectis solitariis terminatis, calycibus velutino-pilosis, corolla campanulata lobis calycinis triplo longioribus.—Tab. 62 fig. 1. (*a*). a flower with the corolla removed.

Hab. Kioonthul in Cashmere.

99. STYLIDIEÆ.

This order forms a portion of the characteristic flora of New Holland, but two species of *Stylidium* very similar to certain intratropical ones of that country were found by Kœnig (*S. uliginosum*) in Ceylon, and (*S. tenellum*) in Malacca. Two additional species are enumerated in Dr. Wallich's catalogue, *S. Wightianum* from the Peninsula, and *S. Kunthii* from Silhet, showing, as in many other instances, the spreading of species into congenial climates beyond what at first appears the natural limits of an order.

100. GOODENOVIEÆ.

This is another of the families of plants almost peculiar to New Holland, and of which a representative is found in the Indian Flora in *Scævola* of the tribe *Scævoleæ* of Mr. Brown, but formed into a distinct order by Dr. Lindley. The species *S. Kœnigii* and *Taccada* are natives of the coasts of the Bay of Bengal and of the Peninsula. The former

former also of New Holland; the rest of the genus being found in the Moluccas, New Holland, and the West Indies. *Pentaphragma* (*Phyteuma*, Roxb.) *begonifolium*, Wall. N. 1315, is referred here by M. A. De Candolle.

101. EPACRIDEÆ.

This is a third family with the peculiar distribution of the two former, but of which no species is found within the proper limits of the Indian Flora, though one is described in the Flora Indica, ed. Wall. 2. p. 301. This is *Leucopogon Malayanus* of Dr. Jack, found abundantly on the small hills of the island of Singapore, as well as on Mount Ophir, elevated 4,000 feet, and situated about thirty miles from Malacca. It is remarkable as forming an exception to the general geographical distribution of this order, and is interesting for the remarks long ago made by Dr. Jack on this subject, and which corroborate the views taken in this work respecting the distribution of the Indian Flora. Dr. Jack remarks that "Singapore, situated at the extremity of the Malay Peninsula, and forming as it were the connecting link between Continental and Western India, and the Islands of the great Eastern Archipelago, partakes of this character in its Flora, which exhibits many remarkable points of coincidence with the Floras of both regions. I have had occasion to observe resemblances between its productions and those of the northern frontier of Bengal on the one hand, and of the Moluccas on the other, while the present connects it with the still more distant range of New Holland." *Fl. Ind.* l. c. from *Mal. Misc.*

102. VACCINACEÆ.

This order, distinguished from *Ericeæ*, with which it was formerly combined, by its inferior ovarium and succulent fruit, is chiefly found in North America, but also in Europe, Siberia, and Japan, with a few species in the mountains of Mexico, South America, and Jamaica; also in the Sandwich Islands and in that of Celebes. A species of *Vaccinium* is mentioned by M. Lechenault de la Tour, as existing on the Neelgherries: and another by Dr. Wallich on the mountains of Silhet. The latter does not seem to have met with it further north, nor have I found any species in the part of the mountains which I have visited; though the bilberry has been mentioned to me as having been found by travellers in the Himalaya, and from the general distribution of the genus, as well as from its extending to Caucasus, it is not improbable that some species may yet be found. The genus *Thibaudia*, differing from *Vaccinium* chiefly in habit and a more elongated corolla, existing in the mountains of New Granada and the Andes of Quito and Peru, is also found in the Himalayas and Neelgherries. These were first discovered by Dr. Roxburgh in the mountains near Chittagong and Silhet, and referred by him to the Peruvian genus *Ceratostemma*. Dr. Wallich has removed them to *Thibaudia*, with which, as well as two of his new species, though differing a little in habit, they appear to agree in all essential characters, and should be united with it, even if a slight enlargement of the generic character be necessary. *T. serrata*, Wall.

Wall. Dr. Lindley has referred to *Gaylussacia,* and other species to *Vaccinium,* to which genus also certainly belongs *Andromeda symplicifolia,* Wall. 1522, from the Neelgherries. The *Thibaudias* are all found on the mountains of Silhet and Pundooa, as on Chirrapoonjee. From Silhet they extend to the coast of Tenasserim, where one species is found, and from that to Java, where there is also a species of *Gaylussacia.* Mr. Don has formed the Asiatic species into a new genus, *Agapetes,* from their ornamental nature.

The stems and leaves of *Vaccinaceæ* are astringent and rich in tannin; the flowers of many are highly ornamental, and the fruit of most acidulous. Those of Bilberries and Whortleberries (*Vaccinium myrtillus,* &c.) are well-known, as are those of Cranberries (*Oxycoccus palustris* and *macrocarpum*): all would succeed well in the Himalayas.

From the Honourable East-India Company's collection of drawings formed under Dr. Wallich's superintendence, I have been enabled to figure two very interesting plants belonging to this family, in Plate 79, but which, from my series having been previously completed, I have been unable to number; though in binding, it may be put in its proper place between Plates 62 and 63. The two plants belonging to this group, first discovered in India, were referred by Dr. Roxburgh to the Peruvian genus *Ceratostemma,* but subsequently by Dr. Wallich to the South American genus *Thibaudia,* as the Javan species have been by Dr. Blume. Though there is some uncertainty respecting one of Dr. Roxburgh's original species, that represented in Plate 79, fig. 1, is certainly his *Ceratostemma variegata,* as marked on the drawing, and agreeing upon the whole very well with the description, but not so well with the specimen *Thibaudia variegata,* No. 751 of the East-Indian Herbarium. But the drawing agrees also very well with the general appearance, leaves, inflorescence and corols of *T. setigera,* which differs however in having the peduncles and calyx covered with setæ, notwithstanding which Dr. Wallich asks if this species, Cat. No. 752, be *T. variegatæ,* var.? It is evident, therefore, that well acquainted as he must be with that species, he can have considered the possibility of *T. setigera* being a variety, only from its great resemblance to that plant; a point in which the drawing has been shewn fully to participate, as the flowers are tubular, somewhat ventricose, and contracted at the mouth; the filaments short, anthers included within the corols, extended into two long tubes, and the bases only projecting a little ("short appendages" of Don), stigma 5-lobed, ovary and berry 5-celled, many-seeded. It appears that this species agrees in all essential points with *Thibaudia,* and in habit the species of that genus differ among themselves, especially with regard to the peculiar venation of some species; and *T. caulialata* is described as having denticulated leaves (G. Don, Gen. Syst. III, p. 861). Dr. Roxburgh moreover describes the filaments as being sometimes slightly united at the base, and the anthers as united their whole length into a tube round the style. This is somewhat analogous to what has been observed by Dr. Lindley, in his new genus *Cavendishia,* belonging also to this family (Bot. Reg. No. 1791), named in honour of the Duke of Devonshire, one of the most munificent patrons of Horticulture. Three other species appear to belong to this genus; No. 752, *T. setigera,* from Pundooa; No. 753, *T. vaccinacea,* Cat. p. 235; *verticillata,* p. 22, from the same locality; and No. 754, *T. loranthiflora* from Tavoy, on the coast of Tenasserim. Not having any of these species in my herbarium, and Mr. Don being absent from London, I referred to Dr. Lindley for his opinion on the subject, who, with his usual liberality, has dissected the flowers of the *Thibaudias* in his possession, and agrees with me in retaining *T. variegata* in this genus; while some others, as *T. Sprengelii,* Cat. No. 6298, he refers to *Vaccinium,* and *T. serrata,* No. 6298, to *Gaylussacia.* This is also represented at Plate 79, fig. 2, and though different from the plant named *Thibaudia vaccinacea,* No. 753, which has smooth, laurel-like, subverticilled leaves, with setose peduncles and calyx: Dr. Wallich puts the query respecting this species "an hæc planta *Ceratostemma vaccinacea,* Roxb," and it certainly agrees in many points with Dr. Roxburgh's description; but in Dr. Wallich's drawing, the berries are represented as 10-celled, with apparently only one seed in each; the corolla ventricose at the base and contracted at the mouth, and the stamens included within the limb; and, therefore, agreeing in all essential points with the character of *Gaylussacia.* The whole of the species are well worthy the attention of any Botanist who has an opportunity of examining the flowers and fruit.

Thibaudia

Thibaudia variegata (Wall. Cat. No. 751). Shrubby; leaves shining, coriaceous, broad-lanceolate, tapering towards base, subdenticulate, short petioled, and generally crowded together; inflorescence axillary racemose, bracts small, calyx and peduncles smooth, flowers variegated with pink and red. *Ceratostemma variegata,* Roxb. Fl. Ind. II. p. 413. *Agapetes variegata,* Don. l. c.—Tab. 79, fig. 1. (*a*) a flower; (*b*) the same, with the corol removed and the calyx cut open; (*c*) the corol opened; (*d*) the pistil; (*e*) two anthers.

Hab. Pundooa Mountain. *Wall.* Mountain forests near Chittagong, Silhet, and the Garrow Hills where it is called *Jalamoot,* flowering in the cool season, when it is highly ornamental, with the seed ripening in July (*Roxb.*)

Gaylussacia serrata (Lindley). Shrubby; leaves narrow-lanceolate, serrate; acute, stiff, coriaceous, shining, short petioled and crowded together, especially towards the extremities of the branches; stipules coloured subulate, racemes axillary, many-flowered; flowers drooping, long pedicelled, white tinged with green, bracts small subulate. *Thibaudia serrata,* Wall. Cat. No. 6299. *Agapetes serrata,* Don. —Tab. 79, fig. 2. (*a*) a flower; (*b*) the same, with the corol opened; (*d*) an anther; (*e*) transverse section of berry.

Hab. Chirraponjee, one of the Silhet mountains; in flower in February.

103. MONOTROPEÆ.

This family consisting of the tribes *Pyroleæ* and *Monotropeæ,* sometimes themselves considered orders, includes but few genera and species; and these nearly confined to the northern parts of Europe, Asia, and America; but *Monotropa,* a genus common to the northern parts of Europe and America, has also species in the Himalayas. Of these one is considered by Mr. Don as identical with the American *M. Morisoniana;* this is found in Kemaon, in the neighbourhood of Mussooree, and Kedarkanta; the other a smaller species, *M. humilis,* Don, was obtained by Dr. Wallich from Gossainthan, who includes both under his *M. Nepalensis.* *Chimaphila umbellata* is diuretic and tonic.

104. ERICACEÆ.

The Heath-tribe are so well known as ornamental plants, that it need only be stated that with generally monopetalous corollas, those of *Ledum* scarcely cohere, and that while others contribute a few, this order gives nearly the whole of its species to the gardens and green-houses of Europe. This fact at once indicates that they are inhabitants of the cold and temperate parts of the world; and we accordingly find the species of the two tribes *Ericeæ* and *Rhodoreæ* distributed through Europe and North America, and along Siberia to Kamschatka and Japan. The heaths are known to be especially abundant at the Cape of Good Hope: a few species of other genera are found in the mountains of South America, in the Islands of Java and Mauritius, and the south of China. In Australia their place is supplied by *Epacrideæ.* A few species are found on the Neelgherries and the Island of Ceylon, but several all along the Himalayas; so that we have *Ericaceæ* in the northern, and *Vaccinaceæ* chiefly in the southern parts of those mountains. *Gaultheria ovalifolia* is found on the Neelgherries, *G. fragrantissima* at Narainhetty in Nepal, and *G. nummularioides* on Gossainthan; of these the last is the only one I have found in the more northern portions of these mountains; but another species, *G. trichophylla,* figured with the former in pl. 63, is common on the Choor and at Jumnotri, as well as on the mountains surrounding Cashmere. The species of *Andromeda* are five in number, *A. formosa, lanceolata, villosa,* and *ovalifolia,* all found in the moun-

tains of Nepal, and referred by Mr. Don with the Japan species to his new genus, *Pieris*. The last is also found in the mountains of Sirmore and Gurhwal, with Dr. Govan's variety if not distinct species, *A. cordata;* both are common at elevations of from 5,000 to 8,000 feet along the Mussooree Range from Dhunoultee to Budraj. The fifth species, *A. fastigiata*, closely resembling *A. hypnoides, lycopodioides,* and *tetragona,* found in northern Europe and America, and along Siberia to Kamschatka, has been formed with these into a new genus (*Cassiope*) by Mr. Don. Dr. Wallich obtained it from Buddrinath and Gossainthan. I have found it on Choor and Kedarkanta at elevations of from 9,000 to 12,000 feet, and have obtained it from Kunawur. It may be seen in flower from April and May to June, according to the elevation, and is called *seeroo* on the Choor mountain. It has been figured by Dr. Wallich, Pl. As. Rar. t. 284, and repeated in this work, t. 63, on account of the interest it has excited in consequence of being supposed to be the only heath found in Asia. This was in consequence of travellers, especially Mr. Fraser, having mentioned that they had met with the heath in the mountains. Mr. Saunders (Turner's Emb. to Tesshooloombo), probably alludes to the same plant. Dr. Govan appropriately calls it the heath-like Andromeda.

The species of *Rhododendron* found in the most southern latitude is *R. nobile,* Wall. found on Adam's Peak, in the Island of Ceylon, and on the Neelgherry mountains; the specimens from Kemaon belong rather to *R. barbatum* and *campanulatum.* This species is nearly allied to the well-known *Boorans* or *R. arboreum,* which is found at the lowest elevations and in the most southern latitudes of the Himalaya, that is, from Chirraponjee and Nepal to the Sutlej, or from 25° to 32° of N. latitude, at elevations in Gurhwal of from 5,000 to 8,000 feet. In the ascent to Mussooree, it is first met with above Jurreepanee, and presents a broad belt of large trees, which, when in flower in March and April, with every branchlet terminated with a bunch of large crimson flowers, forms one of the most magnificent objects in nature. The cold it experiences at the highest elevations is necessarily considerable in winter, but the rise and fall of temperature being so gradual, it is better able to bear a greater degree of severity than the changes of an English climate. But even this, by careful management, it may be made to withstand; for I am informed by Mr. Anderson, of Chelsea, that some trees which were planted more than ten years since in the open air, have flowered this season in great luxuriance at the Earl of Winchester's, at Ashridge, in Herefordshire. The only precautions taken were to place the plants, when two years old, in a sheltered situation, and to cover the ground in their neighbourhood with a thick layer of fern leaves in winter. There is a white variety of this species in Nepal, Kemaon, and Sirmore, but it is not common. It has been figured by Dr. Wallich, from Sheopore, at an elevation of 10,000 feet, where the rose-coloured variety is also found, Pl. As. Rar. t. 128, and by Dr. Lindley, Bot. Reg. N. 1684, from Mr. Well's Conservatory at Redleaf. *R. cinnamomeum,* is nearly allied to *R. arboreum: R. formosum,* Wall., Pl. As. Rar t. 207, is distinguished by its lepidote leaves and few flowers, and *R. barbatum* by the setæ surrounding the petioles and upper part of branches.

The

The next most remarkable species is *R. campanulatum*, which forms a large, very handsome, straggling shrub, never found below 10,000 feet of elevation, and from that up to 12,000, on such mountains as Choor, Urrukta, and Kedarkanta, as well as on Gossainthan. I have also received it from Peerpunjal, and from Lippa in Kunawur. The flowers vary so much in colour, that Capt. Webb proposed calling it *R. mutabile*: I have seen it in flower on Kedarkanta in May, with its branches drooping on the snow which had but recently melted away from about its roots. Its large pink flowers, smooth and shining leaves, with their rough and russet-coloured under surfaces, make this one of the most ornamental shrubs in these mountains. *R. anthopogon* and *lepidotum*, both figured in Pl. 64, f. 1 and 2, are the species found at the highest elevations, extending beyond the limit of forest, or from 11,000 to 13,000 feet all along the mountains, from Nepal to Cashmere, and above 14,000 feet in Kunawur. These, as well as *R. setosum*, of which specimens are mixed with *R. anthopogon*, in the E. I. Herbarium, are allied to *R. Lapponicum*, *Dauricum*, and *ferrugineum*.

The *Ericaceæ* differ in the properties of the tribes *Ericeæ* and *Rhodoreæ*; the former are chiefly astringent; some have succulent fruit which is edible, as *Arbutus Unedo*, *Gaultheria Shallon*, and *procumbens*; the latter, combining some degree of stimulant with the astringent properties, forms one of the kinds of mountain tea. *Arctostaphylos Uva Ursi*, though astringent in taste, is also considered diuretic; and *Andromeda ovalifolia* is said to be fatal to goats in the Himalayas.

The *Rhodoreæ* abound more in stimulant and even deleterious properties. Thus, *Rhododendron ponticum*, *maximum*, *ferrugineum*, and *chrysanthemum*, are poisonous to cattle which feed on them, and in moderate doses are used in medicine, as for the cure of rheumatism, &c. *Azalea procumbens*, and *Ledum palustre*, are accounted diuretic, and *L. latifolium*, being more stimulant, is used as a tea, under the name of Labrador tea, but determines to the head. *Kalmia latifolia* is accounted poisonous, and honey collected by bees from its flower is of a deleterious nature, as is that of *Azalea pontica*, which was fatal to the soldiers in the retreat of the ten thousand. In the Himalayan species, *Rhododendron arboreum* is more remarkable for its uses as a timber tree than for deleterious properties, though these remain to be investigated in this as well as in other species. The flowers are eaten by the hill people, and formed into a jelly by European visitors. The leaves of *R. campanulatum*, being used as a snuff by the natives of India, are imported from Cashmere, under the names of *hoolas-kasmeeree* (Cashmere snuff), and *burg-i-tibbut* (Thibet-leaf), though easily procurable within the British territories. It is remarkable, that De Candolle mentions the employment in the United States, for a similar purpose, of the brown dust which adheres to the petioles of *Kalmias* and *Rhododendrons*. The leaves of *R. lepidotum* are highly fragrant (hence *R. aromaticum*, nob. Journ. As. Soc. 1. p. 467), and of a stimulant nature, and are imported from Caubul under the name *Taleesfur*; to this in Persian works *mafur* and *mafur booz* are assigned as Greek names. In the valuable Dict. de Mat. Med. of M.M. Merat and De Lens, we are informed that *Talisafar* is the Arabic name in Avicenna of

the Macer (μακερ) of the Greeks; (by the Asiatics the *k* has been converted into *f*, as in Lycium, p. 63.) This, however, in all old authors, is described as the bark of an Indian tree. C. d'Acosta considers this is that called *macre* by the Brahmins on the Malabar Coast, of which the bark is useful in dysenteries: but this tree is unknown to botanists.

Andromeda fastigiata. Wall. As. Res. xiii. p. 394. Pl. As. Rar. t. 284. *A. cupressiformis*, Don. Prod. Fl. Nep. p. 150.—Tab. 63, fig. 1. (*a*) anther doubled upon the filament, and appearing as if "apice aristis duabus." (*Wall.*) (*b*) anther turned upwards, showing them as they are "basi bisetosæ." (*Don.*) The flowers are always drooping and the fruit erect.

Hab. Gossainthan and Buddrinath. *Wall.* Choor, Kekarkanta, and Kunawur. 9–14,000 feet.

Gaultheria nummularioides. D. Don. Prod. Fl. Nep. p. 150. Wall. Cat. N. 1524.—Tab. 63, fig. 2. (*a b*) anthers seen from before and behind, (*d*) capsules, (*c*) the same, covered by the semi-baccate calyx, (*e*) transverse section of capsule.

Hab. Gossainthan and Kunawur. *Wall.* Mountains near Barahat on the Jumna.

G. trichophylla; cæspitosa; ramis tenuibus procumbentibus apice præsertim setosis, foliis parvis coriaceis ovatis acutis breve petiolatis marginibus minute serrulatis ciliatisque, floribus axillaribus solitariis bi-bracteatis nutantibus.—Tab. 63, fig. 3—(*a*) a flower, with bell-shaped corol, coloured acute segments of calyx, and green fleshy bracts, (*b*) the same with calyx and corol removed, showing the ten stamens, (*c*) a pistil with truncate stigma, (*d*) anther seen from behind, with short broad filament, terminating on each side in a single horn, (*e*) anther seen in front with both cells opening by pores at the apex.

Hab. This plant is an inhabitant of cold and lofty situations, as Jumnotri, the top of Choor, and of the mountains surrounding Cashmere, and like many plants of such situations is furnished with setæ on the younger upper parts of branches, probably to protect them from the severity of the cold. The calyx is adherent to the lower part of the capsule, becomes succulent, and forms an edible fruit in the month of September.

Rhododendron lepidotum; frutescens; foliis oblongis acutis, basi attenuatis v. spathulatis ut omni plantæ juniore parte lepidosis subtus ferrugineis, floribus terminalibus solitariis vel 1-3 aggregatis, segmentis calycinis rotundatis ciliatis, corollæ tubo brevi, limbo patente rotato, segmentis rotundatis, filamentis lanosis.—*R. lepidotum.* Wall. Cat. N. 758. G. Don. Gen. Syst. of Bot. 3. p. 845.—Tab. 64, fig. 1. (1) flower, (2) the same, with the corol removed, (3) capsule.

Hab. Gossainthan and Bhuddrinath. *Wall.* Choor, Kedarkanta, and Kunawur. v. supra.

R. anthopogon. Don. Prod. Fl. Nep. p. 153. Wall. Cat. N. 759. G. Don. l. c. (1) flower with salver-shaped corol, (2) corol opened, hairy within the tube, (3) flower with the corol removed.

Hab. Gossainthan and Sereenugur. *Wall.* Choor, Kedarkanta, and Lippa, &c. in Kunawur.

C. COROLLIFLORÆ.

M. De Candolle's great division of *Calycifloræ* concludes with the *Ericaceæ;* the following families are included in his subclass *Corollifloræ.*

105. STYRACEÆ.

This order, sometimes called *Symplocineæ,* requires to be more carefully investigated and definitively settled, as it has sometimes been divided into almost as many orders as it contains genera, as *Styraceæ, Symplocineæ,* and *Halesiaceæ.* Of the genera *Styrax* and *Symplocos,* the first is allied to *Meliaceæ,* and the second to *Ternstræmiaceæ. Schæpfia,* sometimes placed here, has been removed to *Loranthaceæ.*

The *Styraceæ* are chiefly found in the tropical parts both of Asia and America, and in both extending north, as a species of *Styrax* (*S. officinale*), is found in the S. of Europe, probably introduced from Asia Minor or Syria; and in the New World species of

Hopea,

Hopea, Styrax, and *Halesia,* are found in Carolina and Florida; so we have species of *Symplocos* both at the base and at moderate elevations in the Himalayas.

The Indian species of *Styrax* and *Symplocos* extend from the islands of the Indian Archipelago along the Malayan Peninsula to the forests of Silhet; *Styrax* (*Lithocarpus*. Blume) *Benzoin* being found in Sumatra, *S. serrulata* near Chittagong, and *S. virgata* on Chirraponjee. The species of *Symplocos* are also found in the Indian Peninsula, and extend from Silhet to Nepal and Sirmore. *S. racemosa,* found near Burdwan and Midnapore, occurs also in Nepal and Kemaon. *S. Hamiltoniana,* a nearly allied species, is found on the Central Range, and *S. paniculata,* which varies so much as to seem to include more than one species, is common at Mussooree, Urrukta, and every where in the mountains.

As we have seen that there is no exact analogy of structure, so are we without general correspondence in properties. Storax, known in India by the name *usteruk,* is afforded by *Styrax officinale* in the Oriental region, and Benzoin by *S. Benzoin* in the islands of Borneo and Sumatra. This in Bengal is called *looban,* but in Northern India this name is applicable only to the produce of *Boswellia thurifera.* Benzoin is in Persian works on Materia Medica distinguished by the names *Hussee-ool-jawee* (Java?) and *Hussee-looban* (an Asa?). The species of *Symplocos* are remarkable for becoming yellow in drying, and some are used in dyeing; as *S. racemosa,* called *lodh,* much in demand in Calcutta, according to Dr. Roxburgh, as a mordant in dyeing red with *munjeeth, Rubia* (*munjista,* Roxb.) *cordifolia.* In northern India the same name *lodh* is applied to the bark of *Symplocos paniculata,* which is substituted for that of *S. racemosa.*

106. ILICINEÆ.

The *Ilicineæ,* separated from *Celastrineæ* by M. Ad. Brogniart, as mentioned at p. 167, q. v., are placed here on account of their close relation to *Ebenaceæ.* To the Indian species ought probably to be added a large diæcious tree common at Mussooree and other parts of the mountains.

107. EBENACEÆ.

This order, named from the black and heavy wood for which the principal genus is so celebrated, is allied to the foregoing and the following order, as well as to *Oleaceæ,* and as has been stated at p. 132, also to *Guttiferæ.* They are chiefly found within the tropics of Asia and America, with a few species spreading north; as *Diospyros Lotus* to the N. of Africa and S. of Europe, and some species into the United States. Southwards we have *Royena* at the Cape of Good Hope, and species of *Cargillia, Diospyros,* and *Maba,* in New Holland. In India there are only species of the two last genera. The species of *Diospyros,* with *Maba buxifolia,* are found in the islands of the Indian Archipelago, and in both the Indian and Malayan Peninsulas; *Diospyros* extends to the mountains of the Central Range, and from Silhet, along the foot of the mountains to Nepal, and the Deyra and Kheree forests.

Of

Of the species of *Diospyros*, *D. Kaki* is stated by Dr. Roxburgh to be common to Nepal, China, and Japan. *D. Ebenaster* is a native of Ceylon; *D. melanoxylon* and *chloroxylon*, of the mountains of the Peninsula. *D. Embryopteris*, found with them, extends from Silhet and Bengal near to the Deyra Doon along the foot of the mountains: and *D. montana* to the borders of the Ruenka Lake, near Nahn. *D. cordifolia* seems to be common in every part of India: and *D. tomentosa*, first described by Dr. Roxburgh, from the northern parts of Bengal, extends to the Kheree jungle, and the foot of the lower hills; the same species appears also to exist in the Central Range. *D. Roylei*, Wall. Cat. N. 4134, is a nearly-allied species, which I found growing in abundance near Adjeeghur and the Bisrumgunge ghaut; it is interesting as an indication of the nature of the little known Flora of Central India.

The genus *Diospyros* is noted for the heart-wood of so many of its species becoming of a black colour, and affording the Ebony of commerce. Though that of the Mauritius yielded by *D. Ebenus* is reckoned the best, some of very good quality is obtained from the Indian species, as, according to Dr. Roxburgh, from the *Ebenus* of Rumphius, 3. t. 1. from *D. Ebenaster*, and *D. melanoxylon*, the Ebony-tree of Coromandel. It is also afforded by *D. tomentosa* and *Roylei*. The timber of other species though not black is of excellent quality. Some of the species are also noted for their sweetish, clammy, and subastringent, though edible, fruit, as *Diospyros Lotus* in the N. of Africa, and *D. Kaki* in China, so in India *D. chloroxylon*, *melanoxylon*, *racemosa*, and *tomentosa*; the fruit of the last is in Northern India called *meetha tendoo*. That of *D. Embryopteris* (*glutinosa*, Roxb.) is particularly viscid, and well-known in Bengal, where it is called *gab*, for its uses in paying boats. The unripe fruit is very astringent.

108. SAPOTEÆ.

This family, named from a fruit of the West-Indies, is chiefly found within the tropics of Asia and America, with species of *Bumelia* extending into the United States, and of *Sideroxylon* to the N. of Africa. A species of the former genus is also found at the Cape of Good Hope, and several genera and species in New Holland. In India are found the genera *Chrysophyllum*, *Sideroxylon*, *Mimusops*, and *Bassia*. The two last spread from the Tropical Islands into India on the north, and *Mimusops* into New Holland on the south. It is more than probable that a species of *Bassia* occurs in Africa. Species of *Sideroxylon* are more widely diffused, as they occur in New Holland as well as in the N. of Africa and the West-Indies, where *Chrysophyllum* is found as well as in South America.

The Indian *Sapoteæ* spread from the Islands of the Indian Archipelago along the Malayan Peninsula to Silhet, and from that to Nepal, where *Bassia butyracea* is found, as well as in the neighbourhood of Almora. *B. latifolia* is probably indigenous in the Central Range, and is common in the northern, as *B. longifolia* is in the southern provinces of India. *Mimusops Elengi* and *Kauki* may be seen every where in a cultivated state: the former, Dr. Roxburgh only found once in a wild state on the

mountains

mountains of the Rajamundry Circars. The species of *Chrysophyllum* and *Sideroxylon* are confined to Silhet and the Peninsula. Dr. Roxburgh states with respect to *Achras Sapota*, that plants from China and from the West-Indies do not differ from one another. It was succeeding well in the Saharunpore Botanic Garden.

Many of the plants of this family are known as affording edible fruits in different parts of the world: as *Achras Mammosa*, the American Marmalade. *A. Sapota* and *Zapotilla;* the different kinds of Star-apple or *Chrysophyllum*, especially *C. Cainito.* The kernels of *Theophrasta Jussiæi*, are made into a kind of bread in St. Domingo; those of *Inocarpus edulis* are eaten in the Molucca Islands. The bark of several species of *Achras* is astringent, and used as a substitute for Peruvian bark; so in India the bark of *Mimusops Elengi* is astringent, and used in Native medicine, as is that of both *Bassia latifolia* and *longifolia. Mimusops Kauki* yields a gum like many trees having astringent bark, while its fruit is of a sweetish taste and much eaten by the natives of India. That of *M. Elengi* is less so, but the tree is highly valued for its fragrant flowers and the deep shade thrown by its highly ornamental, smooth, and shining leaves. The fruit of *Chrysophyllum acuminatum*, like the Star-apples of the West-Indies and of Western Africa, is greedily eaten by the natives of Silhet. (Roxb.)

But the common species of *Bassia, B. latifolia* and *longifolia*, are much the most valuable in an economical point of view, as besides yielding parts useful in medicine for their astringent or emollient properties, their wood is valuable as timber, and a gum exudes from their bark. The fleshy, berry-like flowers, are eaten either raw or are dried (when they are described as tasting like dried grapes) and then roasted. Those of *B. latifolia* or the *Mahwa* (Sans. *Madhuca*) tree are, moreover, subjected to fermentation, and have a powerful and cheap spirit distilled from them; which is that principally drank in some parts of Northern India. The seeds also yield oil on expression. *B. longifolia*, or the Illupei tree of the Peninsula, is also celebrated for the quantity, as well as the uses to which, like that of the *Mahwa*, it is applied; being used as a substitute for that of the Cocoa-nut in cookery, as lamp-oil, and for making soap. But the most remarkable produce is that of the Fulwa or Phulwara, *Bassia butyracea;* the Butter or Ghee tree of the Almora and Nepal Hills, which is of a delicate white colour, and of the consistence of fine lard, but without any disagreeable smell; it is highly esteemed as a liniment in rheumatism, contraction of the limbs, &c., and when used by natives of rank is frequently impregnated with some fragrant *atr*. The tree very much resembles *B. latifolia*, but may be distinguished by its much less fleshy corols and more numerous stamens. It grows on the southern aspect of the Almora Hills, flowering in January and ripening its fruit in August. The kernels, about the size and shape of almonds, are easily extracted from the smooth chestnut-coloured pericarps, when they are bruised and rubbed up to the consistency of cream, and subjected to a moderate pressure in a cloth bag. The oil concretes immediately it is expressed, and retains its consistency at a temperature of 95°. (Roxb. As. Res. viii.)

A resem-

A resemblance between the floras of parts of Africa and India has frequently been pointed out (v. p. 157); it is interesting to find there a product analogous to that of the *Fulwa,* in the *Shea* or Butter tree of Bambarra. This is described by Mungo Park as procured, by means of boiling water, from the kernels of that tree: and as being of the consistence but of a richer flavour than the best butter. According to Mr. Park, " the appearance of the fruit evidently places the Shea tree in the natural order of *Sapoteæ,* and it has resemblance to the Madhuca tree, *Bassia latifolia,* described by Lieut.-Col. Hamilton, As. Res. 1. p. 300."* It is probably this substance which is mentioned in Persian works, under the names *kawind* and *sheerbung,* being described as a concrete oil like fat, produced by the fruit of a tree of Yemen and Abyssinia. Mr. Park describes the Shea butter as forming an important article in the food of the natives, supplying every purpose of oil and butter; and states that the growth and preparation of this commodity seem to be among the first objects of African industry, as it forms one of the main articles of their internal commerce.

It might also become so in India, where its congeners thrive so well: or the cultivation of the Fulwa might be extended, or acclimated in the plains; as a tree introduced by the late Colonel Pleydell into his garden at Saharunpore lived for several years, and only died when six or eight feet high, on being transplanted, in consequence of the site of the garden being changed by Colonel Bird. But the *Mahwa* appears as worthy as any for extended and profitable culture in dry and barren parts of the country, as long ago recommended by Lieut. Hamilton (As. Res. l. c.), especially as its produce, being independent of rain or irrigation, would yield a crop even in times of famine; for the same reason the Carob tree has been recommended for cultivation at p. 165. The dried flowers, the oil, and the spirit of the *Mahwa,* all form articles of commerce, and the timber is of excellent quality for some parts of ship-building; but in India, as formerly in England, according to the editor of Evelyn's writings, " men are not planters but destroyers of wood, without thought of the future."

109. MYRSINEÆ.

The *Myrsineæ,* called also *Ardisiaceæ* by some botanists, have been shown by Mr. Brown to be related on one hand to *Sapoteæ* through *Jacquinia,* and on the other to *Primulaceæ,* though they differ much from the latter in habit. M. A. De Candolle in his late review of the order (Lin. Trans. xvii. p. 95), has suggested an analogy with the distant order of *Rhamneæ,* and has stated the difficulty which arises from the genus *Mæsa* (*Bæobotrys*) having a great number of seeds, as in many *Primulaceæ,* and an inferior ovarium, as in the well-known and anomalous genus *Samolus,* but thinks it best

* Mr. Brown, in the *App. to Denham and Clapperton's Travels,* p. 239, states, that the only plant of this family in the Herbarium is the *Micadania,* or Butter-tree of Soudan. The specimen, though very imperfect, he has identified with the specimens of M. Park's Shea-tree in the Banksian Herbarium. " Whether this plant," Mr B. adds, " is really a Bassia is not equally certain; and the seed at least agrees better with *Vitellaria paradoxa* of the younger Gartner (*Carpol. tab.* 205,) than with that of *Bassia* figured by his father." (De Fruct. et Sem. Pl. t. 104).

best to include among *Myrsineæ* the tribe of *Mæseæ*, and in *Primulaceæ* that of *Samoleæ*. With regard to their distribution, he remarks, that they grow commonly on the hilly and mountainous regions of the hottest parts of the globe. None have yet been found beyond the 39th or 40th degrees of latitude, *viz.* in Japan. The 180 known species are distributed as follows: 112 in Asia and New Holland, 48 in America, and 20 in Africa; that is, at the Cape and in the Islands. Of the above, 36 species are found in India.

Of the genera occurring in India, *Myrsine* and *Ardisia* are common to Asia and America, and the first exists also at the Cape, Azores, Canaries, China, and Japan. *Ægiceras, Embelia,* and *Mæsa,* are found in the Indian Archipelago and the Burmese territories; the first, also, indeed the same species, *Æ. fragrans,* spreads to New Holland, is common in the Delta of the Ganges, and the coasts of the Peninsula; whence it has been well-figured by Dr. Wight (Bot. Misc. Supp. t. xxi). *Mæsa* occurs also in Arabia and Madagascar. *Choripetalum* is a new genus formed by M. A. De Candolle of two plants, one from Nepal and the other from the Indian Peninsula. *Myrsine, Mæsa, Ardisia,* and *Embelia,* are found in the Indian Peninsula and Silhet, whence they spread along the foot of the mountains to Nepal and the Deyra Doon: the two first alone ascend the mountains in this northern latitude; but *Ardisia* is found on the Silhet mountains as well as on the Neelgherries.

Ardisia (*solanacea,* Roxb.) *humilis,* Vahl, already the most widely-diffused species of the family, is that which runs furthest north, being found in the forests below Nahn; and *Embelia* (*Samara?* Ham.) *picta,* Wall. 2302, first found at Goalpara, extends north even to below Sabathoo, along the so frequently alluded to tropic-girt base of the Himalaya. Here also occurs *E. robusta,* first found on the Rajmahl Hills. In ascending we are deserted by all, except species of *Myrsine* and *Mæsa;* of the former *M. bifaria, semiserrata,* and a new species, *M. acuminata,* nob. are found as high as Mussooree, with *Mæsa argentea* and *M. indica;* the last is also common about Suhunsudhara.

The properties of *Myrsineæ* are not well-known, but some of them afford wood of good quality, though small. M. A. De Candolle has observed in them a "disposition to produce a resinous substance, which appears as dots or *reservoirs* in different parts of the plant, chiefly in the leaves, flowers, and berries." The berries of *Embelia Ribes* are collected in the Silhet district, and mixed with black pepper by the small traders in that article, and the fraud is assisted by their being possessed of some degree of pungency (Roxb.), which M. A. De Candolle ascribes to the quantity and some peculiar quality of the resinous substance. The berries called *bae bhirung* are, however, also collected for medical use, as they are considered by the Natives in the northern provinces to be cathartic and anthelmintic: those of *E. robusta* are substituted for them under the same name, as we have seen is done with *Symplocos paniculata* for *S. racemosa.* Cathartic properties are also ascribed, and it is to be remarked, by people unacquainted with the natural affinities of plants, to *Myrsine bifaria,* which is used in India under

the name *manus-rohunee.* It is frequently called *Box* by Himalayan travellers, from its general resemblance to that common ornament of English gardens.

110. OLEACEÆ.

The Olive tribe so favourably known by one of its species having been dedicated to Minerva, and having become the symbol of peace, is sometimes united with the Jasmines; at others the *Fraxineæ* are separated from them either under this name or that of *Lilaceæ.* It may therefore be inferred, that though closely allied, as proved according to M. De Candolle, by their grafting on one another, yet there are some differences of structure, which may account for the differences of climate in which they are found.

Thus, species of the genera found in the Himalayas at moderate elevations, as *Fraxinus, Ligustrum,* and *Syringa,* form some of the most common plants in Europe; the first occurring also in great numbers in North America, the second in China, and the last in both Persia and China: while *Linociera* (*Chionanthus,* Roxb.), occurring only in warm countries, as the West-Indies and the Mauritius, is found in India, in Silhet, Ceylon, and both the Indian and Malayan Peninsulas. *Chondrospermum* is a new genus found in the last and near Chittagong. *Olea* is not only the best known genus, but that which has the most extensive distribution, being found as far north as the South of Europe, southwards at the Cape of Good Hope, and in New Holland; eastward in China and Japan; and westward in the Canary Islands. So in the Himalayas we have species of the genus extending from the Sutlej to Silhet, and along the Malayan Peninsula as far south as Cape Rochado. The genus, however, seems opposed to great extremes of heat or cold, as I have only seen species in sheltered vallies and at moderate elevations in the Himalayas; as *O. glandulifera* at Suhansudhara and the valley leading to Kuerkoolee, as well as near Jurreepanee; and *O. ferruginea* in the valleys of the Jumna and Sutlej: *O. acuminata* probably also occurs in such situations, as it extends from Kemaon to Silhet and Penang. *O. compacta, grandiflora,* and *robusta* (*Phyllyrea,* Roxb.), are the other Himalayan species, the last found on Chirraponjee and the Morung Hills. The Himalayan Lilac is found in Kemaon, and in Sirmore on the Suen range and the banks of the Giree and Jumna rivers. Of the Himalayan Ashes, *Fraxinus floribunda* is found in Nepal, and *F. zanthoxyloides* in Kemaon, as well as on the northern face of the Himalaya near Meeroo in Kunawur.

The bark and leaves of some of this tribe are bitterish and astringent, as are the capsules of the Lilac, hence some have been employed in tanning leather and others as febrifuges. The flowers of some are fragrant like those of their allies the Jasmines; those of *Olea fragrans* are used by the Chinese for flavouring their tea. The timber of many is of very good quality in India, as in other parts of the world. Some of the Ashes are remarkable, like the Sugar maples to which in some respects they are allied, for the sweetness of their sap, which on concreting by exposure to the sun is so well known as Manna. Of this several kinds are known in India; 1st, the best, called *sheerkhisht,*

is

is said to be procured from a tree of Khorasan, perhaps a species of this very genus: 2d, Toorunjbeen, the produce of *Alhagi Maurorum*, v. p. 194: 3d, Guzunjbeen, of a Tamarisk, p. 214: and 4th, *shukhr-ool-ashur*, produced on *Calotropis procera*, or a kindred species (v. *Asclepiadeæ*); and 5thly, one kind is mentioned as being obtained on an umbelliferous plant.

But the Olive alone is of much importance, and this so much so, as to have been called by one author, "a mine upon earth;" it is remarkable, too, for a peculiarity adverted to when treating of the Melias (p. 143), for containing oil in the fleshy part of its pericarp, instead of, as is usual, in the kernels of the seeds. Like the Manna ash it flourishes only in the warm and even arid parts of the world, as the South of Spain and of France, in Sicily, Syria, and the North of Africa; or as the Baron Humboldt has stated it, "the olive flourishes between the parallels of 36° and 44°, wherever the annual temperature is from 62°.6 to 58°.1, where the mean temperature of the coldest month is not below from 41° to 42°.8, and that of the whole summer from 71°.6 to 73°.4." But as from the recent travels of Mr. Bové, we learn that the olive thrives successfully in Egypt, it is evident that it is capable of bearing a still greater degree of heat, and yet yielding a profitable crop; for Delile states, as already quoted at p. 163, "les vignes, les olives et les roses, contribuent à la richesse de Fayoume," which is nearly in the latitude of Cairo, and the mean annual temperature of Cairo is 73°.3, that of summer 85°.10, and of winter 58°.46. It is probable, therefore, that the olive might be successfully cultivated in the north of India, which corresponds with Cairo in latitude, agrees in many respects with Egypt in climate and vegetation (v. p. 159—161), and where, by ascending the mountain-side, any degree of temperature may be obtained for varying and insuring success in our experiments. Besides, the olive appears to have been originally introduced from Asia into Europe, and is well-known to the Arabs and Persians by the name *zuetoon*, derived apparently from the Hebrew *zait* (Harris's Dict.). It has grown for many years in the open air in the Calcutta Botanic Garden, so far south as to be just within the tropic.

Olea ferruginea; foliis coriaceis lanceolatis mucronatis subtus ferrugineis, ramis rotundatis cinereis, racemis axillaribus paniculatis multifloris.—*O. cuspidata*, Wall. Cat. n. 2817. Tab. 65. fig. 1. (*a*) corol opened; (*b*) calyx and bifid stigma; (*c*) drupes; (*d*) one transversely, and (*e*) longitudinally divided; (*f g*) seed transversely and longitudinally divided.

Hab. Banks of Jumna and of Sutlej, near Turanda. Dr. Wallich's query (*O. sativa ?*) having induced me to think that his plant must be distinct from mine, I regret the plate having been struck off before I discovered that they were the same.

Syringa Emodi; (Wall. Cat. n. 2831) frutescens; foliis latis oblongis utrinque attenuatis apice quandoque obtusis reticulato-venosis junioribus subtus albescentibus.—Tab. 65. fig. 2, (*a*) corol opened; (*b*) calyx and bifid stigma; (*c*) capsule; (*f*) seed seen in front; (*e*) laterally.

Hab. Kemaon versus Himalayanum. *Wall.* Suen and Kedarkanta above the Giree and Jumna rivers.

111. JASMINEÆ.

The plants of this family were formerly united with those of the preceding, but have been separated by Mr. Brown and form a very natural group, distinguished, among other

other characters, by the want of symmetry between the number of the stamens and those of the divisions of the calyx and corolla. In this respect they serve to connect the preceding with the following, and some other orders in which a like want of correspondence is observed.

The Jasmines are found in small numbers in Tropical islands, in Africa and South America, as well as in China and New Holland; but in great numbers in the East-Indies, whence they extend into Arabia and Persia, and from that to the South of Europe, where *J. fruticosum* is found, as well as *J. odoratissimum*, introduced from the Island of Madeira. *J. officinale* has become so naturalized in the gardens of England, that we cannot believe it, as generally supposed to be, a native of India, as we know no other instance where a shrub from the plains or southern parts of that country has become acclimated so far north: but the common name of the Jasmine in the languages of Europe indicate their origin from the Arabic name *Yasmeen*. *J. grandiflorum* is the most nearly allied species, and this flourishes in the hottest parts of India: Dr. Wallich has, however, obtained specimens from the mountains of Kemaon, which he has referred to this species, and which are very similar to some I have gathered on such mountains as Dhunoultee, Suen, Acharanda, Kedarkanta, and Urrukta. These I have been in the habit of considering as *J. officinale*, as it is not usual to find the same shrub, common in the plains and at 7,000 and 8,000 feet of elevation in 30° of N. latitude. The other mountain species are *J. dispermum*, found in Nepal, Kemaon, and at Mussooree, and which I found in great abundance in descending from Bechur-bagh on the Suen range to the Giree river. The other mountain species are yellow-flowered, as *J. pubigerum*, Don., *glandulosum*, Wall., and *chrysanthemoides, nob.*, as well as *J. nanum*, allied to *J. humile*, which descends from Mussooree to the Deyra Doon; in the latter are also found *J. hirsutum* and *arborescens*. The species most commonly cultivated in gardens are *J. chrysanthemum* and *grandiflorum*. *J. laurifolium* from Chirrapoonjee is highly ornamental, and *J. Zambac* is remarkable for frequently exhibiting several corols, one contained within the other, with the innermost only occasionally bearing stamens.

Nyctanthes arbor tristis or Hursinghar, cultivated in every garden, with the native site of which Dr. Roxburgh expresses himself as unacquainted, is extremely common along the foot of the mountains which skirt the Deyra Doon, and may be seen for several hundred feet above Rajpore in the ascent to Mussooree. I have also met with it further north on the Suen Range in the descent to the Giree. Dr. Wallich also found it in a wild state near the banks of the Irrawaddy, on the hills near Prome; and as there can be no doubt about this species even to the most sceptical, it affords a very satisfactory instance of the extensive distribution of the same species along the base of the mountains, even when separated by 12° of latitude, or from 18° to 30°.

The Jasmines, like the Olives, though in a less degree, are possessed of a slight degree of bitterness in their leaves, but are conspicuous for their delicate fragrance; which is, however, of so evanescent a nature, as only to be fixed by the flowers being

immersed

immersed in some of the finer of the expressed oils. The *Hursinghar* scents the gardens with its delightful perfume only during the night, covering the ground in the morning with its short-lived flowers, which being collected like those of the *Chumbelee*, are strung on threads and worn as necklaces, or entwined in the hair of the native women. The tubes of the corols are moreover dried and used for dyeing an orange colour.

112. POTALIACEÆ.

This small order, pointed out by Mr. Brown (Tuckey's Congo, p. 449), has been established by Von Martius, and is allied to both *Apocyneæ* and *Loganieæ*, and is, like the latter, found in the tropical parts of Asia, Africa, and America. The species of *Fagræa* are found in the Islands of the Indian Archipelago, in both the Indian and Malayan Peninsulas, and at the foot of the ramifications of the Himalaya, in the forests of Silhet. The properties of the plants of this genus do not seem to have been examined; those of *Potalia* are bitter and acrid.

113. APOCYNEÆ.

The *Apocyneæ*, remarkable for abounding in milky juice, are allied to the preceding as well as the following order; by the celebrated Jussieu, indeed, they were united with *Asclepiadeæ*. Both are allied to *Rubiaceæ* and *Gentianeæ*, from the former of which they are distinguished by their superior fruit, and from the latter by their minute embryo, double ovaria, and milkiness, and from both by their contorted flowers.

The *Apocyneæ* are chiefly found in the tropical parts of the world, as in Asia, Africa, America, and New Holland, where many of them form trees of considerable size; but like many other tropical families, they extend in small numbers, and in a herbaceous state, beyond the strict limits of a tropical climate. Thus we have *Apocynum* in Siberia and N. America, *Vinca* in the latter as well as in Europe; *Amsonia* occurs in Japan, and *Carissa* as far south as the Cape of Good Hope. The Oleander, *Nerium odorum*, which I was delighted on first recognizing, growing wildly luxuriant on the banks of rivulets, at the foot of the Nahn Hills, is found in similar situations, or on the sides of water-courses in Syria, Egypt, and Barbary, and in the South of Spain, on the banks of the Guadalquiver.

In India they chiefly prevail in the Peninsula and the southern parts of the Bengal Presidency, as the forests of Silhet, from whence they extend to those bounding Nepal, and southwards into the Burmese territories and the Malayan Peninsula, and from that into the Islands. These belong to the genera *Beaumontia*, *Holarrhena*, *Cryptolepis*, *Alstonia*, *Willoughbeia*, *Melodinus*, *Hunteria*, and *Ophioxylon*. *Urceola* is confined to the Malayan Peninsula and Sumatra, and *Alyxia* does not extend further north. *Vallaris*, *Wrightia*, *Carissa*, and *Strychnos*, extend from thence into New Holland, where are also found *Parsonsia*, and *Tabernæmontana*, which also occur as well as *Echites* and *Cerbera* in both India and America. *Strophanthus* is common to India

India and Africa, as are *Ichnocarpus* and *Carissa* found at the Cape of Good Hope, and *Strychnos* in the Island of Madagascar.

The genera and species which extend furthest north in the belt of forest are *Echites macrophylla, Holarrhena pubescens, Ichnocarpus fragrans, Cryptolepis reticulata, Wrightia mollissima, Tabernæmontana coronaria,* and *Alstonia scholaris,* the last occurring as far north as Mirzapore, in the state of a handsome tree, and probably still further, as there is a specimen from Dr. Govan marked A. *cuneata* in the E. I. Herbarium, which does not appear to be more than a variety. Those found also in the open plains are *Carissa Carandas, Ichnocarpus frutescens, Vallaris dichotoma,* and *Vinca parviflora.* I have not observed any of the family at any great elevation in the mountains, but *Gardnera* referred here has one species *G. angustifolia* in Nepal, *G. ovata* in Silhet, and *G. Wallichii,* in the Indian Peninsula.* Many of those from the South succeed well in Northern India, as *Wrightia coccinea* and *tinctoria,* the first ornamental for its flowers and useful for its timber; the other, indigenous over a tract of 1,000 miles, is valuable for the indigo of the best quality which is yielded by its leaves, and is recommended by Dr. Roxburgh for cultivation, because less dependent on rain and irrigation, and being a perennial which grows freely and throws out shoots rapidly as they are cut away. With these many S. American trees have become perfectly naturalized, as *Cerbera Thevetia, Allamanda cathartica,* and *Plumieria acuminata;* the last I have seen in a luxuriant state in the garden in the Pinjore Valley.

The *Apocyneæ* abound in a milky juice, with which some acrid principle is frequently combined, rendering the whole suspicious and many highly dangerous; but owing to the absence of this acrid principle, the milk of some is of an innocuous nature, as exemplified in the Milk-tree, or *Hya-hya,* of Demarara, referred to this order and called *Tabernæmontana utilis* by Mr. Arnott. (*Lindley, Nat. orders,* p. 214.)

This milky juice is frequently of a tenacious nature and abounds in Caoutchouc. Thus, in Sumatra, *Urceola elastica* yields that substance as a *Vahea* does in Madagascar, and birdlime is prepared from the *Voacanga;* as in India from species of *Ficus,* some of which, especially *F. elastica,* yield Caoutchouc. It is, probably, owing to the presence of this principle, that some of the species are, in this and the kindred family of *Asclepiadeæ* idnebted for the tenacity of their fibre, as *Nerium piscidium, Marsdenia* (*Asclepias,* Roxb.), *tenacissima,* &c. *Willoughbeia edulis* also yields Caoutchouc, but of indifferent quality (Roxb.) Several yield good timber, as *Wrightia coccinea,* which for its lightness and strength is used in making palanquins in the South, while in the North of India that of *W. mollissima* is used by turners; *Holarrhena pubescens* (*koora*), yields light wood, and species of *Strychnos* some of superior quality. The bark of some is astringent and febrifugal as that of *Wrightia antidysenterica,* called *Conessi,* and

* This genus was referred by Dr. Wallich to *Loganieæ* (Fl. Ind. ed. Wall. 1. p. 400), but subsequently considered as a distinct order (v. Catalogue). It has been referred by Dr. Lindley to *Apocyneæ,* and forms the section *Gardnereæ* of that order, in the "Conspectus Regni Vegetabilis" of Von Martius.

and which has been introduced into European practice. Both the bark and seeds have long been employed by the Asiatics, and are the *Tiwaj* and *lissan-ool-asafeer* of the Arabs, who assign to it the Greek name of *andursaroon*. The Hindoos call it *indurjuo*, and distinguish the seeds by the name of *indurjuo shereen* (mild), from those of *Holarrhena antidysenterica* and *pubescens*, which they call *indurjuo tulkh* (bitter). The name *koora*, applied in different parts of India to these three plants, the two last being substituted for *Wrightia antidysenterica* where this is not indigenous, is evidently the *Coru* or *Cura* of Crist. d'Acosta (*Clusius. Exot*, p. 265), of which the Malabar name he informs us is *Curodapala* (Codagapala? Ainslie Mat. Ind. 1. p. 88), a tree with pinnate leaves and milky juice, of which the bark is much used on the Malabar Coast in affections of the bowels. *Ichnocarpus frutescens* is one of the plants sometimes used as a substitute for Sarsaparilla, and *Ophioxylon serpentinum* has derived its specific name from its employment in snake bites: by Dr. Horsfield it is described as febrifugal and a valuable remedy in various disorders.

The presence of the acrid principle, however, in a greater or less degree, renders many of the *Apocyneæ* highly dangerous, as the *Oleander*, known from ancient times; as it is the νεριον of the Greeks, corrupted in India into *sirion*, as *dufle*, its name in Avicenna, is probably a corruption of *Daphne*. *Nerium piscidium*, Roxb. also contains a principle dangerous to fish in the water where it is washed, for the sake of its tough fibres. *Vinca parviflora* is applied in India as an external stimulant in cases of lumbago. Some of the species of *Plumieria* are used in diseases of the skin; and others, as *P. acuminata, alba,* and *obtusa,* rank in Java as purgatives; probably in consequence of their acrid nature. The *Cerberas* are, however, of a much more dangerous nature, though the leaves of some are also employed as purgatives, as of *C. Thevetia* and *Manghas;* but the seeds of the latter are described as narcotic: and *C. Tanghin* (*Tanghinia veninifera*, Pet. Th.), the Tanghin tree of Madagascar, is so powerful a poison, that a single seed is said to be sufficient to destroy twenty persons. (Bot. Mag. 2968.)

The different species of *Strychnos* have appeared to some authors to differ so much in properties from the rest of the *Apocyneæ*, as to render advisable their separation into a distinct order, which they call *Strychneæ;* but there is little difference in this respect between these and those last mentioned. Thus, like some of the *Cerberas*, the seeds of *Strychnos Nux Vomica*, and of *S. Ignatii*, and of *S. Tieute*, one of the kinds of Upas, are powerful poisons: the first, from its excitant properties, is in moderate doses employed in medicine, especially in palsy of the lower extremities; while the second, called in India *papeeta*, is by the Hukeems considered in small doses tonic, and is employed by them in cholera, as is another powerful poison, the root of *Aconitum ferox*. The *Nux Vomica*, called in India *Koochla*, is the *Azarakhee* or *Adarachi* of Avicenna; the wood of the tree is described by Dr. Roxburgh as exceedingly bitter, and used to cure intermittent fevers and the bites of venemous snakes: so in Brazil the bark of *S. pseudo-quina* is described as being the most powerful substitute for Peruvian bark; in

in Java, according to Dr. Horsfield, *S. colubrina* is so employed; and in India a fourth kind of *Strychnos* called *Naga-Musadi* (Roxb.), is employed for the same purposes. The seeds of *S. potatorum,* Nirmulee of natives, are sold in every bazar for the purpose of clearing muddy water. Bitter almonds are said to be employed in Egypt for the same purpose, as those of the *Kola* are in Africa. Notwithstanding the poisonous nature of the seeds, the pulpy part of the fruits of some species is eaten by the natives of the countries where they are indigenous, as those of *S. innocua* in Egypt, of *S. pseudo-quina* in Brazil, and of *S. potatorum* in India, and even that of *S. Nux Vomica* by birds. (Roxb.) To these exceptions to the general hurtful nature of this order must be added, *Melodinus monogynus,* and *Willoughbeia edulis* in India, *Carissa edulis* in Nubia, and the Cream fruit of Sierra Leone; all of which yield edible fruit, while that of *Carissa Carandas* is also eaten in India and made into a jelly forms the best substitute for that most commonly employed in Europe.

114. ASCLEPIADEÆ.*

The plants of this family having been separated by Mr. Brown from *Apocyneæ,* on account of the peculiar nature of their sexual apparatus, necessarily partake in the affinities of that family, and have much the same character though a wider range of distribution. Thus, though we find them in abundance in the tropical parts of the world, they also occur in considerable numbers beyond their limits, as at the Cape of Good Hope and in New Holland, and to the North in Europe, Siberia, North America, and Japan.

At the Cape there are numerous species of *Stapelia,* so in the drier parts of the Peninsula, which, like the arid parts of N. India, we have seen to resemble the Flora of Africa, we have species of *Caralluma, Boucerosia,* and *Hitchinia,* which were formerly referred to *Stapelia.* On the arid banks of the Jumna, which has been shewn to be the limit to which the plants extend having a resemblance to the African Flora, we have *Dæmia extensa,* and from thence extending to Umballa, a large town in the plains to the N.W. of Saharunpore: the other species of the genus being found in Egypt and Arabia. *Leptadenia spartium* I found on the banks of the Jumna, where it had before been found by Dr. Hamilton; the other species being found in the Peninsula and in tropical and Northern Africa. *Pentatropis microphylla,* of which the first species was mentioned by Mr. Brown in Salt's Abyssinia, and *Hemidesmus indicus* occur in the same situation with *Calotropis Hamiltonii* of Wight, which was considered by Dr.

* The Indian plants of this family having been described and published by Dr. Wight, in his "Contributions to the Botany of India," it is necessary to observe, that his names are those which have been adopted in this work; and as Dr. Wight has given a copious list of Synonymes, under each of the older plants, little difficulty will be experienced in ascertaining those previously described. The Author feels much indebted to Dr. Wight for having described the *Asclepiadeæ* in his collection; and all Botanists must do so, for his having undertaken so difficult and numerous a family as the Indian *Asclepiadeæ,* of which many no doubt still remain to be discovered, as there appear to be several undescribed species among the late General Hardwicke's Drawings.

Dr. Hamilton to be identical with the Persian *C. procera*. *C. gigantea* is chiefly found in the Peninsula and Bengal.

The genera found in the Southern parts of India, some of them extending into the Indian and others into the Malayan Peninsula, with some of the same species common to all these situations, are such as *Dischidia, Sarcolobus, Finlaysonia, Goniostemma, Physostelma, Raphistemma,* and *Toxocarpus*. *Pentasachme* and *Pterostelma* are found on the Silhet Mountains, and *Brachylepis* on the Neelgherries; *Iphisia* is found on the latter and the Himalayas.

Of genera common to other parts of the world and India, but confined to its Peninsula, we have *Sarcostemma* and *Secamone*, both of which are found in Africa and New Holland; the first also in S. America. Of those which are peculiar to India, and extend from the southern to the more northern parts of that country, are *Heterostemma*, of which the species, very irregular in structure, are also so in distribution, as one is found in the sands of Tanjore, and the other two species in Nepal; of these, one, *H. alata*, extends to Mussooree: *Streptocaulon* spreads from Singapore and the Indian and Malayan Peninsulas to Nepal and the Deyra Doon; the same species, *S. calophyllum*, is found in Nepal and at Suhunsudhara: *Orthanthera*, a new genus formed by Dr. Wight, has been found near the Hetounda and Kheree Passes, and in the forests of Rohilcund: *Pergularia*, found also in China, extends from the Indian and Malayan Peninsulas to the neighbourhood of Nahn. *P. odoratissima* being most common in the southern, and *P. pallida* in the northern provinces of India. The genera which are common to India and New Holland, and which also extend to the most northern limit of the former country, are *Marsdenia, Gymnema, Oxystelma, Tylophora,* and *Hoya:* the two last are also found in Java, the first both in the West-Indies and Syria. *Ceropegia* has a very wide distribution, being found in the West-Indies and North America, at the Cape of Good Hope, in Madagascar, and from the southern to the most northern parts of India, where it also ascends the mountains, as some species do the Silhet and Pundoa Mountains; *C. elegans* is found at 6,000 and 7,000 feet of elevation on the Neelgherries; *C. Wallichii* exists at similar heights, though in a more N. latitude, at Mussooree and Simla, as well as *Iphisia Govanii, Marsdenia Roylei, Tylophora tenerrima,* and *Hoya longifolia;* the last is also found on Sheopore and *H. linearis* on Chundraghiry. Two species of *Eriopetalum* are found on the arid slate hills near Doongee, and the third was found by Dr. Hamilton at Gorukpore. *Gymnema sylvestris* is common to the Peninsula of India and the neighbourhood of Canton; *G. tingens* extends from the forests of Lower Assam to the Kheree Pass, and *Tylophora pauciflora* from the Peninsula and Bengal to Suhunsudhara. The genus *Cynanchum* is, perhaps, the most widely-diffused of the family, being found to the South in New Holland, to the East in China, with a few species at the Cape of Good Hope, and in the North of Africa, it also extends West as far as Mexico and the Andes of Quito; species are found every where in Europe except Great Britain; and from Astrachan to Siberia and Dahuria. So in India we have species in the Malayan and Indian Peninsulas,

also from Silhet and Chirraponjee to Nepal, and from that to Mussooree and Simla, as well as in Cashmere, whence I have received a specimen of *C. Dalhousiæ*, found also in the two last-mentioned places: on the northern face of the Himalayas or in Kunawur, three or four species are found, as *C. auriculatum, Kunawurense,* and *Roylei,* with *Holostemma Rheedii,* at Turanda, which is in the valley of the Sutlej.

The *Asclepiadeæ,* like their allies the *Apocyneæ,* abound in a milky juice, which is, however, less acrid in nature, as a greater proportion of the family are innocuous, some edible, several useful as medicines, and few known as poisons. It is more than probable that Caoutchouc is contained in several, as *Cynanchum ovalifolium,* according to Dr. Wallich, (Asclep. Herb. No. 82) yields excellent Caoutchouc at Penang; the tenacity of some species may be owing to its presence, as of *Marsdenia tenacissima,* employed for bowstrings by the Mountaineers of Rajmahl; the fibre of this plant and of *Urtica tenacissima* were the strongest Dr. Roxburgh ever met with. Another plant of this family, *Orthanthera viminea,* attaining a height of ten feet, is also remarkable for the length and tenacity of its fibres. This grows luxuriantly along the foot of the mountains, and its long, straight, leafless, slender, and wandlike stems, point it out as seemingly well suited for rope-making. Like the *Apocyneæ* here also some plants yield indigo of excellent quality, as *Marsdenia tinctoria,* found in Silhet; and as the plantation, like that of *Wrightia tinctoria,* has the advantage of being permanent, it might be well suited to some parts of India. *Gymnema tingens* is also used in dyeing.

Of the innocuous plants may be mentioned the *Stapelias* of the Cape; *Gymnema* (*Asclepias*) *lactiferum* is said in Ceylon to yield a mild and copious milk; *Sarcostemma brevistylum* (*Asclepias acida* and *aphylla,* Roxb.), a milky juice of an acid nature which is taken by the natives to quench their thirst. (Roxb.) Cattle eat the roots of *Oxystelma esculentum;* wild hogs those of *Ceropegia bulbosa* (Wight), and men every part. (Roxb.) So *Pergularia edulis* and *Periploca esculenta* are described as being edible; as *Asclepias stipitacea* and *spiralis* are said by Forskal to be in Arabia. Owing, however, to the presence of an active principle, some of the species are employed in medicine, as *Asclepias decumbens* and *tuberosa,* for diaphoretics in America: so in India *Tylophora* (*Asclepias,* Roxb.) *ashmatica* has been considered an efficient substitute for Ipecacuanha, and an excellent remedy in dysentery. *Hemidesmus indicus* (*Asclepias pseudosarsa* Roxb.) is considered by the medical officers on the Coromondel Coast as an efficient substitute for Sarsaparilla in the cure of Syphilis, Scrophula, and cutaneous affections, while *Secamone emetica* (*Periploca emetica,* Retz.) probably contains a greater proportion of the acrid principle, as it is emetic in its action, as are *Asclepias curassivica* and *Vincetoxicum, Cynanchum tomentosum,* &c. Others, however, of the *Asclepiadeæ* act as purgatives, as *Cynanchum Arghel,* of which the leaves are employed to adulterate Senna; *Cynanchum monspeliacum,* said to yield French scammony (Fée), as *Periploca Secamone* (*Secamone* of Prosper Alpinus from the *Sukmoonya* of the Arabs), does that of Smyrna, *Asclepias syriaca* is acrid and caustic, and *Periploca græca* is described as being acrid and poisonous.

Valuable

Valuable as it is probable that some of this family will prove as medicinal agents, the *Mudar*, *Calotropis* (*Asclepias*, Auct.) *gigantea* is the only one that has yet attracted any attention in Europe. This has long been employed as an article of the Indian Materia Medica, by the native practitioners, with their many other very efficient remedies. It is called *Arka* and *Akund* in Sanscrit, and *Ashur* by the Arabs; it is the *Ak* and *Mudar* of the Hindoos, to which *jumakioos* is assigned as a Greek name. From the united testimony of Europeans and natives, there is no doubt of its being a powerful alterative in leprosy, elephantiasis, &c. (v. *Ainslie, Mat. Ind.* 1. p. 486.) From this plant Dr. Duncan obtained "that singular substance Mudarine, which possesses the property of coagulating by heat, and becoming again fluid on exposure to cold." *Wight*, l. c. Another, but a less known product, is obtained on the Mudar, or some nearly allied species, probably the *Calotropis procera* of Persia: this is a sweetish exudation formed on the plant in consequence of the puncture of an insect called *gultigal*; the substance is called *sukkur-ool-ashur*, and *ak* or *mudar-ke-shukur* (sugar). The species most common in the Northern provinces, and nearly allied to the Persian *C. procera*, is *Calotropis Hamiltonii*, of Wight, which obtains among the natives the same names as *C. gigantea*: it possesses also many of the properties of that species, as I have proved from prescribing it in cases of incipient leprosy and cutaneous affections, in the civil and military hospitals at Saharunpore.

It is much to be desired that these experiments should be repeated and others instituted, on the plants of this as well as of other families, for I have no doubt that, with a diminution of the prejudice in favour of things brought from a distance, it will be found, that India is capable of producing, and does produce, many as efficient as those which have to make a series of voyages before they can be brought into use. For it must be allowed, that the climate is favourable for the production of drugs of the most energetic nature, as may be witnessed in the *Nux vomica*, the *Aconitum ferox*, Opium, Bhang, Datura, &c. among narcotics; Croton Tiglium, Jatropha, Castor-oil, Turbith, and Senna, as cathartics; among tonics and febrifuges, the Rohuna (*Soymida febrifuga*), Kutkurunja (*Cæsalpinia Bonduc*), which has long maintained its station in the Materia Medica of the East, with the Gentian, Cheretta, Creyat, and several others as bitters; the Catechu, Kino, &c. as astringents, and innumerable mucilaginous demulcents. It is improbable, therefore, that India should be deficient only in those of which the physical properties being less obvious, and the effects on the human system less decided, require for their discovery and ascertainment nicer powers of discrimination. But as numbers of the Medical Establishment possess the requisite qualifications, it is to be hoped that some may be induced to investigate the properties and powers of the Indian Materia Medica. The sensible properties will frequently yield considerable assistance, while the natural affinities of the plants will shew the strong probability of their possessing much the same powers as some of their congeners: at least, the experience of the Natives will often give assurance to the inferences we may have deduced, and confidence in prescribing a new medicine, by attending to the

doses in which they themselves are in the habit of administering it. Chemical analysis, finally, will reveal the hidden principle, and enable us to dispense with the great mass of vegetable matter which is now prescribed for the sake of a few grains of energetic principle. Perseverance in such a course for a few years will not only encrease the present resources of medical officers wherever they may be situated, but by attaching a definite character to many of the articles they now employ, will give them value in Europe; ensure to some of them importance as commercial articles; and have, at the same time, a result not less important to a philanthropic mind, that of placing within the reach of the immense Native population, a better defined selection of efficient agents from their heterogeneous mass of materials than their scientific attainments will at present enable them to select. A result which will be appreciated in proportion to the improvement of the education of the Native Doctors now taking place under the auspices of Government; the effects of which will, in India as elsewhere, descend lower and spread wider with the lapse of years.

Orthanthera viminea. Wight. Contrib. to Botany of India, p. 48. Tab. 66. f. 1.

Hab. Base of Himalayas, v. supra.

2. *Holostemma Brunoniana.* Tab. 66. f. 2.

I regret that I have been unable to find the specimens from which this very elegant plant has been drawn, and which I have named after the illustrious botanist, Mr. Brown, who first threw light on the order to which it belongs, and to whom has been unanimously awarded, by the botanists of Europe, the title first bestowed on Linneus, of "Botanicorum Princeps."

3. *Ceropegia Wallichii.* Wight. l.c. p. 32.

Hab. Nepal. *Wall.* Lohooghat, in Kemaon. *Lindsay.* Mussooree and Simla.

115. GENTIANEÆ.

This family, so familiarly known by many of its species forming medicinal plants, as well as the ornaments of gardens, is "allied on one hand to certain *Apocyneæ*, and on the other to *Polemoniaceæ*, and *Scrophularineæ*." Though all the species are very closely allied in structure and properties, they display the anomaly of some growing in very hot places, while the majority occur only in cold and temperate parts of the world.

The Indian species are about sixty in number, of about four-sixths of which there are specimens in the author's collection. These Mr. D. Don has had the kindness to examine and describe in a paper read before the Linnean Society (3d Nov. 1835). *Gentiana* and *Swertia* he has subdivided, and favoured me with the geographical distribution of his new genera; whence it will be seen that here, as elsewhere, circumscription of character is not always accompanied by a more limited distribution of a genus.

The genera inhabiting the plains of India are, *Erythræa, Canscora, Exacum,* and *Slevogtea*. The first, found in the south of Europe, north of Africa, and New Holland, occurs only in the cold weather; the others are peculiar to India. *Exacum tetragonum* extends from Silhet to Kheree; Mr. Don has united with it *E. roseum*, nob., Ic. ined., 256, from the sides of Kedarkanta, but which I consider to be distinct.

The other Indian genera are *Crawfurdia* and Mr. Don's *Agathotes* and *Ophelia*, all found only in the Himalayas, with *Swertia* and *Eurythalia*, Don, of which the other species

species occur in Europe and the colder parts of Asia. *Gentiana, Pneumonanthe,* and *Ericala,* Don, are the other genera inhabiting the Himalayas, as well as the coldest parts of Europe, North America, and Siberia: the first is also found in Ludak, in New Zealand, Van Diemen's Land; and with *Ericala,* in the Andes of Peru and Quito. Of the last genus, as constituted by Mr. Don, species are however found in the hot parts of India; as *E. orbiculata* in the Peninsula, and *E. decemfida* in the Kheree Pass. *Halenia* is found in Siberia and the Himalayas, the United States, the Andes of Peru and Quito: Mr. Don states that they are perennials in the southern, and annuals in the northern hemisphere.

In addition to *Erythræa,* the genus *Mitrasacme* belongs to both the Indian and New Holland Floras, a species of the latter having been found by Dr. Wallich in Nepal. The genus *Mitreola* occurs both in the Malayan Peninsula and Lower Assam.

The *Menyantheæ* are sometimes separated as a small family, and are distinguished by being alternate leaved, as is *Swertia alternifolia,* nob. Here, as in other aquatic genera, we find the same species in every part of India, as *Villarsia indica* and *cristata:* a European species, *V. nymphæoides,* extends even to the lake of Cashmere.

Many of the same species spread all along the Himalayas, as several of Dr. Wallich's exist also in the author's collection. Several are highly ornamental, as *Swertia speciosa,* Wall., which spreads from Nepal to Cashmere. So are also *S. cuneata,* Wall., *S. alternifolia, cærulea,* and *petiolata,* nob., with *Gentiana Kurroo,* and the species of *Crawfurdia.* The *Chirata,* found in the Morung mountains, in Nepal, and in Kemaon, referred by Dr. Roxburgh to *Gentiana,* by Dr. Hamilton to *Swertia* (Wall. Pl. As. Rar. t. 252), formed into a new genus, *Henricea* (Bull. Soc. Philom. 1824), has been referred by Mr. Don to his *Agathotes.* With it also he has united a purple-flowered variety, or species (*Swertia purpurea,* nob., Ic. ined. 254, fig. 2), which is common on the Mussooree range. *A.* (*Swertia,* nob.) *alata,* Don, is a species from the Choor mountain.

The plants of this family are so well known for their uniform and extreme bitterness, that it is unnecessary to say more than that the Indian species afford no exception to the rule. The *Chiretta* or *Chirayita* contains malic acid, bitter extractive and resinous matter, gum, and some salts (v. *Fée; and Battley in Wall.* l.c.); it is much valued in India both by European and native practitioners for its tonic and febrifugal virtues, as it answers every purpose of *Gentiana lutea.* The cold infusion is recommended by Drs. Fleming and Wallich. Several other species may be substituted for it. *Ophelia* (*Swertia,* Wall.) *angustifolia,* Don, is so in Northern India, and called *puharee* (hill) *chiretta,* to distinguish it from the true or *dukhunee* (southern) *chiretta.* *Exacum tetragonum* is called *ooda* (purple) *chiretta.* The species of *Canscora* are all bitter, as is *Erythræa Roxburghii,* Don (*Chironia centauroides,* Roxb.)

It has lately been contended by M. Guibourt, as indeed from their references it seems to have been considered by many old authors, that *Chiretta* is the *Calamus aromaticus* of the ancients. Considering that this is described by Theophrastus and Dioscorides

Dioscorides with the most fragrant and aromatic substances known in ancient times, placed also by the latter between Juncus odoratus (Σχίνος, *Andropogon Schenanthus*, Auct.) and the Balsam of Gilead tree (βαλσαμον); it appears at first sight improbable, that a pure bitter of the tribe of Gentians should be the famed and fragrant Calamus odoratus (καλαμος αρομματικος, Diosc. 1. c. xvii). The Persian authors on Materia Medica, who translated from the Arabic, give no Greek synonyme for the *Chiretta,* though almost every name in Dioscorides, as I have myself proved, may be traced out in their writings. But the Arabic name, they inform us, is *kusb-al-zurireh*. *Kusb,* a reed or cane, &c. is, in Persian works on Materia Medica, especially applied to the bamboo, for which *Kalamus* is given as the Greek name, though in Europe an *Arundo* is supposed to be the *Calamus* of Dioscorides. *Kusb-al-sukkur* is the sugar-cane, and *kusb-al-zarireh* the *Chiretta*. *Zarireh,* in Richardson's Dictionary, is translated wormwood; and *zarir,* a yellow dyeing wood, jaundice, &c. The meaning of the term applied to *Chiretta* is therefore the bitter or yellow reed or Calamus; and the older commentators on the writings of the Greeks, finding a *Calamus* among the Arabs unappropriated, have supposed it to be *Calamus aromaticus;* for the *Casab-al-daterah* of Matthiolus, (*darrira* of other authors), is no doubt the Chiretta. My own opinion has long been, and its probable correctness I hope on some future occasion to be able to prove, that the *Calamus aromaticus* is the *Andropogon Iwaruncusa,* or some nearly allied species yielding the fragrant "grass oil of Namur."

The accompanying description of the plants figured, I have been obligingly favoured with by Mr. Don.

Gentiana contorta (Royle) annua; floribus solitariis, corolla infundibuliformi 5-loba, lobis lineari-oblongis obtusis æstivatione convolutis, dentibus calycinis lanceolatis acuminatis, foliis ellipticis obtusis 5-nerviis subsessilibus.—Tab. 68. f. 3. (*a*) corol; (*b*) calyx; (*c*) pistil.

Hab. Mussooree, near Captain Debude's house and the Abbey-hill; in flower in the rainy season. I regret that I have been unable to find my specimens of this plant, from which the drawing by Luchmun Sing was made when he was there with me.

Pneumonanthe Kurroo; caulescens, subuniflora; dentibus calycinis elongatis subulatis, corolla campanulata, lobis acutis, foliis obtusis, radicalibus elongato-lanceolatis, caulinis linearibus.—*Gentiana Kurroo;* (Royle). Tab. 68. fig. 2. (*a*) calyx and pistil; (*b*) corol.

Hab. Kuerkoolee, Mussooree; Budraj, Simla. Root used in medicine by natives, and called *kurroo.*

Eurythalia coronata; subacaulis; floribus aggregatis, corolla 10-loba, sinubus lobis subæqualibus ovatis uniformibus, foliis lanceolatis acutis margine cartilagineis.—*Gentiana coronata.* (Royle). Tab. 68. f. 1. (*a*) Flowers supported by bracts; (*b*) corol opened; (*c*) calyx.

Hab. Kedarkanta, near the top of the Peak.

Swertia alternifolia; (Royle) foliis alternis! elliptico-oblongis acuminatis 7-nerviis basi vaginantibus, floribus racemoso-paniculatis, corollæ segmentis ellipticis obtusis, glandulis orbiculatis contiguis.—Tab. 67. fig. 2. (*a*) A flower.

Hab. Kedarkanta.

S. cærulea; (Royle) floribus subsolitariis, corollæ segmentis ovatis mucronulatis, glandulis linearibus distantibus, foliis inferioribus spathulatis petiolatis, superioribus calycibusque lanceolatis obtusiusculis. Tab. 67. f. 1. (*a*) A flower; (*b*) segments of corol; (*c*) of calyx separated from (*d*) the stamens and pistil.

Hab. Shalimar in Cashmere, and on Peer Punjal.

116. SOLANEÆ.

116. SOLANEÆ.

The *Solaneæ*, remarkable for containing many plants important as articles of diet, for their uses in medicine, or for giving rise to an extensive commerce, are allied in some respects to *Gentianeæ*, and in others to *Scrophularineæ*. They are chiefly found in tropical parts of the world, though they exist also in small numbers in cold countries; so we have them equally in the plains and on the mountains of India. Thus, of the genera found in Europe, *Atropa* and *Hyoscyamus* occur also in Kunawur on the northern face of the Himalaya: of the former, the species *Atropa acuminata*, nob., is nearly allied to *A. Belladonna*, and of the latter, the species is the well-known *Henbane*, or *Hyoscyamus niger*, which is here found wild as well as in Europe and Caucasus. It has been supposed to be so in the plains of Northern India; but its seeds are so extensively employed by the natives in medicine, under the name of Bunj (benjé, Avicenna trans.) that it is probable these may have occasionally escaped in the course of transmission, as they are also called *Khorassanee ujwain*. With these there is in Kunawur, a new species of *Solanum* (*S. laxum*, nob.), of a loose spreading habit. On the southern face of the Himalayas, there are a few species of this genus, as *S. lysimachioides* and *crassipetalum*, with *S. rubrum*, and a species nearly allied to, if it be not only a variety of *S. Dulcamara* on Choor; with *Physalis angulata* and *Datura ferox*, Linn., if this be different from *D. Stramonium*, common in the mountains; while *Anisodus luridus*, Link, the *Physalis stramonifolia* of Dr. Wallich, is found on Gossainthan.

This order, though numerous enough in genera, has the mass of its species belonging to the genus *Solanum*, which occurs in great numbers in the tropical parts of the world, but also extends north, as we have seen, in small numbers, as well as south, to New Holland and Van Diemen's Land. Of at least four hundred described species, only about thirty occur in India, and these chiefly in the southern parts, of which a few extend to the most northern parts, as the shrubby *S. verbascifolium*, all along the foot of the hills to the Deyra Doon; in the open plains, *S. indicum* and *Jacquini*, are common every where, with the varieties of or species nearly allied to *S. nigrum*. The common species of *Datura*, *D. fastuosa*, and *alba*, are very generally diffused, as well as *Physalis somnifera* and *angulata*. The several varieties of *Solanum Melongena*, or the Egg-plant, are every where cultivated in India and in Cashmere. Along with these may also be seen *Nicandra indica*, very closely allied to the Peruvian species, *N. physalodes*, which the natives give as one of the kinds of *Kaknuj*; *Physalis somnifera* being the other. In the arid country in the vicinity of Delhi, *Lycium Europæum* is found, which like the remainder of the species extends from the south of Europe into parts of the Oriental region and into Africa. There can be no doubt that the genera *Datura* and *Physalis* are common to the Old and New World, and therefore there would be nothing remarkable in the *Capsicum* also being so, were it not unaccountable that a plant so universally employed by even the poorest natives of India, and considered almost an essential of their diet, should be without any other Sanscrit or Hindu names (*mirchia* and *mirch*) than those assigned to the common Pepper, with the

adjuncts

adjuncts of red, green, &c., at least no Sanscrit name is assigned to it by Dr. Carey in the *Flora Indica*. Dr. Ainslie gives *mircha*, but this is also assigned to *Piper nigrum*. Mr. Brown has long ago remarked (Congo, p. 472) that "the fact of *Capsicum frutescens* being a native of Asia, seems to be set aside, merely by the appellations of *Tchilli* and *Lada Tchilli*, as given to it in the Malay Islands; *Chilli*, either simply, or in composition, being the Mexican name for all the varieties and species of this genus." The Capsicum, however, is now very extensively cultivated every where, both in the plains and mountains, and forms one of the articles of export from the latter to the former; but from this no argument can be drawn, as the same would apply to the common Tobacco, an undoubted native of America; but all may be adduced, as well as the Potatoe, coming fast into use, as strong arguments against the so frequently stated unchangeable habits of the Hindoos.

The *Solaneæ* contain so many well-known narcotic plants, that the whole may be considered of a suspicious nature; though to this, there are, no doubt, many exceptions, whether the result of the secretion of a smaller quantity of active principle in proportion to the mass of inert vegetable matter, or to the increase of the latter, in consequence of cultivation. Thus the large fruits of the Egg-plant and Tomato are both eaten, as the Potatoe, after being subjected to heat, which probably destroys some portion of deleterious principle in all, as it no doubt does in the last, as well as in the *Cassava*. Some of the species of *Physalis*, or winter Cherry, are subacid and edible; others are considered narcotic; and though the herbaceous parts of some of the *Solanums* are used as a pot-herb, Dr. Wallich has mentioned his witnessing the case of an officer, who suffered from the narcotic powers of one of these, which had been employed as an ingredient in a soup. A bitter principle is secreted by *Solanum pseudoquina*, as well as in the calyx of several species of *Physalis*. The former is in Brazil employed as a substitute for Peruvian bark, and the *Capsicums* are well known for the acrid and pungent principle they secrete.

But the great mass of species, as before stated, are possessed of narcotic properties, as may be witnessed in *Atropa Belladonna, Datura, Hyoscyamus*, and some of the *Solanums;* the powers of which are supposed to depend on the presence of the Alcaloids, *Atropine, Daturine, Hyoscyamine, Solanine*. The same properties are observed in *Solandra, Jaborosa, Mandragora, Nicandra, Physalis, Cestrum*, &c. Several of the family are employed as narcotics by the hukeems of India, as *Henbane* (*bunj*), *Datura* (*jowz-masil*, i.e. *methel*), the seeds of which are frequently employed in India for poisoning. *Solanum nigrum* (*anub ul salib*), *Physalis somnifera* (*asgund*), *Nicandra indica* (*kaknuj, al kaknegi, Alkekengi*, Auct.), though there is some doubt whether this may not have become a substitute for *Physalis somnifera*.

In the introductory observations, it has been stated that in the cold weather of Northern India, or from October to March, the annuals of Europe, whether used as vegetables or as medicines, could be successfully grown; while in the mountains, the same plants found a congenial climate from April to October. Accordingly, at these stations

stations in the respective seasons, *Henbane, Datura Stramonium,* and *Nicandra indica,* were successfully grown, and afterwards converted into extract for experiment, and subsequently for the Medical Depôts. The extract of *Henbane* particularly was highly approved of by several medical officers, and pronounced by Mr. Twining, after trial in the General Hospital of Calcutta, to be of " most excellent quality." In the same places and seasons, the Belladonna, Foxglove, and Hemlock, could be equally well grown, with many other plants requiring a similar climate.

But a plant, second hardly to any in point of importance in furnishing food for man, requiring also the same climates, has been introduced into the same countries. This is the Potatoe, for which India, as well as the rest of the Old World, is indebted to the New World. It has been found in a wild state, in 33° of S. latitude, in Chili, in the mountains near Valparaiso and Mendoza, and also near Lima, Quito, and Santa Fé de Bagota ; but in these situations it is supposed to have escaped from a state of cultivation, as the illustrious Humboldt argues that it must have travelled north in " the course followed by the Incas in their conquests." But as it was introduced into England from Virginia in 1586 by Sir W. Raleigh, and not known to the Mexicans in the time of Montezuma, he concludes it as probable, that if the English colonies did not receive it from South America, this plant was originally wild in some country of the northern hemisphere, as it was in Chili. This conjecture has been singularly confirmed by the Potatoe being found wild on the Pic d'Orizaba by Deppe and Schiede. (*D. Don*).

The Potatoe, we are informed by Dr. Ainslie, was introduced into India from the Cape of Good Hope, and some of excellent quality are produced in the Mysore country, particularly at Bangalore and Nundydroog. They are grown all over India (Roxb.), and of a very fine quality in the cold weather, or from October to March, along the plains of India from Patna to Loodiana. Dr. Wallich states, that " they are planted in the valleys and lower hills of Nepal, so as to afford fresh crops all the year round : the roots are planted in February, June, and November, and gathered after three months." They were introduced into the northern mountains, and grown in the neighbourhood of Simla, at an elevation of near 7,500 feet; and by Major Young, on the mountains north of Deyra, at an elevation of 6,700 feet ; so that Mussooree made its first appearance on the map by the name of the Potatoe Garden. Their quality was subsequently much improved by Captain Townsend raising some from seed, which in the third year became of enormous size, and of very good quality. They are now becoming very generally cultivated, both in the hills and plains of Northern India ; and it is fortunate both for sellers and consumers, that those grown in the former come in when the others are going out of season. Potatoes are in some places becoming adopted as food by the natives of India, though more slowly than could be wished; at this we need not be surprised, as even in France their use was not generally adopted until after their introduction into Europe more than two hundred years, and then only owing to the persevering efforts of the philanthropic Parmentier, round whose tomb, in Pere la Chaise, they are now yearly planted : so that M. Fée remarks, " verité frappante,

toujours repetée et toujours nouvelle: il faut déployer plus d'activité et plus de ressources d'esprit pour faire du bien aux hommes que pour leur nuire."

Indebted as India is to the New World for the Capsicum and Potatoe, there is yet another plant, which, though not to be compared with the last in real importance, is still more valuable as an article of commerce. This is the TOBACCO, which from being the solace only of the red American, has become one of the luxuries of the rich, and almost a necessary of life for the poorer inhabitants of a great portion of the globe. The Hindoo, slow to adopt strange customs, has been caught with the general infection; and though some religiously abstain from its use, their nobles, as their women, may be seen inhaling it in the midst of perfumed essences, while the labouring bearer and hard-working boatman seem to derive fresh vigour from their ever-in-hand hooqqas: the mountaineer, finding it inconvenient to carry such an apparatus over his rugged roads, makes a hole in the ground, through which he smokes.

The Spaniards are said to have first become acquainted with the Tobacco in the West Indies. The name by which it is now known was that used in the Haytian language to designate the pipe used in smoking the herb, which by the Mexicans was called *yetl*, and by the Peruvians *sayri* (Humboldt). It was first cultivated near Lisbon about 1560; and introduced into England in 1586 by Sir Walter Raleigh and his companions. It early attracted the notice of the English settlers in Virginia, especially after the founding of James Town in 1607. Shortly after this, it appears that Tobacco was introduced in lieu of specie, as the tavern-keepers were compelled to exchange a dinner for a few pounds of Tobacco, and government officers were paid in the same commodity (Tatham, p. 180); Malte Brune, quoting from Morse, states that, about 1619, on the arrival of a fresh body of emigrants, 150 young women were sold to the planters as wives, at 150lbs. of Tobacco each. In the native annals Tobacco is described to have been first taken to Java in 1601. In Persian works on Materia Medica, it is stated to have been introduced into India in A.H. 1014 (A.D. 1605) towards the end of the Sultunnut of Jelaladeen Akbar Padshaw. This is confirmed by a proclamation of Jehangeer, who succeeded in July of that year. From India Tobacco was probably taken to the Malayan Peninsula, and perhaps to China; but Pallas, Rumphius, and Loureiro, are of opinion that in China the use of Tobacco is more ancient than the discovery of the New World.

As Tobacco is now extensively cultivated both in the Old and New World, it will be proper, if we wish to obtain an idea of the climate best suited to it, to ascertain that of the places where the best kinds are grown. The species referred to the genus *Nicotiana* are twenty-six in number in the Syst. Vegetabilium of Rœmer and Schultes. Of these, some are doubtful and others probably only varieties; so that one-fifth may be safely deducted from the above number. The remainder are indigenous in America from Brazil and Chili, along Peru, to Mexico and the rocky mountains on the north. One species, *N. Australasiæ*, R. Brown Congo, p. 472 (*suaveolens*, Lehm., *undulata*, Bot. Mag. 673) is undoubtedly wild in New Holland, in the neighbourhood of Port Jackson.

N. persica,

N. persica, of Dr. Lindley, affording the fine Shiraz Tobacco, is supposed to be so in Persia and *N. chinensis*, in China.

The species most generally cultivated is *N. Tabacum*. The seeds of *N. repanda*, Bot. Mag., t. 2484, were given to Mr. G. Don, as that of the species from which the small Havannah Cigars are manufactured; but smokers find little difference in flavour between these and the larger kind. *N. multivalvis*, Bot. Reg. t. 105, is cultivated by the Indians who inhabit the banks of the Columbia, while those of the rocky mountains and of the banks of the Missouri, prepare their Tobacco from *N. quadrivalvis*, Bot. Mag. t. 1778, and *N. nana*, Bot. Reg. t. 883, which are allied to the former. *N. rustica* is chiefly cultivated in Western Africa (Mr. G. Don), as well as in Egypt, according to Mr. J. Bennet, from specimens brought by Mr. Wilkinson. Mr. D. Don informs me that it also affords the Tobacco of Salonica (the ancient Thessalonica); probably also that of Latakkia (Laodicea), which is so much esteemed. It is also cultivated in the north of Germany, Russia, and Sweden; according to Mr. Loudon, with *N. Tabacum*, near Utrecht and Guelders; and a variety of it in Ireland. From Parkinson we learn, that it was the kind preferred by Sir W. Raleigh.

In taking a view of the climate suited to the cultivation of any of these species, nothing so much excites astonishment as to find a plant, which with rice, sugar, cocoa, coffee, and cotton, attains great perfection in tropical regions, also successfully cultivated in the northern climates of Sweden and Scotland. This is owing to its being a plant requiring only a few months to bring it to perfection, and therefore finding the summer temperature of many countries suffice for its cultivation; but it is still remarkable to find Tobacco cultivated with equal success in Cumana and in Maryland,

The cultivation of Tobacco in North America for foreign commerce, is chiefly carried on in Virginia and Maryland, or almost from 35° to 40° of northern latitude. The climate of America, as we have seen when treating of the cultivation of Tea, p. 113, is like that of China, subject to great vicissitudes between winter and summer, but the latter only being that with which we have any concern in the cultivation of an annual plant, it is sufficient to mention, that according to the illustrious Humboldt, the mean temperature of Williamsbourg in N. lat. 38° 8′ is 58°, and of Philadelphia in N. lat. 39° 56′ is 54°, and the mean temperature of summer in the latter, 73°.94. The other places which are celebrated for their Tobacco, are Havannah, lat. 23° 10′, mean temperature of year, 78°.08; of summer, 83°.3: Vera Cruz, lat. 19° 11′ M.T. 78°.08; and Cumana, lat. 10° 27′ M.T. 81°.86; S.T. 83°.7. But as these much exceed the summer temperature of northern places where it is grown, as of Stockholm, 61°.88; Dublin, 59°.54; Edinburgh, 58°.28; it will be necessary to inquire, whether there are any peculiarities of climate in the places where Tobacco is actually grown. But here we shall meet with considerable difficulties in ascertaining what are all the desiderata with respect to the successful cultivation of Tobacco, as almost of every other plant; for colonial cultivators in the accounts which they have published, so seldom give any good account of the climate in which their experiments have been made, that we find

find it almost impossible to ascertain what are the states of dryness or moisture of the atmosphere, what the nature of the winds, what the proportions between the richness of a soil and the dryness of the air, or even what the temperature during the different processes; for upon all these must depend both the growth of the plant and the nature of its secretions, as already pointed out in the article on the cultivation of Cotton, p. 88.

But from the notices procurable from other sources, and especially the works of the illustrious Humboldt, it appears that though Tobacco be exported from very hot places in the Gulf of Mexico, it is only grown on elevated ground in the vicinity of Vera Cruz, Cumana, and Havannah, where, as will be seen in the accompanying notes,* a very slight elevation is sufficient to produce a modification of temperature, as well as a constant circulation and comparative dryness of the atmosphere; for as the lower strata become heated, they expand, and necessarily ascend; the capacity of air for moisture as for heat being in proportion to its rarefaction; this, with coolness, will also produce dryness, which favours evaporation from the surface of leaves. Mr. Loudon has succinctly stated the requisites for obtaining good Tobacco. "In hot, dry, and short summers, the Tobacco is small, but of delicate quality and fine flavour; in long moist and not very warm summers, it will grow large, but be without that fine flavour, which can only be given by abundance of clear sun-shine and free dry air. In the north of Germany, he adds, a good wine year, which depends on warmth and dryness, is always a good Tobacco year;" and it may be inferred, that the combination of heat with moisture,

* The island of Cuba, lying between N. lat. 23° 15′ and 19° 48′, only seventy miles in breadth, and every where pervaded by mountain ridges, must necessarily have its climate modified by these, as well as by its insular situation; that is described as dry and warm, but more temperate and healthy than that of other W. I. islands. Moreover according to Humboldt, "the influence of localities, of which the study is of so much importance to the cultivator, as the great breadth of the New Continent, the proximity of Canada, the winds which blow from the north, and other causes, give the equinoctial region of Mexico and the island of Cuba, a particular character. One would say, that in these regions the temperate zone, the zone of variable climates, increases towards the south, and passes the tropic of Cancer. In the environs of Havannah (lat. 23° 8′) the thermometer has been seen to descend to the freezing point, at the small elevation of 262 feet above the level of the ocean, and snow has fallen near Valladolid (lat. 19° 42′) at an absolute elevation of 6232 feet, while under the equator, this only takes place at double the elevation." (Pol. Hist. of New Spain, II. p. 362).

In Mexico, the intendancy of Guadalaxara, which must participate in the causes affecting the climate of Valladolid, was celebrated for the abundance and excellent quality of the Tobacco which was produced. The cultivation is now restricted to the environs of Orizaba and Cordoba, and the partidos of Huatusco and Songolica in the intendancy of Vera Cruz. (Humboldt, iii. p. 40). The towns are situated on the eastern declivity of the Pic d'Orizaba, and on the road to Xalappa, which, as elevated 7719 feet, enjoys a cool and agreeable climate; that of Cordoba is warmer, but much cooler than that of Vera Cruz, and from its situation must have a freer circulation of air.

Cumana is noted for the purity and healthiness of its climate, and the great heat incident to the situation being moderated by the sea breezes. "Cumanacoa, fourteen leagues S.E. of Cumana, is a rich plain, surrounded by lofty mountains, and although only 630 feet above the sea, possessed of a mild and even cold climate. Its environs supply the province with Tobacco."—*Enc. Metrop.*

Bahia, also celebrated for its Tobacco, which was exported not only into Spain, but into Africa, and the South American States, has also any excessive heat of climate moderated by the sea breeze.

moisture, will, in this, as in other plants to which it is not fatal, produce great extension of the parts of vegetation with coarseness of fibre, perhaps also of flavour.

Tobacco has been introduced into the Old World, and produced of such excellent quality, over so wide an extent of latitude, as to prove that in properly selected sites, and with the care bestowed on it in America, it may be grown of as fine quality in many parts of the Old Continent. Thus we find it cultivated in the islands of the Indian Archipelago and in Java. Manilla has long been celebrated for its Tobacco; Niebuhr describes it as very fine; many smokers prefer Manilla cheroots to any other. Here the climate, though the Philippines are situated under the Line, is described as excellent, in consequence of the height of the mountains, and the regularity of the sea breezes.

The next Tobacco which has obtained a European reputation, is that of Darabjird in Fars: of this locality it is sufficient to state, that it is in the neighbourhood of Shiraz, in 30° of N. latitude, and situated on the table land of Persia; that the climate, though hot, is dry, and as celebrated for its Wine as for its Tobacco. This has been ascertained by Dr. Lindley to be the produce of his *N. persica* (Bot. Mag. t. 1592); but whether it be a native of Persia is less certain, as the Persians have no other name for it than *tumbakoo;* and the careful culture and cure make one suspect that it was introduced by the Portuguese when in possession of Ormuz. Still further north, the Tobacco, commonly called Turkish, produced by *N. rustica,* and grown on the coasts of the Mediterranean, is highly valued. But the Dutch, which is compared to the Maryland, and like it grown in the highest latitudes, is also much esteemed, chiefly owing to its careful culture and preparation; for the Tobacco of the south of France is intrinsically better, but less carefully prepared (Loudon). It is lamentable to exclude India entirely from this enumeration; but whether this be owing to a defect of climate or of culture, is not yet apparent; or whether in consequence of the large consumption of what is good, the inferior kinds only find their way to the export market: but there is no doubt that East-India Tobacco holds the lowest place in the English market, and is described as being too high dried, or as all stalk and powder, fit only for the inferior kinds of snuff, or for re-exportation. The inconveniences of this are not so much experienced in India as elsewhere, for both natives and Europeans use the Tobacco for their hooqqas, only when beat up with molasses, conserves, and spices.

That it is not owing to any inherent defect in the climate of the British possessions in India, that the Tobacco is of such inferior quality, I am happy to be able to prove by extracts from official documents, with which, owing to his kindness and anxiety to assist in improving the resources of India, I have been favoured by Mr. William Johnson, of the East-India House. First, with respect to that which obtained considerable repute under the name of Martaban Tobacco, Dr. Wallich states, that "the sort is from Arracan and not from Martaban;" and describes it as having "a fine silky leaf: tried by many people, it had been pronounced the very best they had ever tasted, equal to, nay, surpassing the finest imported from Turkey and Persia." An extensive tobacconist says, "a finer and better flavoured Tobacco he never saw or

tasted

tasted in his life." One of the first brokers in the City says, "the sample of leaf Tobacco is certainly of a very fine quality, and appears to have been produced from some peculiar seed, and a greatly improved cultivation and cure." By many manufacturers "it was supposed to be from the seed of Havannah or St. Domingo Tobacco." For smoking, it is compared with Maryland Tobacco, having the same qualities, "except the flavour, which is better, and more like Havannah." The colour and leaf are moreover pronounced excellent for cigar-making; "but if any thing is against it for that purpose, it is the largeness of the principal stalk, and coarseness of the small fibres in the leaf." The commercial gentleman by whom the Tobacco was transmitted to the brokers, pronounces it very superior, and the leaf as very fine, adding, that the price of 6*d.* or 8*d.* might readily be obtained, perhaps more, with the improvements suggested.

As it is interesting, if possible, to ascertain the peculiarities of climate and country where so superior an article is grown, we have a communication from Mr. R. Hunter, the gentleman who brought the Tobacco from Arracan, who states that "the Sandoune Tobacco grows on the sloping banks of rivers not overflowed while the crop is on the ground, but inundated during the rains. The best is that grown above the influence of the tides, about thirty miles from the mouth of the river. The ground receives apparently great attention in cleaning and in breaking the clods. The Tobacco is all transplanted about November, and the crops are cut about March." Here we see the coldest season is selected for the cultivation: with respect to climate, it may be inferred from the province of Arracan extending along the western side of the Bay of Bengal, and included between the coast and a range of mountains, that it must have alternations of temperature, and of land and sea breezes; and that though Arracan Proper is low, inundated, and shut in by low hills, at Bassein the climate is described as neither oppressive nor unhealthy from November to May (Encl. Met. Pegu), and Sandoway as mountainous, and not subject to inundations, enjoying a cool sea breeze, and temperate nights nearly through the year. It is however, probable, that the superiority of the Tobacco is owing to careful cultivation and cure. This was probably taught by Europeans; as Arracan was the seat of a Roman Catholic mission in the beginning of the seventeenth century. It is pleasing to find here, as in the vicinity of Ormuz, the arts continuing to benefit a country long after the conquests of those who introduced them have passed away.

Of other Tobaccos which have some repute in India, Dr. Ainslie states, that "the finest kinds in India, and perhaps in the world, is grown near the village of Woodanum, in the Northern Circars," "and in some of those low sandy islands formed at the mouth of the river Krishna (from which is made the famous Masulipatam snuff); also in the Delta of the Godavery, where the soil is peculiarly rich and fertile." Dr. Wallich, in his evidence before the Committee of the House of Commons, states that some excellent Tobacco was grown at Boglipore, from Havannah seed, and that some very esteemed kind is grown in Bundelcund. The Tobacco of Chûnar is celebrated in India, as is more especially that of Bhilsa, of which a great portion I am informed by Dr. Moore,

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is sent away in presents by the Raja of Nagpore. It is to be regretted that we are unable to ascertain the commercial value of any of these, as they do not appear to have been sent to the English market. The only exception is that mentioned by Mr. Ritchie, of one bale of the fine Tobacco grown in the northern districts of Bombay selling for 6*d.*, while American sold for 5*d.*; but the average of the experimental exportation being found defective in the curing, sold only for 1*d.* and 2*d.*, and did not pay, as is frequently the case with importations of Tobacco from Bengal and Bombay.

Such appears to have been the state of the ordinary Indian Tobacco, when the East-India Company determined on endeavouring to induce cultivators to improve the culture of Tobacco by importing seed from Maryland and Virginia, which was to be freely distributed to those inclined to make experiments on the subject.

These experiments, I regret to say, seem, with one exception, to have been undertaken only in the southern parts of India, at least it is from thence only that samples have been sent to the India House. Importing seed from 35° to 40°, and with territory from 8° to 32° of North latitude, elevated from 0 to 13,000 feet above the sea, it is greatly to be lamented that experimenters should have been confined to between 12° and 16°, that is, to the districts of Cuddapah, Guntoor, and Coimbatore. The object being to get an article similar in properties to that already esteemed in the market: the plan would be to make the first attempts, as failure is so apt to discourage, in the soil and climate most like that whence seed is procured. Though the above districts may by a different treatment be enabled to grow very good Tobacco, there is no doubt that the soil was either too rich for the Virginia seed, or the climate too moist and warm, or perhaps both conjoined, for the plants have grown so luxuriantly, that the stalks and fibres have attained a size and coarseness, fitting them better for twisting into cables than for putting into a pipe. One cultivator, indeed, states that the plants grew so well, as to be twice the size of the country plants. The Tobacco was besides so badly packed, and worse cured, that the brokers describe the different samples as "too dark in colour,"—"thick and coarse grown,"—"nearly all stalk;"—and when the leaf is well grown, it is pronounced "over large, with a thick coarse stalk,"—"unpleasant or musty in flavour,"—"worm-eaten,"—"not properly cured,"—"packed in a damp state,"—and that, as articles of commerce, they are "not marketable,"—or "of no value;"—and of the best it was said, that some Tobacco from Holland of much better quality, had been sold under 2*d.* per pound.

These facts are sufficiently discouraging, and were it not for the author's confidence, that they are the necessary result of inattention to principles, it might perhaps be considered more prudent to withhold them when recommending a new culture. But as others might commit the same mistakes, it is proper at once to meet the difficulty, that we may at the same time suggest a remedy. Besides, the Tobacco of Arracan and that from Bombay has shown that even without the aid of foreign seed, some of very superior quality may be grown in India; while the following facts prove that by careful management, Virginia seed may be made to yield a good crop, even in the rich soil and climate

climate of Bengal. This Tobacco was imported in the Sir T. Munro, and produced from Virginia seed sown in the garden of the Agricultural Society of Calcutta: "the method pursued in its cultivation and preservation is that generally adopted by the Americans." This specimen was submitted by the Court of Directors to the examination of some dealers and manufacturers in London, who pronounced it to be "the best sample of Indian Tobacco they had ever seen. In flavour and general appearance of the leaf, it approaches the descriptions which are usually selected here for manufacturing into cigars, and for smoking in a pipe, *viz.* Havannah, St. Domingo, and Ameersfoorth (Dutch): all of which command high prices in relation to other kinds of leaf Tobacco. A portion of this sample has been made into cigars here, which are much approved; and it is probable that if a moderate supply of Tobacco of the like quality were in this market, it might be in some request for making into cigars, and would come into competition with the Tobacco of St. Domingo, which is at present worth from 6*d.* to 8*d.* per pound in bond."

The successful result of this experiment will, it is hoped, remove any unfavourable impression produced by the former, and prove, as might be inferred indeed, from the Arracan and Bombay samples, that there is nothing in the climate of India unfavourable to the production of good Tobacco, when this is attempted with careful treatment in a good climate. The more temperate climate of N. America, and the modified one of tropical situations, is attained in India by the cultivation being commenced in the cold weather, and the spring temperature equalling the summer one of more northern climates is sufficient to bring it to perfection. That it may also be grown of a superior quality in more southern provinces, is very probable, for it is not a puny seedling which is to be nursed into healthful existence, but the gross-feeding weed luxuriating in rankness, which is to be reduced to more moderate dimensions, and starved into fineness—objects easily effected by a less rich nourishment, and a drier and more open atmosphere, both attainable in poorer, though good soils, or the more elevated parts of the Peninsula, and in many parts of India, as along the banks of the Ganges, as well as in Tirhoot, Rohilcund, and the Doab; and across India, in Bundelcund, Malwa, and the northern provinces of the Bombay Presidency. Success will still depend upon the skill of the agriculturist, in suiting the richness of his soil to the dryness of his climate, diminishing the former in proportion to the moisture of the latter, though it is doubtful whether as fine Tobacco can be grown in a moist as in a dry climate. It must be remembered, that the present excellence of American Tobacco is not the spontaneous effusion of the soil, but the result of the unwearied attention of both the Government and cultivators to the improvement of its produce; for some of the American Planters seemed to think in former times, as Indian Zumeendars appear to do at the present day, that "*any thing was good enough for the merchants.*" (Tatham, p. 141.) The Government, jealous of the good name of Virginian produce, issued rules for checking over-luxuriance, and appointed officers to see them enforced, as well as for rooting up inferior plants: while every hogshead of prepared Tobacco was taken to government warehouses, to be inspected by competent officers before it could be exported; and all

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of an inferior quality condemned to be burnt (Tatham, p. 69—106; and 138, 207).

It is unnecessary to dilate on the cultivation and cure, as these are detailed in the instructions sent out to India by the Court of Directors in 1819, and may be seen fully described in works easily procurable; as *Loudon's Encyclopædia of Agriculture*, which gives, in an excellent article, the cultivation in a variety of places; and "*The Tropical Agriculturist*," which includes the most valuable portions of "Tatham's Essay on Tobacco," as well as the cultivation of Shiraz Tobacco, from the Hort. Trans. v. 1. n. s. p. 205; it is hoped that the remarks in this article on the necessity of paying attention to the strangely-neglected subject of climate will not be without their use. It must never be lost sight of, that the Americans pay equal care and attention to the soil, the seedling nursery, the transplanting, earthing up, keeping the ground clear, removing inferior leaves and side shoots, topping so as to leave only eight to ten leaves on each plant, airing, fermenting, drying, prizing, and packing. It is to be wished, as recommended in the case of Cotton, p. 89, that the effects of good culture and careful curing should be tried upon seed produced from Bhilsa, Arracan, &c. as well as upon that of foreign growth, but at first in situations as similar as possible to them, in climate, soil, and production. This, however, can be hoped for to any extent only, when more attention is paid to the inferences to be deduced from a comparison of scientific data; for the empirical attempts of purely practical people, though sometimes attended with success, are as frequently followed by failure. It is to be hoped that my friend Mr. James Prinsep, will persevere in getting good accounts of the climate of every part of India; and it is to be wished that good specimens of colonial produce could be sent to the several parts of India, so that cultivators might get an idea of what they had to rival, as well as of the prices which would reward their successful exertions.*

117. SCROPHULARINEÆ.

The *Scrophularineæ*, though most nearly allied to *Solaneæ*, are also so to some of the following orders, and consist of several tribes, according to the distribution of Mr. Bentham, as given in the Botanical Register, June 1835, and in his excellent account of the East-Indian *Scrophularineæ*. The plants of this family are found almost every where from the hottest to the coldest parts of the globe: one species of *Pedicularis* extending even to Melville Island. About 160 species are found within the limits of the Indian Flora; they are common in the plains, and occur in considerable numbers in the mountains. But the tribes which prevail in the latter are those of which the genera are chiefly found in temperate countries; though of these a few species occur also

* Having sent the foregoing remarks to Mr. W. Johnson for perusal, he has been good enough to send me the gratifying intelligence, while the previous sheet is passing through the press, as a "strong corroboration of my views respecting the capabilities of the country," that Tobacco has actually arrived from India, and been sold in the London market for 8*d.* a-pound!

also in the plains, but it is only during the cold weather; while the tropical genera which occur in the mountains spring up entirely in the rainy season.

The tribes which affect the mountains are *Verbasceæ, Antirrhineæ, Veroniceæ,* and *Rhinantheæ.* Of *Verbascum* and *Euphrasia* there are only single, but of *Scrophularia, Pedicularis,* and *Veronica,* several species; the two first, with *Verbascum,* confined to the cold and temperate parts of the northern hemisphere, while *Veronica,* like *Euphrasia,* occurs also on the south coast of New Holland, as well as in the Straits of Magalhaens; and *Euphrasia* in South America. *Calorhabdos, Picrorhiza,* and *Hemiphragma,* are the new genera peculiar to these mountains. Of the tribe *Veroniceæ, Wulfenia* has one species in the Himalayas, one in the Carinthian Alps, and the third on the mountains near the Columbia, on the west coast of North America. *Gymnandra* has one species in Cashmere, one in Kunawur, and several in Siberia, as far east as Kamtschatka. *Ourisia,* of a few species, has also one in the Himalayas, one in Van Diemen's Land, and one in the Straits of Magalhaens.

The European species which are found on the Himalayas, are *Verbascum Thapsus, Euphrasia officinalis, Veronica alpina, biloba, Beccabunga, serpyllifolia,* and *Anagallis.* The three last are also found in America, as is *Pedicularis verticillata,* also existing in these mountains, with *P. versicolor.* Though the species of this genus are numerous (twenty), especially in Kunawur, none have been identified with those of Ledebour, though this flora contains so many of the Altaian species.

Veronica Anagallis (*undulata,* Wall.) occurs also in the plains of India, as well as *V. agrestis;* with these are also found, *Antirrhinum Orontium* β. *indicum,* and *Linaria ramosissima* (*Roylei,* Chavannes); the former found also in the Himalayas, at 7,000 feet of elevation, and the latter is mentioned by Dr. Wallich as occurring in Nepal. I have specimens from the Jhilum or Hydaspes. The distribution of *Antirrhineæ* has been admirably elucidated by M. Chavannes, in his Monograph, (for a copy of which I take this opportunity of returning my best thanks) whence it appears that though *Antirrhinum* and *Linaria* chiefly prevail in the Mediterranean region, they are also found in the New World, and a few species spread to the plains of India, as we have seen to be the case with some plants of other families from the same regions. The Indian *Linaria* is most nearly allied to the Egyptian species.

The *Scrophularineæ,* which chiefly prevail in the plains of India and especially in the hot and rainy seasons, belong to the tribes *Gratioleæ, Buddleeæ,* and *Gerardieæ,* with *Celsia,* of the tribe *Verbasceæ.* The genera *Dopatrium* and *Artanema* are confined to India and the Peninsulas; *Lindenbergia* is also found in Arabia, and *Peplidium* in Egypt; *Pterostigma* and *Bonnaya* in both India and China; *Mazus* in both, as well as in New Holland: where are also found, in tropical parts, the Indian genera *Microcarpæa, Limnophila,* and *Centranthera,* as well as species of *Mimulus, Herpestes,* and *Buchnera;* which, as well as in India, occur also in South America, with *Torenia, Stemodia,* and *Vandellia;* the last is also found in China, with species of *Buchnera* and *Buddlea.* The latter exist also in South America and the West-Indies, and *Buchnera*

in

in Africa. *Gerardia*, common in India and the Himalayas, belongs also to the Floras of Brazil, Mexico, and North America, the Cape of Good Hope, and of China. *Glossostylis* is found in the Malayan Peninsula, Brazil, at the Cape, and in Western Africa.

The Indian species found in other countries are *Limnophila gratioloides* in New Holland; *Mazus rugosus* in Cochin-China; *Bonnaya verbenæfolia* and *hyssopioides*, with *Vandellia crustacea*, in China; *Peplidium humifusum* in Egypt; *Herpestes Monnieria* in both tropical Asia and America; also in New Holland; *Vandellia diffusa* and *Torenia parviflora* in the Indian Peninsula, Mauritius, and Brazil.

The genera of these tribes, of which species are found in the mountains in the rainy season, are *Lindenbergia, Stemodia, Mazus, Mimulus, Bonnaya, Torenia, Buchnera, Gerardia, Centranthera*, and *Buddlea*. Those of *Buddlea* form small shrubs, found at moderate elevations; *B. crispa* is highly ornamental; *Centranthera hispida* occurs both in the mountains and in the plains, flowering in the latter in October, and in the former in June; *Torenia cordifolia* is found in the Circar mountains and at Mussooree; *Buchnera orobanchioides* has a very wide distribution, being found in the Peninsula and Central India, in the north at Suhunsudhara, and in both the eastern and western coasts of tropical Africa.

The *Scrophularineæ* contain, with the exception of the Foxglove, but few useful plants. Some others are employed in medicine from their acrid and bitter properties, as *Gratiola officinalis*, some *Calceolarias, Veronicas*, &c., and *Euphrasia officinalis;* so, in India, the root of *Picrorhiza Kurrooa* is used in native medicine, as are the leaves of *Herpestes Monniera;* also *Linaria ramosissima*, Wall. (v. *Ainslie. Mat. Ind.* 11. p. 483), as *L. vulgaris* in Europe. The flowers of *Buddlea Neemda* are delightfully fragrant.

Picrorhiza Kurrooa. nob.—Bentham, Scrophularineæ Indicæ. p. 47. *Veronica? Lindleyana.* Wall. Cat. n. 404.—Tab. 71. f. 2. (*a*) A flower; (*b*) calyx and pistil; (*c*) corol opened out, with the stamens rather too short in proportion; (*e*) capsule opening; (*f*) transverse section of the same; (*g*) a seed enclosed in a beautiful net-like transparent membrane.

Hab. The generic and specific characters of this plant having been already published by Mr. Bentham, it is unnecessary to repeat them here. It was procured by Dr. Wallich from Gossainthan and Kemaon, and by myself from Kedarkanta and Shalma. The genus is named from the bitter root used in native medicine, and for which that of *Gentiana Kurroo*, Tab. 66, fig. 2, is frequently substituted.

Pedicularis versicolor. (Wahlenb.—Stev. monogr. 52). Bentham, Scroph. Indicæ, p. 54.—Tab. 70. fig. 2.

Hab. On Shalma and towards Cashmere.

Gymnandra Cashmeriana. Benth. Scroph. Indicæ. p. 47.—Tab. 73. fig. 3. (*a*) A flower; (*b*) corol opened; (*c*) calyx and pistil.

Hab. Cashmere.

118. OROBANCHEÆ.

The *Orobancheæ*, a small order of parisitical plants, separated from *Scrophularineæ*, are common every where within the limits of the Indian Flora, and though few in number, fully bear out the resemblances which we have endeavoured to point out, in the Flora of different parts of India to that of other countries. Thus, *Orobanche indica*, most nearly allied to *O. Ægyptiaca*, is extremely common in the plains of India, especially

cially in fields of rice and sugar-cane; while *O. caryophyllacea* of Smith, found in Europe, and figured by Ledebour from the Altai mountains, is found at Pungee in Kunawur, where we have already seen so many genera and species of those mountains. In the upper regions of the Himalaya, which we have seen to approximate to the European Flora, we have *Lathræa squamaria,* which I found in abundance on the shoulders of Urrukta. *Æginetia* is peculiar to the country, and the same species, *Æ. indica,* as we have seen in so many other instances, extends from the southern to the most northern parts along the forest-covered base of the mountains, as in the Kheree Pass, Deyra Doon, and valleys within the Himalayas. *Æ. abbreviata* occurs with the last in Silhet and the Indian and Malayan Peninsulas. A doubtful species of *Phelipæa* probably grows in similar situations, as it was found mixed with specimens of *Æ. abbreviata,* in the Madras Herbarium. (Benth. Scroph. p. 55.)

119. LENTIBULAREÆ.

The *Lentibulareæ,* frequently placed near *Primulaceæ* on account of their 1-celled ovarium and free central placenta, are also very closely allied to *Scrophularineæ,* some of which, as several *Limnophilas,* they greatly resemble in habit. Like other plants, delighting only in aquatic situations, they indicate more the presence of moisture than the nature of the climate; we therefore find them in many places where this is present, though the *Pinguiculas* affect the colder, and the *Utricularias* the warmer parts of the globe. Of the last, we find many species in India, either floating on pieces of water, or luxuriating in the moisture of a rice-field. A few species also occur in Nepal. *U. stellaris,* figured by Dr. Wight (Bot. Misc. Suppl. t. xxvii.), is well worthy the attention of the vegetable physiologist for the elegance and size of its utriculi and semi-transparent structure, through which many vegetable phenomena might be observed. The admirable fitness of these air-bladders for enabling the plant to float on the water, is also worthy the attention of those who admire the beautiful adaptation of every thing in the creation, for the purposes it is intended to serve.

120. CYRTANDRACEÆ.

In conformity to the usual custom, I have continued to consider this as a distinct family, though it would be safer to unite it, though exalbuminous, with the *Gesneriaceæ,* as Mr. Brown, in his observations on *Aikinia,* in Wall. Pl. As. Rar. iii. p. 66, states, "that in the forthcoming first part of Dr. Horsfield's *Plantæ Javanicæ Rariores,* I have entered at some length into the subject of the structure and affinities of *Cyrtandraceæ,* and the natural family (*Gesneriaceæ*) to which I have referred that tribe." Professor Von Martius also, in his latest work, *Conspect. Regni Vegetab.,* considers them as tribes of the same family. The *Gesneriaceæ,* generally distinguished from *Cyrtandraceæ* by having albuminous seed and usually a semi-adherent ovarium, are confined to the tropical parts of the New World, from the West-Indies as far south as Rio Janeiro. Like the *Cyrtandraceæ,* they are closely allied to the three preceding, and to the two following

following orders. *Cyrtandra* consisted at first of a single species found by Forster in the island of Tanna. Dr. Jack discovered others at Sumatra, with some allied genera, which he formed into the family of *Cyrtandraceæ*, Lin. Trans. xiv. 23, described by Mr. Don under the name of *Didymocarpeæ*. Previous to this, a species of the family had been described by Vahl under the name of *Rottlera*, for which Sprengel substituted *Henckelia;* under which name Dietrich. *Syst. Veg.* has since brought together several plants, which by other botanists are arranged under different genera, indeed under different families. Several new genera have been described by Dr. Blume (*Bijdrag.*) and others by Mr. Bentham, in his *Scrophularineæ Indicæ*.

The *Cyrtandraceæ* are now numerous in genera and species, and though restricted to the Old World, and chiefly abounding in its tropical islands, have a very wide distribution in latitude, as *Streptocarpus Rhexii*, Bot. Reg. 1173, is found at the Cape of Good Hope; the two genera, *Dorcoceras* and *Rehmannia*, found by Bungé in the north of China, belong, the former certainly, and the latter probably, as I am informed by Messrs. Bentham and Lindley, who have received specimens, to this family; and if *Ramonda* should be found really to belong to this family, it will be an additional instance of a single species of a tropical family extending into European regions. The tropical species abundant in Java and Sumatra, at Singapore and in Penang, extend along the Malayan Peninsula to Silhet and Pundooa, thence along the mountains to Nepal, Kemaon, and the Northern Himalayas, where a few may be seen at as great an elevation as between 7,000 and 8,000 feet in 30° and 31° of N. latitude. But it is only during the mild temperature and equable moisture of the rainy season that they are seen, when, instead of evaporation, there is always deposition of moisture, and the most delicate plants may remain unchanged for days and weeks. The rest of the year the seeds remain dormant, exposed to both the cold of winter and the heat of summer. But on the return of the dew-point atmosphere, they shoot up with the utmost luxuriance, and form the richest ornaments of what at other seasons appeared the barest rocks. It is not surprising, therefore, that no species have been received from the dry climate of the northern face of the Himalaya. But it is unaccountable that so few species should have been discovered in the Indian Peninsula, consisting only of two species of *Didymocarpus;* a doubtful *Cyrtandra* from the Travancore mountains; a *Glossanthus* from the same and Ceylon, and another species of the same genus from the Neelgherries.

The genera confined to Java and the islands are *Cyrtandra* and *Loxonia* (Jack), *Tromsdorffia, Agalmyla, Whitia, Rhynchotechum, Centronia, Kuhlia* (Blume), *Stauranthera* (Benth.). *Aikinia* (Br.), is found in the island of Timor and in Java. *Glossanthus* does not extend beyond Pundooa, where there are several species of *Æschynanthus*, but only one in Nepal, and also one of *Epithema*. *Lysionotus ternifolia* is found there, as well as in Kemaon; but the species of *Didymocarpus, Chirita, Loxotis,* and *Platystemma,* are found all along the mountains. *C. bifolia* and *P. violoides,* two of the most ornamental, attain also the most northern limits, being found at Jurreepanee, Simla, &c. *Loxotis* (*Wulfenia,* Wall.) *obliqua* approaches the nearest to Kunawur;

Didymocarpus

Didymocarpus venosus and *Chirita diaphana*, nob., attain the highest limits, being found on Tuen, between 7,000 and 8,000 feet of elevation.

The plants of this family are watery in nature, and possessed of little sensible properties; but one species, *Didymocarpus aromatica*, is stated by Dr. Wallich to be used as a perfume and an aromatic drug, and called by the natives *kumkuma* and *rani-govindhi*.

Chirita bifolia. Don Prod. Fl. Nep. p. 90.—*Calosacme amplectens.* Wall. Cat. N. 800.—Tab. 70. fig. 1.
Hab. Nepal and Kemaon. *Wall.* From Jurreepanee upwards towards Mussooree, and near Simla.
Didymocarpus macrophylla. (Wall.) Don. l. c. p. 122. Wall. Cat. N. 784.—Tab. 70. fig. 2.
Hab. Nepal and Kemaon. *Wall.* Jurreepanee towards Mussooree.
Platystemma violoides. Wallich, Pl. As. Rar. 11. p. 42. t. 151. Cat. N. 4410.—Tab. 71. fig. 1. (*a*) Corol enlarged; (*b*) the same, with the two lips separated; (*c*) corol, with four divisions of the lower lip; (*d*) calyx and pistil; (*e*) capsule; (*f*) the same enlarged; (*g*) transverse section of capsule.
Hab. This elegant plant is found, with *Chirita bifolia*, covering the rocks in the rainy season in the Himalayas; v. *supra.* Though already figured by Dr. Wallich, it has been repeated in this work at his particular request, and being so conspicuous a feature of these mountains at one season of the year, could not well be omitted in a work specially dedicated to the illustration of their Flora; but this figure also fails in doing justice to the extreme beauty of the plant. I have referred the genus to *Cyrtandraceæ*, in conformity to the opinion of Mr. Bentham, who has undertaken the monography of that family.

121. PEDALINEÆ.

The *Pedalineæ* of Mr. Brown, *Sesameæ* of some authors, are so closely allied to both the preceding and the following order, that Dr. Lindley states, Nat. Orders, p. 237, that "the three might be re-united without much inconvenience;" they are distinguished from *Cyrtandraceæ* by their woody placentæ and hard, stony fruit; and from *Bignoniaceæ* by their wingless seeds, but like both are found only in tropical parts of the world. The genera found in India are *Pedalium* and *Sesamum*, both probably peculiar to the country; but the latter is so much cultivated, as to have become distributed in different countries of Asia and Africa. *S. prostratum* is found on the coasts: several other species are enumerated; but those which I have seen, though permanent, appear only varieties of one species. One is called *kala til*, from the blackness of its seeds, and is a larger plant than the white-seeded plant, called *suffed til*, which is not so common as the other in Northern India. These plants are every where extensively cultivated in India for the excellent oil yielded by their seeds, and known by the names of Sesamum and Gingilie oil, *meetha tel* and *til ke tel* of the natives. By a little management it may be made to look and taste nearly as well as olive oil, for which it is frequently substituted. The leaves, like those of *Pedalium murex* (*gohhroo-dukhunee*) are mucilaginous, and the meal like that of other mucilaginous seeds, as linseed, is esteemed for poultices.

122. BIGNONIACEÆ.

The *Bignoniaceæ*, in addition to their other alliances, have also a close one to *Acanthaceæ*, from which they are distinguished by their winged seeds. Though generally arborescent, the order also contains herbaceous genera, as *Eccremocarpus*, *Calampelis*,

and

and *Incarvillea*. The *Bignoniaceæ* are found only in tropical parts of the world, extending north to Pennsylvania and the north of China, and south to Chili, the Cape of Good Hope, and New Holland. In India they are found in every part. Dr. Wallich's new genus, *Trigonocarpus*, is confined to the Burmese coast, *Schrebera* to the south of India, and *Wightia gigantea*, Wall. Pl. As. Rar. t. 81, is found only in Nepal. *Bignonia*, indigenous in the tropical parts of America and Africa, and *Spathodea* also in New Holland, are found chiefly in the southern parts of India; but species of the former, as *B. indica* and *suaveolens*, extend to the most northern parts, as the Kheree forest. *B. undulata* also extends far north; I have seen it very abundant on the point of junction of the Chumbul with the Jumna. The genus *Incarvillea*, which supplies the place of *Eccremocarpus* in the Old World, found hitherto only in China and Japan, has also (at least the subgenus *Amphicome*) been discovered in the Himalayas, where Dr. Wallich's *I. Emodi* was found, near Srinuggur, and by myself on the Suen range. An additional species, *I.* (*Amphicome*) *arguta*, Tab. 70, f. 2, was discovered by M. Jacquemont in the valley of the Buspa, and by my plant collectors near Turanda, in Kunawur.

The *Bignoniaceæ* are chiefly remarkable for their trees when in flower, being clothed in the gorgeous colouring which in temperate climates is the characteristic of more humble plants. The leaves of one species, *Bignonia Chica*, yield a red colouring substance known by that name, and several of the Brazilian species afford timber valuable for its hardness, durability, and even elasticity, so that they are employed in ship-building, and even for making bows. (v. Lindley. Nat. Orders, p. 237.) I know not the properties of the timber of the Indian species, but it is large, and worthy of inquiry. The bark and capsules of *Bignonia indica* are described by the natives as being astringent, and used in tanning; as is *B. suaveolens:* "the pleasant-tasted and fragrant flowers of *B. chelonoides*" (an *B. suaveolens?*) are described by Sir W. Ainslie as being employed in making a cooling drink in fevers.

Having, in examining the Himalayan species of *Incarvillea*, observed some appearances not mentioned in, or at variance with, the descriptions of that genus by Jussieu and Lamarck, I was induced to ask the opinion of the highest authority on the subject, and Mr. Brown has been good enough to favour me with his opinion, that the Himalayan species are too closely allied to be separated into a genus distinct from the Chinese *Incarvillea*, but are yet sufficiently distinguished to constitute a subgenus: he has been good enough to enrich my work with the character of this, and an amendment of that of the genus *Incarvillea*.

INCARVILLEA. *Juss. gen.* 138.

"*Calyx* 5-dentatus, nunc 10-dentatus, alternis (accessoriis) membranaceis.
Corolla fauce ventricosa; limbo 5-lobo inæquali.
Stamina antherifera quatuor, didynama inclusa. *Antheræ* lobis distinctis apice convergentibus, singulis infra apicem processu subulato munitis!
Stigma bilamellosum.
Capsula siliquæformis, bilocularis, bivalvis; septo contrario libero intra marginem semenifero.
Semina suspensa (v. membranaceo-marginata v. comosa), radicula supera.

Herbæ

Herbæ alternifoliæ foliis pinnatis bipinnatifidisve: racemi terminalis laxi pedicellis tribracteatis. Rudimentum filamenti quinti (primum in Amphicome detectum a D. Royle). Genus Bignoniaceis adjiciendum, in sectione tamen propria ob habitum et semina pendula, radicula supera (v. Prodr. Flor. Nov-oll. 1. p. 471.) locandum et in duo subgenera dividendum. Horum alterum INCARVILLEA *Juss.* chinense, distinguitur, foliis bipinnatifidis; calyce, præter normales, dentibus 5 accessoriis sinuum loco membranaceis emarginatis; seminibus obovatis margine lato membranaceo indiviso cinctis.

Alterum, AMPHICOME, (Cyrtandraceis quodammodo accedens) ex Indiæ septentrionalis montibus; foliis pinnatis foliolis incisis; calyce 5-dentato sinubus simplicibus; seminibus fere subulatis utrinque acutis, basi et apice membrana capillaceo-lacera comosis."

Incarvillea (*Amphicome*) *arguta;* suffrutex, 3-pedalis, diffusa; foliis pinnatis, foliolis oppositis breve petiolatis 3-4 jugis cum impari lanceolatis acuminatis basi inæqualibus dentato-serratis, floribus diffuse racemosis, racemis axillaribus terminalibusque.—*Amphicome arguta.* Tab. 72. fig. 1. (*a b*) Flowers; (*c*) calyx; (*d*) corol cut open; (*e*) stamen seen in front (*f*) from behind; (*g*) style and stigma; (*i*) capsule with persistent style; (*k*) capsule ripened; (*i*) a portion of the same, with the dissepiment protruding, and of a rounded form when covered with seeds, but is in direction opposite to the valves; (*j h*) seeds.

This elegant species is the second of its genus, which has been found in the Himalayas, and has been drawn (from specimens brought me from Lower Kunawur) by Mr. Wilson Saunders, who has succeeded in giving a good general idea of the plant. It is most probably like the kindred species, *I. Emodi*, provided with a subterranean perennial stem, from which shoot the annual, striated, leafy stalks. *Leaves* alternate, petioled. *Racemes* long, few, or many-flowered, somewhat secund. *Pedicels* long, slender, with two or three small subulate bracts, more or less near to the flower, according to the elongation of the pedicel. *Calyx* tubular, pentagonal, angles stiffer than the membranous ciliate sides, terminating in 5-narrow subulate, slightly hairy teeth. *Corolla* hypogynous, monopetalous, irregular, tubular near the base, ventricose above, limb 5-lobed, lobes short, rounded, ciliate, imbricated in æstivation. *Stamens* 4 didynamous inserted into tube of corolla, with the rudiment of a fifth stamen (not represented in the figure.) *Anthers* 2-lobed, lobes converging towards apex, one a little longer than the other, each furnished about its middle with a small tail-like process, filament terminated above the anthers in a broad membranous process. *Germen* oblong, with its base surrounded by a small cup-like disk. *Style* long, slender, persistent. *Stigma* composed of two thin lamellar plates. *Capsule* long, slender, silique-like, somewhat twisted when ripe, 2-valved, but the valves remain permanently united on one side, and open on the other, as in *Wightia gigantea.* *Dissepiment* thin, free, opposite to the valves, covered on both sides along the margins with suspended seeds, which are oblong, rough externally, slightly winged at both ends, and terminating in a much-divided coma of fine hairs. *Embryo* exalbuminous, straight, almond-like; radicle above. *Cotyledons* foliaceous.

123. ACANTHACEÆ.

As in several of the preceding, so in this family many of the species have a general resemblance to some of the *Scrophularineæ*, though the order is more closely allied to *Bignoniaceæ*. This might be inferred from Blume having united the *Cyrtandraceæ* with the latter, while Bartling has placed them under *Acanthaceæ*. These are, however, distinguished from *Bignoniaceæ* by their seeds, though exalbuminous, being without wings. Resembling the last-named family in structure, they do so also in geographical distribution, for they are found in the equinoctial regions of both the Old and New World, with a few species extending north into the south of Europe, Pennsylvania, and Japan, and southwards to the Cape of Good Hope and the southern coast of New Holland.

In India the *Acanthaceæ* are found every where in the plains, and also at considerable elevations in the mountains: the distribution of the genera, and even of some of the species,

species, fully bears out the resemblance which we have seen that the Flora of India bears to that of some other countries. Thus, taking the genera as they were until lately circumscribed, we find, as stated by Mr. Brown, Congo., p. 450, that all the genera found on the western coast of Africa, exist also in India; as *Nelsonia, Adenosma, Elytraria, Lepidagathis, Justicia, Hypoestes, Ætheilema,* and *Blepharis.* Of these, the three last occur also in Arabia, with *Ruellia, Barleria, Justicia,* and *Dicliptera.* The last-mentioned genera are moreover found at the Cape of Good Hope, with *Thunbergia, Acanthus, Blepharis,* and *Hypoestes:* the last also in New Holland, with, chiefly in the tropical parts, species of *Nelsonia, Adenosma, Hygrophila, Justicia, Eranthemum, Ruellia,* and *Dilivaria.* Many of these Indian genera, and also some of the same species are found in the islands of the Indian Archipelago, whence they extend northwards along the Malayan Peninsula, and from Cochin-China into China, and a few into Japan. Being a tropical family, we find here, as in many others, several genera common to the Old and New Worlds; as *Thunbergia, Barleria, Lepidagathis, Ætheilema, Eranthemum, Dicliptera, Ruellia,* and *Elytraria:* to these may be added, Professor Nees Von Esenbeck's new genera *Ebermaiera, Leptostachya, Gendarussa,* and even *Blechum,* Juss. of which, though hitherto supposed to be confined to America, this celebrated botanist states having seen a species from the island of Luzon. With the exception of the last, all these genera are found in India, with *Crossandra;* a true species of *Acanthus* has been added by Dr. Wallich from Silhet.

Such were the names and number of the genera of Indian *Acanthaceæ,* when they were subjected to an elaborate examination by Professor Nees Von Esenbeck, the results of which are published in an admirable monograph in the third volume of Dr. Wallich's Plantæ Asiat. Rar., p. 70–117. In this the Indian *Acanthaceæ* are divided into the three tribes of *Thunbergieæ, Nelsonieæ,* and *Echmatacanthi,* including all those with hooked retinacula. The first tribe contains the genera *Thunbergia, Meyenia,* and *Hexacentris;* and the second, *Elytraria, Nelsonia, Adenosma; Ebermaiera,* and *Erythracanthus.* The third tribe is subdivided into the sub-tribes of—1. Hygrophileæ, containing the genera *Hemiadelphis* and *Hygrophila.* 2. Ruellieæ, containing *Dyschoriste, Dipteracanthus, Petalidium, Ruellia, Phlebophyllum, Buteræa, Adenacanthus, Stenosiphonium, Strobilanthes, Æchmanthera, Goldfussia, Asystasia, Echinacanthus,* and *Leptacanthus.* 3. Barlerieæ—*Asteracantha, Barleria, Ætheilema, Lepidagathis, Neuracanthus, Blepharis, Acanthus,* and *Dilivaria.* 5. Justicieæ—*Crossandra, Endopogon, Loxanthus, Phlogacanthus, Cryptophragmium, Rostellaria, Hemichoriste, Graptophyllum, Adhatoda, Gendarussa, Leptostachya, Gymnostachyum, Eranthemum, Justicia,* and *Rhinacanthus.* 6. Dicliptereæ—*Rungia, Dicliptera, Peristrophe, Hypoestes,* and *Raphidospora.* 7. Andrographideæ—*Erianthera, Haplanthus,* and *Andrographis.*

Many of these genera are peculiar to India, especially its southern parts, or common to these, the Malayan Peninsula, and Indian Archipelago. From the forests of Silhet a few extend to Nepal, and thence as far north as the banks of the Sutlej. Some penetrate from the longitudinal into the transverse vallies of the Himalaya, even in the

most northern parts, as *Adhatoda Vasica, Phlogocanthus thyrsiflorus, Andrographis echioides, Eranthemum nervosum, Barleria ciliata* and *cristata, Strobilanthes auriculata, Petalidium barlerioides,* and *Rhinacanthus communis,* all of which are found in the Kheree and Deyra jungles, and several in the interior. In the arid country on the banks of the Jumna are found *Elytraria crenata, Barleria Hystrix, Blepharis molluginifolia* and *boerhaviæfolia, Lepidagathis cristata,* with several species of *Rostellaria,* &c. A few only of this family ascend the mountains, as species of *Æchmanthera, Goldfussia, Strobilanthes, Echinacanthus,* and *Peristrophe;* some of which may be seen at as great an elevation as between 7,000 and 8,000 feet, in 30° of N. lat. Most of these are highly ornamental, and therefore well worthy of introduction into at least the green-houses of England. The most remarkable of the whole is no doubt *Æchmanthera* (*Ruellia*) *gossypina,* with its thick coating of white tomentum.

Of species common to India and other countries, *Adenosma uliginosa, Eranthemum nervosum, Andrographis paniculata,* and *Hypoestes purpurascens,* may be mentioned as likewise found in New Holland; the last also in China. *Dilivaria ilicifolia* occurs in the Delta of the Ganges, on the coasts of the Peninsula, those of Java, Penang, and New Holland.

The *Acanthaceæ* contain few plants possessed of much medical virtues, or useful in the arts. Some are demulcent, others a little bitter and acrid. *Adhatoda Vasica* is esteemed in India as a cure for coughs, *Asteracantha longifolia* is accounted tonic and diuretic, and *Rhinacanthus communis* very efficacious in curing obstinate cutaneous affections; while *Andrographis* (*Justicia*) *paniculata,* called *kulufnath,* &c. by the natives, and known to Europeans by the name *Creyat,* is highly esteemed as a powerful bitter, and, as an ingredient of the *Drogue amere,* obtained considerable repute as a cure for cholera.

124. VERBENACEÆ.

The *Verbenaceæ* resemble several of the preceding orders, in having irregular flowers. They are distinguished from *Labiatæ,* to which they are most closely allied, by their 2-4-celled fruits and terminal style. The order is chiefly found in tropical countries, with a few species extending into higher latitudes, as into Europe, N. America, Japan, the Cape of Good Hope, and New Holland. These are usually annuals, or form small shrubs: the tropical species, on the contrary, consist chiefly of large trees belonging to the genera *Tectona, Hymenopyramis,* Wall., and *Glossocarya,* Wall., found in Burma; also to *Gmelina, Vitex,* and *Premna:* while species of *Symphorema, Congea, Wallrothia, Streptium, Callicarpa, Lantana,* and many species of *Clerodendron* form shrubs. Most of these occur in the greatest abundance in the southern parts of India, while species of the three last occur also in the New World; as well as of *Verbena, Zapania,* and *Vitex.* The last, with *Clerodendron* and *Premna,* is also found in tropical New Holland, and the two first in China. *Lantana* is often supposed to be confined to America, but a species is stated to be found at the Cape of Good Hope, and another in Arabia, while there are two undoubted species (*L. indica,* Roxb., and *dubia,* Wall.), found wild in

several

several parts of India. *Phryma* is another American genus, which must in future be included in the Indian Flora, as the same species, *P. leptostachya,* exists in such widely-separated localities as N. America, and Mussooree and Simla, elevations of 7,000 and 8,000 in the Himalayas. *Verbena officinalis* and *Zapania nodiflora* are found both in the plains and mountains; the former, common in Europe, occurs only in the cold weather in the plains, while the latter is common in New Holland, and different parts of America. *Avicennia* was first annexed by Mr. Brown to *Myoporineæ,* but has since been restored by him to *Verbenaceæ. A. tomentosa* is found on the coasts of India, New Holland, and of many of the islands; also on the coast of Africa. It is the *rack* of Bruce, v. Prod. Fl. Nov. Holland. and Wall. Pl. As. Rar. t. 276.

The species which extend to the most northern latitudes along the foot of the mountains, are *Gmelina arborea, Premna mucronata, Callicarpa macrophylla, Clerodendron Siphonanthus, dentatum,* and *gratum;* the last of which appears to differ little from *C. odoratum. Vitex trifolia* is found in a cultivated state, and *V. Negundo* most common in the open plains of N. India; on the arid banks of the Jumna *Clerodendron phlomoides,* extending there through Bundlecund from the Indian Peninsula. *Vitex Negundo* and *V. incisa* are found at small elevations, as well as in the vallies within the mountains. *Premna? pygmæa* may be seen in more exposed situations on the mountain-side.

Many of the *Verbenaceæ* are possessed of slightly bitter, subastringent, and some of aromatic, properties. *Verbena officinalis* is employed medicinally in India, as formerly in Europe; so *Volkameria inermis, Clerodendron phlomoides, Premna integrifolia, Zapania nodiflora,* and *Callicarpa lanata* are bitterish, and used, equally with others, in Indian medicine. The last is also accounted sub-aromatic, as are several of the *Lantanas; L. pseudo-thea* being employed as a substitute for tea in Brazil, while *Aloysia* (*Verbena*) *triphylla* displays this principle most fully developed in its sweet-scented leaves. The *Premnas,* on the contrary, are all fœtid; an acrid principle is secreted in the fruit of *Vitex Agnus Castus,* formerly called *piper agrestis,* for which, in India, that of *V. triphylla* and *Negundo* are substituted, and called *filfil burree* (wild pepper): the leaves of both are much used in India for cataplasms and medicated baths.

But timber is by far the most valuable product of the plants of this family. *Vitex altissima* and *arborea, Premna mucronata,* yield it of a hard and durable nature; as does *Gmelina arborea,* esteemed for its resemblance to Teak (v. Roxb. Fl. Ind. iii. p. 84), the most valuable of the family, perhaps, of the vegetable kingdom. This, known to botanists by the name *Tectona grandis,* is called *tekka, teke,* and *sag* or *sagoon* in different parts of India; its sub-astringent leaves are aptly compared to elephant's ears. The teak is well known to be a native of Burma and Pegu, especially along the banks of the Irrawady; also of Ava, Siam, and Java. The teak forests from which Bombay is chiefly supplied lie along the western face of the Malabar ghauts. Dr. Roxburgh describes it as also found on the mountainous parts of the Coromandel coast, and on the banks of the Godavery, above Rajamundry. From this, or from the western

ghauts, it proceeds far into the interior of India, as I have seen it abundant, though small, in the vicinity of the mountain fort of Adjeegurh, in Bundlecund. The teak has been introduced as far north as Saharunpore, where it succeeds well, and has been extensively planted along the banks of the canals by Major Colvin and Lieut. Cautley. Others of the family would also succeed well in every part of India.

Lantana dubia (Wall.) frutex inermis; foliis oppositis cordato-ovatis acuminatis serratis scabris subtus sericeo-pilosis, ramis quadrangularibus hispidis, pedunculis foliis æquantibus, capitulis rotundatis demum elongatis spiciformibus, bracteis cordatis foliaceis squarrosis.—*Lantana dubia.* Wall. Cat. N. 1823.—Tab. 73. fig. 2.

Hab. This plant was first discovered by Dr. Hamilton on the banks of the Jumna, and called by him *Lantana Gochana* (v. Wall. Cat. N. 1821. c.) where I myself found it in several places, as well as in the neighbourhood of Saharunpore, and have received specimens from the Pinjore valley. Dr. Wallich also collected specimens of the same species at Assufghur in Rohilcund. I have no doubt that this species is indigenous, and therefore regret that the specific name *dubia* should have been applied to it; perhaps the name of the discoverer or his original MS. name would be preferable.

125. LABIATÆ.

The *Labiatæ* form so natural an order, as to have induced Jussieu to say that the whole might almost be considered one huge genus. They are connected by their irregular flowers with several of the preceding, but are distinguished by their 4-lobed ovary, and style arising from the base of the ovules. The species are distributed over every region of the globe, though they affect temperate rather than very hot or very cold countries; but some are found in all, with the exception only of the very coldest. The whole have been subjected to a rigorous investigation by Mr. Bentham, in his elaborate and admirable monograph of the *Labiatæ*, consisting of 1,696 species belonging to 108 genera, of which 25 are common to the Old and New Worlds. These are distributed into the eleven tribes of *Ocimoideæ, Menthoideæ, Monardeæ, Satureineæ, Melissineæ, Scutellerineæ, Prostrantheræ, Nepeteæ, Stachydeæ, Prasieæ,* and *Ajugoideæ,* of all which, except *Prostrantheræ,* there are Indian or Himalayan species, 113 being found in the former, and 200 in the latter. The genera which are prevalent in the plains, chiefly of southern parts, and nearly peculiar to the country, or extending along the Malayan Peninsula to the Indian Archipelago, are *Anisochilus, Pogostemon, Dysophylla, Colebrookia, Gomphostemma, Cymaria,* and *Achyrospermum.* Those, of which species are also found in Africa, are *Geniosporum, Acrocephalus, Coleus, Leonotis, Leucas, Moschosma,* and *Plectranthus;* the two last, with *Anisomeles,* also extend to New Holland. *Orthosiphon,* with several Indian, has one American species, and *Ocimum* a few species in both Africa and S. America. Of several of these, species extend to the most northern parts of India, and a few also ascend the Himalayas, as species of *Plectranthus* and *Coleus. Gomphostemma* extends to Nepal, as does *Dysophylla pumila,* found also as far north as Cashmere by M. Jacquemont. *Lavandula,* of the tribe *Ocimoideæ,* is chiefly found in the south of Europe and north of Africa; also in Egypt, Arabia, and Persia; but one species, *L. Burmanni,* extends to the western parts of India (Bombay, *Col. Sykes;* Deccan, *M. Jacquemont*); whence it was

probably

probably first made known to botanists. *Leonurus*, indeed the same species, *L. Sibericus*, is found in Europe, Northern Asia, Africa, and America; it occurs both in the plains of India and in the Himalayas.

Of species which extend from the southern to the northern parts of India, *Anisochilus carnosus* and *Leonotis nepetæfolia*, may be mentioned as common on the banks of the Jumna and in the interior of the mountains. *Leucas procumbens* and *L. urticæfolia* occur in Bundlecund, and the latter also in Arabia and Abyssinia. *Anisomeles Heyneana* spreads from the Peninsula to Salsette. *Coleus barbatus* is found in the mountains of the Peninsula, and of Arabia Felix, in Nepal, Kemaon, and near Kedarkanta. *Moschosma polystachya* and *Coleus scutellaroides* extend to New Holland; *Acrocephalus capitatus*, *Leucas chinensis* and *mollissima*, with *Anisomeles ovata*, spread eastward into China. *Ocimum canum* and *basilicum*, *Leucas martinicensis*, exist also in Africa and America; *Leonotis nepetæfolia* in the former only. *Salvia acaulis* and *plebeia*, belonging to sections found in Africa and also in America, are both indigenous in the plains of India. *S. plebeia* occurs also in tropical Asia generally, in China, and New Holland; it extends north in India to the banks of the Jumna.

The genera, on the contrary, which are found in the Himalayas, display, as we should expect from the differences in climate, affinities in vegetation to very different countries. Those which are peculiar to these mountains, are *Perilla*, *Marmoritis*, *Roylea*, *Notochæte*, *Eriophyton*, and *Colquhounia*. *Holmskioldia* keeps to the jungly base. *Plectranthus*, *Meriandra*, *Craniotome*, are genera of which some of the species are seen in these mountains, but others in hot parts of the world. *Salvia*, *Prunella*, *Stachys*, *Leonurus*, *Teucrium*, and *Ajuga* exist almost every where, except the last, which is not found in America; and *Scutellaria* every where, but in tropical and Southern Africa. The above, therefore, do not prove analogies in vegetation. *Elsholtzia* and *Eremostachys* are common to the north of Asia and the Himalayas. *Mentha*, *Melissa*, *Dracocephalum*, and *Lycopus* chiefly inhabit the temperate parts of Europe, Asia, and America; the last has also one species in New Holland. *Hyssopus*, *Lamium*, and *Marrubium* exist in Europe and Northern Asia. Of the last, one species extends to Cashmere, and one as far as America. *Hedeoma* is an American genus, of which one species has been found in the Himalayas. *Origanum*, *Thymus*, *Phlomis*, *Ballota*, chiefly occupy Europe and the Mediterranean region. The Himalayas appear to be the head-quarters of *Nepeta*, as five species were discovered by Dr. Wallich, eleven by the Author, and ten additional species by M. Jacquemont, of the latter, *N. glutinosa* exists also in Mr. Inglis's collection.

Hyptis is a vast American genus, of which a few species spread to the Old World, perhaps not originally indigenous, as *H. spicigera* and *pectinata*, found in tropical Africa, and the last also in Asia; but *H. obtusifolia*, Br., is a new, though undescribed species, found by Mr. Salt in Abyssinia. *H. nepalensis Lehm*, is not known to Mr. Bentham, but *H. suaveolens* was brought me by my plant collectors; they stated from the Choor mountain. It is found in S. America, tropical Asia, and also in the Indian Peninsula.

As

As the species of *Labiatæ* are numerous in the Himalayas, so are those common to these mountains and to Europe; as *Thymus Serpyllum, Origanum vulgare, Prunella vulgaris,* and *Lamium amplexicaule. Leonurus cardiaca, Lycopus exaltatus, Hyssopus officinalis,* and *Mentha sylvestris* are found in Kunawur; *Nepeta Cataria, Melissa Clinopodium, Mentha sylvestris, arvensis,* and *viridis,* in Cashmere. The last is also common in the Himalayas in a cultivated state, and called by the people of the plains *puharee podeena,* (hill-mint), to distinguish it from *desee podeena,* or the mint of the plains, cultivated in gardens. *Lamium amplexicaule* is also found in the plains in the cold weather. The species of the south of Europe, and of parts of the Oriental or Siberian regions, which also spread to the Himalayas, are *Scutellaria orientalis* and *galericulata, Salvia Sibthorpii, Marrubium astracanicum, Melissa umbrosa,* and *Elsholtzia cristata,* while *Origanum normale* and *Stachys sericea,* first described from Nepal, have been found much further north, the first near Lake Baical, and the second in Ghilan. *Ballota limbata,* of the section inhabiting the south of Europe, Persia, and Arabia, was found by M. Jacquemont in the Punjab at Pindaden Khan. *Scutellaria rivularis* and *Ajuga decumbens* are common to the Himalayas and to China. *Micromeria biflora* with *Prunella vulgaris,* exists both in the Himalayas and Neelgherries.

The *Labiatæ* are well known for the odoriferous nature of many of the species, dependant on the presence of a pungent, generally fragrant essential oil, which is remarkable for commonly containing camphor. Some of the family are also possessed of bitter properties, hence a few have been employed as tonics and febrifuges, as *Teucrium Chamædrys, Scordium* and *Chamæpitys, Glechoma hederacea, Ocimum febrifugum, Salvia amarissima,* &c. Some are better, and perhaps more deservedly, known for their uses in seasoning food, as thyme, sage, savory, marjoram, and mint; while others, as lavender and rosemary, are more celebrated for their uses as perfumes. Many of these having been described in the works of the ancients, have found their way into those of the Asiatics, where *Lavendula stæchas* may be found under the name *oostakhoodus;* rosemary under *ukleel-ool-jibbul;* thyme, as *hasha;* hyssop, *zoofae-yabis;* basil, *rihan;* marjoram, *satur;* mint, *nana;* and sage, under the names *salbiah* and *sefakuss* (Ainslie, 1. p. 359), which last are evident corruptions of *Salvia* and *elisphacos.* It is remarkable, that though many of these, as thyme, hyssop, and marjoram, are indigenous in the Himalayas, they, or rather some inefficient substitutes, continue to be imported into India by the Red Sea, to be prescribed at the foot of mountains where the fresh and genuine articles may be had in any quantity. Several of the above succeed well also in the gardens of Northern India; but perhaps none would be so much valued by the natives as the peppermint, with the essential oil of which they have become so well acquainted, from its frequent prescription in cholera. Some efficient substitute might, however, be found for this from among the indigenous plants of this family, of which several are already used by the natives for the same purposes as their European allies; as species of *Anisomeles, Dysophila, Elsholtzia,* and *Pogostemon.* Though the different species of *Ocimum* are the most grateful and most highly esteemed, *O. sanctum,* forming

one

one of the sacred plants of the Hindoos. *Plectanthrus cordifolius, Coleus barbatus* and *aromaticus* are also very aromatic. Both the hill and plain varieties of mint are much used by the natives in medicine, as is *Mentha Royleana* by the hill-people. But *Meriandra strobilifera* (*murtoo*), from its strong fragrance, promises to be as useful as any. *M. Bengalensis* is already much used by the natives, and called *kafoor ka putta.* Camphor-leaf. *Roylea elegans,* called *putkuroo,* is, on the contrary, employed in the mountains as a febrifuge, as we have seen to be the case with some of the Teucriums in Europe.

Dracocephalum Royleanum, or *Balungoo* of the natives, is the only plant of the family at present much cultivated in Northern India, and this on account of its seeds, *tookhm-balungoo,* which are extensively employed in India for forming mucilaginous drinks, in cases where these are indicated.

Salvia hians (Royle), Bentham in Hooker's Botanical Miscellany, vol. 3. p. 373, and Labiatarum Genera et Species, p. 219 and 717.—Tab. 75. fig. 2.

Hab. This very handsome species was brought me by my plant collectors from Cashmere. It was subsequently found, as we learn from Mr. Bentham, l. c. p. 717, by M. Jacquemont, in the elevated herbaceous regions of Cashmere, near Banhatti, and also on Peer Punjal. It is well worthy of introduction into the gardens of England, together with *Salvia Moorcroftiana,* and some others of the ornamental *Labiatæ,* found in the elevated regions of the Himalaya.

Phlomis Cashmeriana (Royle), Benth. in Hook. Bot. Misc. 3. p. 382, and Labiatarum Genera et Species p. 630.—Tab. 75 a fig. 1.

Hab. This, like the preceding, and figured with it in the same plate, is from Cashmere, and also well worthy of introduction into England.

Eremostachys superba (Royle), Benth. in Hook. Bot. Misc. 3. p. 381, and Labiatarum Genera et Species, p. 637.—Tab. 74.—Plant half the natural size. (*a*) A flower of the natural size; (*b*) the same seen sideways; (*c*) the same, with the corol removed, and the calyx cut open; (*d*) upper lip of corol, with the style closely embraced by the stamens, of which the filaments are covered with closely interlaced hairs, so as to give them somewhat the appearance of being bound down by a membrane, filaments terminated at their base by laciniated appendages, as in the filaments of the lower lip (*d**); (*e*) vertical section of two achenia; (*f*) achenium thickly covered with hair; (*g*) transverse section of the four achenia.

Hab. This very showy and elegant plant I have only met with in the Kheree Pass, or entrance on the direct road from Saharunpore into the Deyra Doon. Introduced into the Botanic Garden, it became perfectly naturalized, and highly ornamental. I have little to add to Mr. Bentham's excellent description of the generic and specific characters published in his Monograph of the *Labiatæ,* except that all the four filaments are terminated by the laciniate appendages, and that the annual stem springs from a large tuberous root-stock.

126. BORAGINEÆ.

The *Boragineæ,* very nearly allied to *Labiatæ* by their 4-lobed fruit, are sometimes divided into several orders, as *Boragineæ, Heliotropiceæ,* and *Ehretiaceæ;* but these it is more convenient to treat of as tribes of the first. The *Boragineæ,* including in this term the sub-orders, *Borageæ* and *Cynoglosseæ,* particularly abound in the temperate parts of the northern, with a small proportion also in the southern hemisphere, as at the Cape of Good Hope, in New Holland, Chili, and Peru. They are especially abundant in the temperate parts of Europe, in the Mediterranean, and Oriental regions. From Caucasus they extend into Siberia and the Altai mountains, and southwards to the Himalayas,

Himalayas, where are found the genera *Echium, Onosma, Anchusa, Myosotis,* and *Cynoglossum. Lithospermum* and *Echinospermum* are confined to Kunawur, with one species, *L. vestitum,* of the former, found both there and in the arid parts of the plains of N. India. This species is closely allied to another, found by Lieut. Wellsted on the shores of the Red Sea. Species of all these genera, except of the three first, are found in North America; but *Anchusa* exists at the Cape of Good Hope, with *Echinospermum, Myosotis,* and *Cynoglossum,* of which the two latter occur in S. America and New Holland, with *Lithospermum* also in the former. Some European species of this, as of other families, extend to the Himalayas, as may be seen in the accompanying account of the *Boragineæ* in my collection, with which I have been favoured by my friend, Mr. Bentham. A few species descend from the mountains to the plains, as *Cynoglossum canescens* and *furcatum,* where is also found *Trichodesma indica,* which likewise occurs at low elevations within the mountains. *T. zeylanica,* spreading to New Holland, is confined to the more southern parts of India. The other species of the genus are found in the Oriental region and in New Holland. *Coldenia,* of two species, has one in the southern provinces of India, and the other in Peru.

The *Ehretiæ* include both herbaceous and shrubby plants, with some of the *Ehretias* even forming small trees. They are found within the tropics, both of the Old and New World, and in tropical New Holland, with some of the herbaceous genera, such as *Heliotropium,* extending south to the Cape of Good Hope, and north to the south of Europe. The genera found in India are also so in the warm parts of America, and some of them in New Holland. *Ehretia, Tiaridium,* and *Tournefortia* occur chiefly in the southern parts of India; but species of the first extend to the most northern. *Heliotropium* is common in every part of the plains, but especially in the arid country, near Delhi, where are found *H. europæum, supinum, coromandelianum,* and *brevifolium,* with *Messerschmidia hispida,* whence species of this genus extend to Siberia and the Canaries, and of *Heliotropium* to Egypt and the south of Europe.

Several of the *Boragineæ* have been employed in medicine from the most ancient times, and those described by the Greeks hold a place in the Indian Materia Medica; but few of them are possessed of any other than mucilaginous properties; the roots, however, of several, as *Anchusa tinctoria* or Dyer's *Alkanet, Onosma echioides, Echium rubrum,* and *Anchusa virginica,* contain a reddish brown substance used by dyers (Lindley. Nat. Orders. p. 242); so, in the Himalayas, the roots of *Onosma emodi,* Wall., allied to *O. tinctorium,* Bieb., and called *maharunga,* from its intensity of colour, are also used in dyeing; another species, *Lithospermum euchromon,* nob., has been so named from the same circumstance. *Onosma bracteatum* is called *gao-zuban,* or ox-tongue, and has *fooghulus* and *bugloozun* assigned as its Greek names. *Borago officinalis* is supposed in Europe to be the true *Bugloss. Symphytum* has been transformed by the Asiatics into *sunkootun,* and *Lithospermum* into *lubishfirmun.* The species of *Trichodesma* are considered diuretic, and one of the supposed cures for snake-bites.

BORAGINEÆ ROYLEANEÆ.*

Auct. G. BENTHAM.

Subordo I. Borageæ.—*Nuces distinctæ fundo calycis affixæ.*

* *Faux corollæ nuda.*

I. Onosma.—*Linn.—Lehm.*

1. *O. echioides.* Bieb. Fl. Taur. Cauc. 1. 130.

Rogee in Kunawur.—Tagla. *R. Inglis, Esq.*

2. *O. bracteatum.* Wall. in Roxb. Fl. Ind. ed. Car. et Wall. 2. 13.

Himalayas, Shalma, and mountains of Cashmere.

II. Lithospermum.—*Linn.—Lehm.*

Sect. Rhytispermum. Link.—Reichb. Fl. Germ. Exc. 336.

1. *L. arvense.* Linn.

Meero in Kunawur.

2. *L. vestitum* (Wall. Cat. n. 941) pilis rigidis hispidissimum, ramis adscendentibus parce ramosis, foliis lanceolatis vel lanceolato-linearibus, spicis densis cymosis, calycis laciniis lanceolato-linearibus, tubo corollæ tenui pubescente brevioribus, corollæ fauce plicata, nucibus rugosis.—Affine videtur *L. decumbenti, Vent.*, sed calyces basi non pentagoni, et rami floriferi parce foliosi.

Plains of Northern India.—Chango and Hango in Kunawur. *R. Inglis, Esq.*

Sect. Margarospermum. Reichb. l. c. 337.

3. *L. euchromon* (Royle MSS.) hispidum, ramis adscendentibus subsimplicibus, foliis radicalibus lanceolato-linearibus basi longe angustatis, caulinis lato-lanceolatis cordato-amplexicaulibus, calycis laciniis lanceolatis tubum corollæ glabrum æquantibus.—Habitus fere *Anchusæ tinctoriæ*, at major, et corolla omnino *Lithospermi.* Radix crassa intense colorata. Corolla *L. purpureo-cærulei.*

Nako in Kunawur.

4. *L. echioides* (Royle MSS.) hispidum, humile, cæspitosum, foliis oblongis inferioribus longe petiolatis, corollæ glabræ calyce duplo longioris limbo erecto, laciniis superioribus longioribus.—Corollæ forma *Echiis* quodammodo accedit, sed stamina omnia æqualia. Faux corollæ nuda; filamenta brevissima supra medium tubi inserta. Nuces ad basin calycis insertæ, maturas non vidi.

Soongnum in Kunawur.—Kherang Pass. *R. Inglis, Esq.*

** *Faux corollæ fornicibus instructa.*

III. Anchusa.—*Linn.—Lehm.*

The collection contains one species allied to *A. italica*, and perhaps not different from it; but the specimens are too imperfect to determine. They were gathered at Jhilum, on the road to Cashmere.

IV. Myosotis.—*Linn.—Lehm.*

1. *M. racemosa* (Royle MSS.) foliis radicalibus longe petiolatis ovatis basi subcordatis caulinis petiolatis basi rotundatis, racemis longis ebracteatis, calycis laciniis subulatis hispidis corollæ tubo brevioribus, nucibus angulatis vix reticulato-rugosis.—Affinis *M. macrophyllæ*, sed floribus duplo majoribus, et tubo corollæ exserto abunde distincta. A *M. ovalifolia* calyce et habitu diversa.

Urrukta and Choor.

2. *M. rotundifolia* (Wall. Cat. n. 930) humilis, glabriuscula, foliis radicalibus longe petiolatis parvis subrotundis, caulinis oblongis petiolis dilatatis, supremis sessilibus, racemis ebracteatis, calycis laciniis ovato-lanceolatis tubo corollæ vix brevioribus.—Affinis *M. ovalifoliæ.* Wall., sed satis diversa videtur.

Choor and Kedarkanta.

3. *M. moltkioides* (Royle MSS.) humilis, hispida, foliis ad basin caulis numerosis parvis petiolatis oblongis, scapo subnudo apice dense cymoso, bracteis nullis, calycis laciniis linearibus hispidis tubo corollæ amplo dimidio brevioribus.

Peer Punjal.

Anchusa Moltkioides Illustr. T. 73. fig. 1. *a.* Flower; *b. c.* calyx and corol opened; *d. e.* anthers; *f.* pollen; *g.* stigma; *h.* a nut.

The three preceding species belong to the same series as the *M. macrophylla*, which Lehmann refers to *Anchusa.*

4. *M. sylvatica. Ehrh?*

Pungee in Kunawur.

5. *M. alpestris. Ehrh?*

Peer Punjal and Surthul on the road to Cashmere.

6. *M. collina. Ehrh?*

Soongnum in Kunawur.

7. *M. intermedia. Ehrh?*

Himalayas. *Lady Sarah Amherst.*

The specimens of these last four species are not perfect, but do not appear to differ from the European forms.

8. *M. palustris.* With.

Cashmere and Cheenee in Kunawur.

Subordo II. Cynoglosseæ.—*Nuces lateraliter stylo affixæ.*

V. Cynoglossum.—*Linn.—Lehm.*

*Nuces margine aculeis uniserialibus basi subconnexis glochidiatæ, superficie nuda vel aculeis paucis brevibus.

1. *C uncinatum* (Royle MSS.) ramis laxis divaricatis, foliis petiolatis ovatis acuminatis inferioribus basi subcordatis, racemis laxis ebracteatis, nucibus marginatis aculeis uniserialibus nuce longioribus.—*Rindera glochidiata.* Wall. Cat. n. 926.

Choor, Acharanda, Dokree in Kunawur.

β. *laxiflora*, glabrior, foliis majoribus.—*C. macrophyllum* (Royle MSS.)

Nagkanda, Tuen, Urrukta.

2. *C. microglochin* (Royle MSS.) pubescens, foliis subsessilibus ovatis acuminatis basi rotundatis, racemis ebracteatis, nucibus marginatis, aculeis uniserialibus, paucisque brevissimis sparsis.

Cashmere.

3. *C. grandiflorum* (Royle MSS.) pilosum, foliis oblongis acuminatis basi angustatis et cordato-amplexicaulibus, racemis ebracteatis, calycis laciniis tubum corollæ æquantibus, nucibus marginatis aculeis uniserialibus paucisque brevibus sparsis.—Nuces tantum juniores vidi.

Cashmere, Hurpoo, Choor, Kedarkanta.

4. *C. longiflorum* (Royle MSS. pilosum, foliis oblongis acuminatis, superioribus basi cordato-amplexicaulibus, racemis

* The arrangement and circumscription of the genera is taken partly from Lehmann's monograph, partly from Reichenbach's Flora Germanica Excursoria.

cemis ebracteatis, calycis laciniis tubo corollæ dimidio brevioribus, nucibus marginatis, aculeis uniserialibus paucisque sparsis?—Exemplaria incompleta; at species, etsi præcedenti affinis, corolla distinctissima est.

Cashmere.

5. *C. glochidiatum* (Wall. Cat. n. 922) pilosum, divaricato-ramosum, foliis oblongis acuminatis basi angustatis sessilibus, racemis elongatis tenuibus, floribus subsessilibus, nucibus parvis marginatis aculeis brevibus uniserialibus paucisque sparsis.—Flores dimidio minores quam in præcedentibus.—*C. vesiculosum.* Wall. Cat. n. 920.—Also the Nepal specimens of *C. canescens.* Wall. Cat. n. 918.

Choor, Simla, Rogee and Chaogaon in Kunawur.—Chinee. *R. Inglis, Esq.*

**Nuces per omnem superficiem dense et subæqualiter glochidiatæ.

6. *C. canescens.* Willd. Enum. Hort Berol. 1. 180.—*C. racemosum.* Roxb. ex Wall. in Roxb. Fl. Ind. 2. 6.

Mussooree and Saharunpore.

7. *C. furcatum.* Wall. in Roxb. l. c.

Mussooree, Saharunpore, and Kheree.

β. *tenerum* (Royle) foliis brevioribus.

Mussooree.

8, 9. There are two other species apparently belonging to this genus, but in too imperfect a state to determine; the one gathered in Cashmere, the other on Shalma.

VI. Echinospermum.—*Lehm.*

1. *E. canum* (Benth.) perenne, cæspitosum, sericeo-incanum, ramis strictis erectis, foliis oblongo-linearibus, racemis strictis, bracteis minutis, nucibus marginatis aculeis brevibus uniserialibus.—Caules numerosi pedales. Flores parvi. Nuces per omnem superficiem minute tuberculosæ.

Lippa and Pungee in Kunawur.—Kherang Pass. *R. Inglis, Esq.*

2. *E. sericeum* (Benth.) perenne, cæspitosum, pilis longis sericeo-villosum, foliis oblongo-lanceolatis, racemis laxe corymbosis basi vix bracteatis, nucibus marginatis aculeis longis uniserialibus.—Caules vix semipedales. Habitus et flores *Myosotidis nanæ.* Vill. (*Eritrichium.* Reichb.) Nuces maturas non vidi.

Nako in Kunawur.

3. *E. spathulatum* (Benth.) perenne, cæspitosum, pilis adpressis incanum, foliis oblongis obtusis inferioribus longe petiolatis, racemis laxe corymbosis basi vix bracteatis, nucibus marginatis aculeis numerosis uniserialibus basi connatis.—Habitus et flores fere *Myosotidis alpestris.*

Chango in Kunawur.

VII. Trichodesma.—*Br.*

1. *T. indicum.* Br. Prod. 1. 496.

Plains of Northern India and lower mountains.

Subordo III. Heliotropeæ.—*Nuces coalitæ, in fructu maturo sæpius partibiles.*

VIII. Heliotropium.—*Linn.*—*Lehm.*

1. *H. supinum.* Linn. Spec. 187.—*H. malabaricum.* Retz. Obs. 4. 24.

Plains of Northern India.

2. *H. europæum.* Linn. Spec. 187.

Plains of Northern India.

3. *H. brevifolium.* Wall. in Roxb. Fl. Ind. ed. Wall. 2. 2.

Plains of Northern India.

4. *H. coromandelianum.* Retz. Obs. 2. 9.

Plains of Northern India.

IX. Messerschmidia.—*Roem. et Schult. Syst.* 4. li.

1. *M. hispida* (Benth.) caule hispido, foliis oblongo-lanceolatis strigoso-hispidis, spicis elongatis paniculato-ramosis.—Corollæ tubus calyce duplo longior, laciniis longe subulato-acuminatis. Bacca subsicca tetrapyrena ossiculis monospermis.

Delhi.

X. Ehretia.

1. *E. serrata.* Roxb. Fl. Ind. ed. Car. et Wall. 2. 340.

Deyra Doon and Kheree Pass.

2. *E. floribunda* (Royle MSS.) arborea, foliis ovatis junioribus ramisque novellis pubescentibus demum glabratis, cymis ample dichotomis axillaribus terminalibusque.—Corolla major quam in *E. lævi* et *E. aspera.* Bacca magnitudine grani piperitis maturitate 4-partibilis.

Deyra Doon and Kheeree Pass, and Central Range.

3. *E. lævis.* Roxb. Pl. Corom. 1. p. 42. t. 56.

Deyra Doon and Kheree Pass.

4. *E. pubescens* (Royle MSS.) foliis ovatis supra scabris subtus pubescentibus, cymis lateralibus paucifloris.—Ab *E. aspera* differt foliis amplis coriaceis et inflorescentia. Corolla *E. lævis.*

Foot of the Himalayas.

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127. CORDIACEÆ.

This small order, separated from the old *Boragineæ* on account of the plaited cotyledons and dichotomous styles, in which it closely resembles *Convolvulaceæ,* is chiefly confined to the tropical parts of the Old and New World. *Cordia,* the only genus in India, has the distribution of the order in Africa and America, and is found in Arabia, China, and New Holland. One species, *C. Myxa,* extends into Egypt, where it has probably been introduced. This species is also found in every part of India. *C. angustifolia* extends from the Peninsula up to the banks of the Ganges. *C. latifolia* and *tomentosa* are confined to the southern parts. In the Deyra and Kheree jungles is found *C. Latora,* Hb. Ham., perhaps only a variety of *C. Myxa,* with a new species, *C. incana,* nob.

The

The succulent, clammy, subastringent fruit of *C. Myxa,* has been long esteemed as a medicine, under the name *Sebesten,* and is also eaten by Asiatics. *C. latifolia* is supposed by Dr. Roxburgh and Mr. Colebrooke (*Fl. Indica* 1. p. 590) to produce the larger, while *C. Myxa* affords the smaller *sepistans* or *sebestans.* From these the order was named *Sebestineæ* by Ventenat. The bark of *C. Myxa* is accounted a mild tonic; that of *C. angustifolia,* Roxb., (*reticulata,* Roth.), *goondnee,* is much used for making astringent gargles; the fruit also is employed as an astringent.

128. CONVOLVULACEÆ.

The *Convolvulaceæ,* generally known by their twining habit and plaited corols, are allied to *Cordiaceæ* by their shrivelled cotyledons, and are, like them, chiefly found in tropical countries, with a few species extending north, and ascending the mountains in warm latitudes. Thus we have them in abundance in the plains of India, with a few only in the Himalayas. The Indian species have been carefully examined by M. Choisy, in a memoir published in the Mem. de la Soc. d'Hist. Nat. de Geneve, where he has given a tabular view of the genera belonging to this family. Of these, several are peculiar to the southern parts of India and the Malayan Peninsula, as *Blinkworthia, Moorcroftia, Shuteria, Skinneria, Neuropeltis,* and *Lepistemon;* of the last, one species extends to Java. *Argyreia* is common to India and China, *Calystegia* to India and New Holland. Of the other genera found in India, *Porana* occurs in Western Africa; *Calystegia, Breweria,* and *Dichondra,* in New Holland; of the two last, species are also found in America. *Quamoclit* and *Aniseia* are chiefly found in America; but species of both are indigenous in India and China, while *Calonictyon* has several species in India, but only one in the West-Indies. *Rivea, Ipomœa, Convolvulus, Evolvulus,* and *Batatas,* are found in the tropical parts of Asia, Africa, and America; and, with the exception of the first, also in New Holland. *Cressa* extends from India to the south of Europe, and species of *Convolvulus* and *Calystegia* to several northern parts. *Cuscuta* has a very wide distribution in the Old World, both in hot and cold countries.

Many of the same species spread from the southern to the most northern parts of India along the foot of the mountains, as we have seen to be the case in other families, as *Rivea ornata, Argyreia speciosa, Porana racemosa, Quamoclit vulgaris,* &c., all of which are found wild in the Deyra Doon. Some are common to India, China, and New Holland, as *Ipomœa pescapræ, reptans,* and *dasysperma;* others, found chiefly in arid parts of the country, to India and Western Africa, as *I. coptica, filicaulis,* and *reptans, Batatas paniculatus* and *pentaphyllus,* all of which, with the exception of the first, spread to America. *Batatas edulis* is cultivated in all the tropical parts of the world. Other instances of the same nature may be seen in M. Choisy's Memoir. A few species only of those found in the plains ascend the mountains, as *Rivea ornata,* to moderate elevations, *Pharbitis Nil,* common in various parts of the world, to as high as 5,000 feet; *Ipomœa atropurpurea* and *cuspidata* occur in Nepal; *Aniseia burlerioides* in Kemaon, and on the banks of the Tonse. *Cuscuta grandiflora* is common in the Himalayas,

layas, and also in Kunawur, with a species allied to *C. Europæa*. *Convolvulus arvensis*, found almost every where, occurs both in the plains and mountains of India.

The *Convolvulaceæ* are well known for the purgative properties of the roots of many of the family, as of Jalap, Scammony, &c. *Convolvulus panduratus* is substituted in the United States for the former; so, in India, *Ipomæa Turpethum, toorbud* of the Arabs, supposed to be a corruption of the Sanscrit *trivrit*, Hindee *nusot*, is accounted a powerful cathartic, and by Dr. Wallich an excellent substitute for jalap, (v. Gordon, in Roxb. Fl. Ind. ed. Wall. 2. p. 58); so the seeds of *Ipomæa cærulea, hub-ool-nil, kala dana*, are accounted purgative in India, as are several others of this family. The annual shoots not having secreted the due proportion of resin, are inert, and even edible; as the stalks of *C. edulis* and *repens*. The tubers of *Batatas edulis*, or sweet potatoe, have long been employed as food.

Convolvulus Scammonia, of which the dried resinous juice forms scammony, *sukmoonya* of the Arabs, is chiefly produced near Smyrna and Aleppo; but only inferior kinds find their way to India, though there is little doubt that it might be produced of the best quality in Northern India. The Jalap exported from Vera Cruz was supposed to be produced in that neighbourhood, or in that of Xalapa, by *Ipomæa macrorhiza* of Michaux. But it was known to Humboldt (New Spain. vol. iii. p. 36), and also to Dr. Coxe (v. Thomson. Elem. of Mat. Med. ii. p. 289), to be the produce of a different plant. The latter calls it *I. Jalapa*, and the former says, "that the true *Purga de Xalapa* delights only in a temperate climate, or rather an almost cold one, in shaded valleys, and on the slope of mountains." The true plant has been fully described by Professor Don, in a paper read before the Linnean Society, from specimens grown from seeds sent by Dr. Schiede, which he procured from Chiconquiera, on the eastern declivity of the Mexican Andes, at an elevation of 6,000 feet. Mr. Don retains for this the name *I. Jalapa*, instead of *Schiedeana* and *Purga*, given it by Zuccarini and Wenderoth. The discovery of the true locality is important, as shewing that the Jalap requires a cool climate, and may no doubt therefore be cultivated in the Himalayas.

129. HYDROLEACEÆ.

This small order, separated from *Convolvulaceæ*, contains genera which inhabit very different kinds of climate. *Nama* is found in both the East and West-Indies; and *N. (Hydrolea) zeylanica* extends from the southern to the most northern parts of the plains of India, where it forms an ornament of damp and swampy situations.

130. POLEMONIACEÆ.

This family, allied on one hand to *Gentianeæ*, and on the other to *Convolvulaceæ*, abounds chiefly in America, as in Chili, Peru, Mexico, and the more southern of the United States provinces, but especially in California. Dr. Richardson states 54° as the most northern limit of the order. The genus *Phlox* has also a species in Siberia, and *Polemorium* extends from Europe across Siberia to Japan, and south-

wards

wards to the Mediterranean, the Caucasus, and even the Himalayas, where only a single species (*P. cæruleum* according to Dr. Wallich) is found in Kemaon and at Kotgurh; but the specimens which I have from the Choor Mountain and the Borang Pass, as well as from Cashmere, agree better, according to Mr. Don, with *P. gracile* of Fischer, from Siberia. In addition to this, there is another genus found on lofty situations in the Himalaya, which is referable to this family, on the authority of Mr. Bentham, who has named and described so many of the new genera and species of *Polemoniaceæ*, and has with his accustomed kindness favoured me with the following character of those of *Cyananthus*, which with its 5-celled ovary and 5-lobed stigma, agreeing with some *Campanulaceæ*, differs from them in its inadherent calyx.

CYANANTHUS, WALL.

"Calyx inferus tubuloso-campanulatus semi-5-fiduslobis non membranaceis. Corolla subinfundibuliformis tubo amplo limbo 5-fido. Stamina 5 ad basin corollæ inserta ejusque lobis alternantia. Anthera ovario adpressa connatave. Ovarium liberum 5-loculare. Ovula in quoque loculo plurima. Stylus simplex. Stigma 5-lobum lobis ovatis patentibus. Capsula oblongo-conica valvis 5 loculicide-dehiscens.—Herbæ annuæ parum ramosæ procumbentes vel adscendentes. Folia alterna simplicia. Flores pauci solitarii sæpius terminales. Calyces nigro-villosi. Corollæ speciosæ cæruleæ. Semina oblongo-linearia.

1. *C. integra*, (Wall. Cat. Herb. Ind. n. 1472), foliis ovato-oblongis integerrimis serrulatisve.

Hab. Kemaon. *Wallich.* Kedarkanta. *Royle.*

2. *C. lobata* (Wall. l. c. n. 1473), foliis cuneatis inciso-lobatis.

Hab. Kemaon et Gossainthan. *Wallich.* Kedarkanta. *Royle.*

These plants differ from the other genera of the order in their 5-celled ovarium and 5-lobed stigma, but in every other respect they appear more nearly connected with Polemoniaceæ than with any other tribe."

131. PRIMULACEÆ.

The *Primulaceæ*, well known from affording so many ornamental and favourite flowers, are most closely allied in structure to *Myrsineæ*, from which, however, they differ much in habit. Dr. Lindley has remarked, that "they are nearly allied to all the regular monopetalous orders, with capsular fruit, especially *Solaneæ* and *Gentianeæ*." They are usually placed next *Lentibulareæ*, which are more closely related to *Scrophularineæ*. Hence it is difficult to place this family appropriately in a linear series; but if we suppose the series as returning into itself, and forming a plexus of circles and natural classes, the *Primulaceæ* will serve to connect several together.

Ornamental as are all the known *Primulaceæ*, they are no where more so than on the coldest and most exposed of the Himalayan peaks, and at a season when returning warmth has but just begun to displace the scene of wintery desolation. The plants of this family are chiefly diffused through the temperate and cold parts of the northern hemisphere, both in the Old and New World, where they are found in moist, shady, and frequently mountainous situations. But they exist also in the southern hemisphere, as *Primula* in the Straits of Magalhaens, and I believe also on the mountains of Van Diemen's Land; *Lysimachia* and *Centunculus* in New Holland, and *Anagallis* in Chili and Peru.

In India, the only plant of this family which is generally diffused through the plains, but this only during the cold weather, is *Anagallis arvensis*, found also in the Himalayas,

layas, in Europe, and so many other places. *Lysimachia obovata* was found by Dr. Wallich at the foot of the mountains, in the forests bounding Oude; *Androsace rotundifolia* and *incisa* descend to the Deyra Doon. But in the mountains the species of *Primulaceæ* are about forty-five in number, belonging to the genera *Primula, Androsace, Lysimachia, Centunculus,* and *Samolus,* which are all, except *Androsace,* found also in America. Of these, *Lysimachia* extends most southerly, as it is found on the Pundua and Neelgherry mountains, as well as on those of Taong Dong, and in Ava. (v. Wall. Cat. N. 1489); species are very generally diffused in the Himalayas, and found as high as 7,000 feet at Mussooree, but chiefly during the rainy season; one or two species occur also in Kunawur, with *L. thyrsiflora?* Linn. *Samolus Valerandi,* found already so widely diffused in Europe, Asia, and N. America, also in New Holland, and in Central Africa, is likewise found in the Himalayas by the sides of springs and little rivulets, at elevations of 5,000 feet, as near Chinalug, on the Suen range, and also in Kunawur, at Chaogaon. *Centunculus indicus,* nob. (v. Ic. ined. N. 348) is also found at moderate elevations. The genera *Primula* and *Androsace* have much the same distribution, sending a few species towards the foot of the mountains, and others towards the highest points of vegetation. Thus, as we have seen, *Androsace rotundifolia* and *incisa* descend towards the Doon; *A. lanuginosa* is found on Choor, &c., and other species, as *A. reptans* and *nidulans,* nob., in cold and bleak parts of Kunawur; so *Primula* has one species, *P. floribunda,* at as low an elevation as 5,000 feet in the neighbourhood of Kuerkoolee; but at higher elevations, as in the ascent to Choor in the earliest spring, and when the snow has just begun to melt from the neighbourhood of stones or trees, or from situations exposed to the full influence of the solar rays, we find, in full and luxuriant flower, *P. denticulata* and *petiolaris;* on still loftier situations, as Gossainthan, Kedarkanta, and some of the passes, we find *P. Stuartii,* with its rich yellow glow, by the side of the equally beautiful *P. purpurea:* the first also extends to Peer Punjal, where is also found *P. elliptica;* and in Kunawur, the new species, *P. obtusifolia, spathulata, involucrata* and *nana,* nob.

When we take into consideration the several genera which we have so frequently seen occupying the more elevated belt of the Himalaya, one regrets the poverty of the language at present applied to the geography of plants, as it is impossible to indicate the nature of mountain vegetation by merely using the name of the range; for as we have seen in the case of these mountains, the vegetation varies, and is analogous to that of very different countries, according to the elevation or as peculiarities of local circumstances cause a variation in climate. The inconveniences of this might, it appears, be considerably remedied, if botanical regions on the surface were more circumscribed according to their respective climates, or taking the several zones of latitude, as done by M. Mirbel; or arranging under them the several countries, as done by Mr. Bentham, but commencing with the equatorial, and bringing together the two temperate, as well as the arctic and antarctic zones; or, if necessary, dividing the space between the equator and poles into a greater number of zones, in conformity to

Baron

Baron Humboldt's Isothermal lines: giving appropriate names to each, and arranging under them, according to their climates the several regions of the globe, &c.; we should have brought together all those which corresponded in meteorological phenomena, in vegetation, and animal life, frequently in agriculture, often in manners and customs, as these so frequently depend upon climate. Mountains might be similarly divided into zones or belts, according as elevation, climate, and vegetation, displayed sufficient differences to warrant the distinction. We have frequently seen, that according as we observe the natural phenomena, at the base or towards the apex of these mountains, the correspondence is either with tropical, European, or polar regions. This might be indicated by a word compounded of that of the mountain range, and of the zone to which the belt corresponded, as Tropico-Himalayan, Arcto-Himalayan, &c., which would sufficiently indicate the nature of the vegetation at different elevations, as well as the geographical situation. The Author hopes, on some future occasion, to follow up this subject in its details as well as its generalisation.

Primula purpurea; foliis oblongis lanceolatis basi attenuatis in petiolum decurrentibus subtus pulverulentis marginibus integris revolutis, umbella multiflora, calyce profunde 5-fida, laciniis linearibus elongatis intus albicantibus.—Affinis *P. Stuartii.*—Tab. 77. fig. 2.

Hab. Kedarkanta, at an elevation of 12,000 feet.

P. obtusifolia; foliis obovatis obtusis basi attenuatis membranaceis subtus farinosis, margine subcrenato undulato, petiolis latis membranaceis, umbella erecta pauciflora, corolla sub-hypocrateriformi.—Tab. 77. fig. 1.

Hab. Lippa, in Kunawur. I am indebted to my friend, W. Wilson Saunders, Esq., for the drawing of this plant.

P. rosea; foliis lanceolatis acutis serratis utrinque glaberrimis breve petiolatis dense fasciculatis, umbella multiflora erecta, calyce tubolosa 5-fida laciniis linearibus corollæ tubo subæquantibus, corollæ limbo plano segmentis emarginatis.—Tab. 76, marked 75, fig. 1.

Hab. Kedarkanta.

P. elliptica; foliis longe petiolatis ellipticis serratis in petiolum decurrentibus, umbella pauciflora, corollæ segmentis obcordatis emarginatis.—Tab. 76. fig. 2.

Hab. Cashmere.

132. PLUMBAGINEÆ.

The *Plumbagineæ* form a small order chiefly found in temperate parts of the world, as in the south of Europe, the Mediterranean and Oriental regions, and the Cape of Good Hope; but species occur also in very cold, as others in very hot parts of the world. Among the latter is the genus *Plumbago,* found in India and America, and having the distribution of the order north and south. *P. zeylanica* extends from 30° N. in the plains of India, to 34° S. near Port Jackson. *Ægialitis,* a genus found by Mr. Brown among the mangroves of New Holland, has also a species, *Æ. rotundifolia,* in the Sunderbunds, or Delta of the Ganges. *Plumbago Europæa* is well known for its acrid and even caustic nature, while *P. scandens* is, for the same properties, called in St. Domingo *herbe-au-diable;* so, in India, *P. rosea* is named "Radix vesicatoria" by Rheede; while *P. zeylanica* is called by the natives *chitraka;* also "Vahni, and all the names of fire."

133. PLANTAGINEÆ.

Plantagineæ are considered by Dr. Lindley more nearly allied to *Plumbagineæ* than to any other order; and he quotes Mr. Don, as referring "Glaux to *Plantagineæ*, where it will form the connecting link between that family and *Primulaceæ*." The *Plantagineæ* are found in various parts of the globe, but chiefly in temperate and cool climates. They are therefore absent from the plains of India, though they may be cultivated there in the cold weather months. Several species, among them the European *P. lanceolata*, are found in the Himalayas, both on the northern and southern face, and as far as Cashmere; these M. De Caine has kindly undertaken to describe, and include in his monograph of the *Plantagineæ*, upon which he has been for some time engaged.

The *Plantagineæ* are a little bitter and astringent, but they are best known for their seeds affording abundant mucilage. Those of *Plantago Psyllium* have been long used for this property, and those of *P. arenaria* are exported from the south to the north of Europe (D. C.), probably also to India; as I have grown plants from seed bought in the bazar. *P. Isphagula*, probably a native of Persia, is cultivated in India in the cold weather, on account of the mucilage afforded by its seeds, which are called *isufghol*, from the Persian *ispagool*. The Arabic synonyme given is *buzr-katoona*, and the Greek *fuslioon*, an evident corruption of Ψυλλιον.

MONOCHLAMYDEÆ. (Apetalæ.)

All the preceding orders, with the exception of the two last, are included in M. De Candolle's great subdivision of Dichlamydeæ, or those having a double perianth, or both calyx and corolla. The following Dicotyledons form the subdivision of Monochlamydeæ, or those having only a single perianth, being the Apetalæ of other authors.

134. NYCTAGINEÆ.

The *Nyctagineæ*, though sufficiently distinguished, are allied in some respects to *Plumbagineæ*. They are chiefly found in tropical parts of the world, though *Abronia* occurs in California. The genera *Pisonia* and *Boerhaavia*, found in the West-Indies and New Holland, are also so in India. *Pisonia*, consisting of shrubs, is confined to the Peninsula; where *P. aculeata* is also found, according to Dr. Roxburgh, and the East-Indian plant said not to differ in any way from the West Indian. *Boerhaavia* is found in every part of the plains of India; and the same species, *B. diffusa* and *repanda*, almost every where. *Mirabilis Jalapa* is cultivated only in gardens.

135. BEGONIACEÆ.

This family, consisting of but a single genus, containing numerous species, is uncertain in its relation to other families, being placed by some botanists among polypetalous, and by others among apetalous orders, but most frequently near *Polygoneæ*, which they resemble in some respects. The *Begoniaceæ* consist generally of small

small herbaceous plants, which affect the tropical parts of Asia and America, as they require both heat and humidity for their development. In India they occur in the mountains of the Peninsula, and from Penang and Siam they extend to Silhet, and thence along the foot of the Himalayas to Nepal, and the Kheree Pass, where *B. tenella* is found in 30° of N. latitude. *B. echinata* and *picta* ascend the mountains in Kemaon, and at Mussooree are found at as great an elevation as 7,000 feet, with *B. cordata,* nob., but it is only during the moisture and equable temperature of the rainy season, when we have seen that other tropical plants of an equally delicate texture and fugitive nature are found to flourish in the same localities. The leaves of *B. barbata,* called *tengoor,* are eaten by the natives as a pot-herb, on the mountains near Chirraponjee. *Wall. E. I. Herb. N.* 3679.

Begonia echinata (Wall. Ic. ined. 1199. and Govan 741) herbacea, radice tuberosa, foliis subæqualiter cordatis acuminatis inæqualiter duplicato-serratis, supra reticulato-venosis, subtus rubentibus utrinque pilosis, stipulis acutis scariosis, cymis paucifloris, capsulis dense stellato-tomentosis alis acutis, una maxima.—Tab. 80. fig. 1.—(*a*) male; (*b*) female flower; (*c*) anther; (*d e*) stigmas; (*f*) capsule; (*g*) stellate pubescence.

From Dr. Wallich's series of the Hon. E. I. Company's unpublished drawings.

136. POLYGONEÆ.

The *Polygoneæ,* allied in some points to *Begoniaceæ,* are so in others to *Chenopodeæ.* They are very generally diffused through the hot and cold parts of the world, and we have them both in the plains and mountains of India; in the former, the genera *Polygonum* and *Rumex,* and in the Himalayas, species of these, with *Kænigia, Oxyria, Rheum,* and *Fagopyrum.*

The East-Indian *Polygoneæ* have been fully illustrated by Dr. Meisner, in the third volume of Dr. Wallich's Pl. As. Rar. Thence we learn, that in this, as in other families, species extend from the southern to the most northern parts of India, while others are common to it with other countries. Of the former, *Rumex Roxburghianus, Polygonum barbatum, glabrum,* and *tomentosum,* may be adduced, as found near Saharunpore, but only in the neighbourhood of water. The first occurs also in Java, China, Japan, Siberia, the West-Indies, and N. America; an extent of distribution which we seldom see, except in plants influenced by the equalizing effects of water on temperature. *P. tomentosum* belongs to the same section as *P. senegalense* and *orientale;* the latter found in India, as well as at the Cape of Good Hope and in New Holland. *P. lanigerum* is found in the two last, in Japan, as well as on the Neelgherries, in Nepal, the Deyra Doon, and Rama Serai, a valley within the Himalaya. *P. chinense* is indigenous in the mountains of the Peninsula and the Himalayas, as well as in China and Japan. *P. herniaroides* and *Rumex dentatus* exist in Egypt and the plains of India. *P. acre* is common to S. America, Bengal, and the Peninsula of India. *P. muricatum,* from Nepal, is nearly allied to the N. American *P. arifolium,* and *P. horridium* to *P. sagittatum,* found there, as well as in Siberia.

Of the *Polygonums* which ascend the mountains, *P. lacerum,* of the section *Avicularia,* is found as high as 8,784 feet on the Andes; and in the Alps, *P. aviculare var.*

nana ascends to 5,892 feet on Mount Cenis. Species allied to these are found at considerable elevations in the Himalayas, as at Theog and Phagoo, and a species resembling *P. maritimum*, at Chango and Kanum in Kunawur, where the soil has been shown to be saline. The section *Persicaria* attains the next greatest height, as *P. segetum* is found at an elevation of 8,160 feet on the Andes, and *P. Persicaria var. nana* at 3,054 feet on the Alps; so in the Himalayas we have *P. sphærostachyum, Brunonis, vaccinifolium, Emodi, speciosum*, and *oxyphyllum*, on such mountains as Mussooree, Choor, Kedarkanta, and Peer Punjal, or from 7,000 to near 13,000 feet of elevation, and on the Kherang, Chandow, and other passes. *P. viviparum*, Lin., is also found in such situations, with a new species, *P. bulbiferum*, nob., nearly allied to it. The section *Tiniaria* does not ascend so high, *P. tamnifolium*, existing from 5,400—7,200 feet on the Alps; and in the Himalayas, *P. pterocarpum* at Mussooree, &c., and *P. Convolvulus*, Lin., at Leeo in Kunawur. The species of *Fagopyrum*, with the exception of *F. triangulare*, are found in a cultivated state. *Rumex Nepalensis* occurs everywhere; and *R. hastatus*, found at the foot of the mountains, is allied to *R. Acetosella*.

Kænigia, found in Iceland and Lapland, occurs also in the higher mountains of Nepal; so *Oxyria*, indigenous in the mountains of Scotland, Siberia, North America, and Melville Island, has also a species, *O. elatior*, in the Himalayas, on such mountains as Peer Punjal, and in Kunawur. This Dr. Meisner describes as "*O. reniformi* nimis fere affinis;" and though generally distinguished by its greater size, I have specimens varying from one inch to a foot and a half, so that the emargination of the winged seed remains as the only character, and this also varies in degree in different specimens.

The genus *Rheum*, or Rhubarb, so important in a commercial point of view, is more interesting than any other in its geographical distribution. *R. Rhaponticum* is found in several parts of Russia, on the shores of the Bosphorus and of the Caspian Sea, eastwards in Siberia, and the lower mountains of the Altai Range: *R. sibericum* and *undulatum* of Pallas are considered by Ledebour to be only varieties of this. *R. leucorhizum* (*nanum Sievers*) is also found in the Altai mountains and the deserts of the Kirghis. Neither of these afford the Rhubarb of commerce, which is not found within the Russian territories, but well known to be brought by the Chinese to the Russian frontier town of Kiakhta, according to the treaty formed between these powers in 1772. The Chinese obtain the Rhubarb produced in China Proper, from that part of the province of Shensee, now called Kansu, situated between N. lat. 35° and 40°. But the best, according to the Missionaries, who say it is called *Tai-hoang*, in the province of Setchuen, from the mountains called Sue-chan, or of snow, which extend from N. lat. 26° to 33°, and from about 100° to 105° of E. longitude. That from the latter province probably forms much of what is called China Rhubarb: the Missionaries met large quantities of it brought down in the months of October and November. That from Kansu may afford some of what is called Russian Rhubarb; but both Pallas and Rehman have ascertained that the greater portion, if not the whole of this, is obtained

in

in April and May, from the clefts of rocks in high and arid mountains surrounding lake Kokonor. Bell also learnt that it was the produce of Mongolia, and Marco Polo, of Succuir, in Tanguth. Dr. Rehman ascertained that the trade is in the hands of one Bucharian family, who farm the monopoly from the Chinese government, and reside at Si-ning, a Chinese town on the very frontiers of Tibet, 3,000 verstes from Kiakhta, and twenty days' journey from *Kian-sin* and *Schan-sin*, Tangutian towns, where the Bucharians go to purchase Rhubarb. This would bring the Rhubarb country within 95° of E. long. in 35° of N. latitude, that is, into the heart of Tibet. As no naturalist has visited this part, and neither seeds nor plants have been obtained thence, it is as yet unknown what species yields this Rhubarb. Pallas thinks it may be *R. compactum*, as the leaves are said to be round and toothed; the Rhubarb merchants, to whom he showed the plant, did not know *R. palmatum*. Both these were obtained from China and Tatary, as well as *R. tataricum* and *undulatum*. It is probable, therefore, that some of these yield a portion of the Rhubarb of commerce, as they have some of very good quality, when cultivated in England and France. But as it is improbable, from the nature of the country, that the best Rhubarb is confined within very narrow limits, it becomes interesting to ascertain how near it approaches the British territories in India, in order to share in the trade, or attempt the cultivation.

That this might very reasonably be undertaken within the British territories, will be apparent from the distribution of Rhubarb in the Himalayas. Passing from Hindoo-khoosh, where is found *Rheum Ribes* (ribas of the Persians), mentioned by Chardin, &c., more recently by Lieut. Burnes, who also met with Rhubarb at Caubul and Bokhara; we find Rhubarb common in the Himalayas, as on Choor, near Jumnotree, on Jacho in Kemaon, Gossainthan in Nepal, and near Tassisudon in Butan, that is, from 30° to 27°, and from E. long. 79° to 89°, and at elevations of 9,000 and 10,000 feet. Mr. Moorcroft discovered Rhubarb at Niti, and next day between Niti and Gotung, that is, at elevations of 12,000 feet. His companion, Major Hearsay, thought he saw three kinds, and has described two of them to me, one round-leaved and long-stalked, and the other short-stalked, but large and broad-leaved (*R. Moorcroftianum*, nob.), with the root more purgative than that of the former. These are called *doelooh* or *dooloo* by the Bhoteas, and *tantara* (Webb), *rantra* (Hearsay). One of these appears to be the Rhubarb described by Dr. Meisner under the name *R. Emodi* (*R. Webbianum*, nob.), which differs from the original *R. Emodi*, described by Mr. Don under the name *R. Australe*. If we turn our attention to the northern face of the Himalaya, which has so many features of a Tatarian climate, we find *R. spiciforme*, nob., discovered by Mr. Inglis on the Kherang Pass, and at several places beyond. Dr. Gerard describes the table-land of Tatary as covered with Rhubarb, at elevations of 16,000 feet. Mr. Moorcroft sent some Rhubarb, which for compactness of texture, colour, and properties, was as fine as any I have ever seen, from near Ludak, in N. lat. 34°, and E. long. 77½°.

But these are only the western boundaries of the elevated, cold, and bleak regions, known under the names of Tatary, Mongolia, and Tibet, of which Kunawur is essentially

tially a part, participating in the same great physical features, climate, and vegetation; already possessing one, if not two species of Rhubarb, and having the best growing in its immediate vicinity. There can therefore be no rational doubt about the successful cultivation of the true Rhubarb in territories within the British influence, as in Kunawur, or the Bhoteah pergunnahs of Kemaon, and that with little more labour than placing the roots or seeds in favourable situations, and this in a country where little else can be produced fit for export. The only difficulty will be to obtain specimens or seeds of the true Rhubarb. But it must be considered, that even the eastern boundaries of the country producing the best Rhubarb, and which, to make their purchases, the Chinese reach, after a journey of twenty days, is only one half the distance from the British territories in Upper Assam, that it is from the Russian town of Kiakhta. Also, that there is reason for supposing Rhubarb may be found much further to the westward, and consequently still nearer to the Himalayas. It would not therefore be difficult from Kunawur, or Upper Assam, or for such active and intelligent officers as Messrs. Traill and Hodgson, in Kemaon and Nepal, to obtain some of the seed or roots. They might at the same time succeed in establishing a trade in Rhubarb with Tibet, or Western Mongolia, by means of the Tatars who resort to the Hill Fairs. This trade might easily be encouraged by the government purchasing all the Rhubarb it requires, which might thus be employed for hospital use after crossing the frontiers, instead of as now, after making a journey of 20,000 miles, or nearly the circuit of the globe.

Even this would not probably be so difficult as at first sight appears, for the whole of the Tatarian Rhubarb trade is not engrossed by the Russians, as much of it takes a western direction, and has always formed one of the imports from China into Bokhara, whence passing to Smyrna, it is known in Europe as Turkey Rhubarb. Chardin, treating of that known in Persia, states—" La meilleure vient du pais des Tartares Orientaux qui sont entre la Mer Caspienne et la Chine." (Voyages, ii. p. 12.) Rhubarb, also of the best quality, and closely resembling the Russian, is to be purchased in the bazars of N. India, under the name *rewund-khatai*, from the old name *Cathay*, of Northern China. This is sold for ten times the price of the Himalayan Rhubarb, which makes its way into the plains of India through Khalsee, Almora, and Butan, and is probably from its usual dark colour and spongy texture, the produce of either or both *R. Emodi* and *Webbianum*.* The roots of *R. spiciforme* and *Moorcroftianum* are lighter-coloured

* That the Rhubarb of this species is not without some valuable properties, we may learn from Dr. Twining's report on experiments made on forty-three cases in the general hospital of Calcutta, of which the following are extracts:—Dr. T. states, that it has " less aroma and more astringency to the taste than the best Turkey Rhubarb; in doses of 2 or 3 drs. it has a good purgative effect, operating three or four times, nearly as freely as the best Turkey Rhubarb. The effects of small doses of the remedy, as a tonic and astringent, are highly satisfactory, as far as four or five cases can be relied on. In this respect its efficacy appears to be superior to corresponding quantities of the best Rhubarb. On the whole, it appears not an eligible remedy in obstinate costiveness, on account of its aroma and astringency; " it is not apt to gripe," "but it is very efficacious in moderate doses for such cases as Rhubarb is generally used to purge; and its cultivation at the Mussooree Garden

coloured and more compact in structure. Rhubarb is, in India, commonly denominated *rewund-cheenee* (*rivend-tchini* in Persia, *Chardin*), with *rawund* assigned as its Arabic, and *reon* (ρηον) as its Greek name. The above are evidently the *rewund* of Avicenna, and the *raued-seni* of the translators of Mesue. Three kinds are described in Persian works on Materia Medica. 1. *Cheenee*; 2. *Khorassanee;* 3. *Hindee.*

The roots of Rhubarb we have seen to be pretty uniform in secreting the peculiar principle, called *Rhabarbarin,* possessing properties which make them useful as purgative medicines; but these are also accompanied by astringent properties, while the stalks secrete acid, chiefly acetic and tartaric, with oxalate of lime (Fée), oxalic acid (Turner); this is most fully developed in Sorrel (*Rumex Acetosa* and *Acetosella*), while the astringent principle, dependent on the presence of gallic acid and tannin, in many of the roots of the *Polygoneæ,* is most fully secreted in *Coccoloba uvifera,* and "so powerful as to rival gum kino in its effects." (Lindley.) Some of the *Polygonums* are, however, acrid, as *P. Hydropiper* and *acre,* and others, as *P. tinctorium, chinense,* and *barbatum,* yield a blue dye like indigo, in Cochin-china, China, and Japan. The albumen of *Polygoneæ* being farinaceous, and in some considerably developed, has been used for food, as Buckwheat, *Fagopyrum esculentum,* and *tataricum,* cultivated in many parts of Europe, and in the Himalayas with *P. emarginatum.* The two first are no doubt originally inhabitants of the mountains of Central Asia, and were first known in Europe under the name of "frumentum Sarracenicum." Both are much cultivated in Russia and Siberia; the first is usually preferred in other parts of Europe, but the second grows in every soil, and requires less time; Professor De Candolle says it is preferred to *F. esculentum* in Piedmont in the Luzerne valley, because it ripens quicker, and therefore in late years, and at higher elevations in the Alps. In the Himalayas, *Fagopyrum esculentum* (*phaphra* and *kooltoo* of the natives) is also most commonly cultivated, but *F. emarginatum* (*ogla*) which comes very near the Linnean specimens of *F. tataricum,* is preferred in higher and drier climates, as in Kunawur. Thus the more closely we examine the distribution of plants and the agriculture of different countries, the nearer do we observe the correspondence in practical results among those which participate in the same peculiarities of climate; and we cannot but admire the bounty of Nature which affords even in what appear sterile wastes, some article fitted for the food of man, and suited to the climate, with others which are adapted for commerce, as Buckwheat, Borax, Musk, and Rhubarb, from the three kingdoms of Nature, in the cold, bleak, and arid plains and mountains of Tatary.

Polygonum vaccinifolium. Wall. Pl. As. Rar. iii. p. 54.—Tab. 80. fig. 2.

P. Brunonis. Wall. l. c.—Tab. 80. fig. 3.

RHEI HIMALENSES.

* racemis paniculatis.

Rheum Emodi. Wall.—*R. Australe.* Don. Fl. Nep. p. 75. Sweet's British Flower Garden. Ic. 270.

R. Webbianum;

Garden may be expected to afford a very valuable remedy, which is less disagreeable to take than the best Turkey Rhubarb, nearly equally efficacious as a purge, and very superior in small doses as a tonic and astringent in profluvia."—*Trans. Med. and Physic. Soc. of Calcutta.* Vol. iii. p 441.

R. Webbianum; racemis axillaribus aggregatis, terminalibus paniculatis, pedicellis ternis fructu maturo dimidio brevioribus, sepalis integris late ovalibus obtusis, cariopsidis basi subcordato, apice integro v. subemarginato, foliis radicalibus amplis longe petiolatis cordato-acutis, caulinis obtusis, in venis subtus margineque hirtellis supra pilosiusculis, petiolis rotundatis, pedunculis ramisque superne rotundis glabris leviter striatis.—*R. Emodi.* Wall. Cat. 1727.—Emodus ad Gossainthan, et ex Niti, (*Webb.*) Wall. Pl. As. Rar. 3. p. 65.

A few only of the specimens in the E. I. Herbarium correspond with the original *R. Emodi*, as figured and described by Mr. Don, *l. c.* under the name *R. Australe.*—Tab. 78[a]. fig. 1.—(*a*) Flower opening; (*b*) the same, with the segments of the perianth cut off; (*c*) stigma; (*d*) fruit.

** racemis radicalibus spiciformibus.

R. spiciforme; racemis radicalibus spiciformibus, pedicellis plurimis aggregatis fructu maturo subæqualibus, sepalis oblongis obtusis alternis angustioribus petaloideis, cariopsidis basi apiceque rotundatis, foliis crassis coriaceis cordato-obtusis subtus rubris reticulato-venosis utrinque stellato-pubescentibus, petiolis pedunculisque glabris.—Tab. 78.—(*a*) Flower seen from above; (*b*) from below; (*c d*) fruit; (*e*) pistil.

R. Moorcroftianum; Wall. E. I. Herb. n. 1727, marked "small-stalked Rhubarb."

I do not possess specimens of this species, but the most cursory examination will shew that it does not belong to *R. Emodi* or *Webbianum*, and that it is also distinct from, though allied to *R. spiciforme.*

137. CHENOPODEÆ.

The *Chenopodeæ* (*Atriplices*, Juss.), are very closely allied to *Phytolacceæ*, and also to *Amarantaceæ;* but, unlike the latter, affect the temperate rather than the tropical zone, and chiefly that part of the former, which is beyond the influence of great heats, and not so far towards the poles as the cold and changeable climates of high latitudes, as the Mediterranean and Oriental regions, Siberia, Tatary, and N. America, the Cape of Good Hope, and New Holland. The genera found in the plains of India are, *Salicornia, Salsola, Chenopodium,* and *Basella;* all, except the last, having nearly the above distribution. *Basella* is found in China, and, with *Chenopodium,* also in S. America. *Salicornia indica* and *brachiata* are common in the Peninsula; and a species, apparently of this genus, in the saline country near Delhi, where *Salsola indica* is extremely common, as well as in the Peninsula. Several species of *Chenopodium* (*bhutwa*) are common in the cold weather in every part of the plains of India; a species of *Atriplex* is mentioned in Bengal, and also in the Peninsula. *Spinacia tetrandra,* called *isfanakh,* is cultivated in the same season in gardens; as are *Beta vulgaris* (*chookundur*) and *B. bengalensis* (*paluk*).

On the southern slope of the Himalaya, plants of this family are not common, though a few species of *Chenopodium* are to be found; but on the northern face, or in Kunawur, which has been shown to approximate in climate and vegetation to parts of the Oriental region and of Siberia, we have species of *Blitum, Salsola, Axyris, Atriplex,* and several of *Chenopodium. C. Botrys* and *Blitum virgatum* extend here from the south of Europe; the former is found also in Siberia and N. America. *Axyris Moorcroftiana,* sent by the discoverer from Ludak, was brought by my plant collectors from Leeo and Hango, and by Mr. Inglis from Nako and Chango. The other two species of the genus are found in Tauria and Siberia. Several of the *Chenopodiums* are

are of gigantic size, and analogous to the Mexican *C. Quinoa,* which, forming so important an article of food in Peru (v. Humboldt), might, no doubt, be successfully cultivated in the Himalayas.

Salvadora, which is placed in this order by Jussieu, but by Bartling in *Myrsineæ,* is a genus common to India, Persia, and Arabia; and the same species, *S. persica,* occurs in the Circars, N. of India, and the Persian Gulf; but along with this, another species is found on the banks of the Jumna, and from Delhi to Saharunpore. This is *S. indica,* nob., *jal* of the Hindoos, *irak-hindee* of Persian authors, who also give this tree the name of *miswak* or toothbrush-tree: the leaves are called *ra-suna,* resemble those of the lanceolate Senna, and are, like them, of a purgative nature; the fruit is called *peel* and *pinjoo.* I know not if it be the same as that brought from Hansi, and sold in the Delhi bazar as an edible fruit, under the name of *peeloo. S. persica* is called *khurjal* in N. India, *arak* and *irak* in works on Materia Medica. The bark of the root is acrid, and raises blisters (Roxb.); a decoction of the bark of the stem is considered tonic, and the red berries are said to be edible.

The herbaceous parts of many of this family, as spinage, &c. being insipid and mucilaginous, have been used as vegetable food in many parts of the world; so, in India, are several species of *Chenopodium* (bhutwa, &c.) *Beta bengalensis* (palung and paluk), *Spinacia tetrandra* (isfanakh), and also *Basella rubra* (poee). The roots of beet and mangel-wurzul also afford food: the successful extraction of sugar from the former, is one of the triumphs of science. The seed of some are considered aromatic and stimulant, as *Chenopodium Botrys,* and *Ambrosoides. C. vulvaria* is said by M. Chevalier to exhale ammonia during the whole of its existence. (Lindley. Nat. Ord. p. 168.) The loose cellular texture of many of this family is supposed to favour the absorption and deposition of soda in their substance, when growing in the vicinity of the sea; and this in such considerable quantities, as to afford, by the incineration of several species of *Salsola, Salicornia, Sueda,* &c., the chief supply of the barilla of commerce on the coasts of Spain, the S. of France, and of Arabia. Dr. Roxburgh has already suggested (Flor. Ind. 2. p. 62), that *Salicornia indica* and *brachiata,* with *Salsola nudiflora,* are so abundant on the coasts of India, as to be able to supply barilla sufficient to make soap and glass for the whole world. A coarse kind of barilla is procurable in Indian bazars, under the name *sejjee muttee* (soda-earth.) This is procured by the incineration of plants (unknown) growing not in the neighbourhood of the sea, but on the shores of the salt lakes scattered through the Indian deserts. It seems worthy of inquiry, whether the *Salsola,* so abundant on the banks of the Jumna, would yield soda, and also, whether it would be possible to grow any of these soda-secreting plants in the saline and barren country to its westward, where nothing else will now grow.

138. PHYTOLACCEÆ.

This is a small order, separated from *Chenopodeæ,* and as Dr. Lindley states, natives of either America, within or without the tropics, Africa, and India; in the latter, we find

find *Gisekia pharnacioides* common in the plains from the Peninsula to Saharunpore; it is also found in Egypt. *Phytolacca,* occurring in both North and South America, as well as in Africa, has also a species in the Himalayas, which Dr. Roxburgh having first obtained from Nepal, has named *P. acinosa.* This is also common further north, as on the Choor mountain; and as the leaves of *P. decandra,* though acrid, yet lose this quality by boiling in water, and are eaten in the United States; so are those of *P. acinosa* in these mountains. A bundle of them were presented me by the head man on my arrival at Gundooree, on the Choor mountain, which I did not hesitate to have cooked according to their own fashion, and found very palatable. I know not if this species unboiled, has any of the cathartic, emetic, or anti-rheumatic properties for which *P. decandra* is famed.

139. AMARANTACEÆ.

The *Amarantaceæ,* though differing in habit, are so closely allied, as scarcely to be differently characterised from *Chenopodeæ;* but they affect warm rather than temperate countries, and as stated by Dr. Martius, though rather rare under the equator, increase in numbers towards the tropics, where they occur in the greatest numbers, with only a few species extending to much higher latitudes. *Achyranthes* occurs in Sicily and Norfolk Island; an *Amarantus* in S. and temperate Europe. They are common in every part of the plains of India, but unlike the *Chenopodeæ,* chiefly in the hot and rainy seasons. The genera are, *Chamissoa, Alternanthera, Amarantus, Celosia, Gomphrena, Alternanthera, Achyranthes,* and *Pupalia,* which are also found in America, and, except the two first, also in Africa, especially on the western coast, where *Ærua* is indigenous, as well as in Arabia. *Digera* is common to India, Arabia, and Egypt, and *Deeringia* to India and New Holland; where are also found species of *Amarantus, Gomphrena,* and *Alternanthera. Desmochæta,* found in the Isle of Bourbon, Java, &c. spreads northwards into India. *Allmannia* has species in Singapore and the Indian Peninsula. *Cladostachys* is found in India and Nepal, and *Centrostachys* extends from the Peninsula to the Turraye of Nepal. *Polyscalis* is peculiar to the mountains.

Many of the same species are found in every part of the plains, and those common in the Peninsula may be traced to the banks of the Jumna; the few which are common to India, Arabia, and Egypt, are *Digera arvensis, Ærua javanica,* and *tomentosa. Alternanthera sessilis, Achyranthes fruticosa,* and *Pupalia prostrata,* are found in India, and the west coast of Africa; as well as *Amarantus polygonoides,* which also extends to S. America, with *Chamissoa nodiflora, Amarantus melancholicon,* and *Celosia margaritacea. C. argentea* and *cristata* are common to India, China, and Japan. *Deeringia celosioides* has a very wide distribution, being found in New Holland, and in every part of India, especially along the foot of the Himalayas; and even ascending, with *Ærua scandens* and *Celosia margaritacea,* moderate elevations, as the Suen range, above the banks of the Giree. A new species, *D. Amherstiana,* however, is most common in the vallies in this latitude. The species of *Polyscalis* are found at the

greatest

greatest elevations, as *P. sequax,* in Nepal, and at Turanda in Lower Kunawur; *P. capitata*, on Gossainthan, and on Surkunda between 7,000 and 8,000 feet of elevation.

Several of the *Amarantaceæ,* like so many of the *Chenopodeæ,* though without taste, are, on account of the mucilaginous nature of their leaves, used as vegetable pot-herbs, and cultivated in India, as *Amarantus polygamus, polygonoides, tristis, oleraceus, gangeticus,* and *polystachyus. A. frumentaceus* is cultivated for its seed in Mysore, as *A. Anardhana* is in the Himalayas. Some of the plants of this family have slightly astringent, expectorant, and diuretic properties ascribed to them in India; but it is doubtful whether they possess any. *Gomphrena officinalis* and *macrocephala* are esteemed useful in all kinds of diseases in Brazil (Lindley.) Mr. W. Crawford, of the Bengal Civil Service, informed me that *Achyranthes aspera* (*chirchita*) was considered by some of the natives a cure for snake-bites.

140. THYMELÆÆ.

The *Thymelææ* are allied to *Santalaceæ,* participate in their affinities, and like the majority of that family, affect the central parts of the temperate zones, as Europe, Northern Asia, and North America, the Straits of Magalhaens, the Cape of Good Hope, and New Holland. They are also found in mountainous situations, as in the East and West Indies, and in S. America. *Daphne,* which has the most extensive distribution, and nearly that of the order itself, is found in various parts of India, as *D. eriocephala,* in the mountains of the Peninsula and of the Dukhun (Sykes), and from Pundua to the most northern portion of the Himalayas, where *Daphne cannabina*, Lour., is found at elevations of 8,000 and 9,000 feet, this Mr. Don thinks does not differ from *D. odora,* Thunb., and of which his own, *D. Bholua,* appears to be only a variety. In Kunawur there is a new species, *D. mucronata*, nob., and in Cashmere, *D. coriacea,* nob., the former somewhat resembles *D. Gnidium,* yielding the *Grana Gnidia,* and used, like *Passerina tinctoria,* in the S. of Europe, to dye wool yellow (Lindley.) *Cansiera,* referred to this order, is found in Madagascar, and the southern parts of India. One species seems to have been collected by Dr. Hamilton as far north as Monghir. *Linostoma* is a new genus formed of Dr. Roxburgh's *Nectandra decandra,* found in the mountains of Silhet (Wall. Cat. 4203.) Many of the *Daphnes* are known for the caustic nature of their bark; hence their employment in medicine from very ancient times. *D. Mezereon* is called *mazrioon,* in Persian works on Materia Medica, with *khamela* (χαμελαία) assigned as its Greek name; that of *D. Laureola* (δαφνοειδες); *Daphnoides* is corrupted into *zaknadeedus. D. eriocephala,* found in the Peninsula, is likewise acrid; the bark applied to the skin causes a burning heat, with some swelling (Wall. E. I. Herb. No. 1351.) *Daphne Lajetta,* or lace bark tree of Jamaica, is remarkable for the beautiful net-like appearance of its several easily separable layers of bark, whence it has received its English name. As the fibres of the bark possess a considerable degree of tenacity, cordage has been manufactured from several species (Lindley, p. 76); so, in Nepal, as in Cochin-china, a soft, smooth, and very tough paper,

paper, is manufactured from the inner bark of *D. cannabina, setburwa* of the natives. (v. *Moorcroft. Asiat. Res.* V. xii., and *Hodgson. Journ. As. Soc. of Bengal.* 1. p. 8.)

Daphne mucronata; floribus terminalibus sessilibus 2-3 aggregatis, laciniis corollæ incano-villosæ acutis, foliis alternis lineari-lanceolatis basi attenuatis mucronatis glaberrimis, ramis junioribus sericeis. —Tab. 81. fig. 2.—(*a b*) Flowers; (*c*) The same, cut open; (*d*) berry; (*e*) the same, cut transversely; (*f*) seed; (*g*) cut transversely; (*i h*) embryo.

141. SANTALACEÆ.

Santalaceæ, allied both to *Elæagneæ* and *Thymelææ,* as well as to *Aquilarineæ,* are, with the exception of the genus from which the order is named, chiefly prevalent in the temperate zone of both hemispheres, as in Europe and N. America, New Holland, the Cape of Good Hope, and S. America. *Santalum album,* so well known as affording the fragrant sandal wood of commerce, is diffused through many of the tropical islands of the East. It is described by Dr. Roxburgh, though that of Malabar is the best, as being found wild in the mountains north of the Rajamundry Circar. This he distinguishes from his *S. myrtifolium,* found in the same mountains, but of which, the wood, he says, is of little value, though Dr. Wallich states of the Botanic Garden specimen "certe odoratissimum." The southern parts of India, as Travancore, and similar parts of the Indian and Malayan Peninsulas up to Silhet, seem best suited for the growth of this tree.

In the Himalayas we have species of a genus found in Europe and Central Asia, N. and S. Africa, and in New Holland. This is *Thesium,* of which the species, *T. Himalense,* nob., which I found on the arid rocky soil near Choupal, to the north of Choor, is nearly allied to *T. liniphyllum:* apparently the same species is also found in Kunawur.

Osyris, distinguished by its diæcious flowers, with their ternary division of parts, is usually referred here, but sometimes formed into a separate order. Of three species, one is found in the S. of Europe, the second in Japan, and the third, *O. Nepalensis,* Don (*arborea,* Wall.), all along the foot of the Himalayas. The leaves of this plant are in Kemaon employed as a substitute for tea: hence some travellers have been led into the error of stating that the true tea-plant was to be found in this part of the mountains.

142. ELÆAGNEÆ.

The *Elæagneæ,* containing but few genera and species, are allied both to *Thymelææ* and to *Santalaceæ,* as well as to *Proteaceæ,* and are found in the northern hemisphere, both in the Old and New World. The genera found in India are *Elæagnus* and *Hippophae*; the former affecting warm parts of the world, extends from the S. of Europe to Sumatra. Species are also found in Japan and India, existing in the latter chiefly in hilly situations, as in Travancore, the Neelgherries, and the vallies of the Himalaya in northern, but at moderate elevations in southern parts: they are, however, cultivable in the plains. *Hippophae,* found in the northern parts of Europe,

occurs

occurs in the colder parts of the Himalaya and in Kunawur, and the species (*H. conferta*) is nearly allied to *H. salicifolia*.

The fruit of *Elæagnus angustifolia* is acidulous, that of *E. orientalis* (*zinzid*) is eaten in Persia, as is, in India, that of *E. arborea* and *conferta*, and in the Himalayas that of *E. Ghuwaeen*, nob., and *Hippophae conferta*; as of *H. rhamnoides* in Europe.

Elæagnus parvifolia. Wall. Cat. N. 4026. Ic. ined. 849.—Tab. 81. fig. 1.—(*a*) Flower seen from above; (*b*) from below; (*c*) the same, cut open.

I have figured this species from the E. I. Company's drawings made under Dr. Wallich's superintendence, though none of my specimens exactly correspond with it; but those of the species called *ghuwaeen*, in Sirmore and Bisseher, approach it, as well as *E. umbellata*, Thunb. All the species require revision, as some vary much in the form of their leaves, others are spinescent or unarmed, according to the locality.

143. PROTEACEÆ.

As we have seen the *Elæagneæ* in the northern, so the *Proteaceæ* chiefly inhabit the southern hemisphere, especially New Holland, Southern Africa, and S. America. *Embothrium*, the most southern genus, ascends, as Mr. Brown remarks, in his masterly exposition of the order, the greatest elevation: some extend north even to Guiana. A genuine species of *Protea* was found by Mr. Bruce in Abyssinia. *Rhopala*, chiefly occurring in S. America, is also met with in Cochin-china and the Malayan Archipelago. To this genus the Indian species of *Helicia* were referred. This must now be considered the most northern in its distribution, as species extend along the Malayan Peninsula to Silhet and the Pundua mountains (v. Wall. Cat. N. 1040, 2072, and 3661); so that here, as in the *Epacrideæ*, we find the flora of India connected with that of New Holland, even by a family so strikingly characteristic of the latter.

144. MYRISTICEÆ.

The *Myristiceæ*, usually placed near *Laurineæ*, are considered by Dr. Lindley more closely allied to *Anonaceæ*. They are natives exclusively of the tropics of India and America. In the Old World, they extend southwards from the tropical islands to New Holland, and northwards along the Malayan Peninsula to Silhet, where is found *M. longifolia*, Wall., and in the mountains of that district *M. floribunda*, Wall., with *M. angustifolia*, Roxb. Other species are peculiar to the Peninsula.

Nutmeg forming the albumen, and *Mace* the arillus of the seed of *Myristica moschata*, are well known for their grateful and aromatic properties. They are produced in the largest quantities in the Moluccas, but have been successfully cultivated in Penang and Bencoolen, but especially in Sumatra. The trees thrive and bear fruit even so far north as the Calcutta Botanic Garden, and might no doubt be successfully cultivated in Travancore and the Tinnivelly district, as well as on the Malayan Peninsula. The nutmeg is called *juephul* in India, with *jouz-boa* (fragrant nut) as its Persian name; and mace—*jawuntree*, *P. bisbaseh* with *amakun* (μάκερ) assigned as its Greek name. Other species yield aromatic nuts, as *M. tomentosa*, perhaps the *M. dactyloides* of Gærtner; *M. officinalis*, according to Dr. Martius, in Brazil, and *M. Oloba*, in Santa Fé. The plants of this family, like those of the following, have a volatile, as well as a fixed

fixed oil, contained in their nuts. The latter is so abundant in *Virola sebifera*, as to be extracted for economical purposes. Like many of the *Laurineæ*, the *Myristiceæ* exude an acrid reddish-coloured juice from incisions in their bark.

145. LAURINEÆ.

The Laurel, famed for its employment in crowning poets, philosophers, and heroes, in ancient, and, figuratively so, in modern times, has given its name to this rich and valuable family, which is abundant in the hot parts of Asia and America, but (except *Cassytha*) absent from the continent of Africa. Like other tropical families, the *Laurineæ* send a few species northward, as *Laurus nobilis*, the Sweet Bay, to the S. of Europe; *L. indica*, Royal Bay, to Teneriffe and Madeira; *Camphora* to Japan; *Sassafras* and *Benzoin* to North America; and southwards to New Holland species of other genera. In Asia, the *Laurineæ* extend northwards from the tropical islands along the Malayan Peninsula to China and Japan, and from Ceylon into the Indian Peninsula, where they ascend to elevations of 2,000 and 3,000 feet on the Dindygul, and probably higher on the Neelgherry mountains. From Silhet species extend all along the base of the Himalayas, even to near the banks of the Sutlej, and ascend elevations of 7,000 feet, in 30° of N. latitude. The majority of species of this family were formerly referred to the genus *Laurus;* but Professor Nees Von Esenbeck, in an elaborate monograph on the East-Indian species, published in Dr. Wallich's Pl. As. Rar. vol. ii. and iii., has formed a number of new, and circumscribed the old genera. Of the former, *Polyadenia, Tetradenia, Cylicodaphne, Actinodaphne, Beilschmeidea, Cecidodaphne,* and *Alceodaphne,* are confined to the southern parts of India, and from Silhet along the Malayan Peninsula. *Endiandra* and *Cryptocarya,* two of Mr. Brown's New Holland genera, are also found in Silhet and Pundua. *Gyrocarpus* is found on the coasts of India, as well as of Asia generally, of New Holland, and of S. America; the species are distinct. The anomalous *Cassytha,* sometimes separated into an order, occurs in the same countries, as well as in Africa. *Daphnidium, Dodecadenia,* and *Machilus,* extend to more northern latitudes along and on the Himalayas in Nepal, Kemaon, and Sirmore. *Machilus odoratissimus* is found as high as Mussooree, and another species on the Neelgherries. *Ocotea,* common in S. and N. America, with one or two species in the island of Madeira, extends from Silhet to the Deyra Doon, and ascends to 7,000 feet. *Tetranthera,* found in China and New Holland, is so almost every where in the warm parts of India, *T. apetala* and *Roxburghiana* extending up to the Doon.

Benzoin, so called, because *B. odoriferum,* with a stimulant and tonic bark, smells of Benzoin, with three species in N. America, has also one, *B. Neesianum,* in Nepal, of which the berries smell strongly of Cajeputi oil. *Camphora,* of which the officinal species yields the camphor of China and Japan, inferior to that of Sumatra, v. p. 106, has one species, *C. Parthenoxylon,* in Penang and Sumatra, which yields an oil useful in rheumatic affections, and has an infusion of its roots drank as sassafras; with another, *C. glandulifera,* in the mountains of Nepal, containing camphor in its wood.

Cinnamomum,

Cinnamomum, the most numerous in species, contains also the most valuable plants, as *C. zeylanicum*, the Cinnamon of Ceylon, yielding one of the most valuable articles of a very ancient commerce, of which the coarse kinds are said by Mr. Marshall to be the common *Cassia*. The natives of India call the former *dar-cheenee*, and assign *akimoona* (κινομον?) as a Greek name, from Persian works on Materia Medica. It is only produced good on the S. and E. of Ceylon, in a sandy soil. Dr. Davy states, "that the garden is nearly on a level with the lake of Colombo; its situation is sheltered, the climate is remarkably damp, showers are frequent, and the temperature uncommonly equable." The cultivation has been commenced in Travancore and Tinnivelly, and would probably succeed in some of the territories acquired from the Burmese. *C. aromaticum*, cultivated in the South of China, affords the cinnamon of that country, which is reckoned superior to that of Ceylon by Loureiro and M. Poivre (Fée). *C. Culitlawan*, of Amboyna, yielding the *selackal* or *sindoc* bark, which appears to be the *suleekhe* of the Arabs (*selicha* of Mathiolus, *salichacha*, Avic. Trans.); has *islioos* assigned as the Greek name; I know not of what word this can be a corruption; it has no resemblance to *Cassia*. In Hindee it is called *kuhela*, and considered the produce of the *Tuj*, v. infra. Another wood of a dark red colour, is described under the name *kusela*, as the produce of Nubia, and of which the plant is said to be like that of *suleekhe*, but the seed to resemble that of *hilm* (*Balsamodendron*). Can this have caused some of the confusion in the old descriptions of Cassia? Another famed product is the *Bay-leaf* of India, the *Malabathrum* of the ancients, for which *malatroon* is assigned as the Greek name in Persian Materia Medica, and of which *Tamalapatra* (Tamala leaf) is given as the Indian synonyme by Garcias, of which he says "Græci et Latini imitantes corrupte *malabatrum* nuncuparunt," and which he describes under the name "Folium" simply. This, in India, is called *tej-pat*, the leaf of the *tej* or *tuj* (with *putruj* as that of the bark), a name which Dr. Hamilton found applied to *Cinnamomum Tamala*, growing in Rungpore and Silhet, and Dr. Roxburgh, as well as myself, to *C. albiflorum*, very nearly allied to the former, and growing along the foot of the mountains in the vallies, from Rungpore to the Deyra Doon, in 30° of N. latitude. Both yield the leaves called by the Arabians *saduj-hindee*, which form so extensive a commerce, and from very ancient times. The leaves of *C. eucalyptoides* (*malabathricum*, Roxb.) have a strong smell and taste of cloves, with a slight tincture of camphor. *C. nitidum*, *coolit-manes* of Sumatra, has bark with the smell and taste of cinnamon. *C. Kiamis* of Java, is also remarkable for both. Some species are peculiar to the Peninsula, and one, according to Dr. Hamilton, yields a kind of *Cassia* in Canara. The wood of *Tetranthera apetala* and *Roxburghiana*, called *mueda-lukree*, is applied to wounds and bruises. It is a little astringent, with a degree of balsamic sweetness (Roxb.); and is used by the hill-people as a cure for diarrhæa. The leaves are eaten by a kind of silk-worm (Wall.)

The aromatic and stimulant properties for which, from the above enumeration, it is evident the Laurel tribe are conspicuous, is owing to the presence in almost every part of a volatile oil, which, in its concrete state, or, according to Dr. A. T. Thomson, a higher

higher degree of oxygenation, forms camphor. The essential is frequently accompanied with a fatty oil, most fully developed in *Tetranthera sebifera;* and also, it is supposed in *Persea gratissima,* the Avocado pear of the West-Indies. Other species in S. America yield a warm and pungent stimulant oil. (Lindley.) In addition to those already mentioned as the produce of Asia, *Laurus cupularis* forms the cinnamon of the Isle of France, *L. cinnamomoides* that of Santa Fé de Bagota, and *L. quixos* of Peru. As the bark of many contains tannin in conjunction with the aromatic principle, they are useful as tonics and febrifuges. The sassafras nuts of the London shops are the produce of *Ocotea Pichurim.* Laurel berries, formerly used in medicine in Europe, are still so in India, under the name *hub-ool-ghar,* with the Greek name Daphne corrupted into *zaknee* and *zafnee.* Thus we find the Asiatics, like Europeans, esteem that which is brought from a distance, even when they possess indigenous drugs of a more powerful nature.

146. EUPHORBIACEÆ.

The place of the *Euphorbiaceæ* is unsettled; as though usually placed among apetalous orders, it has been well observed that twenty-five out of the eighty genera are not so: their nearest affinity is to *Rhamneæ* and *Celastrineæ;* they have been placed near the latter by Mr. Brown. By some Indian botanists, species of this order have been referred to *Zizyphus;* there would appear also some affinity to *Sapindaceæ,* to which *Pierardia* is referred by some botanists, but placed by Blume in the present order; of which some of the genera are allied to a few of the *Urticeæ.*

The *Euphorbiaceæ* are chiefly found in the tropical parts of the world, especially America and Asia, with several genera and species extending to the Cape and New Holland, and northwards into Europe and N. America. It is difficult to compare the distribution of the genera and species of *Euphorbiaceæ* in India with that of other countries, as we require not only a full account of all the species of this order, but also of those of India, which are about 400 in number: and upon which Prof. Rœper is at present engaged. But the admirable monograph of M. Adrien Jussieu, which, for clearness of character and skill in grouping, leaves nothing to be wished with respect to genera, except the addition of the new ones, will enable us to give a general idea of their distribution in India. Those which are either common to the tropical islands of Asia and to India, or peculiar to the latter, are *Fluggea, Emblica, Rottlera, Glochidion,* (*Bradleia,* Gært.), *Agyneia, Andrachne, Codiæum, Gelonium* (which includes *Surigada,* Roxb.), *Aleurites, Claoxylon, Mappa, Caturus.* Of these, species are confined to the southern parts of India, except of the three first, which extend to every part. *Glochidion* and *Agyneia* occur in China, and a species of *Andrachne* (*A. telephioides*) also in the S. and E. of Europe. The new genera which have as yet only been named, but of which species are deposited in the E. I. Herbareum, are *Hæmatospermum,* Wall. Cat. 7953. (*Adelia neriifolia,* Roxb.), *Moacurra,* Roxb. Fl. Ind. ii. p. 69, (*Celastrus acuminata?* Wall. 4342.) *Periplexis,* Wall. Cat. 8022. Ic. ined. 782. *Eremanthus,* Wall. Cat. n. 7505 and 8011. *Gyrandra Lindl.* Wall. Cat. n. 8020. c. charact. Specimens of

of *Choulmoogra* of Dr. Roxburgh, but without either flowers or fruit, are also placed here, Cat. n. 7998, though he has indicated its affinity to *Capparideæ*.

Cicca, Xylophylla, and *Excæcaria,* are common to the tropical parts of Asia and of America; while *Phyllanthus, Croton, Jatropha, Acalypha, Tragia, Sapium,* and *Dalechampia,* exist in these, as well as in Africa; and *Briedelia, Cluytia, Crozophora,* and *Ricinus,* in the latter, as well as India, and, except the first, also in Arabia: the two last send species to the south of Europe. *Euphorbia* has the extensive distribution of the order, both in hot and cold countries: in India we have species of the genus, both in the plains and mountains. But those at the foot of the latter are conspicuous for their size and cactus-like appearance, while those growing at any considerable elevation are either annuals, or have great root-stocks, which are protected by their situation from the cold of winter.

The plants of this family extending to the most northern parts of India, are the more common species of *Euphorbia* and *Phyllanthus;* and on the banks of the Jumna, some which spread up from the Peninsula; with *Tragia cannabina, Acalypha indica,* and *Crozophora plicata. Croton polyandrum* is very common there, and called by the same name, *jumalgotta,* as *C. Tiglium,* which is only found in Goalpara, and thence in Tavoy, &c., and the Moluccas. The arboreous species are, *Emblica officinalis, Fluggea retusa* and *virosa, Rottlera renee,* nob. (*R. tinctoria?* Roxb.), *Andrachne trifoliata,* Roxb. *Briedelia montana, Jatropha Curcas,* near Hurdwar, and *Ricinus communis.*

Those which ascend the mountains are species of *Phyllanthus,* as *P. cordata,* with others in Nepal and Kemaon: several new *Euphorbias,* the only genus of which species are found in Kunawur. *Glochidion bifaria,* nob., is found at Jurreepanee, and is very common in the Himalayas. *Acalypha tenera,* nob., is only found during the moisture of the rainy season, as high as 7,000 feet; with two shrubby species, *Sarcococca pruniformis* and *nepalensis,* which are allied to *Tricera* of America, and to *Pachysandra* of the Alleghanys, as well as *Buxus,* to all which they have been referred by different botanists; though generally tetrandrous and tetrasepalous, I have frequently seen it triandrous and trisepalous. But a true species of *Buxus* is common in these mountains, found chiefly in vallies, as at Mugra, and near Khalsee, as well as in Kemaon. It grows to a considerable size and thickness, and the wood appears as compact and good as that of the common box.

The properties of Indian *Euphorbiaceæ* correspond with those which have been observed in plants of this family in other parts of the world. All abound in a milky juice, which contains *Caoutchouc,* and is generally united with a highly acrid principle of a very volatile nature, and therefore easily dissipated by heat. According to the degree of concentration of this principle is the innocuous or deadly nature of the substance with which it is combined. Thus the seeds of some *Euphorbiaceæ,* in which it exists in small quantity, are eaten; as those of *Aleurites ambinux,* and of *A. triloba,* in India: the fruit of *Cicca disticha* is acid, as is that of *Emblica officinalis,* forming *Emblic myrobolans.* Though united with fecula in the roots of *Janipha Manihot* or the

Cassava,

Cassava, so that they are poisonous when raw, it is so effectually separated by heat, as to afford an abundant and nourishing food to thousands in S. America, the West-Indies, and Mexico. The plant succeeds completely in India, but it is remarkable that it should have been made so little use of, though Sir W. Ainslie has mentioned making *Tapioca* from it when in India. This acrid and stimulant principle is combined with fixed oils in many of the seeds of *Euphorbiaceæ*, which are well known for their uses as purgative medicines, as the Castor oil plant, *Ricinus communis, khiroa* or *cherua* of the Arabs, *aranda* of the Hindoos, κρότων and κίκι of the Greeks; and also several species of *Jatropha*, as *J. Curcas*, physic-nut (*H. bagh-burinda*). *J. glandulifera* is used as an escharotic to remove opacities of the eye in India (Roxb.) The most active, being at the same time safe, and which is perhaps the most extensively used in India, and also considered emmenogogue, is the *Croton Tiglium*, Grana Molluccana and Tilli of old Pharmacopœias, *jumalgotta* of the Hindoos, *dund* of the Arabs and Avicenna, for which, in N. India, those of *C. polyandrum* are substituted, and called by the same name. Species of *Phyllanthus* are considered diuretic, others of the order sudorific, and some emetic. The best substitutes for Ipecacuanha are said to be some species of *Euphorbia*, as *E. Ipecacuanha, Gerardiana*, &c.; also *Pedilanthus tithymaloides*. Space would fail, if we were merely to enumerate all those to which useful properties have been ascribed, but they may be seen in the Essay of M. Adrien de Jussieu, Lindley, Fée, Roxburgh, and Ainslie. The acrid and stimulant principle is united with essential and fragrant oil in some barks and woods, as in *Croton Cascarilla, Eluteria*, and *gratissimum*. The wood-cutters of the Delta of the Ganges state, that no *Agallochum* is afforded by *Excæcaria Agallocha* (Roxb.) A peculiar principle (*cereo-resine*, Fée), called *Euphorbium, furfiyoon*, (Gr. *afirbiyoon*) of the Persian works on Materia Medica, and said in them to be a produce of Soudan and Africa, is considered by botanists to be yielded by *Euphorbia officinarum, Canariensis*, and *antiquorum*. I doubt whether the last, at least the species so called in India, yields any, as in some experiments I made on the subject, I found the juice comparatively inert. The leaves of *E. nereifolia* are considered purgative and deostruent (Ainslie); the root of *E. ligularia*, mixed with black pepper, is employed for the cure of snake-bites. Some of this family are violent poisons, as *Hippomane Mancinella, Hura crepitans, Hyænanche globosa, Excæcaria Agallocha, Sapium aucuparium* and *indicum*. Seeds of the latter intoxicate fish, as does the bark of *Fluggea virosa* (Roxb.), and the hairs of some species, as *Tragia cannabina* and *involucrata*, sting as violently as nettles. Some species yield oil useful for burning, as *Elæococca* (*Dryandra*, Thunb.), *verrucosa*, and *Vernicia*, the oil and varnish trees of China, *Aleurites triloba, Ricinus communis*, &c.; while *Stillingia sebifera*, or tallow-tree of China, yielding a vegetable fat, is now common about Calcutta, but it is only during cold weather that this substance becomes firm. (Roxb.) The most useful product of the family, however, and that which has lately become so important an article of commerce, and of great utility in a variety of arts, is *Caoutchouc*, so well known as *India-rubber*, and exported principally from Para. This is chiefly yielded by *Siphonia elastica*,

Hevea

(*Hevea guianensis*, Aubl.), a tree of Guiana and Brazil, which would no doubt thrive in Bengal. *Caoutchouc* is also imported from Penang, the produce of *Urceola elastica* (As. Res. v. p. 157 and 167), but I hope it will be also from the continent of India.

The expressed oil of the seeds of *Jatropha Curcas*, boiled with oxide of iron, is said to form the varnish used by the Chinese for covering boxes (Lindley.) The juice of this plant is of a very tenacious nature, and when blown into, forms very large bubbles, probably owing to the presence of *Caoutchouc;* this is also afforded by an African tree of this order.

The dye called *Turnsol*, is yielded by *Crozophora* (*Croton*) *tinctoria*, as is a colouring matter by *C. plicata* (v. Roxb. Fl. Ind. iii. p. 68); also by *Rottlera tinctoria*, of which the strigose pubescence, like that of *Mucuna pruriens*, is administered for expelling intestinal worms. Several of this family yield hard and valuable timber in India, as *Emblica officinalis*, *Rottlera tetracocca*, *Adelia castanicarpa*, species of *Briedelia*, *Cluytia*, &c. African oak or teak is supposed by some to belong to this family.

Though belonging to so dangerous a family, the leaves of *Plukenetia corniculata* are said to be eaten as a vegetable; and the domesticated Arindy silk-worm (*Phalæna Cynthia*) is fed upon the leaves of *Ricinus communis*. (Roxb.)

Euphorbia pentagona, fructicosa, ramosa; ramis 5-angularibus ascendentibus, angulis acutis prominentibus marginibus undulatis aculeatis, aculeis geminis subsubulatis, floribus sessilibus aggregatis solitariisve.—Tab. 82. fig. 1. (*a*) Transverse section of a branch; (*b*) a cluster of flowers; (*c*) a male flower; (*d e*) capsule.

Hab. Very common along the foot of the hills, especially on the Suen Range.

E. nana; caule ex rhizomate magno assurgente brevissimo dichotomo paucifloro, ramis simplicibus unifloris basi squamis duabus canaliculatis cuneiformibus cuspidatis, floribus solitariis terminalibus involucro subtubuloso, foliis post florescentiam rhizomatis apice aggregatis magnis ovato-oblongis crassis, basi attenuatis sessilibus.—*E. fusiformi* (Ham.) affinis.—Tab. 82. fig. 2. (*a*) A flower magnified; (*b*) the same opened, with one of the scales of the branch separated; (*c*) a male flower, with the fringed bract at the base of the pedicel.

Hab. Kheree Pass and Suen Range.

E. humilis; ramis 3-4 tenuibus dichotomis rhizomatis apice assurgentibus, aphyllis sed ex dichotomia squamis duabus membranaceis acutis munitis, floribus solitariis terminalibus involucro quinquefido segmentis glandulosis squamis fimbriatis alternantibus, foliis post florescentiam rhizomatis apice roseolatis oblongis acutis basi attenuatis sessilibus.—Tab. 82. fig. 3.

Hab. Kheree Pass, and low elevations in the Himalayas.

Euphorbia Cashmeriana; caule erecto folioso, foliis alternis sessilibus ovato-lanceolatis, ramis floriferis axillaribus gracillibus, foliis floralibus tribus cordato-rotundatis coloratis involucrum mentientibus, umbella 4-fida radiis simplicibus centrale maximo, lateralibus sæpe abortivis.—Tab. 82. fig. 4.

Hab. Cashmere and neighbouring mountains.

147. ARISTOLOCHIEÆ.

The *Aristolochieæ* are chiefly found in tropical countries, especially S. America, the West-Indies, and the southern provinces of N. America. *Asarum* occurs in Europe, Japan, and N. America, with a few species of *Aristolochia*. Species of the last and *Bragantia* are found in the Indian and Malayan Peninsulas. *A. saccata* occurs in the mountains of Silhet, and *A. bracteata* spreads from the Peninsula to the banks of the Jumna. *A. indica* is common to India and New Holland.

The *Aristolochias* secrete a bitter principle and an essential oil; owing to the presence of the latter, they are sometimes very fragrant, and are used, like *Aristolochia serpentaria,* as diaphoretics. Several are bitter, as *A. longa* and *rotunda,* still forming, though natives of the S. of Europe, a portion of the Asiatic Materia Medica, under the names *zurawund tuweel* (Pers. *duraz,* long), and *zurawund moodehruj* (*P. gird,* round), with *Aristolokhia,* as the Greek name. *A. indica* and *bracteata,* natives of the plains of India, are also both intensely bitter. It is remarkable that the first should be considered by the natives a cure for snake-bites, as are some of the American species: both are employed to restrain diarrhæas, and the latter is accounted emmenagogue in N. India. *Asarum Europæum* is also sold in Indian bazars, under the name *Asaroon;* but I have only found a plant from the hills called *tuggur* substituted for it.*

148. BALANOPHOREÆ.

This forms one of the small orders, which it is difficult to know where to refer. It was considered by M. Richard allied to *Hydrocharideæ,* and also to *Aroideæ.* In its affinity to the latter, MM. Endlicher and Schott are disposed to coincide. The discovery of spiral vessels in *Rafflesia,* as well as in M. Guillemen's new genus *Pilostyles,* has rendered less evident the connection of these with *Cellulares.* In an admirable monograph, MM. Endlicher and Schott have united the three orders of *Balanophoreæ, Cytineæ,* and *Rafflesiaceæ,* into one class, which they call *Rhizantheæ.* In these we see the same rules apply with respect to distribution as in other families; that is, where the majority occur in hot parts of the world, a few representatives spread into higher latitudes. *Cynomorium* and *Cytinus* existing in the S. of Europe, *Sarcophyte* and *Aphyteia* at the Cape of Good Hope. In like manner some species of these orders ascend moderate elevations in mountains bordering tropical countries, where local circumstances are favourable to their development. Thus the genus *Balanophora,* originally found in the island of Tanna and New Caledonia, and subsequently in Java, has also a species, *B. indica,* in the Peninsula of India; two, *B. typhina* and *gigantea,* in Burma; and one extending to Nepal, *B. dioica,* Br., which is considered to be identical with *B. elongata* of Blume, found in Java. This is figured in Tab. 99, from Dr. Wallich's drawings; but I possess no specimens to give a description.

The properties of the plants of this class, as far as at present known, are of an astringent nature, as *Cynomorium* and *Cytinus,* which contain gallic acid, in Europe, and *Rafflesia* in Sumatra and Java. I learn from a note in the E. I. Herbarium, N. 7249, that *Balanophora gigantea* (Gen. nov.? *Sarcocordylis,* Wall.) is found in every bazar in Burma, being used in medicine; and infer from Dr. Wallich's MS. name *Neerbis khaseeanum* for *B. dioica,* Br., that this may be one kind of *Nirbisi* (v. p. 49.)

149. PODOSTEMEÆ.

* The *Nepentheæ* or *Pitcher Plants,* are so strictly a tropical family, that they do not require notice in this work. Though found in the tropical islands of the east, the southern part of China, Cochin-china, at Singapore, and at Courtallum in the Indian Peninsula, *N. distillatoria* was found by Dr. Wallich as far north as Silhet. Madagascar is the most southern distribution of the order.

149. PODOSTEMEÆ.

This is one of the small orders which seems to destroy the distinction between Monocotyledons and Dicotyledons—being usually placed in the former, but considered by Dr. Lindley as allied to *Piperaceæ*. Though thought to be confined to the warm parts of S. America, with one species in N. America, and others in the islands of Madagascar and the Mauritius, one species, *Podostema Wallichii*, Br., has been discovered by Dr. Wallich on the mountains of Silhet.

150. CHLORANTHEÆ.

This is a small order established by Mr. Brown, and allied to *Saururea* and *Piperaceæ*, of which the species are found in the tropical parts of S. America, the West-Indies, and Society Islands. The genus *Chloranthus* occurs in China, Japan, and in India in the forests of Goalpara, and Silhet, where is found *C. erectus*, Wall., nearly allied to *C. inconspicuus* and *serratus*, found in those countries. Many of the plants of this family are aromatic and fragrant, and the leaves and roots of some species are said to resemble snake-root in their properties and uses.

151. SAURUREÆ.

The *Saururea* are, like *Chlorantheæ*, allied to *Piperaceæ*. The genus found in North America, from which the order is named, has its place supplied in the Old World by *Aponogeton*, existing in similar situations, and which in its habits has considerable resemblance to *Fluviales*. It is found in ponds of water (and the same species, *A. monostachyon* and *undulatum*) all over the plains of India, as well as of China; also in Ceylon, and at the Cape of Good Hope. *Houttuynia*, placed here by Bartling, but referred by Jussieu to *Aroideæ*, with a query "An Naiadibus affinia," is also common to India, Cochin-china, and Japan; and the same species, *H. cordata*, has been found in all these countries, and in the vallies of the Himalayas, from Goalpara to the Sutlej. Its leaves are said to be used as a pot-herb in Nepal. Dr. Roxburgh states, that the natives of India are fond of the roots of *Aponogeton monostachyon*, which he states are nearly as good as potatoes.

152. PIPERACEÆ.

The *Piperaceæ*, like some of the preceding families, are sometimes placed among Monocotyledons, and at others among Dicotyledons; as by Richard, Mirbel, De Candolle, and Blume, in the former. By Jussieu, the genus *Piper* was placed near *Urticeæ*. Mr. Brown has omitted them in the first volume of his Prodromus, whence we may infer that he considers them to belong to Dicotyledons, where they are placed by Meyer and Dr. Lindley. The latter considering them related to *Polygoneæ*, *Saururea*, and *Urticeæ*, as well as to *Chlorantheæ*, adds, "in the opinion of those who believe *Piperaceæ* to be Monocotyledons, their station is near *Aroideæ*, with which, indeed, they must be considered in any point of view to be closely connected."

The *Piperaceæ* are found in tropical parts, as those of Asia, S. America, and in the West-Indies. They are deficient on the west coast of Africa, as we have seen to be the case with *Begoniaceæ*, and some others which delight in moist and sheltered situations. They are found in Brazil, the Cape of Good Hope, Mauritius, and abundantly in all the islands of the Pacific and Indian oceans. From the Moluccas, Sumatra, and Java, they extend along the Malayan Peninsula to Goalpara and Silhet. Several species are found in the Indian Peninsula, and a few extend from Silhet to Nepal, and even as far as the vallies of the Suen Range, or in N. lat. 30½°. Carolina is the most northern habitat in the New World. A few species ascend the Peruvian Andes, so do others the Himalayas.

Those which are found in Nepal are, *P. peepuloides*, Roxb. (the peepul of Silhet), and *P. aurantiacum*, Wall.; while *P. brachystachyum*, Wall., found in the vallies of Noakote and Nepal, extends also to those below the Mussooree and Suen Ranges, where it is called *puharee pan*, or hill-betle. *P. longum*, also found in the Peninsula and the vallies of the Circar mountains, as well as in Bengal and Silhet, I am unable to distinguish from specimens collected in the Kheree Pass, and there called *puharee peepul*, or hill long-pepper. This name is said by Dr. Roxburgh to be applied in the mountains N.W. (an N.E.?) of Bengal to his *P. sylvaticum*, which is no doubt allied to *P. longum*. *P.* (*Peperomia*, Don.) *saxatilis* is probably that which occurs at the highest elevations, as it is found on the mountains of Dindygul in the Peninsula, also on those of Silhet, in Nepal, Kemaon, and still further north on Suen, Surkunda, and Deobun.

The tribe of Peppers is well characterized by the warm, pungent, and aromatic properties for which some of the species have been celebrated from the earliest to the present times, either as condiments, or for their uses as stimulant and stomachic medicines. Of these, *Piper nigrum*, affording the Black and White Pepper (Pers. *pilpil*) of Commerce, is, no doubt, the most celebrated. That of Malabar has long been considered the best; but that of Sumatra, and many of the islands, is reckoned nearly as good. Mr. Crawford states, "The Pepper countries extend from above the longitude of 96° to that of 115° E., beyond which no Pepper is to be found, and they reach from 5° S. lat. to 12° N., where it again ceases. Within these limits, we have Sumatra, Borneo, the Malayan Peninsula, and certain countries lying on the east coast of the Gulf of Siam." It is cultivated all along the Malabar coast, and also near Courtallum. Dr. Roxburgh describes it as being found wild in the hills of the Rajamundry district. But this may be the species which he describes under the name *P. trioicum*, of which I have seen no specimens; but the Pepper Dr. R. states to be "exceedingly pungent, and by merchants at Madras reckoned equal, if not superior to the best Pepper of the Malabar coast or Ceylon."

The Betle-leaf, *P. Betle*, *pan* of the natives, Sans. *Tamboolee*, Pers. *tumbol*, so well known for its moderately pungent and aromatic properties, is cultivated throughout tropical Asia, and over a great part of India. I have seen it as high as Bundlecund

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and the southern parts of the Doab, though it requires a rich moist soil, and shady situation. These are obtained in Northern India by irrigation, and covering the plants around and above with a light thatch of grass or reeds. *P. longum, pippul* of the natives, and the root *pippula-moola* and *peepla-moor*, is cultivated in Bengal and the Circars, both for its pepper and its roots: the former in use as a condiment, and the latter extensively so as a stimulant medicine. *P. chaba* (As. Res. ix. 391) is called *mug-peepul*, and similarly used. The root of *P. methysticum* is that employed in the Society and Friendly Islands, under the name of *Ava* or *Kava*, to produce by fermentation a pungent and stimulant beverage. *P. inebrians* is substituted for it. *P. anisatum*, as its name implies, smells of Anise; other species possess the general pungent and stimulant properties of the family. *P. Cubeba*, grown in Java and Penang, affords the well-known *Cubebs*, which are the *kubabeh* of the Arabs, *kubab-cheenee* of the Hindoos; for these *kurfiyoon* is assigned as the Greek name, intended probably for *Carpesium*, as this has been supposed by some authors to be Cubebs. The seeds of *tezbul*, *Xanthoxylum hostile*, p. 157, are said to be one kind of Cubebs. They have much the same warm, pungent, and stimulant properties.

153. URTICEÆ.

The *Urticeæ*, as separated from *Artocarpeæ*, are chiefly distinguished by their want of milkiness, shrubby or herbaceous nature, and by their erect ovula, with the radicle remote from the hilum. They are widely diffused, both in tropical and temperate climates. In India, the herbaceous and shrubby species, as those of *Boehmeria*, *Urtica*, and *Procris*, found in America, as well as in Asia, occur where there is considerable moisture of climate, whence we may account for their comparative absence from Africa; but the arboreous genus *Trophis*, is found in every part, even on the arid banks of the Jumna. *Parietaria*, very widely diffused both in the Old and New World, is mentioned as having species, *P. indica* and *Sonneratii*, in India; neither are enumerated by Drs. Roxburgh or Wallich. The species of *Urtica* and *Procris* extend from the Indian and Malayan Peninsulas, along the Himalayas to Nepal, and thence to Kemaon and Sirmore. The species of *Procris* occur in the mountains only in the rainy season. Of Nettles, *Urtica parviflora* is found in the north of Rohilcund; *U. virulens* is common in the Deyra Doon; and other species at Mussooree, Simla, &c. *Boehmeria frutescens* is common to Nepal and Japan; and *B. salicifolia*, said by Dr. Roxburgh to have been received from the Moluccas, is found along the foot of the Himalayas, as far north as the Deyra Doon, where by the aggregation of its small berries it yields an edible fruit.

The Hemp (*Cannabis sativa*), so well known in Asia from affording an intoxicating drug, and in Europe the strongest fibre for rope-making, is cultivated for the former product in small quantities every where in the plains of India, near villages: but in the Himalayas it is extremely abundant, at elevations of 6,000 and 7,000 feet, and of very luxuriant growth, rising sometimes to a height of ten and twelve feet. Here, though

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it likewise affords an intoxicating drug, it is also known for the tenacity of its fibre, which is employed by the mountaineers in Gurhwal and Sirmore for making a coarse sackcloth, and strong ropes for crossing their rivers. Considering that this fact was early made known by Col. Kirkpatrick in his account of Nepal, ascertained by Gen. Hardwicke in his journey to Srinuggur, and repeated by Dr. Roxburgh in his account of experiments on substitutes for Hemp; it is remarkable that no one should yet have attempted to obtain it for commercial purposes, particularly as during the late war so many attempts were made to find an efficient substitute for this important plant; and so many others are cultivated in India for the product which this yields of so superior a quality. It may be mentioned, that I have seen it abundant in the Deyra Doon and plains of Northern India, especially in the upper part of the Doab Canal; of these only a small portion is employed for making *bhang;* but this might probably be obtained from the leaves, even while the stems yielded the fibre.

The Hemp is supposed by some to be a native of India; it no doubt is so of some part of Asia. It appears to be wild in the Himalayas. The Arabic name *kinnub* is thought to have been corrupted into the Dutch *hennep,* whence we no doubt have our *hemp; kinnabis* is given as its Greek name by the eastern writers on Materia Medica; *bunj* as Persian; and *bhung* and *bhang* as Hindee. It is said by Herodotus to have been made into cloth by the Thracians, and is now well known to be extensively cultivated in Italy, Poland, and Russia to the south of Moscow, with a small quantity only in England. It requires a rich soil and moist situation; is pulled when in flower, if the fibre alone be required, but if the seed also, then the male plants are pulled as soon as they have shed their pollen, and the others when the seed is ripe. These yield oil, which is employed by painters, or they are used for feeding poultry; so that every part of the plant is turned to some account. The leaves are sometimes smoked in India, and occasionally added to Tobacco, but are chiefly employed for making *bhang,* and *subzee,* of which the intoxicating powers are so well known. But a peculiar substance is yielded by the plants in the hills, in the form of a glandular secretion, which is collected by the natives pressing the upper part of the growing plant between the palms of their hands, and then scraping off the secretion which adheres. This is well known in India by the name *cherris,* and is considered more intoxicating than any other preparation of this plant, which is so highly esteemed by many Asiatics, serving them both for wine and opium; it has in consequence a variety of names applied to it in Arabic, some of which were translated to me, as "grass of fuqueers,"—"leaf of delusion,"—"increaser of pleasure,"—"exciter of desire,"—"cementer of friendship," &c. Linneus was well acquainted with its "vis narcotica, phantastica, dementens." It is as likely as any other to have been the *Nepenthes* of Homer. Besides *kinnabis,* it has *defroonus* assigned as a Greek name.

It is interesting to find in the same family with the Hemp, the *Urtica tenacissima* or *Calooee* of Marsden, *Rami* of the Malays, a native of Sumatra, also of Rungpore, where it is called *kunkomis,* and which Dr. Roxburgh found one of the strongest of all the vegetable

table fibres, which he subjected to experiment. Average weight with which lines made of the different substances broke, were, *Asclepias tenacissima, Jetee* of the Rajmahl mountaineers, 248; *Urtica tenacissima, Calooee,* 240; the strongest *Sunn, Crotolaria juncea,* 160. Hemp, *Cannabis sativa,* grown in the year 1800, in the Company's Hemp Farm near Calcutta, 158, but much stronger when tanned. Europe Hemp, however, was always found stronger than Sunn, though not more so than the others. Dr. Roxburgh speaks of the beauty, fineness, and softness of the fibre of this plant, and says, he learnt from a friend resident at Canton, that the grass-cloth of China is made of this material. It is cultivated in Sumatra for the fibres of its bark. The Malays use it for sewing-thread and twine, and for making fishing-nets. It is as readily cultivated as the willow from cuttings, grows luxuriantly in the northern, as in the southern parts of India, throws up numerous shoots, as soon as they are cut down, which may be done about five times a-year. Dr. Roxburgh, however, found some difficulty in cleaning the fibres of this plant, notwithstanding his anxious desire to succeed with this substitute for both hemp and flax. *Urtica heterophylla,* is another Indian nettle, which succeeds well in every part, and of which the bark abounds in fine white, glossy, silk-like strong fibres (Roxb.) The stinging properties of the nettle are well known, but they are all exceeded by the last-mentioned plant, as well as by *U. crenulata* and *stimulans.*

The Hop (*Humulus Lupulus*) is another plant of this family, which affords fibre fit for rope and cloth-making, and which would be a valuable acquisition to India, as many situations at moderate elevations are admirably fitted for the brewing of beer. In one establishment which I visited several times, the temperature within the buildings never varied much from 60°. The Hop is also a remarkable instance of the change of prejudice with regard to the same thing. Thus, at an early period, in the petition against it, we hear of it as the "wicked weed called hops;" in a subsequent age we find it noted as a subject of admiration, that "on Kent's rich plains green hop-grounds scent the gales;" and now, many think, that no beer can be made without it. The plant grows wild in most parts of Europe, and is described further south by Bieberstein, in his Flora Tauro-Caucasica, as "copiosa in dumetis et sepibus." It requires a rich strong soil, especially if it be rocky a few feet below the surface. It is planted in October or March, shoots up about the middle of April, flowers in July, and ripens its seeds in September. Warm seasons, without wet, are required for good crops; great heat after rains, and high winds, are destructive. It might be cultivated in Nepal, or, perhaps, the Deyra Doon; but it is feared that the rainy season would interfere much with the proper growth of the plant. The subject is well worthy of experiment, and a few plants would suffice to ascertain the effects of the seasons.

154. ARTOCARPEÆ.

The *Artocarpeæ,* separated from *Urticeæ,* may be recognised by their milky juice and flowers aggregated in fleshy heads. This is strictly a tropical family, but like many such, sends a few species both north and south beyond strictly tropical limits,

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as southwards to the Cape and southern parts of New Holland, and north to Japan and the south of Europe. Two species of *Morus* and one of *Maclura* extend into the United States of America,

The genera of *Artocarpeæ* are few in number; those found in India are, *Artocarpus, Ficus, Broussonetia,* and *Morus*. *Gunnera,* thought to be confined to the New World, has been found by Blume in Java. *Artocarpus,* from which the family is named, and the genus, from the well-known species, *A. incisa,* or Bread-fruit tree of the Pacific Islands, and which is also found in the Moluccas, has also species in India and the islands, as *A. integrifolia,* or the Jak fruit, much cultivated in Southern India, and found in many parts where the climate is not too dry. *A. Chaplasha* and *A. Lakoocha,* Roxb., with other species, are also common in the southern parts, as Silhet, and the latter in gardens even in the most northern parts. The genus *Ficus,* the most numerous in species, is also the most abundant in India. Species may be seen nearly every where, either cultivated in the neighbourhood of villages, or wild in every jungle or hilly situation, from the Peninsula to the most northern portion of the Himalayas; one or two species are found as high as at Mussooree, *F. laurifolia,* nob., and *foveolata,* Wall. Dr. Roxburgh has described about fifty species, Dr. Wallich has added nearly as many, without including those from the Malayan Peninsula or islands. The whole require a more critical examination than they have yet received, before we can determine the species which are common to India with other countries; but many of the same species extend from the southern to the most northern parts, as *F. indica, religiosa, glomerata, conglomerata, venosa,* &c. *F. Rumphii* occurs in the vallies in Kemaon, and at Barahat on the Ganges; but it may have been introduced, as it is held in veneration by the Hindoos. *F. elastica* does not extend beyond Pundua, Juntypore, and Chirraponjee. *Broussonetia,* with species in the West-Indies, Louisiania, and Brazil, has one species, *B. papyrifera,* common to the Society Islands, New Zealand, and Japan; and another, *B. integrifolia,* at Goalpara, in Lower Assam. The Mulberry, though not so numerous in species, is more widely diffused than any other genus of the family. Species are found in Madagascar and Mauritius, in the islands of the Pacific Ocean, in Java, Quito, N. America, and China. In India we trace them from the southern to the most northern parts; with one species common in the Himalayas: thence we find them in Cashmere, Persia, Asia Minor, and Media, near Bokhara, and S. of Russia. In a great part of Europe *Morus nigra* is common, but probably introduced from the South.

Of *M. alba,* so valuable in an economical point of view, and especially cultivated in the south of Europe for feeding the silk-worm, the native country is not well known; but it is supposed by some to be Persia, Media, and Asia Minor, and by others China; though we do not hear when it was introduced into Europe, nor is it mentioned at the time when the Monks brought the eggs of the silk insect to Constantinople. The species of this genus, like that of almost every other which is cultivated, has been so little attended to by those best qualified to determine the degree of variation, and consequently

quently the limits of species, that some may be confounded with others; it is therefore difficult, from the notices of travellers, to say what species prevail in different countries. *Morus alba* may be common in China, but it is little known in India, though Dr. Roxburgh mentions it as occurring in gardens in the south: it is not found in the north, nor is his *M. indica,* so extensively cultivated in Bengal for feeding the silk-worm; this, however, occurs in the Peninsula, as I see by specimens sent thence in the British Museum and E. I. Herbarium. *M. atropurpurea,* introduced from China, succeeds well in every part of India, but the leaves are not relished by the silk-worm (Roxb.) The species most common in the north of India are, *M. lævigata,* Wall., called *seah toot,* or black mulberry, of which the long, cylindrical, purple fruit is much eaten; also *M. parvifolia,* nob., found wild in the jungles, and called *toothree;* its wood is highly esteemed for hardness and tenacity. Two other species found in gardens in Northern India are not known in the south; one originally from the valley of Cashmere, *M. Cashmeriana,* nob., is called *suffed-toot* (white mulberry), by the natives, but it has long pendulous fruit; and another from the same valley, *M. dulcis,* nob., of which some of the varieties resemble *M. alba,* and others *M. tatarica;* but its fruit is superior in flavour to that of all the other species. *M. serrata,* Roxb. (*cuspidata,* Wall.), is very common in the mountains in Kemaon, Sirmore, below Mussooree, and at Simla.

The *Artocarpeæ* contain many plants very important in an economical point of view; as the Mulberry, already mentioned, for feeding the silk-worm; it is interesting to find, as stated by Dr. Roxburgh, that next to mulberry leaves, they prefer those of the *pippul,* or *Ficus religiosa,* also a plant of this family. The Bread-fruit tree (*Artocarpus incisa*), belonging to the genus which gives its name to the family, forms a large portion of the food of the South-Sea Islanders. The Jak (*A. integrifolia*) affords an agreeable fruit; its seeds roasted, are much eaten in the south of India and in Ceylon. *A. Lakoocha* and *echinata* form very inferior fruits, though they are eaten by the natives of the countries where the trees are indigenous. *A. integrifolia* and *Chaplasha* yield excellent timber. The Figs are well known for their delicious fruit, though this is not usually produced of a fine quality in all parts of India; but varieties of *F. Carica* are common in gardens, and might no doubt be much improved, as they are produced of a fine quality in the Bombay presidency, in the south of Europe, and Asia Minor, as well as in Northern Africa. The fruit of other species is eaten by the natives of India, as of *F. glomerata, hirsuta, scabrella,* and *virgata.*

The *Artocarpeæ* all abound in a milky juice, frequently of a bland nature; as in the Cow-tree, or *Palo de Vacca* of South America, supposed to be related to *Brosimum,* and abounding in caoutchouc. But it is often united with an acrid principle, secreted in some in so large a proportion as to render them poisonous; as witnessed in *Ficus toxicaria,* and especially in *Antiaris toxicaria,* the Upas-tree of Java, owing to the presence of *Strychnia.* So, in the *Apocyneæ,* we have seen the equal presence in the same family, of caoutchouc-yielding milky juice, either of a bland nature, or combined

with an acrid principle. Many species yield tenacious juice, of which bird-lime is frequently made, as *Artocarpus integrifolia* and *Lakoocha*, *Ficus indica* and *religiosa*; also, *F. Tsiela*, *Roxburghii*, *glomerata*, and *oppositifolia*. From some of these an inferior kind of caoutchouc has been obtained; but in considerable quantities, and of a very good quality, from Dr. Roxburgh's *F. elastica*, which he describes as being of the size of a mango-tree, or full-grown sycamore; the older trees yield a richer juice than the younger, from incisions cut in the bark all round the trunk from its base to the top. Of this milky juice, 50 oz. yielded 15½ oz. of the clean-washed caoutchouc. With the milk the natives pay the insides of their vessels and baskets, so as to enable these to hold liquids: the caoutchouc furnishes them with candles and flambeaux. Dr. Roxburgh discovered many years ago that it was perfectly soluble in Cajeputi oil, rather an expensive medium, but sufficient to indicate the kind of menstruum of a cheaper nature which would dissolve it. The other plants made known by Dr. Roxburgh as secreting caoutchouc are, *Urceola elastica*, which yields in Penang the best kind, *Willoughbeia edulis*, and *Melodinus monogynus* (v. p. 270.)*

The

* Since the above passage was in type, I have received specimens of the Caoutchouc of *Ficus elastica*, from Mr. G. Swinton, late Chief Secretary to the Bengal Government, who had it collected so long ago as 1826 in Silhet, and sent it to Sir D. Brewster for experiment; but it never attracted the notice of commercial men, either in India or England. Notwithstanding that Professor Seddon, at the desire of the late Mr. D. Scott (so well known for his zealous endeavours to elicit the resources of the districts committed to his charge), sent it from Assam to a principal house of agency in Calcutta; but was informed that "the article being unknown in this (the Calcutta) market, we are sorry we can give you no idea of its value:" and this, in March 1828, when it was selling in London for two shillings a-pound. As Caoutchouc has now become an extensive article of commerce, and a Company has been formed in London called the London Caoutchouc Company, of which one of the objects is to encourage the collection of this substance in India, so that the home manufactures may not be dependent upon too limited a field of supply, it cannot but be highly gratifying to Mr. Swinton to have his early anticipations of its value so completely substantiated. This, the more so, as so few were found either here or in India, who perceived the importance or encouraged the prosecution of his exertions, to bring not only this, but many other Indian products into notice; several of which might by this time have become important articles of commerce. It is curious that Mr. Swinton should also have been the medium of communication with Mr. Scott, for announcing the fact of the Tea-plant being both indigenous and cultivated within our then newly-acquired territories in Assam. As the Caoutchouc was pronounced to be of no value, so the Tea was said to be only a Camellia; and as the former has come to be so desirable an article for a commercial body here; so has the latter become an object of solicitude even to the Indian Government: a scientific expedition, headed by Dr. Wallich, having been sent into Upper Assam to explore the Tea country, whose report the scientific world are anxiously expecting.

I have been favoured with a letter from my friend, Professor Christison, of Edinburgh, who obtained specimens of the above East-India Caoutchouc, after it had been eight years in the country, and employed it in making a flexible tube for conveying coal-gas. Respecting it, he says "I can most decidedly state, that so far as my trials go, it is a far better article than is commonly thought, and quite fit for many most important economical uses." Since the arrival in London, from Mr. Swinton, of the specimens of this Caoutchouc, they have been submitted to experiment by Mr. Sievier, the Sculptor, so well known for his numerous experiments on, and important applications of, this substance. He pronounces the India-rubber from Silhet, though carelessly collected, and so long ago as eleven years since, to be equal in elasticity to the best

The *Banyan*, or *Ficus indica*, is famed for its "pillared shade, where daughters grow about the mother tree," and the "tot rami, quot arbores," which has furnished a motto to the Royal Asiatic Society. Species of the genus afford grateful shade in America, as in India. The wood of *Morus tinctoria*, called *fustick*, is used for dyeing yellow, so also of *Broussonetia* and *Ficus tinctoria*; in India, the roots of *Artocarpus Lakoocha* are used for dyeing the same colour. From the fondness of birds for the fruit and the tenacity of life in the seed of two species, *F. indica* and *religiosa*, are explained two phenomena very familiar to all who have visited India: one is that of a palm-tree growing out of the centre of the Banyan: and the other that of the pippul, *F. religiosa*, vegetating, (where the seed has been deposited in cracks), on the driest walls and most elevated domes and minarets, which, by its increase, it soon destroys. The former appearance Dr. Roxburgh has also well explained, as proceeding from the seed of the Banyan germinating, on the moist upper parts of the palmyra-tree (*Borassus flabelliformis*); and thence sending down its descending shoots, which in time entirely enclose the palm; this finally appears with only its bunch of leaves projecting beyond the

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best from South America, and superior to it from lightness of colour, and freedom from smell. There can be little doubt, therefore, of its becoming an important and profitable article of commerce, since nearly 500 tons of Caoutchouc are now imported from other parts of the world; and its applications and uses are so rapidly increasing, that it is not possible at present for the supply to keep pace with the demand. It may be hoped, therefore, that some enterprizing individuals will be induced to collect carefully, that is, keep clean, the milky juice of *Ficus elastica*. The tree is called *kasmeer* by the inhabitants of the Pundua and Juntipoor mountains, which bound the province of Silhet on the north. It is also found near Durrunj, in Assam, between the Burrampooter and the Bootan Hills. The highest price for caoutchouc can, however, only be obtained for that which is collected in the bottle-form; or preferably in that of a cylinder of $1\frac{1}{2}$ to $2\frac{1}{2}$ inches in diameter, and 4 or 5 inches in length, according to the models sent by theauthor to both the Asiatic and Agricultural Societies of Calcutta. Much useful information will be found on this subject in Dr. Roxburgh's Flora Indica, vol. iii. p. 541-545; also, in his article on *Urceola elastica*, or Caoutchouc-vine of Sumatra and Pulo Penang, following another by Mr. Howison on the same subject, in the fifth volume of the Transactions of the Asiatic Society of Calcutta. *Vide* pamphlet on the Plants which yield Caoutchouc, by the Author.

As connected with this subject may be mentioned a discovery to which the author was led, and announced in a paper read before the British Association at Bristol (v. Athenæum, 3d Sept. 1836). By referring to the observations on the families of *Cichoraceæ*, *Lobeliaceæ*, *Apocyneæ*, *Asclepiadeæ*, *Euphorbiaceæ*, *Urticeæ*, and *Artocarpeæ*, it will be seen that in each of these families there are plants yielding Caoutchouc, and in some of them a few employed in making bird-lime; with others remarkable for the tenacity of their fibre. But it is singular that in these same families should be contained the several plants on which the silk-worm feeds, when unable to obtain its favourite food, the leaf of the mulberry. Thus, in Europe, it is fed on lettuce and dandelion leaves, lately on those of a species of *Scorzonera*, all belonging to the *Cichoraceæ*; so, in India, *Ficus religiosa*, of the family of *Artocarpeæ*, has been found the best substitute for the mulberry leaf. Other species of silk-worm also feed on plants of these families; as *Phalæna Cynthia*, or Arindy silk-worm, on the leaves of *Ricinus communis*, one of the *Euphorbiaceæ*. Mr. Morley informs me, that a caterpillar, which has a very large cocoon and spins a tough, but coarse kind of silk, feeds on the leaves of the South American Caoutchouc-tree, or *Siphonia elastica*, also of this family. Considering that such facts were not likely to be accidental, I was led to suppose that this substance might possibly form a necessary ingredient in the food of silk-worms, and be in some way employed in giving tenacity to their silk. I therefore inferred that it might probably be found

the top of the trunk of a lofty Banyan, out of which it appears to be growing; though actually older, and like it, having its roots fixed in the ground. The Lac insect delights in several species of *Ficus*, as *F. indica, religiosa, glomerata*, &c.; the twigs of which it may frequently be seen covering. *Broussonetia papyrifera* affords fibres, which are convertible into ropes; made into a kind of cloth; or manufactured into paper. *Urticeæ* and *Artocarpeæ* are now re-united by M. Gaudichaud and Dr. Lindley.

155. DATISCEÆ.

This small order was formed by Mr. Brown of the genus from which it is named, and *Tetrameles*, discovered by Dr. Horsfield, in Java. *Datisca* is found both in the Old and New World, existing in the latter in Pennsylvania. *D. cannabina*, so named from its great resemblance to the Hemp-plant, extends from the south of Europe and Asia Minor through Iberia to the vallies of the Himalaya. I have obtained it from Cashmere and Kunawur, and found it at the foot of the Choor and Kedarkanta mountains. It spreads also to Nepal; *D. nepalensis*, Don, being the same species.

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found in their favourite food, the mulberry leaf, even though this is represented as being without milky juice, and subsequently requested Mr. Sievier, who was living out of town, to ascertain whether any Caoutchouc did exist in the juice of the mulberry: a few days afterwards, he informed me that I was perfectly correct in my inference, as the juice of the mulberry not only contained Caoutchouc, but was also milky, as might be seen on breaking the petioles of the leaves, especially on dry and bright sunny days. This fact may partly explain why mulberry leaves, grown on dry, sandy, or gravelly situations, and even on the higher lands in the south of France, are more nourishing to the silk-worm, than those produced in rich or moist lands; the latter, from their quicker growth, being more watery, and therefore not so favourable for the production of the peculiar secretions of the mulberry.

On reading the above paper, the Rev. F. Hope, late President of the Entomological Society, inquired whether the Spindle-tree, *Euonymus europæa*, belonged to any of the above families of plants, as it was occasionally employed for feeding the silk-worm. This would at first sight appear to be an exception; but it may be observed, that Caoutchouc is a substance much more extensively diffused in plants than is generally supposed; also, that the Tusseh silk-worm, *Phalæna Paphia*, described by Dr. Roxburgh (*Trans. of the Lin. Soc.* vol. vii.) feeds on *Zizyphus Jujuba;* and though the former, *Euonymus*, is now placed in *Celastrineæ*, p. 166, and *Zizyphus* in *Rhamneæ*, p. 168, these two families are so closely allied to one another, as to have formed the *Rhamni* of Jussieu; and both are allied to the *Ilicineæ*, a tribe of *Celastrineæ*, according to De Candolle (v. p. 167), and which contains the common holly, so well known as employed in making bird-lime. This substance (*glu* of French chemists) is very analogous to Caoutchouc, or only a modification of the latter. The Bughy silk-worm of the natives of the Birbhoom Hills, where Tusseh silk is manufactured, however, feeds on *Pentaptera glabra* (*Ascen* of the natives) of the family of *Combretaceæ;* but we do not know that any of these contain Caoutchouc; though I have no doubt that some will be found in these plants. The subject is well worthy of investigation, especially as shewing the important inferences we may sometimes draw from the natural affinities of plants; and also, in a practical point of view, as assisting us in finding fit food for the fastidious silk-worm; and therefore extending the silk cultivation into new situations. The number of plants suited to silk-worms may, I think, be increased, by experimenting on those belonging to families which yield Caoutchouc. It does not follow that all which yield this substance are fitted for its food; for many we have seen are united with an acrid principle: and the surface of the leaves of others may be both too rough, as well as the texture too thick and hard for so delicate a tribe of animals.

156. ULMACEÆ.

156. ULMACEÆ.

The *Ulmaceæ* of Mirbel, *Celtideæ* of Richard, separated from *Amentaceæ*, and nearly allied to *Urticeæ*, form a small order containing but few genera and species. Species are found in India of *Ulmus* and *Celtis*. The former is common in Europe, N. America, China, and Japan; from Siberia and the shores of the Caspian, species extend to the Himalayas, where several form magnificent trees. *Ulmus integrifolia* (Wall. 3547) is found at the foot of these mountains, as well as on those of the Circars; and *U. lancifolia* as far south as the Chittagong mountains. *U. erosa*, Roth., thought at one time by Dr. Wallich to be *U. effusa*, Wild., appears to have a wide distribution, if the specimens described by the former were obtained by Dr. Heyne from the Peninsula; as it is common in Kemaon, and at the foot of the Choor mountain. I have specimens in leaf of apparently the same species from Pungee in Kunawur, where there is also a smooth-leaved species, *U. lævigata*, nob. *U. virgata*, which Dr. Roxburgh states as having received from China, was found by Dr. Wallich in Nepal and Kemaon, and by myself at Mussooree, &c., so that it may be enumerated as one of the plants common to India and China. *Celtis*, on the contrary, occurs in tropical as well as in cold parts of the world, as in Northern and Tropical America, Africa, and Asia, spreading thence into the south of Europe; so we have species of the genus extending from Penang and Singapore along the Malayan Peninsula to Silhet; also in the Indian Peninsula, and some of the hills of Central India; likewise in Nepal and the Deyra Doon, at considerable elevations in the Himalayas, and as far north as Cashmere. *C. orientalis*, Wall. Cat. 3689, and species allied to it, occur in the hottest places; *C. tetrandra*, Roxb., extends along the foot of the mountains as far as Cashmere. *C. alpina*, nob., I found on Urrukta, nearly at the greatest elevation; and *C. Inglisii*, nob., occurs in Kunawur.

The Elms are well known to afford good timber in Europe, so do those which are found in India and its mountains. *Ulmin* is a natural exudation: the bark is bitter.

157. ANTIDESMEÆ.

This is another small order, with solitary carpels, consisting of only two genera; that from which the order is named, and *Stilago*, sometimes united with the former, and from which the order is frequently named STILAGINEÆ. The species of *Antidesma* seem to be entirely confined to the warm parts of the Old World, especially of India; but there is one species in Madagascar. From Amboina and Penang, they spread to Chittagong and Silhet. *A. paniculata* extends from Penang to Nepal; and *A.* (*Stilago*, Roxb.) *diandra*, even to the Deyra Dóon, and the vallies of the Himalaya. This seems to be the most extensively diffused species, as it was described by Dr. Roxburgh from the Circars; *A. sylvestris*, Wall. Cat. 7281, sent by Dr. Heyne, probably from the Peninsula, does not seem to differ from it. The fruits of *A. pubescens*, *Bunias*, and *diandra*, are said by Dr. Roxburgh to be eaten by the natives of India.

158. JUGLANDEÆ.

This is a small family, usually placed near *Terebinthaceæ*, but considered by Dr. Lindley as more closely allied to *Cupuliferæ*. It was supposed to have the mass of the family in America, with only a single species, the common Walnut, in the Old World. But though the great proportion of the genus *Juglans*, now placed under *Carya*, is common in North America, *J. regia* extends from Greece and Asia Minor, over Lebanon and Persia, probably all along the Hindookoosh to the Himalayas. It is abundant in Cashmere, Sirmore, Kemaon, and Nepal. A new species occurs on Caucasus; and another, *J. arguta*, was found by Dr. Wallich as far south as Taong Dong.

In addition, a new genus, *Engelhardtia*, Lesch. first discovered in the Malayan Archipelago, has also been found in the Himalayas; to it belong Dr. Roxburgh's *Juglans pterococca*, and two other species. Of these, *E. Colebrookiana*, Wall. Pl. As. Rar. t. 208, is found as far north as Jurreepanee and in Nepal; *E. Roxburghiana*, in Silhet and at Chappedong; where, in the vast forests of the former, it forms a large tree; of which the wood is valued by turners, and the bark, containing much tannin, is considered the best used by natives in the art of tanning (Roxb.) *E. Wallichiana* is found as far south as Penang and Singapore.

Walnuts are imported into the plains of India from the Himalayas, but chiefly from Cashmere. They are known to the Arabs by the name *jowz*, or the nut. The Hindoos call them *ukhrot*, and the Persians *chuhar-mughz* (four-brains); *farsia* is given as their Greek name, a corruption, no doubt, of *Persica*. The oil is much esteemed, though seldom expressed by the natives of India.

159. AMENTACEÆ.

The *Amentaceæ* of Jussieu have been divided into several orders; a separation required by the more minute and exact examinations of recent times; but as the inconveniences of a multiplication of orders, unless accompanied by an arrangement into classes; more than counterbalance the advantages of separation in a general point of view; it is preferable for such purposes to retain together those which are united in so many respects. No plants are better known in Europe than those which belong to the orders formed out of the old *Amentaceæ*, since they contribute so great a portion of the forest-trees of northern latitudes, as the oak, chestnut, beech, birch, hazel, hornbeam, alder, willow, and poplar. These are common in Europe and North America, with a few in Northern Africa, and extend all along the north of Asia, from Siberia to Kamtschatka and the island of Japan. From Asia Minor we trace them along Caucasus and the Hindookoosh to the Himalayas, even in their most southern ramifications. A few oaks are also found on the mountains of the Malayan Archipelago, and with alders in South America; a birch (*Betula antarctica*), as far south as the island of Chiloe and Terra del Fuego; willows in Peru and Patagonia, with one also in Senegambia.

The genera of *Cupuliferæ*, found in the Himalayas, are *Quercus*, *Corylus*, *Carpinus*, and *Castanea*; the three first have the most northern distribution, though that of

Quercus

Quercus is very extended, being found from the northern to the most southern parts, as the mountains of Silhet, Chittagong, Penang, and Taong Dong, and from moderate elevations (*Q. incana, ban* of the Hill people), to the limits of forest (*Q. semecarpifolia, khursoo.*) The last species varies much in appearance, and as this is likewise observed in others, some reduction will take place in the number of Himalayan oaks at present enumerated. *Corylus* extends from Cashmere to Kemaon, and is found in shady forests on the shoulders of such mountains as Choor and Kedarkanta; with the same species, *C. lacera,* on all. *Carpinus viminea* occurs in Nepal, Kemaon, and on Mussooree at an elevation of 6,500 feet. *Castanea* having the most southern distribution in Europe, is that which extends less to the north in the Himalayas than the other genera. *C. indica* and *tribuloides* occur in Nepal and Silhet; other species in Goalpara, and as far south as Penang. It is remarkable, that so many of the *Cupuliferæ* having been found along the Himalaya, and even in the Malayan Islands, that not one should be mentioned in books, or specimens exist in the E. I. Herbarium, from the mountains of the Indian Peninsula.

Of *Betulineæ, Alnus* having the distribution of the order in the northern hemisphere, and existing in moist situations, especially along the course of rivers, occurs in the Himalayas in similar localities. *A. obtusifolia,* nob., is very abundant on the banks of the Jumna and Tonse; *A. elongata,* nob., occurs in Cashmere; and *A. nepalensis,* in the valley from which it is named. *Betula,* on the contrary, occupies the loftiest situations in these, as in other mountains; which we might expect from its extending to the highest latitudes. *B. Bhojputtra,* Wall., the most useful and best-known species, is found on Gossainthan, in Kemaon, on Choor and Kedarkanta. *B. nitida* and *cylindrostachya* occur with the former in Kemaon; the latter extends also to Manma and Dhunoultee. *B resinifera,* nob., confined to Kunawur, with catkins resembling those of *B. lutea,* Mich., has leaves something like those of *B. papyrifera.*

The Willows, diffused in distribution, are also multiform in habit; the species peculiar to the Himalayas are not found easier than others of discrimination. As they occur both in warm and cold parts of the world, so we have them both in the plains and mountains of India. *Salix babylonica* is common in gardens in Northern India, as is *S. ægyptiaca,* while the polyandrous *S. tetrasperma,* Roxb., is found in the Kheree Pass, along the foot of the mountains, and in other hot parts of India, as Bengal and the Peninsula. A species of this genus, as we have seen, is common also on the Senegal. We know that a dwarfish willow (*Salix arctica*) extends to, and forms the only woody plant of high northern latitudes; so the diminutive *S. Lindleyana,* is found on the loftiest parts, or between 12,000 and 13,000 feet, of such mountains as Kedarkanta; with *Rhododendron lepidotum* and *anthopogon,* the only other ligneous plants. *S. hirta* and *rotundifolia,* nob., from Kunawur, resemble, the former, *S. hastata* from Lapland, and the latter, *S. polaris* and *S. herbacea.*

The Poplars are confined to the northern hemisphere: we find them flourishing on the Himalayas, only at considerable elevations. *Populus ciliata,* found in Kemaon, is

common

common on the northern face of the Choor, at Muttiana, and at Seran in Lower Kunawur. *P. pyriformis*, nob., occurs on Deobun. *P. alba*, Lin., common in Europe and the north of Asia, extends to the north of the Himalayas, as I have had specimens brought me from Kunawur. The native country of *P. dilatata*, or the *Lombardy Poplar*, seems to be quite unknown; some authors considering it a native of Italy, and others of America, while some even account it a hybrid. But from the following facts, I think there is little doubt of its having been brought to Europe from some Eastern country in former times, when the communication by the East and interchange of commodities was greater than in recent times. Understanding that a tree, which from the description appeared to be a poplar, had been introduced from the Punjab, and was common in gardens to the north of the Jumna, I sent for it into the Saharunpore Botanic Garden. The slips obtained, grew well, and the plants were ten or twelve feet high, with the habit of the Lombardy Poplar, when I left Saharunpore; the specimens in my herbarium were immediately recognised by Mr. Don as those of *P. dilatata*. In Northern India it is called *ghurb*, and it is described in Persian works under this Arabic name, with Pers. *wussuk* and *supuedan*; Hind. *safueda*. The two last having reference to the whiteness of some part of the plant, probably the wood. One of the Greek names given is *ata*, probably a corruption of ιτεα. The white poplar is generally supposed to be the ιτεα λευκη of Theophrastus, simply λευκη of Dioscorides. The *ghurb*, or Lombardy Poplar, is said in Persian works to be a native of Dailim and Tinkaboon, near the south shore of the Caspian. Mr. Baillie Fraser, I understand from Mr. Don, says it is one of the most common trees in Persia, and is that usually taken for the cypress in Persian drawings. *Dundar*, Pers. *daroon*, is said to be a species of *ghurb*, and from the description of the seed it is probably one of the *Salicineæ*. In the Latin translation of Avicenna, we are referred from *dundar* to *Ulmus*, the πτελεα of Dioscorides; but unless the description refers to galls, and not to the fruit, we cannot understand the comparison of the contents of its seeds to flies.

Platanus orientalis, a native of Asia Minor and the Oriental Region, *doolb* of the Arabs, and *chinar* of the Persians, by whom it is much esteemed on account of the grateful shade it affords, extends as far south as Cashmere; where its occurrence was first mentioned by Bernier, and whence I have received some very fine specimens. The Greek name has been converted into *klitanos* in Persian works.

The oaks, chestnuts, and others of the *Amentaceæ*, are so well known for their rich and luxuriant growth, and as forming the ornaments of European forests, that we can hardly fancy the so-much-boasted trees of tropical regions to be more magnificent. One thing is certain, that they do not furnish more valuable timber, whether we consider the English oak, or those found in the Himalayas. The bark of oaks, alders, birches, willows, and poplars, abounds in gallic acid and tannin, and all have therefore been frequently employed as tonics and febrifuges, as well as in tanning. Some are useful in dyeing, as *Quercitron*, the bark of the North American *Quercus tinctoria*, which dyes wool yellow. Gall-nuts, called *majoophul*, are imported into India, being produced by the

the puncture of *Cynips Quercus folii* on *Quercus infectoria*, a native of Asia Minor, Armenia, and Kurdistan. *Q. Ilex* and *Cerris* afford inferior galls. The cupules of the glands of *Q. Ægilops*, called *velonia* and *velani* (a corruption of Βαλανι), and *velaneda* by the modern Greeks, are collected in Ceos, and used for the same purposes. The Kermes insect fixes itself upon *Q. coccifera*, hence called Kermes Oak, a native of the S. of Europe and N. of Africa. *Q. Ballota*, sweet-acorn oak, that probably described in Persian works under the names *shah-bulloot* and *bulloot-ool-mulik*, is a native of Spain, N. of Africa, and of parts of Greece; this having acorns free from tannin, has been long used as food by the inhabitants of the above countries. It might very probably, as well as the Cork-tree (*Q. Suber*), a native of the hot parts of Spain and France, be naturalised in the plains of Northern India; where *Q. incana*, from elevations of 5,000 to 7,000 feet in the Himalayas, is perfectly at home. The acorns of this species are sold in bazars under the name *bulloot*, being used by the natives in medicine. The nuts of others of the *Amentaceæ* are used for food, as Spanish chestnuts, the beech and hazel-nut: the first contain sugar, and the two latter much oil, for which they are often subjected to expression. The nuts of the hazel, abundant in the Himalayas, may be met with in bazars under the name *binduk* or *finduk*. An edible nut is afforded by the Indian chestnut, *Castanea indica*, Roxb., a native of the mountains of Silhet, where it is called *nikari*.

The black birch, *Betula nigra*, of N. America, is celebrated for the hardness of its timber; the astringent bark is used in tanning, and the leaves for dyeing yellow in Lapland. *B. nana* yields a vegetable wax, like *Myrica Gale*. The bark of *B. alba*, reduced to powder, as well as the wood of the black poplar, is eaten by the inhabitants of Kamtschatka, beaten up with the ova of the sturgeon; the sap of this species, as of *Alnus glutinosa*, is fermentible; the catkins of the latter are employed in tanning. The bark of *Betula Bhojputtra* is well known for serving as a substitute for writing-paper, and for wrapping hooqqa-snakes. Cattle are fed on the leaves of *Populus nigra*, and the coma of the seeds is employed for making paper. That of the Himalayan *P. ciliata*, being particularly abundant, might be employed for the same purpose. Some of the poplars, like the *Balsamifluæ* (natives of Java, the Levant, and N. America), secrete a fragrant gum-resin, as *P. nigra*, *P. nana*, and *P. balsamifera*, a native of N. America and Siberia. *Betula resinifera*, nob., has its leaves covered with numerous resinous dots. *Salix ægyptiaca*, *khilaf-bulkhee* of the Arabs, Calif or Egyptian willow, called in Persia and in the gardens of Northern India, *bed-mooshk*, has a fragrant water distilled from its catkins. A kind of manna, called *bed-khisht*, is said, in Persian works, to be collected off a species of willow in Persian Khorassan.

As species of all the above genera exist in the Himalayas, it becomes an important subject of inquiry, whether some would not yield products now forming articles of commerce in other parts of the world: the above detail has therefore been introduced. Some of the most useful species of other countries might, no doubt, be

successfully introduced into the Himalayas; as those indigenous there might equally be naturalized in European climates, whether for the purposes of use or ornament.

Populus ciliata; (Wall. Cat. N. 2796) foliis amplis auriculato-cordatis acutis serratis ciliatis subtus candicantibus, ramis teretibus glaberrimis, petiolis gracilibus elongatis.—Tab. 84[a]. or 98. fig. 1.*

Hab. Kemaon, Northern face of Choor, near Muttiana, and at Seran, in Lower Kunawur.

Quercus dilatata, mohroo of the natives, has inadvertently been written *dealbata* in Plate 84. fig. 2.

160. SCEPACEÆ.

This new family, distinguished by being amentaceous, with arillate albuminous seeds, and a dehiscent 2-celled pericarp, has been established by my friend, Dr. Lindley, in the Second Edition of his Natural System of Botany. He remarks, that "*Scepaceæ*, in their male state, have much the aspect of *Cupuliferæ* or *Betulaceæ*, and one of them has actually been considered an *Alnus* by Dr. Roxburgh: but the females have more the appearance of *Antiaris*, or some such *Urticaceous* genus." The genera referred here by Dr. Lindley are, *Scepa*, found in Burma; *Lepidostachys*, of which one species, *L. Roxburghii* (*Alnus dioica*, Roxb.), occurs in Silhet, where it is called *kokra*, and forms a large tree, with hard timber: the third genus is *Hymenocardia*, placed here with doubt.

161. HENSLOVIACEÆ.

This order, composed only of two species of the genus, named by Dr. Wallich in honour of the estimable and able Professor of Botany in the University of Cambridge, has been placed here by Professors Martius and Lindley. *Henslovia pubescens* is found in Penang, and *H. glabra* in Silhet. Both are trees with the habit and inflorescence of *Combretaceæ*. (Griffith in Lindley Nat. Syst. of Bot.)

162. MYRICEÆ.

The *Myriceæ* form a small family, formerly included in *Amentaceæ*. Of the few genera composing it, *Myrica* occurs in the marshy parts of Europe and N. America; also in S. America, at the Azores, and in Southern Africa; and one species, *M. sapida*, Wall. Tent. Fl. Nep. t. 45. *kuephul* of the natives, in the Himalayas from the Sutlej to Silhet; as I do not think *M. integrifolia*, Wall., is a distinct species.

Casuarina is an "anomalous genus, with the habit of a gigantic Equisetum." It occurs in the islands of the Pacific Ocean, New Holland, and Van Diemen's Land, Eastern Africa, and along the Malayan Peninsula to Chittagong, where is found *C. muricata*. This species has been introduced into every part of the plains of India, and is so perfectly naturalized in some places, as completely to alter the character of the scenery. Travellers in India, and persons ignorant of botany, usually mistake this for one of the fir tribe. Mr. Brown's view of the parts of the flower tends to approximate *Casuarina* to *Coniferæ*, where it was formerly associated; and, in fact, the aspect of *Callitris* is that of a *Casuarina* or *Equisetum* (Lindl.)

The

* In this Plate has also been figured a new genus, which will be described at the end of the *Exogens*.

The *Myriceæ* are astringent and aromatic. *M. cerifera* yields wax, and *M. sapida* an agreeable flavoured fruit, though with too large a stone in proportion to the fleshy part; but this might probably be increased by cultivation. This fruit-tree would probably repay the trouble of culture, as it appears, from the elevation at which it grows, to be suited to the climate of many parts of England.

Putranjiva, referred by Dr. Roxburgh to *Nageia*, but formed into a new genus under its native name by Dr. Wallich, Tent. Fl. Nep. p. 61, and referred to this family, is found in the mountainous parts of the Coromandel coast, as well as near Patna and Monghir; and from Silhet all along the foot of the Himalayas to the Kheree jungle. It has been so admirably described by Dr. Roxburgh, that it is necessary only to refer to his description for an explanation of Tab. 100, where both the male and female flowers have been figured. The Sanscrit name, Dr. Roxburgh informs us, is compounded of *Pootra*, a son, and *jeeva*, life; the Hindoostanee name *jeeapoota* is similarly derived. "The nuts are strung by parents round the necks of their children to keep them in health." Roxb. Fl. Ind. 111. p. 766.

Putranjiva Roxburghii. Wall. Tent. Fl. Nep. p. 61. Cat. N. 6814.—*Nageia Putranjiva.* Roxb. Fl. Ind. 111. p. 766.—Tab. 83[1]. or 100. 1. Male plant. (*a*) expanded flower with three filaments; (*b*) half-expanded flower, with two filaments. 2. Female plant. (*c*) female flower; (*d*) the same, with five sepals separated; (*e*) vertical (*f*) transverse section of half ripe fruit; (*g*) fruit; (*hh*) transverse (*i*) vertical sections of the same; (*k*) seed, with and without the integuments on one side; (*l*) embryo.

163. GNETACEÆ.

This is a small order, formed of *Gnetum* and *Ephedra*, constituting, with *Cycadeæ** and *Coniferæ*, the natural class of plants called *Gymnospermæ*, which agree in all respects

* The *Cycadaceæ* forming an entirely tropical family, do not come within the limits of this work; but it is interesting to notice, that though formerly thought to be allied both to Ferns and Palms, they have, by the more profound researches of Mr. Brown, been found to be most closely allied to *Coniferæ* in the structure of their flowers. Hence it is curious to find them so nearly associated together in some old geological formations, as the dirt-bed of the Isle of Wight. *Zamia* is found in Florida, the Bahamas, and in Caraccas; as well as at the Cape of Good Hope, with one species in New Holland. *Cycas* occurs in the last, as well as in Madagascar, in the Molucca Islands, Cochin-china, China, and in Japan. Professor Don has favoured me with the following observations on this subject:—"The recent *Cycadeæ* amount to twenty-seven species, distributed into three genera, namely, *Cycas, Zamia,* and *Encephalartos,* of which thirteen belong to the southern, and fourteen to the northern hemisphere; of these, twelve are tropical, and the remaining fifteen extra-tropical; eleven extend in the southern hemisphere from the thirty-third to the thirty-fifth degree of latitude, but only two as high in the northern hemisphere; eleven belong to Africa; three to Asia; three to New Holland and nine to America, where, however, the species are entirely confined to the northern hemisphere. The fossil species amount to twenty-five, which have been distributed into four genera—*Cycadites, Zamites, Nilsonia,* and *Pterophyllum;* these two last, containing each but a single species. It is curious to observe the near coincidence in numbers between the recent and fossil species of this remarkable family. The fossil *Cycadeæ* were supposed to differ from the recent ones in the absence of the glandular dots from the vessels composing their fibrous tissue; but Mr. Brown has, with his usual sagacity, discovered that the American portion of the family agree with the fossil ones in that respect." *Cycas circinalis, revoluta,* and *sphærica,*

respects with *Exogens;* but are distinguished by their ovules being exposed naked to the fertilising influence of the pollen, instead of being enclosed in a pericarp, and by the vessels of their wood having large apparent perforations or disks (Lindley.) *Gnetum* is found in the tropical parts of the Old and New World, occurring in the latter in Guiana, whence it was first described by Aublet under the name *Thoa:* in the former the genus is found from the islands of the Indian Archipelago along the Malayan Peninsula up to Chittagong and the Silhet district, where is found *Gnetum scandens;* as well as on the Malabar coast and the Dindygul mountains.

Ephedra affects drier and more temperate, though still warm climates, as the South of Europe and the North of Africa, Siberia, and the mountains of Chili. In the Himalayas the only species, *E. Gerardiana,* which approaches *E. distachya* in character, is found, as far as I know, only in the Tatarian climate of Kunawur.

164. CONIFERÆ.

No plants are, perhaps, more extensively known than the *Coniferæ;* the pines, firs, and larches, forming a great portion of the forests, and much of the ornament of the pleasure-grounds of European countries. In the southern hemisphere they occur in the forms of *Araucaria, Dammara, Dacrydium, Podocarpus,* and *Callitris.* Even in hot countries, some are as familiarly known as pines are in the north, and Oriental poets compare even the grace and elegancies of the female form with the tall and slender cypress; while the mountains, such as Hindookoosh and the Himalayas, nourish, even to the extreme limits of forest, stupendous pines, called by Col. Hodgson "gigantic sons of the snow;" while the juniper, as in northern climes, reaches almost the line of perpetual congelation.

The *Coniferæ,* like the *Amentaceæ,* have been divided into a number of distinct families, but it is preferable for general purposes to treat together of the *Abietineæ, Cupressineæ,* and *Taxineæ.* Of these, we find in the southern hemisphere, *Araucaria* in Norfolk Island, New Holland, New Caledonia, also in Chili and Brazil; *Dammara* in New Zealand and Amboyna; *Dacrydium* in New Zealand, Van Diemen's Land, and Pulo Penang; and *Phyllocladus* in New Zealand and Van Diemen's Land. *Podocarpus,* with species at the Cape, in New Holland, New Zealand, Peru, Chili, and the West-Indies, exists also in China, Japan, and Nepal: so *Schubertia* (*Taxodium,* Rich.), with one species at the Cape, and another in Japan, has two in North America.* As these genera of southern distribution send their representatives into the northern

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sphærica, have been introduced into, and grow well in the southern provinces of, India. Dr. Roxburgh states, from the two first there is discharged a clear insipid mucilage, which soon hardens into firm transparent gum, like tragacanth, but clearer. Dr. Roxburgh had not been able to ascertain that any of the species yielded sago, or a substitute for it. (*Fl. Ind.* iii. p. 744.)

* The Cape and Japanese species here alluded to, are *Taxus nucifera* of Kæmpfer, and *Cupressus juniperoides* of Linnæus, which have been lately referred to *Taxodium,* by Adolphe Brongniart, but Professor Don does not regard them as belonging to that genus.

northern hemisphere, so do some species of those genera which are most prevalent in the latter, stray into southern regions. Thus a juniper (*J. uvifera*, Don) occurs at Cape Horn, a species of *Thuja* in Chili, another at the Straits of Magellan, a third at the Cape of Good Hope, and a fourth in Madagascar. The Cape and Madagascar species of *Thuja*, in the structure of their fruit, approach very near to *Callitris*, a genus of which, about twenty species occur in New Holland, with a solitary one on Mount Atlas. The genera which prevail in the high latitudes of Europe, Asia, and America, and are most abundant in the temperate parts of these quarters of the world are, *Pinus, Abies, Larix, Taxus, Juniperus, Thuja*, and *Cupressus*. Species of all which are found in the Himalayas, with one, as we have seen, of *Podocarpus;* also in China, in addition to *Cunninghamia*, and *Gingko* in Japan. There is an undescribed species of *Abies* from Japan, which was shown to me by Mr. Brown, among the plants of Kæmpfer in the British Museum. *Pinus* is found as far south as Cochin-china, with one species in Arabia. A *Juniper* occurs in Bermuda, and another in Jamaica. *Cupressus*, which flourishes in hot countries, extends north only to the south of Europe.

The species of *Coniferæ*, found within the limits of the Indian Flora, are, first, *Cupressus sempervirens* called *suroo;* the Goa Cedar (*Cupressus pendula*), and *Thuja orientalis*, which succeed in the gardens of the north as of the south of India. *Podocarpus latifolia* occurs in the mountains of Silhet, and *P. macrophylla* in Nepal, Japan, Amboyna, and Penang. Professor Don formerly considered the Nepal and Japan plants as distinct species, but from a comparison of specimens of *P. macrophylla*, from Dr. Siebold, he is now convinced of their identity. Dr. Wallich says, he cannot distinguish *P. macrophylla*, found in the lower parts of Nepal, from trees found at Singapore. The species of *Pinus* found at the lowest elevations, is *P. longifolia*, Lamb. Pinus 8vo. t. 21. allied to *P. canariensis*, found in the Canaries; it is called *cheer*, *sullah*, and *thansa*, also *surul;* but Huree Sing, the head native in the Saharunpore Botanic Garden, informed me that the last is a variety, if not a distinct species. The Hon. Mr. Shore also informed me, that he had seen what he thought a distinct kind of *Cheer* from near Almorah; but he observed it chiefly on account of the twisted appearance of its bark and wood, which was ascribed by some of the inhabitants to the constant blowing of the wind. My friend Capt. Cautley, who has so much distinguished himself by his researches in Fossil Zoology, also writes me that he has seen a fir, which, in habit and general appearance, "resembles *Pinus longifolia;* but the foliage is more tufty, and the cones slender and pendulous." This, if not *P. excelsa*, may be the above *surul*. The *Cheer* is found in the entrance to Nepal, in the Kheree Pass, along the Tonse and Jumna rivers, and at elevations of 5,000 and 6,000 feet within the Himalayas. *P. excelsa*, Lamb. Fol. Tab. 3. 8vo. Tab. 33. Wall. Pl. As. Rar. t. 201, *kuel* of the natives of Sirmore and Gurhwal, resembles *P. Strobus*, or the Weymouth Pine, and is remarkable for its drooping branches, whence it is frequently called the "weeping fir" by travellers in the Himalaya. It is found, with the *Deodar*, at

Narainhetty,

Narainhetty, in Nepal, and at Simla, Theog, &c.; and in the Bhotea pergunnahs of Kemaon. Dr. Wallich mentions a variety, if not a species, still nearer *P. Strobus*, at Bunipa and Toka, in Nepal. *P. Smithiana* is figured by Dr. Wallich, Pl. As. Rar. t. 246. from Kemaon and Sirmore; but respecting this there seems to be some doubt, as the cones very closely resemble those of the species I have figured at Tab. 84, under the name *P. Khutrow*, and which Messrs. Lambert and Don conceive to be identical with *P. Smithiana;* but as the leaves of this are so much broader than those of the *Khutrow*, there appears to me some ambiguity on the subject, which, I have no doubt Dr. Wallich will be able to resolve, and it is therefore referred for his decision. *P. Brunoniana*, Wall. Pl. As. Rar. t. 247 (*dumosa*, Don), approximating to *P. Canadensis*, is a rarer species, at least I have not met with it in the more northern parts of the Hills. It is found in Nepal, on the northern descent from Sheopore, on Gossainthan, and on the southern borders of the Bhotea pergunnah of Kemaon, where it is called *Tan-shing*.

P. Gerardiana, Lamb. 8vo. Tab. 79. nob. t. 85. fig. 2. *neoza* of the natives, is a fifth species of *Pinus*, but it is entirely confined to the northern and drier face of the Himalaya, at least to the south of 32° of latitude; further north, where the influence of the rainy season is less felt, it is also found on the southern face of the mountains, at least, if it be the *Chilghoza* of Mr. Elphinstone; but of this, there is no proof: the two have been supposed to be identical from both affording edible seed. It is found in Kunawur, beyond Rampore, along the banks of the Sutlej from 5,000 to 10,000 feet of elevation. The *Deodar*, or *Kelon* of the Hills, *Pinus* or *Cedrus Deodara*, figured by Mr. Lambert at Tab. 52. of the 8vo. edition of his work on the *Coniferæ*, is, however, the most celebrated, and the longest-known Himalayan species; having been noticed even by Avicenna in the article ديودار (*deiudar* of the Latin translation): "est ex genere abhel (juniperus) que dicitur pinus Inda; et syr diudar est ejus lac." The *Deodar* is found in Nepal, Kemaon, and as far as Cashmere, and at elevations of from 7,000 to 12,000 feet in Sirmore and Gurhwal, as on Manma, Deobun, Choor, Kedarkanta, and Nagkanda.

The other Himalayan species belong to the genus *Abies*. Of these, that which is best known, and which comes near *Abies Picea*, or Silver fir, is *A. Webbiana*. Lamb. Fol. Tab. 2. 8vo. Tab. 44, called *chilrow* in the Northern Himalayas; also, *gobrea*, *sallur*, and *oonum*, or purple-coned fir: it grows to a great size, and is one of the principal ornaments of the forests, at considerable elevations. It was originally discovered by Capt. Webb, in the Bhotea pergunnahs of Kemaon, and is found, as well as the following species, in the same situations as the Deodar, also in Kemaon; *Abies Pindrow*, nob., Illustr. Tab. 86. extending as a magnificent species even to the limits of forest, is that which comes near *A. Webbiana;* it is called *Pindrow*, and sometimes *Morinda*, a name also occasionally applied to the *Khutrow*.

Along with these magnificent Pines, are also found species of Yew, Juniper, and Cypress. Of the first, one is not to be distinguished from *Taxus baccata*, and another is as closely allied to *T. nucifera*, Tent. Fl. Nep. t. 44, originally discovered by Kæmpfer in

Japan,

Japan, and which has been referred to *Schubertia* (*Taxodium*) by Mr. Adolphe Brongniart. These are found in Nepal, Kemaon, or such mountains as Choor, Kedarkanta, &c. The Juniper, as before observed, may be traced beyond the forest to the highest limits of shrubby vegetation. The European *Juniperus communis* was found by Capt. Webb on the Neetee Pass, (where it is called *Bilhara*, also *pudma* and *pumaroa*;) and by Mr. Inglis in Kunawur. Here there is also another species, *I. religiosa*, nob. (and *J. recurva?*) called *gogul* by the natives, and employed for burning as incense in their religious ceremonies. The most common species, however, is *J. squamosa*, occurring on such mountains as Choor and Kedarkanta, as high as 11,000 feet, as well as near Neetee, &c., and on Peer Punjal, as well as Gossainthan. In the last-mentioned place, *J. recurva* is also found. As there is some difficulty in distinguishing the species, it is not easy to ascertain what kind is called *Bastard*, or *Creeping Cedar*, in contradistinction to the Himalayan cedar-wood, *Juniperus excelsa*, found on Gossainthan, in Kemaon, and the confines of Tartary. This, in its foliage, resembles *Cupressus torulosa*, specimens of which, indeed, are mixed with those of *Juniperus excelsa*, in the E.I.Herbarium. The former appears to be the plant called *theloo* by the natives, and seen by Huree Sing between Simla and Phagoo, near a small piece of water, and by Murdan Aly, a very intelligent plant collector, near Janghee ke Ghat, a high hill, to the southward of Rol. It is also found in Kemaon, near Neetee, Simla, and in Kunawur.

The *Coniferæ* are not more remarkable for general correspondence in botanical characters, than they are for resemblance in properties. The terebinthinate secretion, for which they are chiefly noted, abounds in the bark, but is also found in the wood and in the cones. Turpentine is composed of two parts, resin and essential oil, easily separable by evaporation of the latter. But the *Coniferæ* are chiefly valued for the timber they afford, forming an extensive branch of English commerce with Norway on one hand, and Canada on the other. The timber is known under the names of deal, fir, cedar, lignum vitæ. The pines on the N.W. coast of America are, perhaps, the most magnificent of any, but the *Araucarias*, *Dammaras*, and *Dacrydiums*, of the southern hemisphere, are also of gigantic dimensions. So, in the Himalayas, *Cedrus Deodara* attains a great height, and is sometimes thirty feet in circumference; the wood is particularly valued for its durability, and is therefore much used in the construction of Himalayan houses, as are also planks of *Abies Pindrow*. *Pinus longifolia* being found at the lowest elevations, and therefore most accessible from the plains, is often employed as a substitute for English deal. The wood is light, and being full of resinous matter, like that of the *Deodar*, both are frequently employed in the hills for making torches, as pieces of other species often are in other parts of the world.

Turpentine is the next most important product to be noticed, and this is variously named, according to the tree or place producing it, as Common, Venice, Strasbourg, American, &c., or Canada Balsam, Balm of Gilead Turpentine; so, in the Himalaya, *Pinus longifolia* exudes naturally, or yields to incisions a very fine turpentine, which is called *gunda biroza* in the bazars, *birje* and *cheer ke gond*; Pers. *birozehtur*. This is chiefly

chiefly valued by the natives for its resin; and as this is only obtained by exposing the turpentine to heat, the oil, the more valuable product, is dissipated to procure the resin; but by adopting a very simple still, I was able to obtain the resin as good as ever, for the purposes of the natives; while the oil of turpentine, which distilled over, was pronounced, on being sent to the General Hospital of Calcutta, to be of "very superior quality." The *Deodar* or *kelon*, also yields a coarser, very fluid kind of turpentine, called *kelon ke tel*, which is much valued in Upper India as a stimulating application to foul and indolent ulcers, and is no doubt what is alluded to by Avicenna (*v. supra*). The leaves and small twigs of the *Deodar* are likewise brought down to the plains, being much used in native medicine. A very fine resin is secreted on the cones of the Khutrow pine, which no doubt would yield a superior turpentine, as well probably as some of the other species. From the Himalayan pine forests, resin and oil of turpentine might be obtained in any quantity, as well as pitch and tar. Many of these are described in the native works on Materia Medica, under the names of *aluk*, *zifh-rutub*, *zifh-yabis*, *kutran* and *rateeanuj*. The Greek name of the last is said to be *kulphoonia*, evidently κολοφονια. Pitch and tar have both been made from the Himalayan pines; but have not yet been introduced into the public service, for which I believe these are still imported from Europe.

Though almost every part of a pine-tree usually abounds in turpentine, it is occasionally absent, or present only in small quantity in the seeds, which then contain a comparatively bland oil, easily becoming rancid. The seeds of several of these species are much eaten in the countries where they are indigenous, as of the stone pine, *Pinus Pinea*, and of *P. Cembra* in Europe; of *Gingko* in Japan, of *P. Lambertiana* in California, and of *Araucaria* in the southern hemisphere; so, in the Himalayas, the seed of one species forms one of the principal articles of subsistence in Kunawur, as well as of considerable trade from the hills to the plains. This is *Pinus Gerardiana*, which is called *neoza*, and is by some thought to be the same as the *chilghoza* described by Mr. Elphinstone, as affording edible seed in Caubul. Occupying countries where there is frequently scarcity of food, the inner bark of *P. sylvestris*, ground and mixed with barley-meal, is made into cakes in Lapland. As an aromatic principle is, in addition, secreted by some, the tops of the Black, Hemlock and Norway firs are used in making spruce beer. This aromatic principle, dependent on the presence of an essential oil, is sometimes united with acrid principle, as in the Savin, used to keep up irritation from blistered surfaces. Juniper berries, known to secrete sugar, as well as an essential oil, have long been noted for their diuretic properties, but are as famous for their employment in the manufactory of the spirit in whose honor modern palaces are raised. These berries were formerly much employed in Europe, and at the present day may be bought in Indian bazars under the names *ubhul* and *hoober*, being considered diuretic and emmenagogue; they are now brought from the Himalayas; but formerly from Caubul: *arkonus* and *baratee*, corruptions of *arceuthos* and *barathyos*, are assigned as Greek names. The cypress, also, formerly much esteemed, is so in the present

present day in the East, where it is called *suroo* and *shujrut-ul-hueyat*, the "tree of life," and its berries, as its leaves, thought to be a cure for every disease. Yew-leaves are also much employed in native medicine, under the names *birmee* and *zurnub-burmee*, for which purpose they are brought down from the hills, the produce both of *T. baccata* and *T. nucifera*, called *thoono* and *tooner*.

Sandarach, a substitute for, or the *sundroos* of the Arabs, is produced by *Callitris quadrivalvis* (*Thuja articulata*, Desf.), *roos* of the Arabs, an inhabitant of the north of Africa, and there called *arar*. *Juniperus communis* and *Oxycedrus* are said to give an exudation resembling sandarach. African Olibanum, usually intermixed with some calc-spar, has been considered to be the produce of *Juniperus Lycia*, and also of *Boswellia glabra*. But it may be procured from some totally unknown plant, as *African Bdellium*, by the *Terebinthaceous Heudelotia Africana*, (Flore de Senegambie, i. p. 150. t. 39.) the *Niotout* of Adanson, and which M. Richard has shewn, on the authority of M. Perrotet, to produce African Bdellium, *Arch. de Bot.* i. p. 420. This fact ought to have been mentioned when noticing the *Balsamodendron Agallocha*, p. 176.

In the foregoing observations on the old genus *Pinus*, the species have been named according to the division into the genera *Pinus*, *Abies*, and *Cedrus*; but a still more extended subdivision is adopted by some authors; and even then, species of all these sections or genera, with one exception, are found in the Himalayas. Thus of *Pinus*—*P. longifolia*, *Gerardiana*, and *excelsa*, with a variety of *P. Pinaster*, commonly called *P. Nepalensis*, of which there is a specimen in the Garden of the Horticultural Society at Chiswick: to this probably belongs the cone lately brought from the portion of the Himalayas which bounds Assam, by the collector sent there by his Grace the Duke of Devonshire, and which is figured by Mr. Loudon in his very valuable *Arboretum Brittanicum*, p. 2236. Of *Abies*, or the Spruce Firs, there is *P. Khutrow*, v. *Smithiana*. The specimen in the Horticultural Society's Garden is undoubtedly the former, and which I immediately recognized. Of *Picea* (*Peuce*, Don), *P. Webbiana* and *Pindrow*. Of true *Larix*, none; but of *Cedrus*, there is *C. Deodara*. For the following specific characters I am indebted to the kindness of Professor Don:—

Pinus v. *Abies Khutrow*, Royle (*Smithiana*, Wall., ex Lambert et Don), foliis compresso-tetragonis rectis subulatis pungentibus, strobilis ovato-oblongis: squamis obovato-rotundatis coriaceis rigidis margine lævissimis, antherarum crista subrotunda erose crenulata.—Tab. 84. f. 1. (*a*) male catkin; (*b*) anther; (*c*) scale of the cone; (*d*) seed.

Hab. Choor, Simla, Huttoo, &c.; in Gurhwal, Sirmore, Bissehur, at elevations of from 7,000 to 10,000 feet.

P. longifolia, foliis ternis prælongis tenuisissimis pendulis, vaginis persistentibus elongatis, strobilis ovato-oblongis: squamis apice elevatis crassis obtusis recurvis, seminibus ovalibus compressis.—Strobili 5-7-pollicares, crassitie minores.—Tab. 85. f. 1. Branch with a male catkin and young cone; (*a*) scale of cone, with ripe seeds; (*b c*) scales of cone, with seeds in a young state; (*d*) seed cut transversely; (*e*) the same cut vertically; (*f*) freed of its integuments; (*g*) embryo.

Hab. Entrance to Nepal and to Almora; in the Kheree Pass, at an elevation of 2,000 feet; on banks of Tonse and Jumna; also on Budraj and near Simla, &c. at elevations of 5,000 and 6,000 feet.

P. Gerardiana, foliis ternis abbreviatis, vaginis deciduis, strobilis ovato-oblongis: squamarum apicibus crassis obtusis recurvatis, seminibus oblongis teretiusculis: alâ abbreviatâ.—Strobili 9-10-pollicares, crassitie majores.—Tab, 85. fig. 2. Branch, with young cone and male catkins; (*a*) male catkin; (*b*) anther seen from below; (*c*) ditto from above; (*d*) the same seen laterally; (*d*) seed; (*e*) cut transversely; (*g*) cut vertically; (*h*) the embryo.

Hab. Banks of the Sutlej beyond Rampore, on the northern face of the Himalayas, from 5,000 to 10,000 feet of elevation.

Pinus v. *Picea Pindrow*, foliis bifariam versis linearibus planis utrinque sub-concoloribus apice acute bidentatis, antherarum crista bicorniculata, strobilis ovalibus; squamis trapezoideo-cordatis, bracteolis subrotundis emarginatis erose crenulatis.—Obs. Pinus Webbiana differt foliis duplo brevioribus obtuse emarginatis subtus argenteis, strobilis cylindraceis longioribus, squamis reniformi-rotundatis, bracteolis oblongis apiculatis, denique seminibus alaque pallide spadiceis.—Tab. 86. (*a b c*) branch and leaves; (*d*) male catkin; (*e*) anther; (*f*) cone; (*g*) scales of the cone; (*i k*) seeds.

Hab. Choor, Huttoo, Nagkanda, Kedarkanta, at elevations of 10,000 to 12,000 feet.

FALCONERIA.

Flores dioici. *Masc.* Calyx disepalus. Corolla 0. Stamina duo sepalis alterna; anthera biloba, lobis apice affixis, loculis verticaliter dehiscentibus. *Fem.* Perigonium maris. Ovarium liberum, ovoideum biloculare. Stigmata duo brevissima. Fructus bacciformis, bilocularis, loculis monospermis. Semina lævia, albuminosa, suspensa, radicula supera.—Arbores indici, foliis alternis breve petiolatis, membranaceis dentato-serratis, stipulis caducis, petiolis (in F. Wallichiana) basi glandulifera inflorescentia capitellata in spica disposita; capitella lateraliter bracteis duobus crassis, medio tertia foliaca cordato-acuminata suffulta.

F. insignis, sepalis denticulatis, filamentis longioribus.

Hab. Deyra Doon and above Rajpore; *khirun* and *khiria* of the natives. Tab. 84.*a* or 98. fig. 2.

F. Wallichiana, sepalis integerrimis, filamentis brevioribus.

Hab. Buneepa in Nepal; *kheera* of the natives. Tab. 84.*a* or 98. fig. 3.

I have dedicated this new genus of the family of *Antidesmeæ* to my friend, Dr. Falconer, now Superintendent of the Botanic Garden at Saharunpore, who is as zealous and able a Botanist, as he has shewn himself to be a distinguished Zoologist; as evinced by Wollaston medals having, in 1837, been awarded by the Geological Society to him, and my friend, Capt. Cautley, for their discoveries in Fossil Zoology.

MONOCOTYLEDONES VEL ENDOGENÆ.

165. MUSACEÆ.

The *Musaceæ* have so classical-sounding a name, that its oriental origin is not usually suspected; but it is no doubt derived from *moz*, the Arabic name for the plantain, which in Sanscrit is called *mocha*. As there is no *che* in Arabic, a necessary change has taken place in this name, on being transferred to that language, whence it is more than probable we have *Musa;* and *Musa sapientum*, indicates *mocha* of the Brahmans.

Though the *Musaceæ* are the largest herbaceous plants, they cannot, like the equally Monocotyledonous Palms, be called the princes of the vegetable kingdom; but if we consider the magnificence in appearance of *Strelitzia*, the size of *Ravenala*, or the uses of *Musa*, we may admit that they are well calculated to commence the series of endogenous families. In habit they resemble the two orders, which immediately follow, but in their hexapetalous and hexandrous, sometimes pentandrous nature, their affinity is at first not so evident, except to analytical botanists.

The *Musaceæ* are distributed in tropical or hot parts of the world. *Heliconia* is confined to South America and the West-Indies; *Strelitzia* to the Cape of Good Hope; *Ravenala* (*Urania*, Schreb.) to Madagascar; while *Musa*, consisting of several species, spreads from the islands of the Pacific (*M. textilis*), and those of the Indian Archipelago northwards to China and Japan, and along the Malayan Peninsula (*M. glauca*) to Chittagong (*M. ornata*). In the valleys of the south of the Peninsula of India, and of the Dindygul mountains, *M. superba* is indigenous. From Chittagong northwards along

along the jungly base of the Himalayas, there is a suitable climate, as far north as 30°, for this genus; as *M. Nepalensis* is found in Nepal, and a similar species below Nahn; also near Kuerkoolee, a village below Mussooree. This in both places may be seen growing apparently in a wild state, and like that of the plant in Nepal, the fruit contains little else than the hard dry seeds. The *Ensete* of Bruce, Mr. Brown thinks may be a distinct species of this genus, and therefore probably indigenous in Abyssinia. The most northern latitudes where the plantain is cultivated, are Japan, the Canary Islands, the north of Africa, and parts of the south of Europe.

Baron Humboldt has suggested, that several species of *Musa* may possibly be confounded under the names of Plantain and Banana, and that some of these may be indigenous to America: but, as stated by Mr. Brown, nothing has been advanced to prevent all the cultivated varieties being derived from one species, *Musa sapientum*, of which the original is the wild *Musa*, described by Dr. Roxburgh, as grown from seed received from Chittagong; Mr. B. further adds, that it is not even asserted, that the types of any of those supposed species of American Banana, growing without cultivation, and producing perfect seed, has any where been found.

The Plantain and Banana therefore must be natives of Asia, and no plants can more strikingly display the benefits derivable to one country, from introducing the useful productions of another which is similar in climate; as these are extensively cultivated in America, and as high as 3,000 feet of elevation in the Caraccas. The Banana, as Humboldt has remarked, is for the torrid zone, what the *Cerealia* are for Europe and Western Asia, or rice for Bengal and China, and forms a valuable cultivation, wherever the mean temperature of the year is about 75°. A single cluster often weighs nearly ninety pounds: Humboldt has calculated, that in the space of a year, 1,076 square feet of ground yield more than 4,000 lbs. of nutritive substance, and that the same space will support fifty individuals, which will not maintain more than two when planted with wheat. I doubt whether the cultivation has in India attained the limits of productiveness; neither does the plantain appear to be applied to the same variety of purposes as in South America. There, besides being used as an article of diet in its fresh state, the fruit is also dried, and forms an article of internal trade, besides being converted into flour, and made into biscuits. The young shoots are also described as being eaten as a delicate vegetable, and sheep are said to be fed upon the herbaceous parts. The juice of the unripe fruit, and "the lymph of the stem" are stated by Dr. Lindley to be slightly astringent. It has been mentioned to me, that the latter is used as a kind of marking-ink in the West-Indies. The species of *Musa* are remarkable for the number of spiral vessels which they contain; and one species (*M. textilis*) yields a fine kind of flax, with which a very delicate kind of cloth is fabricated.

166. MARANTACEÆ.

The *Canneæ* of Jussieu formed a family of plants, which has been divided by Mr. Brown into the present and following order. Both resemble *Musaceæ* in the parts

of vegetation, and both approach *Irideæ,* as well as *Orchideæ,* in many points of structure in the flowers.

The *Marantaceæ* have only a single-celled anther placed on one side of the labellum, and are much more irregular in the suppression of parts, and therefore nearer *Orchideæ* than the *Scitamineæ,* from which they are moreover distinguished by the absence, as well of vitellus, as of the spicy flavour from which these have been named. Both orders are confined chiefly to the tropical parts of the world, but each sends a few species into more northern latitudes. Thus we find a *Thalia* and a *Canna* in S. Carolina. The latter genus was inferred from the majority of species being found there to be peculiar to America; but Dr. Wallich has obtained *Canna indica* from both the Indian and Malayan Peninsulas, as well as two new species, *C. Nepalensis* and *speciosa,* from Nepal; and my plant collectors informed me, that they had seen a plant like *C. indica* on Kangra, a mountain in the Himalaya to the west of Khalsee. The other genera found in India are, *Phrynium* and *Maranta; P. imbricatum* and *capitatum,* species of the former genus, in the districts of Chittagong and of Goalpara; while *Maranta,* with its other species in America and the West-Indies, has *M.* (*Phrynium,* Auct.) *dichotoma* and *M. Tonchat,* which includes *M. virgata,* common in the southern parts of India and of the Malayan Peninsula.

The *Marantaceæ* are remarkable for the quantity of fecula which is stored up in their rhizomata, or the so-called roots of several species; which, in its prepared state, is so well known under the name of *Indian Arrow Root.* This is obtained in the West-Indies from *Maranta arundinacea, Allouyia* and *nobilis;* also from *Canna glauca,* called "Tous les mois;" and in the East-Indies, from species of *Curcuma,* as well as from *Maranta ramosissima,* a new species found in Silhet. But it has of late years also been prepared of fine quality from *M. arundinacea,* grown in their gardens by the Horticultural Society of Calcutta; and was so, many years ago, by the late Sir W. Ainslie, from plants grown in his garden near Madras. It might no doubt be successfully introduced into many other parts of India. The leaves of *Calathea* are employed in making baskets in S. America; so the split stems of *Maranta dichotoma,* being tough, are employed in India in making the so-much-celebrated *sital-pati,* or Calcutta mats (Fl. Ind. i. p. 2.)

167. SCITAMINEÆ, OR ZINGIBERACEÆ.

The *Scitamineæ,* containing such plants as the Ginger, Cardamom, Turmeric, Zedoary, and Galangal, with splendid Alpinias and showy Hedychiums, natural as an order, beautiful as plants, and important for their uses, are so named from *Scitamintum;* but are now more frequently denominated *Zingiberaceæ.* They have been separated from *Marantaceæ,* but participate in all the affinities of that order; like them, they are found in tropical parts of the world, but more abundantly in India. A few species of *Amomum* occur on the west coast of Africa, and in Madagascar, also in the West-Indies and S. America, with *Alpinia* and *Costus* in both the latter. An *Hellenia* occurs in New Holland; and with *Alpinia,* in China. *Globba* and *Zingiber* extend as far north as Japan;

Japan; but, as we shall presently see, there is no reason why they should not be found much further north, as the root-stocks, from their under-ground situation, are protected from the vicissitudes of the seasons, and the herbaceous parts make their appearance above-ground only in the warmest part of the year.

The genera found in India are, *Kæmpferia, Alpinia, Amomum, Elettaria* (which is referred to both the two latter), with Dr. Wallich's two new genera, *Monolophus* and *Gastrochilus:* these are principally confined to southern latitudes, as the islands of the Indian Archipelago; along the Malayan Peninsula to Chittagong and Silhet, with a few about Rajmahl; or in the central range of mountains, and in the Indian Peninsula; where I have no doubt many remain to be discovered, on the sides of the Neelgherries and of the Malabar Ghauts. The genera *Costus, Curcuma, Globba, Hedychium,* and *Zingiber,* though equally common in southern latitudes, extend also from Silhet to the Sutlej, along the foot of the Himalayas, and even ascend them to considerable elevations, as well as *Roscoea,* which indeed is found as high as 9,000 feet on mountains covered, in winter, with snow.

Costus speciosus extends from the Indian Peninsula and Rangoon to Silhet, and thence along the foot of the hills to Nahn. It is common in the Kheree jungle, where are also found *Zingiber ligulatum* and *capitatum,* with *Globba orixensis?* in the Kheree Pass. The *Costus* is the only species of the family found in the plains of Northern India, being common and in flower in the jungles about Saharunpore in the rainy season.

Curcuma angustifolia is alone mentioned in Central India: either this, or a species scarcely to be distinguished from it, is common on the sides of mountains, and in very arid situations in the Himalayas. Several *Scitamineæ,* we know, ascend the mountains in southern latitudes; the Cardamom Plant, *Elettaria Cardamomum,* for instance, is found only on those of the Malabar coast; but in the northern portions of the Himalayas, even the Ginger and Turmeric, with a species of *Curcuma, C. Kuchoor,* nob., are cultivated as high as 4,500 feet. *Globba secunda,* nob., occurs at Jurreepanee and on the Agurwal. Species of *Hedychium* are common in Nepal and the mountains of Silhet, as Chirraponjee; while the splendid *Hedychium coccineum* occurs in vallies elevated 5,000 feet; and *H. spicatum* attains a height of four and five feet, at elevations of 6,000 and 7,000 feet, also in 30° of N. latitude on the limestone rocks of Mussooree and the Suen Range; owing to the frequently-mentioned meteorological peculiarities of these mountains in the rainy season. But the genus *Roscoea,* which is peculiar to these mountains, is that found at the greatest elevations. *R. purpurea,* the most common species in Nepal and Kemaon, is extremely abundant at Simla and Mussooree, and as far down as Jurreepanee. *R. elatior* is found at Dhunoultee, and, with the former, also in Nepal and Kemaon. *R. spicata,* discovered on Sheopore and Gossainthan, occurs in the same situations as *Hedychium spicatum;* but *R. alpina,* nob., is that which reaches the greatest elevation, as I have found it as high as 9,000 feet on Tuen Tibba immediately after the accession of the rains, and on places from where the snow had just melted (like the snow-drop in European countries in early spring); but it may

may be found much higher, as on the Choor mountain, which, like the above, is for more than six months covered with snow. The generic character of *Roscoea* will require a little modification to include all these species.

Many of the *Scitamineæ* have been long famed for aromatic and pungent properties, owing to the presence of an essential oil in their leaves, roots, and seeds: but that being more diffused and intermixed with other vegetable matter in the first, the two latter only have been employed as condiments or stimulant medicines. Ginger, the root of *Zingiber officinale,* is, perhaps, the most celebrated of all, being so named from the Latin *zingiber*, Greek Ζιγγιβερι, Arab. *zungibeel,* Pers. *shungveez,* which are, no doubt, all derived from the Sanscrit *sringavera.* It is extensively cultivated in Bengal, as well as in the Himalayas, at elevations even of 4,000 and 5,000 feet in moist situations. The ginger, called *ada* and *udruk,* is dug up in October and November; the outer rind, being rubbed off by various processes, the root is dried in the sun, and then called *sonth.* *Z. Cassumnar, bun-ada,* of a strong camphoraceous smell, yields the true Cassumnar of the shops (Roxb.), which is employed as a stimulant stomachic, as is the root of *Z. Zerumbet.* Bullocks sent into the jungles to graze in the rainy season in Northern India, have a portion of the roots of *Z. capitatum* given them. The large Galangal or *Kholinjan* of the Arabs, from Sans. *Koolunjana,* having a faint aromatic smell, and strong pungent taste, with some bitterness, is yielded by *Alpinia Galanga.* The plant producing the lesser Galangal was not ascertained by Dr. Roxburgh; but *Alpinia alba* and *chinensis* are much used by the Malays and Chinese; the former is called *Galanga alba* by Kænig, while the latter is described as having an aromatic root of a white colour, with an acrid burning flavour. *A. sessilis* again has a root corresponding with this in many respects. *Kæmpferia Galanga* yields a true aromatic root, used by the natives, and called *chundra moola,* but is not the true Galangal. The odorous tuberous root of *A. nutans* is sometimes, according to Dr. Roxburgh, taken to England for Galanga Major; the leaves, when bruised, have a strong smell of cardamoms, whence the plant is frequently called by the Hindee name *elachee,* of that article; also *poonag chumpa.* A fragrant warm aromatic root, used as a stimulant, is met with in the bazars of Northern India, under the names of *seer, suttee,* and *kupoor-kuchree.* This I found was imported from the Himalayas, and produced by a plant called *sidhuoul,* which I afterwards obtained in flower from Mussooree, with the medicinal root attached, and found to be *Hedychium spicatum.* This may, perhaps, be the *sitta ritte,* mentioned under the Lesser Galangal, by Sir W. Ainslie.

The Turmeric, *Terra merita,* produced by *Curcuma longa,* in universal use in Asia, both by rich and poor, Mahomedan and Hindoo, is too well known for its uses as a condiment and as a yellow die, to require further notice. It is remarkable that in Persian works, *khaldoonioon tomagha* is assigned as its Greek name; in the *Tohft-ul-Mumineen,* the description by Dioscorides of *Chelidonium majus,* is translated and applied to the turmeric. But in the *Mukhzun-ool-Udwieh,* a true description is given of this substance, but the corrupt altered form of χελιδονιον το μεγα is equally applied. Several

kinds

kinds are found in bazars, as *poorubee, puharee, amba, moela, joala huldee,* &c.; the three last are used in dyeing. *Curcuma Zerumbet* yields the medicinal root, highly valued by the natives, called *kuchoor* and *nur-kuchoor; zerumbad* and *ark-ul-kafoor* of the Arabs. It is warm with a little aroma, and is considered stomachic in doses of two to three grains, diaphoretic in ten grains, and emetic in doses of one dram. Two kinds are found in bazars, one *poorubee,* from Bengal, the other *puharee* from the Hills. The plant, *Curcuma Kuchoor*, nob., producing the latter, is more nearly allied to *C. montana* than to *C. zerumbet.* It is cultivated in the hills above the Deyra Doon, in Sirmore, and Bissehur, being sown in April, and dug up in November, when the roots are scalded in boiling water, and then shaken in baskets until the fibrils and outer skin are rubbed off. The long Zedoary of the shops, Dr. Roxburgh was unable to trace; but the round Zedoary, fragrant in smell, with a warm bitterish taste, he found to be produced by *Curcuma Zedoaria;* to this, *judwar* and *nirbisee* are assigned as synonymes, but, as mentioned at p. 50, there is considerable difficulty in ascertaining to what products as well as plants these rightfully belong, particularly as several kinds are enumerated. The fresh roots of *C. Amada* have the peculiar smell of a green mango, with the warmth of ginger, and are valued in Bengal as a stomachic. The pendulous tubers of *Curcuma rubescens, leucorrhiza,* and *angustifolia,* yield a very beautiful fecula or starch, which forms an excellent substitute for the West-Indian arrow-root, *Maranta arundinacea.* It is sold in the bazars of Benares, Chittagong, and Travancore, and eaten by the natives; a very excellent kind, called *tikhur*, is also made at Patna and Boglipore, from the tubers of *Batatas edulis.*

The different kinds of Cardamom are yielded by several species of this family, as, for instance, the most valuable of all, the lesser or Malabar cardamoms, called, in Northern India, *chotee* (small), and *Goozuratee elachee,* by *Alpinia,* now *Elettaria Cardamomum,* so abundant along the mountains of the western ghauts, and of which there appears to be a longer and narrower variety (*long Malabar Cardamoms,* Pereira). Dr. Roxburgh supposes that the *Cardamomum medium* of the writers on Materia Medica is the produce of his *Alpinia Cardamomum medium,* indigenous in the mountains of Silhet, and of which the aromatic seeds, called *do-keswa,* are gathered and sold to the druggists in Bengal. The cardamoms which I procured in the bazars with the name of *bura elachee,* or *great,* and in Calcutta, as *Bengal Cardamoms,* are those with the 9-winged capsules, and most probably produced by this species. *Amomum maximum,* Roxb., is the only other species described by him with such capsules. *A. sericeum* is also called *dooikesha.* The remainder of the cardamoms are very uncertain, and require the comparison of specimens with the ripe fruit attached. The round or Cluster cardamoms of Sumatra are said to be yielded by *Amomum Cardamomum,* and those of Madagascar, or greatest cardamom, by *A. angustifolium;* while on the western coast of Africa, *A. Granum Paradisi* (*A. macrospermum,*? Smith v. Rees) yields the grain of Paradise cardamom, or Meleguetta pepper (v. Guibourt and Pereira). *Amomum maximum,* of the Malay Islands, has seeds with a warm, pungent, aromatic taste, not unlike that of cardamoms.

moms. The seeds of *A. villosum,* or rough-fruited *Amomum,* are exported from Java and the Molucca Islands in great quantities to China, where they are considered warm, stomachic, and strengthening. On the eastern frontier of Bengal, *A. aromaticum* ripens its seeds in September, which are gathered and sold to the druggists under the name of *Morung elachi:* though the seed-vessels differ in shape, the seeds have the spicy flavour of the lesser cardamoms. *A. dealbatum* is called *bura-elachi* in Silhet. (v. Roxburgh, Fl. Indica, and Asiatic Res. xi.)

Along with these valuable products of this family, may be mentioned one which has generally been referred here, though without any proof of its being the produce of any *Scitamineous* plant: this is the fragrant root, burnt as incense by the Greeks and Romans on their altars, and called *Costus* by the ancients, which has been supposed by many authors to be the produce of *Costus Arabicus.* Dr. Roxburgh expressly states, that the root of *C. speciosus* does not at all resemble the *Costus arabicus* of the shops. I myself found the fresh roots almost insipid, and without any particular fragrance. The natives make a preserve of them, which they consider wholesome and nutritious.

In the bazars, however, two or three kinds of root are met with, having a general resemblance to one another, and known by the name *kooth,* Arabic *kust;* to this, *koostus* (κοστος) is assigned as a Greek, and *koshta* as a Syriac name. Three kinds are described: 1. sweet, light, and white; 2. black, light, bitter, without fragrance; 3. reddish, and heavy, like *box-wood.* These evidently refer to the three kinds described by Dioscorides, under the names of, 1. αραβικος λευκος; 2. ινδικος; 3. συριακος. I was only able to meet with two kinds, one called *koost-hindee,* and *koost-tulkh,* Indian or bitter *costus,* and said to be brought from Mooltan. This is probably the κοστος ινδικος of Dioscorides. The other kind is called *kust-sheeren,* with the synonymes of *koost-buhree* and *koost-arabee,* which is of a light yellow colour, with a very pleasant fragrant odour, said to be brought into India from Caubul and Cashmere. It is said by the native authorities to be produced by a plant having a root like *Atropa Mandrogora,* without stem, with spreading succulent leaves. This root is found in every bazar, and is what, I believe, is commonly called Indian Orrice (Iris) root, and must form an extensive article of commerce. It does not appear to be produced in any part of India, though I am inclined to think that under the name *puchuk,* it forms one of the exports from Calcutta to China, where the substance is probably employed as incense. On comparing the specimens of the sweet *Costus* in my collection of Materia Medica with those of *Puchuk,* bought in the Calcutta bazar, I am unable to perceive any difference either in appearance or flavour. The whole will form an interesting subject of inquiry for travellers in Northern India, to trace these articles to the places where and the plants by which they are produced.*

168. ORCHIDEÆ.

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* Since the above has been in type, and since my "Essay on the Antiquity of Hindoo Medicine" has been published, where I have (p. 88) adduced from Garcias ab Horto, "Est ergo Costus dictus Arabibus *Cost* aut *Cast*:—in Malaca ubi ejus plurimus est usus, *Pucho,* et inde vehitur in Sinarum regionem;" I have been favoured with a visit from Mr. Beckett, long resident at Allygurh, who informs me that he used to procure this

Roscoea alpina; floribus paucis pedunculatis vaginis foliorum obvolutis; calyce oblique truncato apice bidentato, corollæ lacinia externa suprema lata sub-fornicata, capsula lineari.—Tab. 89. fig. 1. *a.* and 1. *b.* var. minor; *c.* germen; *d.* membranous bracts; *e.* calyx slit open; *f.* tube of corolla; *g.* the upper, and *h. h.* the two lower segments of the outer whorl; and *i. i.* the two upper segments, with *k.* the labellum forming the inner whorl of the corolla.

Hab. Lundour, Manma, Dhunoultee, Simla, Choor.

R. lutea; racemo spiciformi stricto exserto floribus sparsis, calyce oblique truncato obtuse tridentato, capsula bacciformi subrotunda.—Tab. 89. fig. 2. named *R. spicata* in plate, by inadvertence. I had formed this species into a distinct genus by the name *Cautlea*, in compliment to my friend, Capt. Cautley, F. G. S.; but, in deference to the opinion of botanical friends, I have referred it to *Roscoea.* *a.* bract; *b.* germen; *c.* calyx; *d.* the upper, *e.* the two lower segments of the outer; and *f. f.* the two upper, and *g.* the *labellum* of the inner whorl of the corolla; *i. k.* the bacciform capsule bursting its valves and displaying the seeds, covered with purple succulent arillus; *l.* a seed.

Hab. Mussooree, &c. in Himalayas during the rainy season.

R. purpurea; Tab. 89. fig. 3. *a.* ripe capsule; *b.* transverse section, and a longitudinal slit of capsule to display the arrangement of seeds; *d.* a seed, with its aril; *e.* vertical section of the same, displaying the embryo and albumen.

Hab. Mussooree and Simla, and *passim* in Himalayas in rainy season.

168. ORCHIDEÆ.

The *Orchideæ,* named from a European genus, are yet most numerous in tropical countries. Allied to the *Marantaceæ* and *Zingiberaceæ,* like them they are remarkable for irregularity, and still more for their diversity of form, but are distinguished by their stamen and pistil being united into a column. The peculiar organization of *Orchideæ* having been first elucidated by Mr. Brown; their systematic arrangement into genera and species has only recently been fully accomplished by my friend, Dr. Lindley, to whom I am indebted for the examination and naming of all those in the present collection, and to his work for many of the facts in the following observations, which are arranged in conformity to his division of the *Orchideæ* into the tribes *Malaxideæ, Epidendreæ, Vandeæ, Ophrydeæ, Gastrodieæ, Neottieæ, Arethuseæ,* and *Cypripidieæ.*

The *Orchideæ,* whether epiphytal or terrestrial, are found in all parts of the world, which are not very cold nor very dry. Warmth and moisture being most congenial to them, they are necessarily most abundantly diffused within the tropics; but species extend beyond these limits, as *Malaxis paludosa,* to the north of Europe, and *Calypso borealis* even to 60° and 68° in both the Old and New World. The most southern stations of the epiphytes are those of *Earina mucronata* in New Zealand, in lat. 35° S., and of *Gunnia australis* in Emu Bay, Van Diemen's Land, lat. 41° S. Though found in greatest numbers in the moist valleys at the foot of mountains, several ascend them to considerable elevations, and were discovered by Baron Humboldt at elevations of 7,000,

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this Indian orrice-root from Umritseher, under the name of *koot,* to send to Calcutta, where it was sold by the name of *puchuk* or *puchook* for export to China. He also states, that the roots frequently had attached to them pieces of the stem, which were hollow and angular, and appear from description to be those of a channeled umbelliferous plant.—" Ferulaceam quiddam referens" of Clusius. Exot. p. 205. Some species of *Heracleum* in the Himalayas have very fragrant roots.

7,000, 8,000, and 9,000 feet, in the Andes of Quito and Granada; while *Oncidium nubigenum*, occurs as high as at 14,000 feet in the Andes of Peru. So I found *Dendrobium alpestre*, at 7,000, and *Cœlogyne præcox* at 7,500 feet of elevation on the Oaks of Mussooree and Lundour in 30° of N. latitude.

From this extensive distribution, it would appear that there was not the same connexion between structure and climate as we have seen to exist in most other families. But this may be an apparent, rather than a real exception. Many of the *Orchideæ* being provided with tuberous roots, have these, from their under-ground situation, protected from the vicissitudes of temperature, and as they often exist in moist situations, and flourish during the summer temperature, a kind of local climate may be supposed to be produced, in which a less degree of temperature appears to be necessary. Thus, on the mountains of hot countries, there is constant humidity in the rainy season, "from the air charged with moisture in the heated valleys rising and depositing it on the mountains, when it reaches an elevation where it is cooled beyond the point of saturation;" and this being accompanied with equability, we have two of the characteristics of a tropical climate, and find a lower degree of temperature, fully sufficient for the most luxuriant growth of many tropical genera and families of plants, with numerous terrestrial, and the above-named epiphytal *Orchideæ*.

This is the characteristic of the Andes, in what Humboldt has called "the region of clouds;" so, in the Himalayas, at 7,000 and 8,000 feet, the thermometer ranges between 60° and 70° for nearly three months, in the same place where in winter it falls below the freezing point, and snow lies on the ground for a week together. It is worthy of inquiry, whether the equability of temperature, a little higher in the air, is not greater even than it is on the mountain-top, and whether even the vicissitudes of temperature are not less detrimental, because occurring in a very rarified medium. It might be expected, therefore, from the more northern situation, that the *Orchideæ* in the author's collection, would be in less proportional numbers. This is certainly the fact, but more so than is actually the case, because the author was prevented by his medical duties from travelling as much as was necessary, for the discovery of plants not widely diffused; while the native plant-collectors had not sufficient zeal to expose themselves much in the rainy season. The species are not more than eighty in number, and the majority from the neighbourhood of Mussooree. The two most remarkable plants in the collection, Dr. Lindley considers to be a *Corallorhiza* with leaves, and a new species of *Neottia*, allied to our European bird's-nest. Dr. Falconer, my friend and successor in the charge of the Saharunpore Botanic Garden, being required to seek for localities for the cultivation of tea, has fortunately had much greater opportunities of travelling. He has succeeded in making many important accessions to the family of *Orchideæ*, as his untiring zeal induced him to travel much in the midst of the rainy season, to the great risk not only of his health but of his life. He informs me that he has discovered a new genus of the *Gastrodieæ*, and another of the *Malaxideæ*, of which the plant stands nine feet high, and makes a most splendid appearance, with

with rich yellow *Cyrtopera*-like flowers. The seed vessel has no ribs, and in one flower a plurality of stamens was found.

The most important addition, however, which Dr. Falconer has been fortunate enough in making, is one which elucidates the organization of the *Orchideæ*. This is one of the family which is always triandrous, and of which he observes, that the three anthers are not the only singularity; the flower is perfectly regular; the three sepal segments being exactly equal, as are also the three petals, which, although of the same length, are twice as broad as the sepals. The column is also symmetrical; and as there is no labellum, it is difficult, when the flower is removed from the axis, to find out which of the petals represents the lip. Further, and what is most interesting of all, that is, the normal position of the supplementary anthers in the family. Dr. Lindley, in his formula, makes them alternate with the lateral petals, while Mr. Brown, from the structure of *Apostasia* and *Cypripedium*, considers that they alternate with the lateral sepals, and belong to a different whorl from the fertile anther. In Dr. F.'s plant, it is most distinctly evident, both by a decurrent ridge of each filament and by transverse sections of the column, at all heights down to its base, that the supplementary anthers have the same relative position as the usual fertile one, and in harmony with Dr. Lindley's formula. Further, Dr. F. has another variety of the species (he first thought they were two), in which the column is sliced off in front, as is usual in *Dendrobium*, and then the labellar petal is invariably developed into a spurred lip; so that it would appear, that in the family the irregularity of the lip is a state of anamorphosis, consequent on the imperfect development of the column, or *vice versâ;* in fact, that the deficiency in the one is abstracted to make up the excess of the other.

The *Malaxideæ*, though named from the European genus *Malaxis*, consist chiefly of extra-European *Orchideæ*, divided into the tribes *Pleurothalleæ* and *Dendrobieæ*. The former are found in the tropical parts of America and Africa, as well as in the islands of the Pacific and Indian Oceans, with a few species in New Holland, New Zealand, and Norfolk Island. Some ascend considerable elevations, as *Pleurothallis laurifolia* and *pulchella*, to 7,000 and 8,000 feet on the Andes of Quito, and *Restrepia antennifera* to nearly 9,000 feet in New Granada and the Andes of Paraguay. It is of this tribe that the genera and species extend to the most northern latitudes, as *Malaxis paludosa* to the north of Europe, with species of *Microstylis*, *Liparis*, and *Corallorhiza*, which are likewise found in North America. Of these, *Malaxis* is alone of limited distribution. The others, whether few or numerous in species, are yet very widely distributed.

Thus, *Microstylis* and *Liparis*, numerous in species, are found in the tropics, both of the Old and New World, in the island of Otaheite, and in China and Japan, *Liparis* also in New Holland and the Mauritius. Both extend from the Indian Archipelago to Ceylon, and thence along the Himalayas, from Silhet to Nepal and Mussooree. *Corallorhiza*, though consisting of only three species, has these widely distributed, one in Europe, the second in N. America, and the third in the Himalayas. This, *C. foliosa*, Dr. Lindley considers the most curious thing in the Indian collections. But genera are not alone

common to these different parts of the world, the same species appear to be found in widely separated places. Thus, *Microstylis Rheedii* occurs in India, Java, and Otaheite. *Liparis elata* in India and Brazil? *L. longipes* in the mountains of Ceylon, as well as in those of the East of Bengal, (Lindl. Orchid. p. 21-30). *L. olivacea* extends from Nepal to Mussooree, near the Abbey; where *L. livida*, a new species, was likewise discovered.

The remaining *Pleurothallideæ* are either such as are peculiar to India and the Himalayas, or are found rather in the tropical parts, both of the Old and New World. Thus, *Oberonia*, which extends from Java, Ceylon, and Silhet, all along the Himalayas, has *O. brevifolia* common to the Mauritius, and the Society Islands. *O. myosurus* in the latter and Nepal. *O. iridifolia*, found in Otaheite by Sir J. Banks, occurs also in Ceylon, and extends from Taong Dong all along the vallies of the Himalaya, from Silhet to Nepal and the Deyra Doon. *Dienia* has two species in Mexico, one in Siberia, and three in Nepal. *D. congesta* is common to the last and China. *D. cylindrostachya* is the most common species in the Himalayas, extending from Nepal to Mussooree and Simla. *Otochilus* is a Himalayan epiphytal genus from Silhet and Nepal. *Pholidota* occurs in these, as well as in Java and Ceylon; the species *P. imbricata* in Nepal, Silhet, Martaban, and Tavoy. *Empusaria* is a Himalayan genus, of which the species, *E. paradoxa*, extends with *Microstylis Wallichiana* from Nepal to Mussooree, and both are allied to Northern *Malaxideæ*. *Cœlogyne* is one of the most widely diffused, as it is one of the most ornamental, of the Himalayan *Malaxideæ*. Species are found in Java, Tavoy, and Ceylon, as well as in China and Japan. They extend all along the Himalayas to Mussooree and Lundour. *C. cristata* and *ocellata*, found in Silhet, extend as far north as the valleys of Sirmore and Kemaon. The delicately beautiful *C. præcox* extends to as high a latitude, but to a greater elevation, being found ornamenting, with its large richly-coloured flowers, the branches of oaks on Lundour at 7,500 feet of elevation, in 30° of N. latitude; but only during the moisture of the rainy season. *C. fimbriata* is a species which is found in China, as well as, (or a very nearly allied species), in Nepal and Kemaon.

The tribe of *Dendrobriæ* are chiefly found in tropical parts of the world; but, as in others, a few extend beyond these limits, as well as to considerable elevations. Most of the genera included in the Indian Flora are Asiatic, and chiefly found in southern latitudes, as *Trias, Phreatia, Eria, Aporum*, and *Mycaridanthes*. Of the last, one species occurs in Nepal, where *Monomeria* is also found. *Phreatia* and *Eria* occur both in Java and Ceylon; the latter also in China, and along the Himalayas from Pundua, as far as the valleys of the Choor, where are found *E. alba* and *E. flava*, first discovered in Nepal. *Polystachya* contains only five species, but these are widely diffused; one species alone, *P. luteola*, having the distribution of the genus, with the exception of not being found in Sierra Leone, but occurring in Mexico, the West Indies, Mauritius, as well as in Ceylon. *Cirrhopetalum* and *Bolbophyllum* are similarly and widely distributed; and the first has one species, *C. Thouarsii*, in Otaheite, Madagascar, Mauritius, and Java. *C. Roxburghii* is found at the mouths of the

Ganges,

Ganges, and *C. Wallichii* in Nepal. *Bolbophyllum*, very numerous in species, thought to be confined to Africa and Asia, has also been found in Demerara, and extends east to China, with several species in Nepal. *B. Careyanum* spreads from this as far south as Martaban, and *B. odoratissimum* is common to it, with China. *Dendrobium*, however, which gives its name to the tribe, is the most numerous in species, though these are not in proportion widely distributed, as they are chiefly confined to the tropical parts of Asia, two being also found in China and Japan, four in tropical New Holland, and one in the Society Islands. Several species extend as far as Nepal, but only one has as yet been found further north in the Himalayas, and that is *D. alpestre*, figured in the present work, which is very closely allied to, and may be only a variety of, *D. denudans*, discovered in Nepal. *D. alpestre* is found on the oaks and rhododendra of the Mussooree Range, especially on those of the part called the Abbey Hill.

The tribe of *Epidendreæ*, so named from an American Epiphyte, chiefly inhabit the intra-tropical regions of the New World, but also of Asia; a few extend northwards into India and China, and one species, *Bletia aphylla*, remarkable for being destitute of leaves, extends into Florida and South Carolina. A few species of *Epidendrum* attain elevations of 8,000 and 9,000 feet on the Andes of New Granada: so, in the Himalayas, a species of *Spathoglottis* is mentioned from Gossainthan, but the elevation is not indicated. The Indian species are chiefly found in the southern parts, but extend along the Himalayas as far as Nepal. The genera *Ipsea*, *Cytheris*, and *Ania*, do not extend beyond Silhet, where *Bletia obcordata* is also found, and is remarkable as belonging to a genus, of which several species are found in tropical America, with one in Madagascar, and another in Mauritius; *B. hyacinthina*, a native of China and Japan, is naturalized in the Calcutta Botanic Garden. *Spathoglottis*, *Arundina*, and *Phajus*, found in the Indian Archipelago, and also in China, extend likewise to Silhet and Nepal: the last includes among its species, many which are highly ornamental. *Apaturia* having one species in China, near Macao, extends from Ceylon to Silhet, and as far as $28\frac{1}{2}°$ N. latitude; *A. Smithiana* having been found by Dr. Wallich in the jungles near Kadjuree Ghaut in Oude. The species of *Orchideæ*, figured by Dr. Wallich in his Plantæ Asiaticæ Rariores, belong to the tribes *Malaxideæ* and *Epidendreæ*.

The *Vandeæ*, named from the Sanscrit *Vanda*, a name applied to some epiphytal *Orchideæ*, but more especially to *Vanda Roxburghii*, indicates that some at least of this tribe are found in India, as indeed is also apparent from most of the *Orchideæ* figured in Roxburgh's Coromandel Plants belonging to this tribe, though many of the most ornamental genera are S. American, as *Maxillaria*, *Cattleya*, *Catasetum*, *Stanhopea*, *Gongora*, *Coryanthes*, *Burlingtonia*, *Oncidium*. Endlicher has briefly stated, that they are either epiphytes or terrestrial: the American species have in general pseudo-bulbs, with but few leaves, while the Asiatic are chiefly caulescent. They are distributed in almost equal numbers, in intra-tropical Asia and America. *Calypso* alone inhabits the extreme north, or between 60° and 68°, both of the Old and New World, and the same species, *C. borealis*, is indigenous in both. But some are found at considerable elevations

elevations in the Andes, as species of *Maxillaria*, at 7,000 and 8,000 feet in the Andes of Popayan, and *Oncidium nubigenum* as high as 14,000 feet in the Andes of Peru.

The genera, some consisting of only single species, which are peculiar to Nepal, are, *Cremastra, Sunipia,* and *Cryptochilus; Tetrapeltis* and *Chilochista* are found in Nepal and Silhet; *Camarotis* and *Micropera* in Silhet only; *Diplacentrum,* in Hb. Heyne, therefore probably a plant of the peninsula of India; *Acanthophippium* in Silhet and Java; *Cleisostoma* in the latter and Ceylon.

Geodorum is a genus common to New Holland and the southern parts of India and Japan. *G. dilatatum* is found in the latter, as well as in Silhet. *Eulophia* and *Cyrtopera,* nearly allied genera, are also widely diffused, both being found at the Cape of Good Hope and in Madagascar; the latter also in Sierra Leone, and the former in the West Indies and Peru. Though containing but few species, both are widely diffused over India. *Cyptopera flava* extends from the Morung Hills to Deokhutal on the banks of the Tonse, within the Himalayas; and *C. obtusa,* a new species, Tab. 87. fig. 1. is found in the valleys of Mussooree, Shalma, and Surkunda, about the same latitude. So, *Eulophia* extends from the southern to the northern parts of India, *E. herbacea* being found in Ceylon, and as far north as the valleys of the Girie and Agurwal, in 30° of N. latitude. *E. campestris,* found by Dr. Wallich near Bhurtapore, in Oude, I found in arid situations in the Kheree jungles, and in the ascent to Urukta. *E. vera,* nob., is a new species found still further north near the banks of the Jhilum, and not far from the road which leads from N. India to Cashmere.

Other genera, more numerous in species, which extend from the Indian Archipelago along the Malayan Peninsula to Silhet and Nepal, are, *Vanda, Saccolabium, Podochilus, Ærides,* and *Calanthe.* Of these, *Vanda* and *Ærides* occur also in China; and one species, *V. multiflora,* is likewise common to both: so is, also, *Æ. odoratum,* which spreads from Nepal to Chittagong, and thence along the Malayan Peninsula to Cochin-China; *Æ. affine,* a Silhet and Nepal species, spreads even to 30° N. along the valleys of the Himalaya. *Saccolabium* has one species, *S. guitatum,* spreading equally far north, as it grows on trees in the Kheree Pass and Deyra Doon, and is also found in Nepal, Silhet, Malabar, and Java. A few species occur in Madagascar, as well as with *Calanthe* in the Mauritius. *S. guttatum, curvifolium,* and *papillosum,* are common to the Peninsula and Nepal, as is *Calanthe masuca* to the latter and Ceylon. *Calanthe* extends as far north, but to much greater elevations; *C. plantaginea,* a Silhet and Nepal species, being found as high as Mussooree in flower in April; and *C. tricarinata,* a Nepal species, on Manma, Urukta, and Choor.

Æceoclades and *Cymbidium* are more widely diffused, being found in America and the Indian Archipelago, as well as in the Himalayas from Silhet to Nepal, and likewise in China. The former is also found in the Mauritius, and the latter at the Cape of Good Hope and in New Holland, and is that which spreads furthest north; *C. macrorhizum,* Lindl., having been obtained from the valleys near Cashmere. *C. triste* is a

species

species found in Japan, the Ladrone Isles, and in New Caledonia; as well as in Ceylon and at Noakote, in the entrance to Nepal.

The *Ophrydeæ*, named from the European genus, *Ophrys*, are terrestrial plants, with tuberous roots, found in the temperate and sub-tropical parts of the world. Some genera are peculiar to the Indian Flora, as *Ate*, the most southern, found at 4,000 feet of elevation in the Dindygul mountains; *Cæloglossum* in Mysore, Tavoy, and Nepal; *Diplomeris* in Silhet and Nepal; *Aopla* in the latter only; with *Hemipilia*, of which the single species, however, *H. cordifolia*, extends from Gossainthan to Mussooree. The other genera found in the Himalayas are better known, as their species chiefly occur in Europe, N. America, and N. Asia, as *Orchis*, *Gymnadenia*, *Platanthera*, and *Peristylus*, with *Aceras* and *Herminium*, which occur only in Europe and the northern parts of Western Asia.

The genus *Orchis*, containing nearly fifty species in the Old, has only one, *O. spectabilis*, in the New World, which extends from Canada to Carolina; so one only is found in the Himalayas from Peer Punjal to Gossainthan, and this a variety of *O. latifolia*, which occurs in the colder parts of Europe and of Asia. *Gymnadenia cylindrostachya* from Kunawur, differs little from the Siberian form of *G. Conopsea*. *G. spathulata*, a diminutive species, is found on Kedarkanta. *Aceras augustifolia*, *Peristylus goodyeroides*, and *Herminium gramineum*, are found on the Mussooree Hills and in Nepal. Of *Platanthera*, the entire lipped species occur in the Himalayas. Among those with divided lip, are species in Burma and the Peninsula of India. *P. Susannæ* (*P. gigantea*, Sm.?) extends from Amboyna to Canton, and from Java all along the Himalayas to the Kheree Pass, and even to Mussooree. Of *Habenaria*, numerous in species in tropical parts of the world, several occur in the Himalayas in the rainy season. Of these, *H. plantaginea* and *commelinifolia* occur in the Peninsula of India, and also at Mussooree. *H. stenopetala*, (Lind. Sp. 60) from the valleys towards Cashmere, appears to be the most northern species. *Satyrium*, found in Southern Africa, has the same species *S. Nepalensis*, in the southern mountains of Dindygul and in Nepal, whence it extends north even as far as Cashmere, and also into Lower Kunawur, and thus has a very wide distribution.

Dr. Falconer has discovered on Dhunoultee a new genus of the tribe *Gastrodieæ*, of which the other two genera are found, *Gastrodia* in New Holland and Java, and *Epipogium* in Europe and Central Asia. Dr. F. describes his plant as having the habit and look of an *Orobanche*, with a monophyllous perianth, the sepals and petals being united into a tube for two-thirds of their length, whence he has named the genus *Gamoplexis*.

The *Neottieæ* are terrestrial *Orchideæ* of temperate, but also of tropical, parts of the world; so we have them both in the southern latitudes and the colder mountains of India. Of the former, and of those peculiar to this flora, *Hylophila* and *Myoda*, called *Plantæ indicæ* by Endlicher, are found in Singapore and Penang. *Etæria* and *Microchilus* extend from the Mauritius and Java, with *Tropidia* from the Malayan Peninsula

sula to Silhet, where *Tripleura* and *Cnemidia* are found, and *Georchis* and *Herpysma* in Nepal. *Anæctochilus* (*Chrysobaphus*, Wall. Tent. Fl. Nep.) is a genus found in Java; but *A. Roxburghii*, a species which exists in Silhet, Nepal, and as far north as the valleys near Choor and Kedarkanta. *Zeuxina*, Lindl. (*Pterygodium*, Roxb.) contains only one species. *Z. sulcata*, which is very generally diffused over the plains of India, and the only *Orchideous* plant I ever found in them, that is, in the Doab, and have specimens from as far north as the banks of the Sutlej, where it flowers in the month of January.

The *Neottieæ* of the more northern parts of the Himalayas, are better known in northern and temperate regions, as species of *Spiranthes*, *Neottia*, and *Goodyera*. *S. amæna*, a species found in Eastern Siberia and the North of China, extends in the Himalayas from Silhet to Nepal; and thence, with *Goodyera procera*, to Kemaon and Gurhwal. *Neottia* having only a single European species, has another, *N. listeroides*, in these mountains, near Mussooree, which Dr. Lindley considers as most remarkable, in having the brown habit, bird's nest roots, and short round stigma of *N. Nidus avis*, but with the spreading perianth of *Listera;* and as thus confirming the propriety of keeping this genus distinct from *Neottia*.

Epipactis is placed by Endlicher among *Neottieæ*, but by Dr. Lindley among *Arethuseæ*. The genus is common, as well as *Cephalanthera*, in Southern and Central Europe; the former is found in these mountains from the Sutlej to Silhet, and the latter to Nepal. The species are four in number, *E. consimilis*, Don, and *E. macrostachya;* whether or not these be distinct species, they are both very closely allied to the European *E. latifolia*. *E. herbacea* is a new species from Mussooree, and *E. Royleana*, another from Lippa, in Kunawur. *Cephalanthera acuminata* is common in Nepal and Mhassoo near Simla, as well as in the oak forests of Lundour, flowering in spring. Other *Arethuseæ* occur in Nepal, as the new genus *Anthogonium*, with two species of *Pogonia*, of which the others are found in North America.

Vanilla, which is included in *Arethuseæ* by Endlicher, but separated into a distinct order, *Vanillaceæ*, by Dr. Lindley, is best known for its aromatic fruit, and as a produce of the hottest parts of Equinoctial America. The genus is also found in Tropical Asia, one species being indigenous in Penang and another at Singapore. Dr. Lindley informs me that Dr. Wight has a third, *Vanilla pterosperma*.

Cypripedium, which alone forms the tribe of *Cypripedieæ*, is found in the temperate and cold parts of the northern hemisphere. It extends all along the Himalayas, at considerable elevations from Simla to Silhet. The species are highly ornamental. *A. cordigerum*, discovered in Nepal, is also found on Manma and Mhassoo. There is a new species in Lady Dalhousie's collection from Simla.

The *Orchideæ*, remarkable for their extreme variety in form and appearance, as well as for the curious structure of their flowers, are much prized as objects of floriculture, since modern science has shewn the causes of former failure, as well as the mode of insuring the present success by attention to principles which are of the

most

most extensive application; that is, ascertaining not only the temperature, but also the degree of moisture of climate, with all the local circumstances which control the natural growth of plants, before we attempt their artificial cultivation. Considering the number and variety of the species, as well as the extent of gratification which they afford to one of the senses, their utility to man, in the common acceptation of the term, is not of a corresponding degree. Many, however, of the *Orchideæ* are remarkable for their fragrance, as exemplified in several of the East-Indian *Malaxideæ*, as well as in some South American *Epidendra* and in *Maxillaria aromatica;* but most conspicuously in *Vanilla aromatica*, the dried fruit of which is so considerable an article of commerce, solely on account of this property; depending on the presence of an essential oil and benzoic acid. Vanilla has been arranged among aromatics and excitant in medicine, but is chiefly useful for giving a flavour to ices and confectionary, as well as scent to some perfumery.

Some of the *Orchideæ* were in ancient times considered to be vulnerary, and are still stated to be so in Persian works. But the most important product of the family, and one which deserves to be more extensively employed as an article of diet for the sick or the delicate in constitution, especially children, is the nutritious matter secreted in the tubers of many of the *Orchideæ*. These are well known in many places by the name SALEP, which is sometimes corrupted into *salop* or *saloop*. They are of a flattened ovoid form, semi-transparent, and thought, from their appearance probably, to be a gum by some ancient authors, but now usually stated to consist principally of bassorine, some soluble gum, and a very little starch, though the analysis is not yet definitively settled. Salep is often stated to contain the largest quantity of nutritious matter in the smallest space, and that about two drachms is sufficient for an invalid's meal. About sixty parts of boiling water are required to one of powdered salep to dissolve it.

The tubers of the *Orchideæ* have been used as medicinal agents from very early times, as we see from the works of Theophrastus and of Dioscorides, and their statements are repeated in the works of the Arabs. In these they are described under the names *khusyut-al-salib* and *khusyut-al-kulb*, literally *Testiculus vulpis* and *T. canis*, for which the Greek names assigned are *orkhis, saturyoon,* and *turphyla,* evidently the ορχις, Σατυριον, and τριφυλλον of Dioscorides. Several different kinds are mentioned; but, as might be expected in a family like the *Orchideæ*, it is difficult to ascertain what were formerly the officinal species: indeed, even those of the present day are unknown. In the first place, it is uncertain whether the Greeks obtained their knowledge of the uses of these tubers from Eastern nations, or this was the result of their own observation. In the former case, the species must be extra European, and may be still unknown; but in the latter case, some of the European species, which have been employed as substitutes for Oriental salep, may be the original ones.

Sprengel (Diosc. ed Kuhn. ii. p. 553,) considers that *Orchis papilionacea*, L, which is at the present day called σαλεπι by the modern, to be the ορχις of the ancient Greeks. The other plants, which are supposed to be alluded to, have been differently determined by

by different botanists, and are enumerated by Sprengel. *Orchis Morio, mascula* and *militaris* give, according to M. Beissenhirtz, the best salep in Europe; *O. maculata* and *latifolia,* a little inferior; but that of *O. bifolia* is stated to be of bad quality. Cullen, on the contrary, says, "I have seen it prepared in this country from *Orchis bifolia,* as pure and as perfect as any that comes from Turkey." In France, *Salep indigene* is said to come chiefly from Nivernois. The Oriental Salep is obtained in Europe from Turkey, Natolia, and Persia, but the plants which produce it are unknown. In India it is obtained from the North, that is Caubul and Cashmere, and sold at a high price even at the Hurdwar fair. On sending gardeners from the Saharunpore Botanic Garden, in company with the northern merchants, they found the Salep plant in the hills, not far from the Jhilum, and near where the road from India to Cashmere crosses that river. The specimens in fruit, with tubers attached, which resembled the salep of commerce, appear to Dr. Lindley to be those of a species of *Eulophia,* and which I therefore ventured to name *E. vera.* The probability of this genus yielding salep is confirmed by *E. compestris,* which is common in and near the Kheree Pass, yielding some of very good quality, as I have proved by experiment, that is, boiling for a short time, and afterwards carefully drying. This I was led to do, by hearing that the natives were in the habit of preparing and selling it by the name of *Salep misree,* as a substitute for the larger and finer salep of Cashmere. Another kind seems to be prepared in the Himalayas, as Lieut. Hutton, in an account of an excursion to the Broang Pass, states that the grassy hills between Phagoo and Muttiana produce during the rains immense quantities of a species of *Orchis,* which the natives call *Salep misree,* the roots of which are sometimes collected and dried, and afterwards brought to Simla, or sent to the plains for sale." The same statement is made respecting one of the *Orchideæ* at Mussooree, probably *E. herbacea,* which is common there. There is no doubt that very excellent salep might be prepared, both at the foot of and in the hills; while the genuine plant might also be introduced, if it already has not been so, by Dr. Falconer, from Cashmere. Great care would require to be paid to the habits of the plants, as they take some years to come to perfection, so as not to irradicate them after being introduced; particular tracts of the hills might be cleared only in successive years, as is done with the cutting of fir or other forests grown for timber.

Aceras angustifolia. Tab. 87, fig. 1. Lindley. Genera and species of Orchideous plants, p. 282.
Hab. Gossainthan. (*Wallich*). Mussooree and Simla. (*Royle*).

Peristylus goodyeroides. Tab. 87, fig. 2. Lindley, l. c. p. 298.
Hab. Nepal. (*Wallich*). Mussooree and Sabathoo. (*Royle*).

Herminium gramineum. Tab. 87. fig. 3. Lindley. l. c. p. 305.
Hab. Nepal. (*Wallich*). Mussooree. (*Royle*).

Cyrtopera flava. Tab. 88. Lindley, l. c. p. 189.
Hab. Morung Mountains. (*Hamilton*). Deokhutul, on banks of the Tonse. (*Royle*).

Dendrobium alpestre (Lindl. sp. n.) caulibus brevibus ovatis cæspitosis erectis vaginis foliorum laxè vestitis polyphillis, foliis oblongo-lanceolatis tenuibus apice obliquis, racemis lateralibus terminalibusque nutantibus multifloris, sepalis acuminatis lateralibus basi incurvis petalis minoribus, labelli trilobi lobo medio crenulato crispo acuminato lateralibus inciso-serratis: lamellis duabus linearibus in medio. Tab. 88, f. 2.—Dr. Lindley, by whom this and the other *Orchideæ* were selected for figuring, fears this is nothing more

more than an alpine state of *D. denudatum* Don, with which it was placed by him in Dr. Wallich's distribution. It differs chiefly in its shorter stems, and in the lateral segments of its lip being deeply fringed, instead of being slightly serrated; the lamellæ in the middle of the lip seem also smaller and thinner.

Hab. On oaks on the Abbey-hill at Mussooree.

169. IRIDACEÆ.

The *Iridaceæ*, named from the genus *Iris*, which is itself so called from the variety of colour of the flowers of its species, contain genera chiefly found in the temperate parts of the world, but which are not absent from purely tropical regions. They are chiefly abundant at the Cape of Good Hope, occur in Van Diemen's Land and in Patagonia, as well as north in Carolina, Europe, and Siberia.

Gladiolus, *Trichonema*, and *Moræa*, occur in the northern hemisphere of the Old World, as well as at the Cape of Good Hope; the last has two species in S. America. *Crocus*, *Pardanthus* and *Iris*, alone come within the bounds of the Indian Flora. The first is usually considered as being confined to the south of Europe and the Caucasian region, but some species may be indigenous in Persia, where Saffron has long been known and cultivated even as an article of export, as it is in the present day. It is so likewise in the valley of Cashmere, according to the testimony of Bernier, Forster, and Moorcroft; but whence, indeed, I myself received bulbs in 1826, which flowered in the Saharunpore Botanic Garden, and of which a drawing was made (v. Tab. 90. fig. 1). This I consider to be only a variety of *C. sativus*, or common saffron, which has always been considered an Asiatic species early introduced into Europe. *Pardanthus* is common to China, Japan, and the Himalayas; and the same and only species, *P. chinensis*, is found in all. In the plains, both of the Peninsula and of Northern India, it is seen only in a cultivated state, flowering in the rainy season: but on Urukta and Kedarkanta I found it in a wild state, as it no doubt also is in Nepal.

Iris, a genus, containing numerous species, common in the temperate parts of the northern hemisphere; has also several in the Himalayas; one is also common in the gardens of India, and has probably long been known there. It may, perhaps, be identical with the species referred by Dr. Roxburgh to *I. chinensis*, though Mr. Don thinks that my specimens belong to *I. nepalensis*. Four species of *Iris* have been discovered in these mountains; *I. nepalensis* and *decora* in Nepal and Kemaon, and *I. kemaonensis* in the latter. These have all been found further to the N.W., as on Surkunda, Urukta, Kedarkanta, Choor and Lundour. *I. decora* I have also received from Pungee in Kunawur, and *I. Moorcroftiana* from Ludak; but Professor Don, after comparing the latter with specimens sent by Pallas to Linnæus, thinks it hardly merits the rank of a distinct species. *I. longifolia* was grown in the Mussooree Experimental Garden from seeds procured from Cashmere.

The *Irideæ*, conspicuous as ornamental plants, have also been long used medicinally, though not possessed of very active properties. *Iris florentina* is still much employed on account of the agreeable odour of its root-stocks, chiefly in perfumery, and for

 imparting

imparting an agreeable flavour to the breath : being also in some degree acrid, it has been employed in making the *peas* for keeping open issues. *I. germanica* and *Pseudacorus,* are other species supposed to be included under the ancient Iris of the Greeks, while *I. fœtidissima* is conjectured to be the *Xyris* of Dioscorides. The former are referred to in Arabian authors by the name ايرسا *eersa,* with *sosun* for the Arabic and Persian synonyme; and the different kinds distinguished as white, blue, yellow, and many-coloured *sosun.* This name appears to be of the same origin as the Syriac *suseana,* and the *susinum* of the Greeks, and probably also of the *shushan* of Scripture, which is usually translated lily ; and likewise of the *soshannim* of the 45th Psalm, supposed to refer to the "lilies of the Nile," worn as an ornament of the head-dress by the female choristers of Egypt (Athenæum, 1837, p. 537). The species of Iris cultivated in India, it is not uninteresting to observe, is also called *sosun,* and its root-stocks used for the same purposes as the Iris of the Greeks. Dr. Wallich's specimens still retain some of the peculiar odour of the Florentine Iris. The Iris root, sometimes said to be an article of the commerce of N. W. India, is no doubt the *koot* or *Costus,* mentioned at p. 360.

Saffron is another article of Eastern as of Western commerce and medicine. Its European name is evidently derived from the Arabic *zafran* ; while its Greek κροκος, is too closely allied to the Hebrew *karkom* and the Persian *kerkum,* to allow us to doubt of their all having a common origin. Though early cultivated in Europe, it was originally most probably introduced from the East. It is still cultivated in Persia, as well as in Cashmere, and imported into India from the former in *cake,* and from the latter in the form of what is called *hay saffron ;* the former is much the higher priced, but both are as highly esteemed in India as medicinal articles, as saffron ever was in earlier times in Europe. I am indebted to Professor Don for the following characters of the species of Iris.

1. *Iris nepalensis,* barbata, scapo compresso sulcato plurifloro foliis ensiformibus plerumque longiore, spathis foliaceis subæqualibus, sepalis omnibus emarginatis, ovario obtusè trigono tubi perianthii infundibuliformis vix longitudine. Wall. Cat. n. 5050 ; Lindl. in Bot. Reg. t. 818 ; Royle, t. 90. f. 2. *I. japonica.* Thunb. in Linn. Trans. 2, p. 327?

Hab. Nepal (*Wallich*) ; Kemaon (*Blinkworth*) ; Bychucky Ghaut, between Pabur and Tonse, and Bhala Gaon (village), on the ascent to Surkunda (*Royle*).

2. *I. kemaonensis,* barbata ; scapo brevissimo unifloro, perianthii tubo longissimo subfiliformi, sepalis interioribus bilobis longè unguiculatis, ovario turbinato trigono, stigmatis lobis integerrimis.

I. kemaonensis, Wall. Cat. n. 5052 ; Kemaon, (*Blinkworth*) ; Kedarkanta, (*Royle*).

3. *I. decora.* Wall. Pl. Asiat. Rar. 1, p. 77, t. 86.—*I. sulcata.* Ejusd. Cat. n. 5049.—*I. nepalensis.* Don Prod. Fl. Nep. p. 54.—*I. orientalis.* Thunb. in Linn. Trans. 2, p. 328 ?

Hab. Nepal, (*Wallich*) ; Kemaon, (*Blinkworth*) ; Choor and Punjee, (*Royle*).

4. *I. longifolia,* imberbis ; foliis margine scabris, scapo brevissimo unifloro, sepalis sublanceolatis integerrimis, tubo perianthii vix ullo, ovario elongato triguetro scapum adæquante, stigmatis lobis integerrimis.—*I. longifolia,* (Royle) ; t. 91. f. 2.

Hab. From Cashmere seed in Saharunpore Botanic Garden.

5. *Crocus sativus* var. *Cashmerianus.* Tab. 90. fig. 1. Plant in flower (*b*) style and stigmata ; 1 *a.* Plant in leaf.

170. Burmanniaceæ.

170. BURMANNIACEÆ.

The *Burmanniaceæ* are not closely allied to any known family; by some botanists they are placed near *Hæmodoraceæ,* of which no species have been discovered within the limits of the Indian Flora. This family contains but few genera, and these, with the exception of *Burmannia,* but single species. They are found in moist situations within the tropics, both in the Old and New World; extending also in the latter as far north as 35°, and south to the Rio Negro in 33°. In the Old World species occur as far south as 35° at the Cape and in New Holland. From Madagascar and the Tropical Islands they extend into India as far as Nepal, where *Burmannia disticha*, a species first found in Ceylon, occurs, as well as in the more distant locality of the neighbourhood of Port Jackson, in New Holland. Dr. Roxburgh has described *B. triflora* from Penang, which closely corresponds in description with *B. cælestis,* Don, which has been figured in Tab. 91. fig. 1. from an imperfect drawing of Dr. B. Hamilton's. Among which, (*Ic. ined.* 282), there is another closely allied, if, indeed, it be a distinct species, *B. bifaria.* The published figures of this genus display its wide distribution, as *B. capitata,* under the name of *Tripterella,* by Michaux, from N. America; three species by Martius, from Brazil, *B. disticha* from Ceylon, and *B. cælestis* from Nepal.

Burmannia cælestis. Don. Prod. Fl. Nep. p. 44. Syst. Veg. Schultes. vii. p. L. xxv. Tab. 91. fig. 1.

171. AMARYLLIDEÆ.

The *Amaryllideæ,* numerous in genera and species, and well known as ornamental parts, are widely distributed; though we do not observe much correspondence between structure and distribution, as some are found in very hot, and others, as *Galanthus,* in equally cold parts of the world. They abound at the Cape of Good Hope, also in tropical and extra-tropical America, with a few species of other genera, as well as of Narcissus, in the South of Europe and the North of Africa, the Oriental region, and in China and Japan. *Narcissus Tazetta,* known in India by the Persian name *nurgus,* extends from the Mediterranean into the Oriental region and Persia, and thence to the Himalayas and China. Though found in all these, it must, no doubt, have been introduced into some, on account of the high esteem in which it has always been held in Oriental regions. Dr. Wallich obtained it in Nepal, and I found it in some apparently wild situations; but I ascertained that all respecting which I could get any information, were the sites of old habitations and deserted gardens.

Crinum, and *Pancratium* therefore, alone belong to the Indian Flora, and are also both found in Equinoctial America; the former also in Western Africa, the Cape of Good Hope and New Holland. *Pancratium* delights chiefly on the coasts of many of the Indian islands, extending to the coast of Arabia, and thence to those of the Mediterranean, where *P. maritimum* is found. In the gardens of India two species are especially common, *P. zeylanicum,* Hind. *chumbuk,* and *P. longiflorum* of Roxburgh, which, by the natives, is called *sooillia.* *Crinum* likewise delights in tropical islands, and

and extends along the Malayan Peninsula to Silhet, and all along the Himalayas, as well as in Ceylon and the Peninsula of India; but Dr. Wallich not having enumerated either *Crinum* or *Pancratium* in his Catalogue, I find it difficult from want of time to examine the specimens in the E. I. Herbarium, to trace either his own, or Dr. Roxburgh's species to northern parts. But *C. latifolium, sookh-dursun,* a native of Bengal, is common in the gardens of N. India. I obtained another species, apparently *C. toxicarium,* from the Muhunt's (the head priest of the Sieks) garden at Deyra; and a third, which appears to me new, from Munsar, in the interior of the Himalayas, which I have called *C. Himalense.*

The *Amaryllideæ* are conspicuous for their highly ornamental nature. Many of them also possess considerable energy of action, though few are much employed as medicinal agents. *Brunsvigia toxicaria* is said to be used by the Hottentots for poisoning their arrows, and *Hæmanthus coccineus* as a substitute for squills at the Cape of Good Hope. *Crinum asiaticum* is employed medicinally by the natives of India; and the bruised leaves, made into a cataplasm with castor-oil, are applied to whitlows, and their juice dropped into the ears in cases of ear-ache. Dr. Horsfield states that the bulbs are accounted emetic in Java. This species is considered identical with *C. toxicarium* of Dr. Roxburgh, which is said to be employed for curing the effects of the poisoned arrows of the Macassars. The bulbs of the plants of other genera have been employed as emetics, as those of *Galanthus nivalis, Leucoium æstivum,* and *Pancratium maritimum*; but still more frequently those of species of Narcissus, which M. Deslongchamps has recommended as substitutes for ipecacuanha. The bulbs of *Narcissus Jonquilla* are thought by some to be the βολβος εμετικος of Dioscorides, and those of *N. poeticus* by others. This species is usually stated to be his ναρκισσος; but so is *N. pseudo-Narcissus* by some authors. *N. Tazetta* is given as such in India; *nurjus* and *nurgus* being assigned as its Arabic and Persian, with *linoos* as its Greek synonyme; the last probably a corruption of λειριον, stated to be one of its names by Dioscorides.

Agave is frequently placed in *Bromeliaceæ,* from resemblance in habit, and the ovarium being inferior; but it is now usually subjoined to *Amaryllideæ* as a section, by the name Agaveæ, which includes this genus and *Fourcroya.* Both are confined to America, and were probably early introduced by the Portuguese into India, as the species are common, and have native names assigned them. Mr. Don (Lin. Trans. xvii. p. 563) ascertained that *A. cubensis* referred to *Fourcroya* by Ventenat, is the species which Colonel Sykes described as having come up at Poona in a garden, where some Cape bulbs had been grown in the previous year. *A. vivipara,* Hind. *bans-keora* (a compound, of the names of the bamboo, and of *Pandanus odoratissimus*), is the species I found most common in gardens and hedges in N. India, and observed that on rich soils the plant invariably produced bulbs, but no seeds; while a poor stony soil and dry climate, as that of Delhi, had contrary effects, and the latter alone were produced. Dr. Roxburgh describes *A. Cantala,* a species agreeing in several points with *A. vivipara,*

but

but which is referred to *Fourcroya* by Haworth. *Kantala* being a Sanscrit name, Dr. R. thinks that this may be a native of, as it is very common in India; but as there are modern Sanscrit names (v. p. 60), this has most probably been introduced as indicated by one of its names, *Bilatee ananas,* foreign pine-apple.

The species of *Agave* are not alone ornamental as plants and useful as hedges, but are important for their products. The roots, as well as leaves, contain ligneous fibre (*pite thread*), useful for various purposes: these are separated by bruising and steeping in water, and afterwards beating; practises which the natives of India have adopted, either from instruction or original observation. The Mexicans also made their paper of the fibres of *Agave* leaves laid in layers. The expressed juice of the leaves evaporated, is stated by Long in his Hist. of Jamaica, to be also useful as a substitute for soap. But the most important product of *Agave,* and especially of *A. Americana,* the species now most common in the south of Europe, is the sap, which exudes upon the cutting-out of the inner leaves, just before the flower scape is ready to burst forth. Of this a very full account is given by the illustrious Humboldt, in his Political History of New Spain, book iv. c. 9. The species is *A. Americana,* called *metl* by the Mexicans, and *Maguay de Cociuza* in Caraccas. *Pittes* and *maguey metl* are varieties of *A. Americana,* which (Syn. Plant. Æquinoct. i. p. 300) is stated to be common every where in Æquinoctial America, from the plains even to elevations of between 9,000 and 10,000 feet. *A. Mexicana* is also, by some authors, called *maguei, metl,* and also *manguai;* and *A. vivipara* is *Theo-metl* or *manguei divinum.* In Cumana and Caraccas, *A. cubensis* is called *maguey de Cocay.* Humboldt informs us, that the first (*A. Mexicana,*) is extensively cultivated in the interior table-land of Mexico, and, indeed, extends as far as the Aztec language. The juice of the *Agave* is of a very agreeable sour taste. It easily ferments on account of the mucilage and sugar it contains, when it is called *pulque* by the Spaniards. The vinous beverage, which resembles cyder, has an odour of putrid meat, extremely disagreeable; but the Europeans, who have been able to get over the aversion, which this fetid odour inspires, prefer the *pulque* to every other liquor. A very intoxicating brandy is formed from the *pulque,* which is called *mexical* or *aguardiente de maguey.* The Government drew from the *Agave* juice a net revenue of £166,497 in three cities. The cultivation of these plants appears worthy of trial in many parts of India, where the *Agaves* thrive so well.

172. HYPOXIDEÆ.

The *Hypoxideæ* form a small order, which is sometimes united with *Amaryllideæ.* The genera are only two in number. *Curculigo,* found at the Cape of Good Hope, New Holland, and from Java and the other Indian islands, extends along the Malayan Peninsula to Silhet, Nepal, and as far north as the Kheree Pass, where the same species *C. recurvata* and *gracilis* are found, as in every other part of India. *C. orchioides,* from the mountains of the Peninsula, extends also along the Himalayas, being found on Chirraponjee, in Kemaon, and by myself near Gundooree, on the shoulders of the

the Choor mountain. *C. petiolata,* nob., is a new species, allied to *C. orchioides,* (perhaps only a variety) from the Kheree Pass. *Hypoxis,* more numerous in species, is also more extensively diffused, having the distribution of *Curculigo,* as well as occurring in both North and South America. No species of *Hypoxis* has yet been found in the plains of India, but one species is extremely common in the Himalayas. This is *H. minor,* Don (*Curculigoides,* Wall.) There may, however, be two species intermixed among these; one with many flowered scapes, and the flowers small; while the other has larger flowers, but these single, as represented in Tab. 91, fig. 3.*

Hypoxis minor. Don. Prod. Fl. Nep. p. 53. Syst. Veg. Schultes. vii. p. 772. Tab. 91. fig. 3.
Hab. Nepal. (*Wallich*). Mussooree, &c. (*Royle*).

173. HYDROCHARIDEÆ.

This aquatic order, though named from *Hydrocharis,* a European plant, is widely diffused over a great extent of territory and variety of climate; its species may easily be distinguished by their inferior ovary from other water-plants; but, like them, some of the same species are found in very widely-separated countries. The order is divided by Endlicher into the tribes *Anacharideæ, Vallisnerieæ,* and *Stratiotideæ,* of all which some species are found in India. Of the first, *Hydrilla* (*Serpicula,* Roxb., Corom. Pl. t. 164) *verticillata,* is common in still waters all over India, from the Peninsula to Saharunpore, where there is also apparently another species, which I have called *H. subulata.*

Vallisneria is a genus well known in the south of Europe, but which occurs also in N. America, India, and New Holland; and the same species, *V. spiralis,* so remarkable in a physiological point of view, is found in all these countries. *V. alternifolia* is a genuine species of the genus, figured by Dr. Wight (Hook. Misc. Sup. t. xi.), and is found

* The *Bromeliaceæ,* or Pine-apple tribe, are so exclusively an American family, that nothing but the extensive diffusion of the pine-apple over India would render advisable their mention here. The introduction into India of the pine-apple is expressly mentioned by Indian authors, as by Abul Fuzl, in the Ayeen Akberry, and then by the author of the Dhara Shekoih. (Taleef Shereef transl. p. 18). It was introduced into Bengal in 1594 by the Portuguese during the reign of Akbar, and is called by the natives either *ananas* or *kutl-suffree* "artocarpus for a journey," as its fruit ripens even when carried about. Pine-apples succeed as far north as 30° in the open air, but are plentiful in the garden of the Taj-muhul at Agra. They are so abundant in both Ceylon, and near Rangoon in Burma, as to appear wild in both places, and are considered most delicious in flavour in the latter situation. They are mentioned by Capt. Turner in his journey to Teshoo-loomboo, as extremely abundant in the jungly tracts in the entrance to the hills. It is evident, therefore, how well suited the climate and soil of many parts of India are to the cultivation of the pine-apple. This is important not only on account of its fruit, from which a very agreeable beverage is in some countries prepared, but also on account of the fibre which abounds in the leaves, and which has attracted a good deal of attention in this country; as with it cloth has been manufactured as fine as some muslins. The natives of India appear to be well acquainted with the fibre of the pine-apple leaf, as some of very good quality and light-coloured has lately been sent from Bombay to the Royal Asiatic Society. Some years since, Mr. Cracroft also sent from Dacca to the Asiatic Society of Calcutta, specimens of pine-apple fibre, prepared in the Barycote district.

found both about Madras and Calcutta and in Silhet. *V. minor*, nob., is a new species, from the neighbourhood of Allahabad. *Blyxa* (*Saivala*, Wall.), belonging to the same tribe, is a genus common to Madagascar and India. The species found in the latter has been figured by Dr. Roxburgh (Corom. Plant. t. 165), under the name of *Vallisneria octandra*.

The tribe *Stratiotideæ* has the genera *Stratiotes* and *Hydrocharis* in Europe, *Limnobium* in N. America, and *Enhalus* (*Stratiotes acoroides*, Linn. F.), in Ceylon and the Malayan Archipelago. *Boottia* is a new genus discovered by Dr. Wallich, along the banks of the Irrawady and on Taong Dong, and consists of the species, *B. cordata*, figured in Pl. Asiat. Rar. t. 65. *Ottelia*, Pers. (*Damasonium*, Schreb.) has a species, *O. ovalifolium*, in New Holland, and another, *O.* (*Damasonium*, Roxb. Corom. Pl. t. 165), *alismoides*, which is common to every part of India, and is also found in Egypt. A new species, *D. sessile*, Wall. Cat. 5044. Ic. ined. 283, has been found both by Dr. Hamilton and Dr. Wight. A species of *Hydrocharis* is also enumerated by Dr. Wallich (*H. cellulosa*, Cat. 5042), as found in Gorakpore and Silhet.

The *Hydrocharideæ* are not possessed of any active properties, but from their bland and mucilaginous nature, some are employed for food, as *Boottia cordata*, of which the green parts are sold in the market at Ava, being eaten by the Burmese as pot-herbs: so both the leaves and fruit of *Enhalus* are eaten, both raw and cooked, in the Malayan islands. *Hydrilla verticillata* and similar plants are employed by the sugar-refiners of Saharunpore and Berhampore for covering the surface of their sugars, as clay is used in the West-Indies to permit the slow percolation of water.

174. TACCACEÆ.

The *Taccaceæ* form a small order, allied on one hand to *Aroideæ* and on another to *Aristolochiæ*, resembling the preceding orders in their inferior fruit, and *Dioscoreæ* in possessing radical tubers abounding in fecula. They are found in the warm parts of Asia, and consist of the genus *Tacca*, from which has been separated, though not very distinct, *Ataccia*, formed of Dr. Roxburgh's *Tacca integrifolia*, Corom. Plant. t. 257, named *T. aspera*, in his Flora Indica, ii. p. 169. This species he describes as found in the hills behind Chittagong; while *T. lævis*, Wall., Ic. ined. No. 293, was found in Silhet, and by Dr. Hamilton in Goalpara. *T. pinnatifida*, the best known species, is a native of the Malay Peninsula, the Moluccas, Madagascar, and New Holland. It is found in herbaria from the Madras presidency, but Dr. Roxburgh mentions it only as introduced. The other species, *T. montana* and *T. dubia*, are likewise found in the Moluccas; while *T. Rafflesiana*, Jack, is found at Penang and Singapore. From the latter Dr. Jack also sent a species, which is there called "Water Lily," but was named by him *T. cristata*, Wall. Ic. ined. 292.

The plants of this family are possessed of some degree of acridity, both in their tubers and in their herbaceous parts, as Rumphius informs us, that the tubers of *T. pinnatifida, dubia*, and *montana*, are rasped and macerated for four or five days in water, and a fecula

a fecula is separated in the same manner that sago is, and like it employed as an article of diet by the inhabitants of the Malayan and Molucca islands. In Otaheite and other Society islands, they make cakes of the meal of the tubers of *T. pinnatifida*, which are the *tacca youy* of some navigators: they form an article of diet in China and Cochin-China, as also in Travancore, where, Dr. Ainslie informs me, they attain a large size, and that the natives eat them with some acid to subdue the acrimony.

175. DIOSCOREÆ.

The *Dioscoreæ* form a small family, allied to *Smilaceæ*, but from which they are distinguished as well by their inferior ovary as by their capsular fruit. The genera are few in number, and of these, *Tamus* is only allied to this family by its inferior fruit, and, by this being a berry, to *Smilaceæ*. The genus is, moreover, found in Europe and the north of Africa, as well as in the temperate parts of Asia, such as the Tauro-Caucasian region. *Rayania* is a West-India genus, and *Oncus* a little-known Cochin-Chinese one. *Dioscorea*, therefore, alone remains to be treated of; and, as the most numerous in species, is also the most widely diffused through the tropical parts of the world; it extends also south to the Cape of Good Hope, where is found *Testudinaria elephantipes*, (now usually referred to this genus,) and also to New Holland, whence several new species have been described by Mr. Brown. To the north species are found in the United States of America, and in the most northern parts of India, as well as on the Himalayan mountains. The species are, however, most numerous in the hottest parts of the world; but from their numbers, varying forms, diæcious nature, and the want of authentic specimens, it is difficult to ascertain the identity of species found in different parts of the world. Rheede and Rumphius have figured some; Roxburgh has described more; and of these, several are contained in the E. I. Herbarium. *D. pentaphylla*, *dæmonum*, *alata*, *rubella*, *aculeata*, and *nummularia*, are species found in the Malayan islands, as well as in the southern parts of India. Of these, *D. pentaphylla* occurs also in Central India, as I have received specimens from Mr. Malcomson, from near Nagpore, where it is called *yeller-guddoo*; and another species, named *chunchoo-guddoo*. In the most northern parts of India, the most common species is *D. sagittata*, nob., nearly allied to *D. sativa*, Wall. Cat. 5108. *D. versicolor*, Ham., *genthee* of the natives, is extremely common about Lohargaon, in Bundlecund, and partly also in the Peninsula of India, as well as all along the foot of the Himalayas, and as high as 5,000 feet in the neighbourhood of Jurreepanee. *D. virosa* is an Himalayan species, called *ramberee* by the natives in Gurhwal and Sirmore; another, very elegant in appearance, has been named *D. deltoides* by Dr. Wallich from Nepal, and which I obtained on Mussooree and Dhunoultee, and from Gorakhotee, near Rampore, in Lower Kunawur.

The species of this family are important in tropical countries, on account of their large tubers abounding in nutritious fecula, which is employed as food. These tubers are well known by the name of yams; though those of *Tacca* and of *Arum* are sometimes

times confounded with them by travellers in their relations. Dr. Roxburgh mentions that *D. alata*, common West-India yam, and his *D. globosa, purpurea, rubella*, and *fasciculata*, of which the three first, he says, may be varieties of one species, are the best kinds cultivated in India; and that *D. alata* is esteemed next to *D. globosa*. *D. atropurpurea*, he describes as the species so extensively cultivated at Malacca, Pegu, and the eastern islands. *D. bulbifera* is the common Otaheite yam. *D. alata*, called *rut-aloo*, I have alone seen cultivated in N. India; but the tubers of *D. sagittata, toree* of the natives, are eaten, as are in Southern India those of *D. aculeata, anguina, oppositifolia, tomentosa*, and *pentaphylla*. Many of these possess some acridity previous to being dressed; but this, as is the case with potatoes, is no doubt dissipated by heat. It is, therefore, less surprising to find some species with a greater degree of acrid principle, as in *D. dæmonum, virosa*, and, in some degree, in *D. tomentosa, triphylla*, and *pentaphylla;* all which, it is interesting to observe, have compound leaves. The tubers of one of the Himalayan species are employed in washing woollens. *Tamus* has also acrid tubers; but the only species of *Oncus* is called *O. esculentus*, from its large farinaceous and edible tubers. The fleshy mass of those of *Testudinaria* are made use of as food by the Hottentots in times of scarcity: hence called Hottentot's bread.

176. SMILACEÆ.

The *Smilaceæ* form an order, which is differently constituted by different botanists, some of the genera placed here by Mr. Brown being arranged by Dr. Lindley under *Liliaceæ*. Endlicher divides the family into the tribes *Parideæ* and *Convallarieæ*, appending to it several allied genera.

The *Parideæ* consist of *Paris, Trillium*, and *Medeola*. The first found in Europe; the Caucasian and Altai ranges has also a species, *P. polyphylla*, Sm. (Wall. Pl. As. Rar. t. 126) in the Himalayas, where the second, in the form of *T. Govanianum* (v. Tab. 93. fig. 3) is also found at considerable elevations, with other species in Kamtschatka and N. America. The Himalayan species of *Paris* is subject to great irregularities in the number of the leaves and of the parts of the flower, which I observed and communicated to Dr. Wallich (v. l. c. p. 25.)*

The tribe *Convallarieæ* includes the genera *Streptopus, Smilacina, Polygonatum*, and *Smilax*, belonging to the Indian and Himalayan Floras. Some of the other genera are found in New Holland, New Zealand, Chili, and the Straits of Magalhaens; with *Convallaria*

* My friend, Dr. Falconer, in reference to this irregularity of *P. polyphylla*, writes me, "I found *Podophyllum Emodi* growing intermixed with it; and, strange to say, as if bewitched with the same turn for vagaries, with every number of stamens from six to ten, and in almost every flower one filament bearing two anthers, and that filament invariably the one opposite the petiole of the flower-bearing leaf. In one flower I found the following irregularities;—six petals, ten anthers, seven filaments, or stamens if you like; on one filament three anthers; on another two; and the remaining five irregular. Singular that it and the *Paris* should grow together, and both be so irregular."

Convallaria and *Ruscus* in Europe, Northern Asia, and North America; *Streptopus*, distinguished by its jointed peduncles, occurring in Europe and N. America, has also a species, *S. candida*, Wall. (*S. simplex*, Don) in the Himalayas, on Gossainthan and in Kemaon. *Smilacina* having the two species of the subgenus *Majanthemum* in Europe, Siberia, and N. America, has the other species of the genus in the two latter, as well as in the Himalayas. *S. alpina*, nob., from Kedarkanta, Urukta, and Manma, is closely allied to *S. borealis*. Dr. Wallich has figured *S. purpurea* at t. 144, and *S. fusca* at t. 257; the latter from Sheopore, and the former from Gossainthan, in Nepal. Of this he also mentions a white variety from Kemaon, which I have also found on Urukta and Kedarkanta, and which being constant in this character over so great an extent, may be a distinct species, and might be called *S. pallida*. *Polygonatum*, more numerous in species, is not more widely diffused, with the exception of being found also in Japan. The Himalayan species are five or six in number. *P.* (*Convallaria*, Wall.) *oppositifolium*, being found on the Silhet mountains, and with *P. punctatum* in Nepal. *P. cirrhifolium* (*Convallaria*, Wall. As. Res. xiii. p. 382. c. tab.), closely allied to *P. sibiricum*, is found also in Nepal; as well as on Choor, with *P. Govanianum*, Wall. N. 5137, which likewise occurs on Huttoo and in Kemaon. Under *P. verticillatum*, (*Convallaria*, Wall. Cat. N. 5135) seem to be included a plant identical with the European species of this name, and *P. leptophyllum* of Mr. Don, which I have from the Choor mountains. With *P. verticillatum*, another European species *P. multiflorum*, or Common Solomon's Seal, is found on Mussooree and Mhassoo. Two additional species, *P. Inglesii* and *P. ciliatum*, are found, the former on Raldung, and the latter near Lippa, in Kunawur.

Smilax, the genus from which the order is named, is not only important for its medical properties and commercial value, but also for being the most numerous in species, and these the most widely diffused, though unlike the rest of the order, chiefly in hot parts of the world. But the genus is sufficiently distinct in structure as sometimes to be formed with *Ripogonum* into a separate family. The species of *Smilax* are found in the tropical parts of Asia, Africa, and America. From these they extend southwards to New Holland, and northwards to Japan, N. America, and the S. of Europe; where are found *S. catalonica* and *nigra* in Spain, and *S. aspera*, a species which extends also to Syria. *S. mauritanica* occurs in the N. of Africa, and *S. excelsa* in Asia Minor and Caucasus. In India the species are found all along the foot of the Himalayas, from Silhet to the Sutlej, as well as at elevations on the sides of the Choor and Mussooree mountains. They occur also along the Malayan Peninsula, and though common in hot parts of the world, are less so in the Indian Peninsula. But a species, *S. zeylanica*, extends into it from Ceylon, and one or two other little known species are found there. *S. ovalifolia*, Roxb., is a Peninsular species, which extends towards Bombay, and, according to Mr. Don, occurs also in Nepal, as well as *S. prolifera*, a Bengal and Silhet species. Dr. Wallich enumerates several new species from Singapore, Penang, and Burma. On Chiraponjee, in Silhet, and the Garrow Hills, are found *S. lanceæfolia*

and

and *S. glabra;* the former called by the natives *gotee-shook-China,* and the latter *hurria-shook-China,* both having tuberous roots like the Chinese *Smilax China.* In Silhet are also found *S. Roxburghiana,* Wall. (*S. laurifolia,* Roxb.), which is called *koomari* or *koomari-shook-China,* and *S. oxyphylla,* which is called *chotee* (or small *koomaree.*) Under *S. prolifera* more than one species is probably included in the E. I. Herbarium. These are found in Burma, Chittagong, Silhet, Oude, and Nepal. Besides this, *S. rigida* and *ferox* are other Nepal species; as is *S. elegans,* which extends north to the Deyra Doon, and *S. maculata,* (v. Tab. 94. fig. 1.) which is found in Nepal, Kemaon, and on Mussooree. On the latter mountain, and other parts of the hills, occurs *S. Villandia,* Wall. Cat. 5123, (v. Tab. 94. fig. 2.) found by Dr. Hamilton on the Morung Hills.

Of the genera appended to *Smilaceæ,* several belong to the Indian Flora: as of the *Aspidistreæ,* which includes *Rhodea,* the *Orontium japonicum* of authors; *Tupistra,* of which the first species, *T. squalida,* is figured Bot. Mag. 1655; and the second, *T. nutans,* Wall. Bot. Reg. t. 1223, is from the confines of Silhet, where it is called *kala teetee.* In the E. I. Herbarium are also two doubtful species, one *T. aurantiaca,* from Nepal, Wall. Cat. 5194, *Ic. ined.* 263, which may indeed form a new genus; the second is *T. Singaporiana. Aspidistra* includes the S. of China and Japan species of this tribe, which have their flowers solitary, instead of in dense spikes.

The *Roxburghiaceæ* of Drs. Wallich and Lindley, are only admitted here as an allied tribe with a query, whether they are not allied to *Methonica.* There are two species of the genus; the first, *R. gloriosoides* of Dryander, Roxb. Corom., t. 32, a native of moist valleys among the mountains of the Peninsula, where it is called *canipoo taja* by the Telingas. The second species, *R. viridiflora,* with stems sometimes one hundred fathoms long, was discovered in the Chittagong district by Dr. Hamilton. This was first figured by Sir J. Smith in Ex. Bot. t. 57, and subsequently by Dr. Wallich, t. 282, with a full carpological account of the genus by Dr. Lindley. It is the *Stemona tuberosa* of Loureiro, and the *Ubium polypoides* of Rumphius, Herb. Amb. V. t. 129, by whom it is figured among the *Dioscoreas,* though he says its roots are only eaten when preserved in syrup, the acridity being previously removed by boiling and by soaking in lime water. Hence this genus is like so many others, common to the tropical parts of India, Siam, Cochin-china, and the Moluccas.

In *Ophiopogoneæ,* Endlicher has united *Peliosanthes* with the genus from which the sub-tribe is named; the two resembling each other in their berries, while ripening, bursting their covering, and exposing the seeds naked to attain full maturity. *Peliosanthes Teta* (*Teta viridiflora,* Roxb. Fl. Ind. ii. p. 165), is a native of Chittagong and Silhet. It was found by Finlayson in Turon. *P. humilis,* Bot. Reg. 634, is a species from Penang, and a third has been obtained from the Burma territories.

Ophiopogon is a genus common to Japan, China, and the Himalayas, extending also into the Malayan Peninsula. *O. japonicus* was referred by Linnæus to *Convallaria,* and another species was formed into a new genus, *Liriope,* by Loureiro. His *L. spicata,* from Cochin-china, is no doubt the *Convallaria spicata* of Thunberg, now *Ophiopogon spicatus,*

spicatus, Bot. Reg. 593. This is also found in Nepal, and as far north as Mussooree, flowering in April, and also in the rains. Dr. Wallich has referred his specimens from the Himalayas in the E. India Herbarium to *O. japonicus;* which is very distinct from Mr. Don's *O. intermedius*, likewise a Himalayan species; but none of the specimens which I have seen agree with the Japan plant.

But there appear to be several species of this genus in these mountains, *O. mollis*, nob., common in the Himalayas between the Ganges and Sutlej rivers, *O. minor*, from Turanda, in Kunawur; while *O. indicus*, found in the Peninsula by Dr. Heyne, and Dr. Rottler, appears to extend all along the mountains, as I have it from Mussooree, &c. A species from Rangoon, growing in deep shade, near the Gamboge trees of that place, I have named *O. Malcolmsonii*, from being found by Mr. Malcolmson, of the Madras medical service, from whom I received it.

The properties of this family may be considered with reference to both the *Parideæ* and the *Convallarieæ*. The former constituting the *Trilliaceæ* of some authors, sometimes made a distinct family, are, at others, united with *Melanthaceæ*. As difference of opinion still exists respecting the proper place of several of these monocotyledonous groups, it is unreasonable to expect uniformity of properties, where uniformity of structure has not been proved. The roots, leaves, and fruit of *Paris quadrifolia* are possessed of emetic properties. *P. polyphylla* is represented as being poisonous in the Himalayas, and has a nauseous narcotic smell. (Wall. Pl. As. 11. p. 25. t. 129.) The roots of *Trillium cernuum* are in like manner emetic.

The species of *Convallaria*, now referred to this genus, and to *Polygonatum*, were formerly thought to be possessed of active properties. *C. majalis* secretes an acrid principle in its flowers, making them, when dried, useful as sternutatories; they are also emetic and cathartic. *P. verticillatum* has even been thought to be the εφεμερον of the Greeks. v. *Melanthaceæ*. *P. vulgare* (*Convallaria Polygonatum*) and *multiflorum* seem to abound only in fecula, though they have had active properties ascribed to them. *P. verticillatum*, L., called *meetha doodya* in Sirmore, and *Smilacina pallida*, called *doodya mohura*, are both accounted poisonous in the Himalayas.

The genus *Smilax* is distinguished for the extensive medical employment of its roots, called Sarsaparilla. These belong to a variety of species, though there is still some doubt about that which is the best. The kinds known are—1. the Jamaica, imported from S. America; 2. Lima; 3. Lisbon or Brazilian; 4. Honduras or Mexican; and, 5. the Vera Cruz sarsaparilla, and that of the Caraccas, which is exported from La Guyana to N. America. The first kind is supposed to be yielded by *Smilax officinalis*, which grows along the banks of the Magdalena. It is unknown what species, if distinct from the first, affords the sarsaparilla exported from Lima. *S. syphilitica*, found by Humboldt in New Granada, and by Martius in the Brazils, yields the *sarsa* of the Rio Negro, which is probably the same as the third kind. *S. medica*, growing on the mountains of Mexico, produces that exported from Vera Cruz; while *S. cumanensis*, the azocorito of the natives of Cumana, yields some of the sarsaparilla which is obtained

obtained from the Spanish main. The medical virtues of this root are supposed to depend upon a peculiar principle, which possesses a little acridity and is called parigline, or sarsaparilline. Sarsaparilla has been reckoned useful as an alterative; it excites diaphoresis, and has been known to occasion nausea and vomiting; containing much fecula, it may be useful as a demulcent, while its slight bitterness may give it some tonic power. By some practitioners it is pronounced devoid of any useful properties. Dr. Hancock, however, states that most of the sarsaparilla of the shops is inert, while that which is good has a peculiar nauseous acrimony when chewed; and that, in his opinion, only one species of *Smilax* yields genuine sarsaparilla, which grows on the elevated lands of the Rio Imiquer, at Unturana, and Caraburi, but that it is constantly adulterated with inferior sorts. Seeing that so many species of *Smilax* are employed as substitutes for sarsaparilla, it is remarkable that no attempts have been made in India, where so many species are indigenous, to effect the same object, and where the drug must arrive in a still less fresh state than it does in Europe. That the American species are not the only ones endowed with active properties, is proved by *S. aspera,* thought to be the Ξμιλαξ τραχεια of the Greeks, being in the S. of Europe called *Sarsaparilla Italica;* and appearing from the experiments of M. Jaeger, as well as of M. Banor, to be possessed of all the properties of sarsaparilla. *S. Macalucha* is a Philippine island species, which is used medicinally, and *S. glycyphylla* a New Holland one, which is called *sweet tea,* and considered tonic and antiscorbutic. So the celebrated China root (called *chob-cheenee* in India), the produce of *Smilax China,* is esteemed as a diaphoretic and tonic, though probably useful only as a demulcent. It is remarkable that two Indian species, *S. glabra* and *S. lanceæfolia,* having tuberous roots, like *S. China,* are called, in Silhet, *hurina-shook-China* and *gootea-shook-China,* while *S. laurifolia* is called *koomari* or *koomari-sook-China. S. ovalifolia* is called *kunda-gurvatiya* by the Telingas. In a late report, Mr. Gibson mentions having sent some of this plant to Bombay for experiment. It is probable that all the above species are used by the natives of India as medicinal substances, as is, I believe, *S. Villandia,* figured in Tab. 94. fig. 1, of the present work.

Though the substance called E. India sarsaparilla is no doubt the roots of *Hemidesmus indicus,* as was proved in a paper read by the author before the Royal Asiatic Society, 9th June 1838, there is yet a substance in Indian bazars, called اوشبا *aoshba,* or *aoshbeh,* usually translated sarsaparilla in dictionaries. In Persian works on Materia Medica, it is called *aoshbeh mugrabee,* and also *yasmeen-burree-mugrabee.* The specimens which I obtained, it is curious to observe, have a considerable resemblance to those of sarsaparilla, but the plant yielding it, probably a native of Africa, is as yet unknown. The Author is indebted to Professor Don for the ensuing specific characters, as well as for those of the following orders.

Trillium

Trillium Govanianum, foliis ovatis acuminatis petiolatis, sepalis lanceolatis acuminatis; interioribus 3 duplo angustioribus, stigmatibus ovario longioribus.—Tab. 93. fig. 1.

Trillium Govanianum. Wall. Cat. n. 812.

Hab. Choor, Urukta.

Obs. Species inter Trillium et Paridem quasi media.

Smilax Villandia, caule tereti aculeis conicis recurvis armato, foliis ellipticis mucronatis 5-nerviis membranaceis lævibus, petiolis cirrhiferis, umbellis utriusque sexûs multifloris pedunculatis subgeminatis. Tab. 94. fig. 2.—*Smilax Villandia.* Ham. Mss. Wall. Cat. n. 5123.

S. macrophylla. Roxb. Fl. Ind. 3. p. 793?

Hab. Mussooree.

S. maculata, caule angulato aculeis recurvis armato, foliis cordatis subhastato-lanceolatisve mucronatis 5-nerviis coriaceis: nervis subtus petiolisque nunc parce aculeatis, petiolis cirrhiferis, umbellis utriusque sexûs multifloris sessilibus spicatis. Tab. 94. fig. 1.—*Smilax maculata.* Roxb. Fl. Ind. 3. p. 796. Wall. Cat. n. 5113.—*S. fulgens.* Wall. Cat. n. 5122.

Hab. Mussooree.

Ophiopogon intermedius, foliis strictis margine serrulato-scabris scapo triquetro multò longioribus, pedicellis geminis bracteas lanceolatas membranaceas subæquantibus, stylo staminibus longiore subdeclinato. Tab. 96. fig. 1.—*Ophiopogon intermedius.* Don Prod. Fl. Nep. p. 48.

177. MELANTHACEÆ.

Melanthaceæ, often called *Colchicaceæ*, form an order re-established by Mr. Brown, and in which are often included some genera (*Parideæ*) already treated of with *Smilaceæ*. To which, as well as to *Asphodeleæ* and *Junceæ*, the plants of this family are allied. Constituted, however, as at present, it contains some genera which may subsequently be separated from it, and therefore we ought not to expect any great correspondence in climate or properties. The *Melanthaceæ*, however, chiefly prevail in moderate temperatures, and not in either very high or very low latitudes. Divided into the tribes *Colchicaceæ* and *Veratreæ*; the former occur chiefly in the South of Europe, with some in Central Europe, the North of Africa, and the Oriental Region: the latter in New Holland and the Cape of Good Hope, as well as in N. America; with a few in the North of Africa, the mountains of Europe, and Central and Northern Asia.

In India they are absent from the plains, but some are found in the mountains of the Peninsula, probably at seasons when there is moderation of temperature, or moisture of atmosphere. *Anguillaria indica*, the *Melanthium indicum* of Linnæus, is found there, as well as on the coast of New Holland, within the tropics. It was found by Dr. Wallich (v. Pl. As. Rar. t. 259) in the mountains of Prome, along the course of the Irrawady and in Nepal; also by myself in the ascent to Jurreepanee, in 30° of N. latitude. The peninsular specimens are, however, narrower leaved. *Ledebourea* is a new genus, established by Roth, of a plant not well known, but referred by Kœnig, Heyne and Rottler, to both *Melanthium* and *Erythronium*, with the specific name of *hyacinthoides*. It appears to be common all along the Peninsula. Mr. Malcolmson collected it near Nagpore, and I at Lohargaon, in lat. 25° N., coming into flower at the commencement of the rains, and gave specimens to Dr. Wallich, (v. Cat. N. 5170, and Hooker Bot. Mag. t. 3226.)

In the Himalayas we have species of genera found in other temperate parts of the world, as of *Tricyrtis* and *Disporum*, with species, according to Dr. Wallich, also of *Uvularia*.

A species

A species of *Tofieldia, T. nepalensis,* is enumerated by Dr. Wallich in his Catalogue, No. 5097, as being found in Nepal. I have found the same plant (or at least one which is the same with the specimens in flower, and pasted on the same sheet with, but which may belong to a different plant from, those in seed), on Mussooree in flower in the rainy season, but it does not belong to this family. (v. *Ophiopogon.*) *Tricyrtis* and *Disporum* are Himalayan genera. The former, containing but one species, *T. elegans,* figured by Dr. Wallich in his Tent. Fl. Nep. t. 46, (*Compsoa maculata,* Don,) was found on Chundraghiry and Sheopore, in Nepal. It does not seem to extend further to the north-west.

Uvularia is a N. American genus, with some doubtful species in Japan, and others, which are referred both to it and to the genus *Disporum;* but this being little distinguished from *Uvularia,* all the species have been referred to the latter by Dr. Wallich; as *U. Hamiltoniana,* from the mountains of Silhet, Nepal and Sirmore; in the two latter also occur *U. umbellata* (*Streptopus peduncularis,* Smith), and *U. parviflora.* A species is likewise found on the Neelgherries. Professor Don is of opinion, that the Indian *Uvulariæ* are clearly referable to *Disporum,* distinguished by its baccate fruit, with the cells containing only one or two seeds. The sepals are also more or less calcarate at the base, and the inflorescence umbellate.

No other genera have as yet been found on the Himalayas, though among my drawings there is one of a plant which has all the characters of *Veratrum,* but of which the specimen has unfortunately been mislaid; but there is nothing improbable in the genus occurring there like so many other European, Caucasian, and Siberian genera.

The *Melanthaceæ,* though differing considerably in habit, resemble each other very closely in properties, for which some have been employed as medicines from ancient times, as *Colchicum autumnale* and *Veratrum album.* Others have been added in modern times, as *Veratrum Sabadilla* and *Helonias officinalis,* which yield the Cevadilla seeds of commerce; the former, those brought from the West-Indies, and the latter, the Mexican seeds, which are officinal in the London Pharmacopœia. In all, the alkali *Veratria,* remarkable for its acridity, is found. From irritating the pituitary membrane, and causing sneezing, it has been used as an errhine; and acting similarly on the mucous membrane of the stomach, it operates as a violent emetic and cathartic. But, like other violent acting substances, it may, in properly apportioned doses, be made useful as a medicine, and has been so, especially in gout and rheumatism. The χολχικον of the Greeks, as well as their εφεμερον, are thought by many to be species of *Colchicum;* the former, *C. autumnale,* and the latter, either *C. variegatum,* or *C. illyricum.* But other authors conceive that the *Hermodactyls* of old authors was either *Convallaria verticillata* or *Iris tuberosa,* &c. The Arabs usually confound them together; Serapion, however, treats of the two kinds in two different chapters; but Avicenna describes both under the name *sorinjan,* which is translated *Hermodactylus,* and for which *asaba* (finger) *hurmas* is occasionally given as a synonyme. In Persian works, we have *kulchikum, fuljikum* and *ekemaron* as the Greek synonymes of *sorinjan,* which are

are evidently corruptions of the above quoted names. Two kinds are described, *sorinjan tulkh* (bitter), and *sorinjan sheeren* (sweet), both of which I obtained in the bazars of Northern India, brought, I believe, from Surat or Bombay, and probably imported there from the Red Sea. Both kinds are species of *Colchicum*, which many may be surprised to find employed as medicines by the native practitioners of India.

Uvularia Leschenaultiana. Wall. Cat. N. 5089. Tab. 96. fig. 2. (*a*) Flower; (*b*) the same, with the segments (*c*) of the perianth removed; (*d*) a stamen.—Professor Don, however, being of opinion that all the Himalayan species of *Uvularia* belong to the genus *Disporum*, I subjoin his specific character in conformity to this view.

Disporum Leschenaultianum, umbellis sessilibus 3-5-floris, sepalis ovato-lanceolatis acutis basi gibbosis; antheris filamentis vix duplò brevioribus, stylo stigmatibus ter longiore, foliis ovatis subpetiolatis.

Hab. Mussooree.

178. PONTEDERACEÆ.

The *Pontederaceæ* form a small aquatic family, remarkable in habit, and to which are referred the genera *Heteranthera*, (in which is included *Leptanthus*,) *Pontederia*, and *Reussia*, found in the tropical parts of Asia and Africa, and extending in America from 30° S. to 40° of N. latitude. *Pontederia* is alone found in India. The most northern limit has not yet been ascertained; but two species, *P. sagittata* and *vaginalis*, are extremely common in 30° of N. latitude. These occur in places completely parched up in the hot weather, but which become inundated in the rainy season, and support these with many other such water-plants as can resist the changes of temperature, from the under-ground position of their root-like stems. The same two species are common also in the most southern parts of India. *P. plantaginea* appears to be very closely allied to, or only a variety of *P. vaginalis*.

179. TULIPACEÆ.

The group of plants comprehended under the term *Tulipaceæ*, are sometimes arranged as a separate family, either under this name, or under that of *Liliaceæ*. The latter, however, is often employed in a more comprehensive sense, as by Dr. Lindley, to include several families, as the *Tulipaceæ*, *Hemerocallideæ*, and *Asphodeleæ*, of other authors. Dr. L. remarks, "that nothing like a solid distinction, either in the vegetation or the fructification, can be discovered, by which the genera can be separated into distinct orders." In continuing the division into different families, I do so for the convenience of treating of their geographical distribution and uses.

The *Tulipaceæ* contain but few genera, but all are nearly equally well known from the highly ornamental nature of the majority of their species, which are found, though not in great numbers, in the temperate parts of the northern hemisphere. Species of most of the genera, as of *Tulipa*, *Lilium*, *Fritillaria*, *Lloydia*, and *Methonica*, are found in the Himalayan mountains. The last, usually known by the name *Gloriosa*, occurs only at moderate elevations, and is found also in the plains of India, as well as on the banks of the Senegal; but the perennial tuberous roots, with annual stems, enable the species to support great vicissitudes of temperature. *Tulipa*, *Lilium*, and *Fritillaria*, found

found in Europe, and the north of Africa, Persia, and Siberia, with the two last also in China, Japan, and N. America, and *Fritillaria* also in the mountains of Mexico, have all species in the Himalayan mountains. *T. stellata,* Hook. Bot. Mag. t. 2762, procured from Kemaon and the Suen range, is so closely allied to, as to have been mistaken for *T. Clusiana* by Dr. Wallich, Mr. Shepherd, and myself. The species, usually called Persian, are not known in India, even in a cultivated state, as *T. Celsiana,* sometimes called *Tulipa persica,* and *T. Gesneriana,* the common tulip, which is so extensively cultivated, and of which the name is said to be derived from a Persian name, *thoulyban,* hence originally *tulipan* in French. "It appears to have been brought to Europe from Persia by way of Constantinople in 1659," the course followed by so many other plants of the East. *Fritillaria,* like *Tulipa,* has species cultivated in our gardens, supposed to have been introduced from Persia through Constantinople, as *F. persica* and *F. imperialis,* the latter called *tusai* in Turkey, sometimes formed into a distinct genus (*Petilium*). Dr. Falconer has found it wild in the lofty shady forests of Cashmere. A species of this genus, sent by Mr. Moorcroft from near Ludak, and found by Mr. Inglis on the Boorendo Pass, is common in the Himalayas, at elevations of from 9,000 to 12,000 feet, as on Choor, Kedarkanta, and in Kemaon, where the mountains are covered with snow for half the year. This has been described by Mr. Don under the name *F. cirrhosa,* but is referred by Sprengel and Dr. Wallich to, and figured in the present work, Tab. 92. fig. 2, by the name of *F. verticillata,* Willd., a plant of Siberia, and the Altai mountains. But it is doubtful whether all included under this name belong to the same species; and Mr. Don thinks that my plant differs from that he described, which was found on Gossainthan, with *F. macrophylla,* Don; (*Lilium roseum,* Wall. Cat. No. 5077 *a.*) *F. Thomsoniana,* Tab. 92, fig. 1, is a new species from near Mussooree, differing from the genus in some points, and *F. oxypetala* is another species, found on Hurpoo and Shalma.

Lilium is most numerous in species in the Himalayas, where *L. giganteum,* Wall. Fl. Nep. t. 12 and 13; (*L. cordifolium,* Don, Fl. Nep. p. 52), the largest species, is found, and often attains a height of ten feet. The other species are *L. Wallichianum,* (*L. longiflorum,* Tent. Fl. Nep. t. 29, *L. japonicum,* Don, Fl. Nep. p. 52), and *L. nepalense,* which is the most common, with *L. polyphyllum,* from Taranda, in Kunawur.

Gagea, a genus, which extends from Europe into Siberia and the Altai range, has also a species, *G. elegans,* Tab. 95, f. 1, in the Himalayas, which is very closely allied to *G. lutea,* found in all the above localities. *Lloydia,* a genus, formed of *Anthericum serotinum* and *græcum,* found in Central Europe and the Mediterranean region, with the first species extending along Northern Asia to Arctic America, has also a species, *L. himalensis,* Tab. 93. fig. 1, which is very nearly related to *L. alpina,* and which I found in flower in the month of May on the very summits of Choor and Kedarkanta, just as the snow had melted. I obtained another species, *L. kunawurensis,* Tab. 93. fig. 2, from Chango, in Kunawur.

The *Tulipaceæ* have flowers often remarkable for their fragrant odour, but they are chiefly

chiefly distinguished for their mucilaginous properties, and for the secretion, in their bulbs, of fecula, which is accompanied by an acrid principle, easily dissipated by heat. *Lilium candidum*, the κρινον of the Greeks, thought by some to be *sosun* (*soucan*) of the Arabs, has alone been much employed medicinally, sometimes in its recent state in dropsy, but more frequently as an emollient cataplasm. *L. bulbiferum* is thought to be the *Hemerocallis* of Dioscorides. The bulbs of *L. Martagon*, thought by Fée to be the hyacinth of the ancients, are said by Pallas to be eaten by the Cossacks residing between the Volga and the Oural; as are also those of *L. kamtschatense;* so those of *L. Pomponium* and of *L. tigrinum* in China. The bulb-scales of *L. japonicum* dried, are said to be employed in China, like salep, in pectoral complaints. The bulbs of the Crown imperial are acrid and disagreeable, and said even to be poisonous.

FRITILLARIA.

1. *F. Thomsoniana*, caule multifloro, floribus erectiusculis, foliis elongato-linearibus acutis, bracteis lanceolatis scariosis, sepalis lineari-spathulatis obtusis longè unguiculatis, stylo subdeclinato ovario 5-plò longiore, stigmate tripartito, capsulis turbinatis obtusè 6-gonis.

Lilium roseum, β. Wall. Cat. n. 5077.

Hab. Neighbourhood of Mussooree.

Obs. Bulbus e squamis pluribus sublanceolatis acutis carnosis extimis marcescentibus membranaceis compositus. Semina aptera.

I have named this species in honour of my friend, Dr. A. T. Thomson, Professor of Materia Medica in University College, author of Lectures on Botany, 1822, from whom I received my first instructions in this science, and whose zeal in acquiring I ever found equalled only by his desire to communicate information.

2. *F. oxypetala*, caule unifloro, foliis lanceolatis obtusè acuminatis, flore erectiusculo, sepalis acutis unguiculatis, stylo subdeclinato ovarii longitudine, stigmate trifido.

Hab. Shalma.

LILIUM.

1. *L. polyphyllum*, sepalis revolutis unguiculatis glabris, stylo ovario duplò longiore, foliis lanceolatis acuminatis sparsis; floralibus verticillatis, caule subtrifloro.

Hab. Taranda, in Kunawur.

LLOYDIA.

L. himalensis, caule unifloro foliis radicalibus vix longiore, bracteâ flori approximatâ, sepalis spathulatis: nervis lateralibus ramosis, filamentis infernè magis dilatatis, stylo ovarii sublongitudine. Tab. 93, f. 2.

Hab. Kedarkanta, Choor, and Nako.

Obs. *L. alpina* a præcedente dignoscitur bracteâ a flore subremotâ, sepalis brevioribus obovatis, nervis lateralibus ramosissimis, filamentis basi minùs dilatatis, stylo ovario breviore.

L. kunawurensis, caule multifloro foliis breviore, bracteis remotis, sepalis oblongis: nervis lateralibus simplicibus, antheris subrotundis, stylo ovarii longitudine. Tab. 93, f. 3.

Hab. Chango, in Kunawur.

GAGEA.

G. elegans, scapo triquetro paucifloro foliis linearibus planis glabris breviore, bracteis lanceolatis acuminatis pedunculisque subvillosis, sepalis acutis, stylo staminibus parùm longiore. Tab. 95, fig. 1.

Gagea elegans. Wall. Cat. N. 5065.

Hab. Choor, Kedarkanta, &c. in the Himalayas.

I am indebted to Professor Don for the above specific characters.

180. HEMEROCALLIDEÆ.

The *Hemerocallideæ* of Mr. Brown are very closely allied to *Tulipaceæ*, and might be treated of as a section of that order. They nearly correspond with the sub-orders, *Agapantheæ* and *Aloineæ* of Endlicher, and are chiefly found in temperate, with some in hot parts of the world, as the west coast of Africa, the Cape of Good Hope, and South America; *Blandfordia* in New Holland and Van Diemen's Land; *Phormium* in New Zealand and Norfolk Island; while to the north we have *Funkia* and *Hemerocallis* in China and Japan, the latter also in N. America, and with *Czackia* in Europe. A few exist both in the plains of India and in the Himalayas. *Funkia* having the species *F. subcordata* and *F. ovata* in China and Japan, exists also in the Himalayas, as I find by an unpublished drawing, No. 290, of Dr. Wallich's, marked *Hemerocallis cordata*. *Hemerocallis* has one species, *H. flava* in Europe and Siberia; another, *H. fulva*, in China, but which is common in gardens in India, where it is called *jognae;* and a third in the Himalayas, *H. disticha* of Don (scarcely different, however, from *H. fulva*), obtained by Dr. Wallich from Gossainthan, and which I found on the northern face of Manma.

The genera usually placed in this family, and found in the plains of India, are, *Polianthes*, *Sanseviera*, and *Aloe*. The first is usually considered an Asiatic genus, but there are Mexican and Brazilian species; and Rumphius has suggested whether *P. tuberosa* itself may not have been introduced from the West Indies or S. America. It occurs in Mexico, according to Hernandez, (v. Salisbury, Trans. Hort. Soc. 1. p. 41.) The Tuberose is, however, most common in Asiatic gardens, and called by the Persians *gool-shubbo*, or night-flower: it was formerly called *amica nocturna* in Europe. Both the single and double varieties are common in gardens in India, Ceylon, and Java.

Sanseviera, placed with *Aloe* and *Yucca* in the group of *Aloineæ*, is a genus common to India and the west coast of Africa, found also in Java and China. *S. zeylanica* is the oldest and best-known species, so named from being first discovered in Ceylon. From it Salisbury has, apparently on insufficient grounds, distinguished *S. Roxburghiana* from the Peninsula and Bengal, figured by Roxburgh however, under the former name in Coromandel plants, t. 42. *S. lanuginosa, katu-kapel* of Rheede, Hort. Mal. xi. t. 42, is a third species found on the sands of the Malabar coast. All are closely allied to each other, and to the African *S. guineensis*.

Aloe is a genus containing numerous (nearly two hundred) species, which are almost entirely confined to the Cape of Good Hope; but, as in other families, we have a few extending beyond the limits of the majority of the species. *A. abyssinica* and *A. soccotrina* are found in the country and island from which they are named. *A. rubescens* and *arabica*, with Forskal's *A. inermis* and *pendens*, in Arabia. Besides these, he describes two species as common on the coast of Arabia, and both having *sibr*, the Arabic name for aloes, applied to them. One of these has yellow flowers, and is allied to, and may be identical with, *A. abyssinica*. Another has reddish flowers,

and

and is called *A. officinalis* by Forskal, which may be the *Aloe rubescens* of De Candolle. The former, *Aloe vulgaris*, with yellow flowers, has now been subdivided into two species; one *A. abyssinica*, and the other *A. barbadensis*, of which a variety is common in Italy, Malta, Spain, and the south of Europe, and which is supposed to have been introduced thence into the West Indies; as a yellow-flowered plant is cultivated there.

In India there are, no doubt, two species, one figured by Rheede, (Hort. Malab. ii. t. 3), *A. vulgaris* of De Candolle and Lamarck, with yellow flowers, and which may therefore be allied to, if it be not the same as the above, *A. barbadensis*. The other species, with reddish flowers, is common in dry situations in the north-western provinces of India, and which I named *A. indica*, and which, if known to Roxburgh, was probably included by him in the *Aloe perfoliata* of Linnæus, as was formerly the case with several species. Col. Sykes has also a drawing of a species from Bombay, which is very similar to that usually called *A. soccotrina*. *A. rufocincta* is another Indian species described by Haworth, but which he had not seen in flower. The Indian and Arabian species, though few in number, require careful revision from living, or very good dry specimens.

The plants of this group not being very closely connected in structure, cannot be expected to display any great correspondence in properties. The majority, however, are highly ornamental; *Polianthes tuberosa* is remarkable for the fragrance of its flowers, and Aloes for the bitterness of its juice. This, in an inspissated state, has long been employed as a cathartic medicine. It was known as such to Dioscorides, Galen, and Pliny, by the name *Aloe*, which is very like the Indian name *elwa* of this drug. It has no doubt been long an article of the Hindoo Materia Medica. By the Arabs, as Mesue and Avicenna, it has been described by the name *sibbur* or *sibr*, who give *fekra*, (an πικρος), as its Greek name, and state that the best kind is obtained from Socotra, with Dragon's blood. This is still the case, and Lieut. Wellsted informs us it is there called *tayef*. Some is probably prepared in Melinda, as also in Arabia, as Ainslie states that an inferior kind is brought to India from Yemen, but it may be first imported from the opposite coast of Africa. Some may be prepared on the west coast of India, as that which I procured in the bazars in Northern India, having some resemblance to Barbadoes aloes, is said to come from Guzerat; and Mr. Malcolmson informs me, that in Madras they procured their aloes from Bombay, and found an extract of it of excellent quality for hospital use; and also from Salem and Trichinopoly. Browne, in his Natural History of Jamaica, describes two kinds of aloes as made in that island, one of which they call *Soccotrine Aloes*, from being similarly prepared, being the gradually dried juice of the cut leaves. The second and more abundant kind is an extract made by boiling the leaves cut into pieces, with a certain quantity of water, which, when of a proper consistence, is poured into gourds. Nothing could be easier than to cultivate the best kinds of aloes in many comparatively barren parts of India, and to prepare aloes equal to the best procurable elsewhere.

Many plants of this family, like *Agave* and *Bromelia*, are remarkable for the tenacity of the fibre of their leaves. Thus, *Phormium tenax*, or New Zealand Flax, is well known

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as well for the great strength as the fineness of its fibre. It has been cultivated in New Holland, and might be so in North-western India, where *Yucca gloriosa* is quite at home. It grows well in Ireland, and also in the south of England, but the plants in the Apothecaries' garden at Chelsea were killed by the severe frost of Jan. 1838. *Sanseviera guineensis*, or African Bow-string Hemp, a native for a great extent of the western coast of Africa, has been proposed as a substitute for the former, and its fibre is stated to be of nearly equally good quality. This is confirmed by the nearly allied Indian species of *Sanseviera ; S. Roxburghiana*, (*S. zeylanica*, Roxb. Corom. Plants, t. 42), Sans. *moorva ;* Beng. *moorba* ; yielding it of a fine, and at the same time of very strong quality, fitted for bow-strings, fishing-lines, as well as for cordage, which indeed is made from it on the Coromandel coast. Dr. Roxburgh is of opinion, that the fine fibres, called China grass, are made from this plant, which he strongly recommends, as a profitable cultivation in sandy soils in Southern India; where the African *S. guineensis* would itself succeed well. I see by the proceedings of the Agricultural Society of India, that my friend, Mr. Greenlaw, Secretary to the Marine Board, states, that it is proposed to try the fibre of *S. Roxburghiana* on a large scale for ropes.

181. ASPHODELEÆ.

The *Asphodeleæ* are divided by Endlicher into the three tribes of *Hyacintheæ, Anthericeæ*, and *Asparageæ*, with some genera allied to each of these tribes, as well as to *Asphodeleæ* in general. Species of all three tribes are found within the limits of the Indian Flora. Some, frequently referred to in the works of Oriental authors, are either natives of the Persian region, as *Muscari botryoides* and *Hyacinthus orientalis ;* the latter found also in Barbary and the south of Europe, and abundant about Aleppo and Bagdad. This, as referred to as *zunbul-indi* in some European works, appears to be the plant mentioned in Persian works in use in India, by the name *soombul-farsee*. It would be extremely interesting to have genuine specimens of these, as well as of the Flora in general of Persia, to enable us to recognize many of the plants which were introduced into Europe by way of Constantinople during the middle ages.

Scilla, an ill-defined genus, has had several species separated from it. Dr. Roxburgh has described two plants, which he has referred to the genus, *S. coromandeliana* and *S. indica ;* the former is unknown, but is described by him as a native of the sand-hills of the Coromandel coast. It may be the same with *S. polyphylla* of Dr. Wallich, Cat. No. 5062, from the above locality. *S. indica* is mentioned as a native of the sandy shores of many parts of India. Dr. Wallich has inserted it in his Catalogue, No. 5062, by the name, *S. Cunária*, from Monghir, Saluen in Burma, and also from the Indian Peninsula, and which I have found at Rajpore, and in the jungles near Bihut, as well as in the Kheree Pass, in 30° of N. latitude. In most points of structure, this species agrees with *Scilla maritima*, now formed by Steinheil into a new genus, *Urginea* (*Squilla*, Lindley, Fl. Med.), with *Anthericum fugax*, &c.

Asphodelus fistulosus, grown in the Mussooree Experimental Garden from European seed,

seed, closely resembles *A. clavatus* of Dr. Roxburgh, common in fields of cultivation in the N.W. provinces, and, as far southwards, at least, as Allahabad, flowering in February. There is in the Himalayas a magnificent species, *A. pyramidalis*, nob., (allied to *A. albus*), which I obtained from Pungee, in Kunawur. My friend, Dr. Falconer, writes me, that he has met with a species of *Ornithogalum*,? which the Cashmerians call *Prusterien*, with a scape seven feet high.

In the Peninsula there are some species which have been transferred to various genera, as *Ornithogalum* and *Anthericum*, but which, by Dr. Wallich, are placed in *Phalangium*, as *P. alatum*, Cat. No. 5056, which extends into Lower Assam and up to Monghir; and *P. falcatum*, Cat. No. 5057, which seems to be confined to the Peninsula: with these may be mentioned a doubtful species of *Chlorophytum*, *C. Heyneanum*, Cat. No. 5060, found in the same part of India. *Chlorophytum* is a genus found in the south of Africa and in New Holland, to which Dr. Wallich has referred the foregoing plant, as well as another, which he has named *C. undulatum*, Cat. No. 5059, which is found in Silhet and Nepal. All the Peninsular species will, no doubt, be fully elucidated by Dr. Wight, and the others by Professor Don, who has kindly undertaken to describe those in my collection.

Allium is most widely-diffused, being found in Europe and the north of Africa, in the Syrian Region, in Siberia, China, and North America, and in the south at the Cape of Good Hope, and in Chili. The ordinary species are cultivated in the plains of India, as *Allium Cepa*, the onion; *A. sativum*, garlic; *A. Porrum*, the leek; *A. ascalonicum*, the shallot; together with Dr. Roxburgh's *A. tuberosum*, which he compares with *A. schænoprasum*, chives: some also in the mountains, as onions, which are particularly fine in Kunawur. In the Himalayas several new species have been found, as *A. leptophyllyum*, and a variety, or nearly-allied species, *A. lilacinum*, nob., on Mussooree. *A. Govanianum*, *cæruleum*, and *ellipticum*, which extend from Nepal to Sirmore, and are likewise found on such mountains as Urukta and Kedarkanta. The first, called *daona* by the natives, I have also obtained from the Broang Pass, as well as from Peer Punjal. A new species, *A. longistamineum*, nob., has been obtained from Nako, in Kunawur.

Of the tribe *Asparageæ*; *Dianella*, indigenous in Tropical Asia and New Holland, has the species, *D. nemorosa*, common in gardens in Southern India; but Dr. Wallich also enumerates some specimens, (No. 5169, Cat. p. 239) as obtained from Nepal. *Dracæna*, a genus, found in the islands of the Indian Ocean, and southwards in the Mauritius, New Holland, and New Zealand, extends northwards into China, and along the Malayan Peninsula into Chittagong and Silhet; where are found, *D. spicata*, *D. terniflora*, and *D. atropurpurea* of Dr. Roxburgh; and *D. ensifolia* of Dr. Wallich. *D. Heyneana*, Wall. Cat. No. 5151, may have been introduced into the Peninsula, as no locality is given in the Catalogue, nor in Dr. Rottler's Herbarium, where there are specimens apparently of this species. *Dracæna Draco* seems to be indigenous only in Socotra and the Canary islands; perhaps, also on the west coast of Africa.

Asparagus,

Asparagus, common in the temperate and subtropical parts of the Old World, has several species indigenous, both in the plains and mountains of India. *A. officinalis* is known only in a cultivated state, in India as in Europe, and is probably indigenous in the Persian region, as it is the *halyoon* of the Arabs, and *nakdoun* of the Persians. Some species are peculiar to the Peninsula, as *A. floribundus*, *divaricatus*, and *falcatus*, with *A. acerosus*, which occurs along the Malayan Peninsula, and to the eastward of Bengal. *A. racemosus* extends from the Peninsula to the plains of N. India, where it is common in jungles, and highly ornamental, as well as *A. adscendens*, which is indigenous in N.W. India, and extends for a few thousand feet up the Himalayas. *A. Curillus*, found by Dr. Hamilton, in Nepal, extends to Kemaon, and also to such mountains as Urukta, Manma, and Simla: allied to this is *A. filicinus*, nob., from the banks of the Jumna in the interior of the Himalayas. *A. gracilis* and *A. umbellatus*, nob., are likewise found in those mountains.

Many of the *Asphodeleæ* secrete in their bulbs, either volatile oils or acrid principles, and these being in greater or less proportion to the rest of the herbaceous portion, several species have been employed as condiments, or as medicines. Though in the parts of Asia earliest inhabited, the *Asphodeleæ* are less abundant, yet many are mentioned by the Persian writers on Materia Medica, in consequence probably of their being indebted for their information to the Arabic translations of Greek authors. The onion, garlic, and leek, called in Arabic *busl*, *som*, and *korras*, seem to be alluded to in the earliest parts of the Bible (Numb. xi. 12), as the names there used are very similar to these. All are cultivated in gardens in India, as well as *Allium ascalonicum* and *A. tuberosum*. The bulbs of *Allium leptophyllum* are eaten by the Hill people, and the leaves are dried and preserved as a condiment. *Muscari moschatum*, βολβος εμετικος of Dioscorides, is literally translated *busl-al-kue* by the Arabs. Squill has been most anciently and extensively employed, owing to the presence in it, both of a volatile acrid matter and a bitter principle, called *scillitin*: according to the dose squill may stimulate various functions, or act as an emetic. It is curious that in India a species very closely allied to the Mediterranean plant, and called *Scilla indica* by Dr. Roxburgh, is substituted for the *Urginea* or *Squilla maratima*, and *iskeel* given as its Greek name; the bulb is also used by weavers in preparing their thread. *Asparagus officinalis* contains a peculiar principle, which by Vauquelin and Robiquet was called *asparagine*: this has an especial direction to the urinary organs. The roots of *Asparagus racemosus* and of *A. adscendens* are both used medicinally in N. India: those of the latter, conical in form and semi-transparent, are considered a good substitute for salep.

Dracæna Draco, a native of Socotra and the Canaries, yields one of the kinds of dragon's blood, *dum-al-akhwain*; one sort, probably that in tears, still continues to be exported from Socotra, as is stated to have been the case in the time of the Arabs. *Xanthorrhæa hastilis*, or grass-tree of New Holland, appended to this order, yields a yellow gum-resin, which is sometimes imported into Europe.

182. PALMACEÆ.

182. PALMACEÆ.

Palms, important in the countries where they are indigenous, for their multiplied uses, have always been of particular interest to botanists from their peculiarity of structure. By Linnæus they were styled the Princes of the Vegetable Kingdom, and Endlicher calls the class, of which they form the only order, PRINCIPES. Palms, though they are not confined to, yet inhabit in the greatest numbers, the countries within the Tropics. In the southern hemisphere, "one species is found in New Holland, in 34° S. lat.;" but "in New Zealand, a species of *Areca* was observed by Sir Joseph Banks in about 38° S. lat.," which is probably near the limit of Palms in the southern hemisphere (Brown); while *Jubæa spectabilis* occurs in Chili. In the northern hemisphere species of *Sabal* extend from 29° to 41° N. lat. in America; and in Europe, *Chamærops humilis* is found as far as Nice, between 43° and 44° N. lat. In Asia they do not extend so far, the east and west direction of the mountains preventing their extension northwards. *Rhaphis flabelliformis*, with *Chamærops excelsa*, occurs in Japan, and *Phœnix dactylifera*, or Date-tree, is found in Syria, along the course of the Euphrates and Tigris; on the east, in the plains between Bagdad and Kermanshah, lat. 33° 9′; on the north, as far as Tekkred, lat. 34° 40′; on the west it extends to Palmyra, lat. 34° 20′; and from that to the Syrian coast of the Mediterranean. From local causes it does not flourish at Aleppo, but is found still further north at Smyrna, which is in lat. 38° 25′, and the most northern limit of the Date-tree.

Though abounding chiefly in hot and moist parts of the New World, they are probably of the greatest value when flourishing as they do in the arid parts of Africa and Arabia, as well as of Syria; though commonly found in the plains in these countries, they also occur in mountainous regions; as *Chamærops humilis* in the most northern latitude in Europe; so the lofty *C. Martiana* occurs in Nepal at 4,000 feet, and *Phœnix humilis*, nob., is common in the Kheree Pass, at 2,500 feet above the level of the sea, in 30° of N. latitude with *Pinus longifolia*, which is the only one of the *Coniferæ* found there at so low an elevation. So *Brahea* of Martius, the *Corypha dulcis* of Humboldt, occurs in the temperate parts of New Spain at about 4,400 feet, with oaks and pines; while *Iriartea* (*Ceroxylon*) *andicola* is found in the Andes of Peru, at an elevation of from 5,400 to 8,700 feet.

The celebrated Martius, who, in his splendid work on Palms, has so fully elucidated both the systematic and structural history of the family, was led to infer, that the number of species scattered over the face of nature will be found to amount to 1,000 or more, from having observed, when travelling in Brazil, that particular species scarcely extend beyond very contracted limits. The illustrious Humboldt is also of opinion that great numbers remain to be discovered, but as only 175 are at present known, of which 119 are S. American, 14 African, and 42 Indian, it does not even seem probable that the present numbers will ever be doubled. Schow has justly observed, that such Palm-forests as those of S. America are not frequent in other parts of the world.

world. Africa and New Holland appear less favourable to this family, in India we have several of the same species found in every part of that extensive empire. It does not, however, appear to be the general rule, that families of plants are distributed in equal numbers, in all parts of the world where the climate is favourable, but rather that they occur, for reasons we cannot explain, in the greatest numbers in some particular country or region; and yet have their representatives in the form of a few genera or species in other, and often very distant countries.

Palms, therefore, will no doubt continue to be found in the greatest numbers in the equinoctial parts of S. America and the tropical islands of Asia. In other parts of the world they are but sparingly distributed. *Thrinax* is found in the West Indies, and *Sabal* in N. America. On the west coast of Africa we have *Elæis guineensis, Metroxylon,* a *Corypha, Calamus,* and a species very nearly resembling the *Elate* or *Phœnix sylvestris* of India. *Hyphæne Cucifera* is found in Upper Egypt, and *H. coriacea,* like it having a dichotomous stem, in Melinda on the east coast of Africa, probably also in Madagascar, where *Drypsis* is likewise found. The other African Palms, as *Hyophorbe, Latania,* and an *Areca,* are found in the isles of Bourbon and Mauritius. In New Holland, where *Seaforthia* and *Livistona* are indigenous, Mr. Brown remarks that only six Palms have been found, and of two of these, including *Latania chinensis,* the fructification is unknown. He states it as remarkable, that no species of Palm has been found in South Africa, and that none were observed by M. Lechenault on the west coast of New Holland, even within the Tropic. He has further noted it as a remarkable fact respecting the geographical distribution of Palms, that *Elæis guineensis,* so common on the west coast of Africa, and *Cocos indica,* which is indigenous to the shores of equinoctial Asia and its islands, should be the only two species of an extensive section (*Cocoinæ*) of this order, that are not confined to America. The other African Palms are either confined to this continent or its islands, or exist also in India, but none of them have been observed in America, unless perhaps, *Elæis,* if *Alfonsia oleifera* of Humboldt should prove to be a distinct species of that genus.

The Palms which chiefly prevail in the tropical islands of Asia are *Cocos nucifera* and *Areca Catechu,* the Cocoa and Betel-nut Palms; *Arenga saccharifera* (*Saguerus Rumphii*), the *Anou* of the Malays; *Sagus Rumphii* (*S. farinifera,* Gærtn), the Malay Sago Palm; with *Borassus flabelliformis, Caryota urens, Corypha Utan,* and others, together with species of *Calamus,* out of which several genera have been formed. *Lodoicea Seychellarum,* or *Seychelle nut,* is confined to the Seychelle Islands, while *Zalacca edulis* extends from Java along the Malayan Peninsula to Tenasserim, and to the shores of the rivers Saluen and Attran, in Martaban.

Cocos nucifera, and *Areca Catechu,* are abundant in Ceylon, and in Bengal along the Ganges and Burhampootur, as well as also on the Malabar coast, where the common black pepper is usually trained on the latter, but neither of them flourish at any great distance from the sea. Of the Cocoa-nut Palm, Dr. Roxburgh states that several varieties, if not distinct species, are cultivated near the shores of India.

The genus *Areca* we have seen extend as far south as 38° lat.; and though *A. Catechu* is most abundant both in the islands and in India, *A. Dicksonii*, *A. triandra*, and *A. gracilis*, three of Dr. Roxburgh's species, are found, the first in the Malabar mountains, and the two latter in Chittagong. Colonel Sykes mentions an *Areca* in the Dukhun, which he considers to be *A. Catechu*. Besides these *Arecas*, there is in the eastern portion of Bengal *Harina caryotoides* (*Wallichia*, Roxb. Corom. Pl. 295; *Wrightia*, Fl. Ind. iii. p. 621), which is called *Chilputta* or *Bel-putta* by the natives of Chittagong. *Licuala* is a genus of Palms found in the Moluccas and in Java, but of which one species, *L. peltata* (Roxb.), occurs in the mountains between Chittagong and Burma.

Calamus is a genus, of which the species have little, if any thing, of the appearance of Palms, being usually remarkable for their weak and trailing stems, which often extend to a great length, and ascend the loftiest trees. They abound in the islands of the Indian Archipelago, as well as in the Malayan Peninsula; a few species are also found in Peninsular India, as well as in Tropical Africa. In India they chiefly abound in the forests of the districts of Chittagong, Lower Assam, and Sylhet, whence they extend along the foot of the Himalayas as far north as the Deyra Doon, where a species is found, which agrees well with the description by Dr. Roxburgh of his *Calamus Rotang*; but he states that he cannot take upon himself to quote any of the figures of Rumphius for the Indian plant, though, when full grown and divested of the sheath of the leaves, it resembles the common ratan of Malacca so much, that he has scarcely a doubt of their being the same. Until we are better acquainted with the Eastern, the Indian species may therefore be called *C. Roxburghii*.

In the Peninsula of India, *Bentinckia* is a Palm but little known; it was found by Dr. Berry on the Travancore mountains, and is known there by the Tamool name of *Condapanna*. *Caryota urens* is a splendid Palm, which Rumphius, l. t. xiv. p. 64, describes under the name *Saguaster major*, as being common in the Molucca islands, and which Dr. Roxburgh mentions as a native of the various mountainous parts of India, meaning, no doubt, of the Peninsula, where it is known by the Telinga name *Jeeroogoo*, and is the *Schundapana* of Rheede, Hort. Mal. i. t. 11. *Corypha* is found in Java, Bengal, Ceylon, as well as in the Peninsula of India; *C. umbraculifera* is the Talipat, or great Fan Palm of Ceylon; *C. Utan* is a native of the Moluccas (Roxb. Fl. Ind. ii. p. 178), and *C. elata* is a species indigenous in Bengal, and called there *bujoor* and *bujur-batool*. *C. Taliera* (Roxb. Corom. t. 255 and 256) is likewise a native of Bengal, as well as of the Coromandel coast, and is called in the former *Tali* and *Tara*; Dr. Roxburgh remarks, that except when in flower or in seed, this Palm is scarcely to be distinguished from *Borassus flabelliformis*. The latter is the Palmyra-tree of Europeans, and the *Tar* of the natives of India, which is common in the islands of the Indian Archipelago, as well as in the Peninsula and southern parts of India, whence it extends northwards along the Malabar coast, and is described as almost the only tree seen on the flatter alluvium near the sea in Guzerat; it may also occasionally be seen as far north as 30°, or near Saharunpore.

Though

Though Palms flourish most within the tropics, and few, as we have seen, extend beyond these limits, yet *Phœnix* is a genus which only attains perfection in northern latitudes, and refuses to flourish in the south. Thus, *P. dactylifera*, or the true Date-tree, forms the principal food of many of the Arabs, both in Arabia, Egypt, and the northern parts of Africa, whence it has been introduced into the south of Spain, and is cultivated at Bordighiera, in the south of France, on account of its leaves, which are sold at two periods of the year, in Spring for Palm Sunday, and in September for the Jewish Passover. It is common in Syria, and is the *Palm-tree* of Scripture; it was probably the Palm earliest known to the Greeks and Romans, and was emblematic of Judæa, as in the coin with the inscription of "Judæa capta." It is found in oases in the desert, as around Palmyra, supposed to have been so named, from Palma; that indeed seems only the oriental name translated, which is Tadmar, supposed to be a corruption of Tamar (from *Tamr*, a date), a city built in the desert by Solomon. From this it extends along the Euphrates to Bagdad and Bussora, and along the coasts of the Persian Gulf even to India, though it does not ripen its fruit well within the boundaries of the latter. By Mr. Gibson it is mentioned as being common from Chickly to Taptee, in Guzerat; and it was in a flourishing state in the Botanic Garden at Saharunpore. Other species are, however, indigenous to, and flourish in, almost every part of India, as *P.* (*Elate*, Lin.) *sylvestris, khujoor* of the natives, which may be seen in almost every part of India. *P. farinifera* is a dwarf species found in the south in sandy situations, at little distances from the sea, as near Coringa; while *P. paludosa* grows only in the Sunderbunds of the Ganges. These are, however, very moderate in stature, as is *P. acaulis*, another dwarf species, found in Behar, and which is very closely allied to, if, indeed, it be at all distinct from *P. humilis*, nob., which I found in the Kheree Pass, in 30° of N. latitude, and at an elevation of 2,000 feet, but where the climate is sufficiently modified by local causes, so as to allow of the growth of other tropic-like plants, but also with representatives of European genera, as a pine, *Pinus longifolia*, which is here found alongside of the Palm.

Chamærops humilis, often called *Palmetto*, as is sometimes the N. American *Sabal*, is common in Spain and Italy, as well as in the N. of Africa. *Chamærops Martiana* is a new Himalayan species of this genus, of a slender and elegant appearance, and forty or fifty feet high, which Dr. Wallich discovered in considerable abundance in Nepal, and thought it at first to be the Japanese *C. excelsa*, of Thunberg.

It has been said by Humboldt and Martius, that wine, oil, wax, flour, sugar, salt, thread, utensils, weapons, and habitations, are afforded by the Palms; they are therefore among the most useful and important of the plants in intertropical parts of the world. The young and tender leaves of several of the Palms, with their spathes, mild in taste and nutrient in nature, have been used as articles of diet. Thus, *Oreodoxa* (*Areca*, Jacq.) *oleracea*, or esculent Cabbage-tree, has the green top of its trunk eaten both raw and in a cooked state in the West Indies; so *Euterpe oleracea* and *edulis* are likewise eaten in Brazil; in the Old World, the top of *Caryota urens*, and the unexpanded terminal bud of the Cocoa-nut tree form a delicate article of food, so also, probably, do those of many

many other species, as of the *Neebong* and *Pacoo beendoo* in Sumatra (Marsden, p. 77); though in others the juices are too astringent to render them fit for this purpose. The sap of many species being very abundant, at the same time that it is mild, demulcent, and saccharine, is collected by the natives of different countries, by wounding the spathe, and drank in its recent state as a refreshing beverage: such is the case with the sap of *Cocos nucifera, Arenga saccharifera, Caryota urens, Borassus flabelliformis, Phœnix sylvestris,* and others, as well as with what is called the milk of the cocoa-nut. The saccharine principle is, however, so abundant in the sap of some species, that boiled down, it yields an excellent sugar, not to be distinguished from that of the cane, but which is commonly called *jaggery,* a name derived probably from the same source as *sugar. Arenga saccharifera* is in Java and Baleya employed in making sugar; its sap is boiled down to syrup, and then allowed to concrete, but it always retains some degree of moisture; the best is of a yellowish colour, but the inferior kinds, called *saccharum nigrum,* which are blackish-coloured, are commonly mixed with the muscovados of the cane. The sap of the cocoa-nut and of *Caryota urens* are also, in some places, boiled down for a similar product; but *Phœnix sylvestris* is the only one much employed for this purpose in India, as on the Coromandel coast, in Guzerat, and in considerable quantities, especially of late years, in Bengal, whence it has been imported into England. Dr. Roxburgh describes the juice as being extracted in the cold weather, and that each tree yields from 120 to 240 pints; every twelve pints or pounds is boiled down to one of *goor* or *jagari,* and every four of *goor* yields one of good powder sugar, so that the average produce of each tree is about seven or eight pounds of sugar annually. Date sugar, Dr. Roxburgh adds, is not so much esteemed as cane sugar, and sells for about one-fourth less; he states that at the time when he wrote, a hundred thousand hundred-weight of date sugar was made annually in Bengal.

The secretion of sugar being so abundant in the sap of some of these Palms, it would be interesting to ascertain to what purpose it is applied in the economy of the plant, whether going to its nourishment, or to the formation of other secretions, similar in nature, as, for instance, fecula, which is stored up in such large quantities in many of them, and in some of the same species which yield sugar. Sago meal, is obtained chiefly from *Sagus Rumphii* (*Sagus spinosus,* Rumph. i. p. 75), and is the kind which the Malays are said to prefer; granulated sago is made from *Sagus* (*inermis,* Roxb.) *lævis,* Rumph. i. p. 76. Pearl sago is said to be granulated and bleached at Singapore, where it is brought from the islands in which it is grown.

Arenga saccharifera (*Saguerus Rumphii,* Roxb.), *Gomuto* of Rumphius, i. t. 13, *Anou* of Marsden, and *Ejoo* of the Malays, also yields sago, as well as sugar, palm-wine, and black fibres for cables and cordage, all of which makes it highly valuable, and desirable for cultivation in low situations, near the coasts of India. *Caryota urens* yields, in India, farina, equal to the best sago (Roxb.); and *Phœnix farinifera,* a dwarf species of the genus found on sandy hills, at a short distance from the sea near Coringa, also contains farina in its stem, which is used as food by the natives in times of famine.

The

The constituents of the sap being such as may easily be made to undergo the fermentative process, we find that, instead of being boiled down to procure sugar, it is allowed to undergo the vinous fermentation, when it forms palm wine, often called *toddy*, from *tarree*. This being afterwards distilled, yields the spirit called *arrack*, from the Arabic *aruk*, the general term for spirit. The true Date-tree, *Phœnix dactylifera*, is the species which was first known in Europe to have been thus employed, but the fruit being injured when the sap is drawn off, it is probably less frequently so employed than others. In India, *Phœnix sylvestris* or *khujjoor*, commonly called the Date-tree, yields palm wine in great abundance, as does *Borassus flabelliformis*, the *tar* of the natives, whence *tarree*, which has been corrupted into *toddy*. It is called *Palmyra toddy* in Guzerat. *Caryota urens* yields an immense quantity of *toddy* or palm wine—Dr. Roxburgh states, at the rate of one hundred pints in twenty-four hours, during the hot season. *Arenga saccharifera*, so often mentioned, was called *Palma indica vinaria* by Rumphius; and *Metroxylon viniferum*, the *Raphia* of Pal. de Beauvois, has its specific name from yielding the same product on the coast of Africa.

Abounding in demulcent and saccharine juice, the fruit also contains the latter principle in some species, as in the Date, which being esteemed as one of the most agreeable, at the same time that it is one of the most nutritive of fruits, forms a considerable article of commerce from Africa into Europe. The fruit of other species, as that of *P. farinifera, humilis*, and *acaulis*, though small, is likewise eaten. *Zalacca edulis*, found in very different climates, has a pulpy and juicy covering to its seeds, which is much sought after and eaten by the Burmese. The fruit of *Borassus flabelliformis*, called *tur-gool*, is also eaten, as is that of *Chamærops Martiana* in Nepal.

Oil is also yielded by some of this family, but only by the tribe called *Cocoinæ*, which is distinguished by the originally trilocular putamen having its cells, when fertile, perforated opposite to the seat of the embryo, and when abortive indicated by foramina cœca. (Brown). Of these, the Cocoa-nut, *juoz hindee* or *nux indica* of Avicenna, is cultivated in many parts of the Indian islands, for the sake not only of the sap and milk it yields, but for the kernel of its fruit, used both as food and for culinary purposes, and as affording a large proportion of oil, which is burned in lamps throughout India, and forms also a large article of export to Europe. *Elæis guineensis*, or the Oil-palm, *Maba* of the natives of the Congo, and common all along the coast of Africa, and *Alfonsia oleifera*, a native of S. America, so nearly allied to the former, as to be thought identical by some authors, also yield oil. Wax, or rather a mixture of wax and resin, is another product, secreted on the outer surface of the stem, in the spaces between the rings resulting from the fall of the leaves, of *Iriartea* (*Ceroxylon*) *andicola*.

Besides these valuable products, almost every part of Palm trees is made use of in many countries; the stems for many of the purposes of timber, the leaves, especially those of *Corypha Taliera*, for writing on; of *Borassus flabelliformis*, for making punkhas; of *Corypha umbraculifera*, for thatching. Baskets, &c. are made with the leaf-stalks of the

the Date tree in Egypt; so, in India, baskets and boxes, mats and punkhas, are made with the leaf-stalks of the *Khujoor*, or *Phœnix sylvestris*. The fibres of the capsular covering of the cocoa-nut it is well known are extensively employed for cordage; so also are the black horse-hair like fibres, called *ejoo*, surrounding the petioles of the leaves of *Arenga saccharifera*, or the *Gomuto*, for cables and cordage. Canes and ratans, the stems of different species of *Calamus*, as of *Calamus Rotang*, *rudentum*, *verus*, and of others, form considerable articles of commerce. They are exported from the valleys along the foot of the Himalayas into the plains, though the species yielding them are not well known.

An astringent principle is secreted by several of the Palms, as even in the Date tree, where the spathes are employed as astringents by the Arabs, also in *Areca*, or betel-nuts, the *foful* of the Arabs, so much chewed with the leaves of the *Pan* (*Piper Betel*), and a little lime; the Malays chew sliced pieces of the nut of the Pinang, or *Areca oleracea*, with their betel. The nuts of *Areca Dicksonii*, *triandra*, and *gracilis*, are used in Silhet as a substitute for those of *A. Catechu*, as are those of *A. globulifera* in the Moluccas. The resinous reddish-coloured substance, called dragon's blood, *dum-al-akhwain*, we have seen, is produced in the isle of Socotra by *Dracæna Draco;* but in Sumatra and the Malay islands, varieties of a similar substance are yielded by *Calamus Draco*. An exudation of a resinous nature, called *mokul*, is stated by Arabian authors to be produced by the tree called *Doum;* but here the same name appears to be applied to very distinct substances.

Useful and important as are these Palms, their introduction into new situations may not readily engage the attention of cultivators, as they are of such slow growth, but as this objection applies equally to all trees grown for timber, it will be but of secondary consequence to those who look to the permanent improvement of their estates. For such purposes the Cocoa-nut and Areca-nut Palms are most important in the warm and moist parts of India, especially in the vicinity of the sea, but the other species of Palm, which have been mentioned, as yielding useful products, may be found equally suitable to different localities. The *Arenga saccharifera*, or the *Gomuto* of Rumphius, yielding palm-wine, sugar, sago, and fibres for cordage, is probably one of the most important, especially on wet and marshy grounds in southern latitudes; *Elæis guineensis*, or Oil Palm of the west coast of Africa, might no doubt be successfully grown on some of the coasts of India; *Phœnix farinifera* yielding farina fit for food, is suited to dry and sandy plains, while *P. sylvestris*, yielding sap and sago, succeeds well in almost every part of India.

183. JUNCACEÆ.

Juncaceæ, so named from *Juncus*, the Rush, have been considered as related both to petaloideous and glumaceous *Monocotyledons*; Mr. Brown has remarked, that they are intermediate between *Restiaceæ* and *Asphodeleæ*. Endlicher confines the true *Juncaceæ* to *Luzula*, *Juncus*, *Narthecium* and *Prionum;* considering the others, such as *Flagellaria*, *Xerotes*, *Kingia*, and others, as allied genera.

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The genera *Juncus* and *Luzula* are found in the cold and temperate parts of the northern hemisphere; a few species of the former occur in tropical regions, and of the latter in extratropical S. America. *Narthecium* is found in both Europe and N. America, and *Prionum* at the Cape of Good Hope. In the Himalayas, eight species of *Juncus* have been found, of these, *J. membranaceus*, and *J. leucomelas*, are new species from Pungee and Soongnum in Kunawur, and *J. leucanthes* from Shalma; *J. Donnianus*, nob., is a new species, allied to *J. articulatus*, from Mussooree, *J. concinnus* is common all along the Himalayas, as is, in moist situations, *J. glaucus*, a species of Northern and Central Europe. *J. bufonius*, common throughout the northern hemisphere, is found both in Kunawur, near Lippa, and on the southern face of the Himalayas, also in the plains of India, near Delhi, and along the Doab. *J. indicus* is another species which occurs in moist situations on the plains of India, and which I found near Hazaribagh.

The only species of *Luzula* is from Lippa in Kunawur, where *L. spicata* is found, a species of the mountains of the north of England, Scotland, and throughout Europe, reaching as high as 71° north latitude, and which likewise occurs in the Caucasus and Altai mountains; the present locality is 11° more to the south than any station previously recorded for this plant. (v. Prof. Don. Proceed. Linn. Soc. 1. p. 9.)

Flagellaria, of which the common species, *F. indica*, is found in Tropical Asia and New Holland, has this species in the Malayan Peninsula, and extending up to Chittagong and Silhet; a new species was found in Penang and Singapore by Dr. Wallich, and another, in Java, by Dr. Blume.

The *Junceæ*, or true rushes, are insipid and inodorous; several are employed for mechanical purposes only, as the common rush for making mats, baskets, and the bottoms of chairs, while the pith is employed for the wicks of rush-lights. *Juncus effusus*, which is the common European species, is, according to Thunberg, cultivated in Japan for making floor-mats; *J. glaucus*, a European species found in the Himalayas, and closely allied to *J. effusus*, might be employed for all the purposes of the common rush.

184. BUTOMACEÆ.

Butomaceæ, allied to the equally marshy *Alismaceæ*, contain but few genera; as *Hydrocleis*, in Brazil; *Limnocharis*, in the West Indies and equinoctial South America; with *Butomus* in the Old World. *B. umbellatus*, or Flowering Rush, the species best known, common in moist situations in Europe, extends also to the plains of India, where it was found near Bojpoor by Dr. Hamilton, subsequently as M. De Caisne has shewn me by M. Jacquemont in the North of India; by Dr. Falconer near Lodianah, and likewise in lakes, with *Villarsia nymphæoides*, in Cashmere. Another species, *B. lanceolatus*, Roxb. (*B. latifolius*, Don), is very common in the N.W. provinces of India, extending from the Turrai of Nepal as far as Saharunpore, where it flowers in the rainy season. *Limnocharis* is milky, and *Butomus* is acrid. Of the latter, the European species has been employed in medicine, and considered deobstruent.

185. ALISMACEÆ.

The *Alismaceæ*, like the foregoing order, consist of plants found in water, or in moist situations, and like them, both in temperate and tropical climates. *Alisma* and *Sagittaria*, well known European genera, are found in the hot parts, both of the Old and of the New World. *Damasonium*, Juss., has one species in Europe, and the other (*Actinocarpus*, Br.), in Eastern New Holland. *Alisma* extends from Europe to India, whence two or three new species are enumerated by Dr. Wallich, as having been found by Dr. Hamilton along the foot of the Himalaya. *Alisma Plantago* and *Sagittaria sagittifolia*, species common to Europe and N. America, I have obtained from near the Dul or Lake of Cashmere; the former also from the Deyra Doon and the Himalayas, while the latter is common in every part of India, and *S. obtusifolia* in the southern parts; where *S. cordifolia*, Roxb. (*Alisma Hamiltoniana*, Wall.), which I have obtained in the Deyra Doon, also occurs.

The Juncagineæ, sometimes separated into a distinct family, and placed near *Aroideæ*, are by many botanists considered only a section of *Alismaceæ*. Like these they are found, though sparingly, in marshy situations, in most parts of the world, *Lilæa* in New Granada, *Tetroncium* in the Straits of Magelhaens, *Scheuchzeria* in Europe and North America, but *Triglochin*, the most numerous in species, in all parts of the world. *T. palustre*, the most common species in Europe, is also the most widely diffused, being found in N. America, in Siberia, in the Altai Flora, in Kunawur, as well as within the Himalayas, on Kedarkanta: at least the species which I obtained from this locality, and named *T. himalense*, can scarcely be distinguished from European specimens of *T. palustre*.

The fleshy rhizoma of some species of this family is eatable, and one species of *Sagittaria* is said to be cultivated in China for food. (Lindley.) My friend, Dr. Falconer, writes me, that in Cashmere also, the natives collect the roots of a species of *Sagittaria*, and employ it as an article of diet, or as a substitute for salep. The rhizoma of *Alisma Plantago*, possessed of but little sensible property, has been vaunted both in Russia and in America for its sedative and antispasmodic powers, and as a remedy for hydrophobia, but its virtues have never been proved.

186. COMMELINACEÆ.

The plants of this family were placed in *Junceæ* by Jussieu, but Mr. Brown stating that they agree better with *Restiaceæ* in the structure of the embryo, and in their sheathing leaves, formed them into a distinct order. They are found abundantly in intra-tropical parts of the world, prevailing chiefly in the rainy season, which is well suited to their lax habit and delicate texture. Endlicher has briefly stated, that in the Eastern hemisphere they extend from the tropic of Cancer to 35° of S. latitude; but in the Western hemisphere, and the islands of Eastern Asia, they extend to 40° of N. latitude. They are abundant within the limits of the Indian Flora, and

extend

extend to the most northern parts, as 31° of N. latitude, from the prevalence there of the rainy season, and likewise to the Himalayas, where a few species are found during the same period of the year.

About fifty species, referred to the genera *Commelina, Aneilema, Tradescantia,* and *Cyanotis,* are enumerated as having been found in India; but from the imperfection of collections, there is great difficulty in identifying the recent with some of the earlier discovered species, so that all require the careful examination of any Indian botanist, who has opportunities of seeing them in a living state. In the northern parts of the Doab only a few species are found in the rainy season, and these appear to be identical with species indigenous in Bengal and the Peninsula, such as *Commelina communis, bengalensis,* &c., with *Tradescantia axillaris; Commelina obliqua,* Don, found in Nepal, occurs also at Mussooree, and a new species of *Tradescantia, T. radicans,* nob. In Nepal are also found *Aneilema hispida* and *radicans* of Don, with his *Cyanotis barbata.* This genus is distinguished by the outer sepals being connate at the base, the three inner petaloid, with the claws united into a tube, into which the stamens are inserted, and of the two ovules in each cell, one is erect and the other pendulous. *Commelina scapiflora,* Roxb., which appears to be *Aneilema longifolia* of Wallich Cat. No. 5213, extends all along the Himalayas from Silhet to Manma, and is also found in the Kheree jungle, as well as at Mussooree. As this plant does not agree with the character of any of the genera, I have formed it into a new genus, which, in conformity to the example of Dr. Wallich, in instituting his genus *Kurrimia,* I have named *Murdannia,* in compliment to Murdan Aly, a plant collector and keeper of the Herbarium at Saharunpore, who collected many of the plants described in this work, and who had acquired a remarkable tact and quickness in detecting new plants, as well as in remembering the characters by which genera and families are distinguished, so as to be able at once to arrange a new discovery in its appropriate place.

Commelina tuberosa is cultivated, and its tubers eaten by Chinese (Lour.); *Murdannia scapiflora,* mooslee seah, has some repute in Hindoo Materia Medica.

MURDANNIA.

Perigonii exterioris foliola 3 calycina persistentia, interiora 3 petioloidea, sessilia persistentia. Stamina 6, filamenta omnia barbata, apice in connectivum dilatatum, antheræ 3 fertiles loculis parallelis, 3 difformes cassæ.

M. scapiflora. Tab. 95, fig. 3.—Hab. Kheree jungle and Mussooree Hills.

187. NAJADEÆ OR FLUVIALES.

The *Najadeæ* or *Fluviales,* as they are called by different botanists, are aquatic floating plants; cellular in structure, and transparent in nature. They are grouped together from resemblance in general appearance, rather than from identity of character; neither are they very closely allied to any other order, except in some respects to *Aroideæ.* They are found in the current of flowing, or floating on the surface of stagnant water, and in æstuaries of the sea in all climates. The species found in India are one or two of each of the genera *Najas, Caulinia, Ruppia, Zannichelia,* with several species of

of *Potamogeton,* or Pond-weed. The last is extensively diffused throughout the world, the others are found both in Europe and N. America; but *Najas* in the former only. *N. dichotoma* is found in Bengal, *N. spinosa,* Wall. Cat. No. 5182, found by Dr. Hamilton at Paingti, to the east of Bengal, is very closely allied both to *N. major* and to *N. marina.* *Caulinia indica* is found as far south as Travancore; and a species, so named, but different from the Peninsular plant in Rottler's Herbarium, was found by Dr. Hamilton. The former may however be seen in the East-India Herbarium, Wall. Cat. No. 5189, but marked, apparently, by a change in the label *Chara hispida,* while this plant, or at least one of the same genus, is placed in No. 5183, and labelled *Caulinia indica.* *C.? composita,* Wall. Cat. No. 5184, found to the eastward of Bengal, occurs also as far north as Saharunpore, but its genus is still doubtful.

Species of *Zannichelia* are also found in India, as may be seen in the East-India Herbarium, No. 5185, procured by Dr. Hamilton from Onaula; and also, No. 5190, where it is mixed up with the plant named *Chara fœtida,* found near Pangri. *Ruppia* is also found within the limits of the Indian flora, as there are numerous specimens in Dr. Rottler's Herbarium, under the name, however, of *Zannichelia indica.*

Potamogeton, as mentioned, is the genus most numerous in species, and also most extensive in distribution, being found in the stagnant and running waters of hot, cold, and temperate parts of the world. Species of Pond-weed are found in every part of India, and some of the same species in the northern as in the southern parts of the country, as *Potamogeton tuberosum* and *P. indicum;* the latter of which, however, differs but little from the European *P. natans;* a second species is not to be distinguished from *P. marinum,* nor another from *P. rufescens* (*fluitans.*) *P. crispus* is found in the neighbourhood of Saharunpore, and *P. heterophyllus* occurs in the Himalayas, in the vicinity of Dhargaon, on the northern face of the Choor mountain, as well as in the plains of India. But all the species require examination and comparison with each other and with European specimens in every state.

The several plants of this family, bland in taste and mucilaginous in nature, are not possessed of any active properties which would make them useful as medicinal agents; but some of the Pond-weeds, especially *P. tuberosum,* called *suwal,* is much employed in North-western India in the process of purifying sugar.

188. PISTIACEÆ.

The small order of *Pistiaceæ,* called also *Lemnaceæ,* or the Duckweed tribe, contains but two genera, *Pistia* and *Lemna:* these are floating and stemless plants, and as simple in organization as the *Fluviales,* but in fructification they resemble *Aroideæ;* in fact, *Pistia* has the spadix of that order, but with only two flowers, and in the arrangement of Schott forms a tribe of that family. *Lemna,* which is considered as a reduced aroideous plant by Mr. Brown, is placed by Endlicher at the end of *Fluviales;* but the two genera are very closely allied, and form a very natural order, which will serve to connect others. It is curious that the Hindoos, who have shewn themselves in many

things

things an observant people, have, like Linnæus, seen the affinity of *Pistia* to *Lemna*, though the correct anatomy of these plants was known to neither; they call the former *pana*, and the latter *noonya pana*, or *small pana*. *Pistia Stratiotes* is found flourishing in the rainy season in every part of India, that is, from the Peninsula to the neighbourhood of Saharunpore, and is also said to occur in the West Indies.

Lemna, found in ditches and ponds in the cooler parts of the world, occurs also in similar situations in the cold weather months, both in the southern and northern parts of India. Three or four species have been described by Dr. Roxburgh; more will probably be found, and require a careful comparison with European specimens to ascertain their identity or difference.

189. AROIDEÆ.

The *Aroideæ*, named from the genus *Arum*, consisted until lately of only a few other genera, as *Caladium*, *Calla*, *Dracontium*, *Orontium*, and a few others, which have now been removed to different families. Schott having submitted the whole of the well-known species to careful revision, has, in the Meletemata Botanica, divided the old into a number of new genera, of which the names are adopted in this work. The *Aroideæ*, distinguished by having their flowers on a spadix, and supported by a spathe, have occasionally united with them, the genus *Acorus*, which has the scaly rudiments of a perianth, as well as *Pistia*, which is, in fact, a reduced aroideous plant.

Some of the *Aroideæ* are arborescent, or cling to trees by aërial roots, but the majority are herbaceous in nature, and loose in texture, with a colourless or milky, generally acrid juice. They abound in tropical parts of the world, but like many other families of such a distribution, a few species extend to higher latitudes both north and south, especially as they require only a few months to bring them to perfection. They are, moreover, furnished with tubers or rhizomes, which from their underground situation are easily able to bear the vicissitudes of temperature; thus *Arum maculatum* is found in every part of the British isles, and *Calla palustris* extends even to 64° north, where it inhabits moist situations in Southern Lapland. *Richardia* (*Calla*) *Æthiopica* is found at the Cape of Good Hope, and *Gymnostachys* in Eastern extratropical New Holland. In America, according to Humboldt, as quoted by Dr. Lindley, their principal station is on the submontane region between 1,200 and 3,600 feet of elevation, where the climate is temperate, and the rains abundant; in the Andes, *Pothos* (now *Anthurium*) *pedatus* and *P. quinquenervius*, are found at an elevation of 8,400 feet. In the Himalayas, *Pothos* (now *Scindaspus*) *officinalis*, extends to elevations of 2,000 feet in the Kheree Pass in 30° of N. latitude; and species of *Arisæma* are common in Nepal on Sheopore, &c., as well as on Mussooree, and other parts of the Himalayas, at 7,000 and 8,000 feet of elevation, but chiefly in the rainy season.

The species found in the plains of India, and chiefly in the southern parts, have been formed into the genera *Cryptocoryne* (including the Indian species of *Ambrosinia* of Roxburgh), *Typhonium* (*Arum trilobatum*, *orixense*, &c.), *Amorphophallus* (*Arum campanulatum*),

panulatum), *Homalonema* (*Calla occulta* and *aromatica*) also *Pothos scandens*, with many species formerly of that genus, which have now been transferred to *Scindaspus;* and also *Lasia*, which includes *L. aculeata*, Lour., and *Pothos heterophyllus* of Roxburgh. The species of *Colocasia*, including *Arum Colocasia* and *nymphæifolia*, are cultivated in every part of the plains of India, as well in the north as in the south; and *Amorphophallus* extends in a wild state even as far north as the Kheree jungle. *Remusatia* (*Arum*, Roxb.) *vivipara*, stated by Dr. Roxburgh to be a native of Malabar, exists also in Nepal, having been introduced by Dr. Buchanan from the latter into the Calcutta Botanic Garden, where it produced annually in the rainy season abundance of the bulbiferous radical spikes, by which the plant is readily propagated. I have seen it in the same state at Mussooree in the rainy season, and afterwards producing the leaf of an *Arum;* Dr. Buchanan describes it as bearing in Nepal the common flower of the genus.

In the Himalayas the different species of *Arum* obtained from Nepal, and described chiefly by Dr. Wallich in Tent. Fl. Nep. and Pl. As. Rar., have been formed into the genus *Arisæma*; *Arisæma multicarinatum*, Wall. Ic. ined. 1180; an *Arum costatum* Fl. Nep.? extends also to the Suen Hills. *Arum guttatum* is now *Sauromatum*, and *Thomsonia Nepalensis* is formed, with *Arum bulbiferum*, into the genus *Pythonium*, and is found as far north as Nagkanda, and about an elevation of 8,000 or 9,000 feet. Some other species of the genus, as *A. hastatum* and *insignifolium*, and others, are found at Mussooree. A species of this family is cultivated in almost every part of the hills, and appears to belong to the genus *Colocasia*, but my specimens are imperfect.

Acorus, sometimes formed into a distinct order, called *Acoraceæ*, is at other times united with, and forms a section of, *Aroideæ*. The species are few in number, but widely diffused. *Acorus Calamus*, the best known, like many other aquatic plants, occurs both in Europe and India. I have found it in many places in the Himalayas, it was found in Nepal by Dr. Wallich, Rheede figures it from the Malabar coast. It has been supposed by many to be the *Calamus aromaticus* of ancient Materia Medica, but without sufficient consideration, as the two are described separately by Dioscorides, and Arabian authors give *akoron* as the Greek synonyme of *wuj*, which is the *buch* (Sanscrit *vucha*) of the Hindoos. Under this name I obtained the roots of this plant, which continues, on account of its aromatic qualities, to be extensively employed in Eastern medicine, and which I frequently prescribed successfully to natives in India, in conjunction with bitters, especially the seed of *Cæsalpinia Bonducella*, as a cure for the ordinary agues of the country.

The *Aroideæ* abound in an acrid principle, which is volatile in nature, and therefore dissipated by heat; being soluble in water, it is also removed by washing, and easily separated from the fecula with which many of their tuberous roots abound. Hence several have been employed as articles of diet from very ancient times, as *Colocasia antiquorum*, mentioned by Herodotus and Theophrastus, and remarkable as an Indian plant, cultivated in Egypt, and now in most parts of the south of Europe. The roots are without acrimony, as is the case with many other long cultivated plants. They are universally

universally cultivated in India, and known there under the names of *kuchoo* and *gaglee*. *Arum nymphæifolium*, which Dr. Roxburgh considers only a variety of *C. antiquorum*, is but rarely cultivated in Bengal. *Arum indicum*, *man-kuchoo* and *man-guri* of the Bengalese, is a species much cultivated about the huts of the natives for its esculent stems and small pendulous tubers. *Arum campanulatum*, now *Amorphophallus*, Ol of the Bengalese, and which deserves to be called the *Telinga potato*, is also much cultivated, especially in the northern Circars according to Dr. Roxburgh, where it is highly esteemed for the wholesomeness and nourishing quality of its roots. In the Himalayas, the species which I have called *Colocasia himalensis*, forms the principal portion of the food of the Hill-people; so *Colocasia macrorhizon* and *esculentum*, forming the *Tara*, *Taka*, *Taya*, and *Kopeh*, and cocoa-roots, eddoes, and yams, of the Pacific and other islands, yield a considerable portion of the food of the inhabitants. The stalks and leaves also of some of the species are eaten in many places; those of *Arum sagittifolium* are said to be called *chou Caraibe;* so also in the south of Europe, *Arisarium vulgare*, and *A. Dioscoridis*, which is perhaps only a variety of *A. italicum*, are occasionally eaten; but even *Arum maculatum*, and other acrid species, deprived of their acridity, are sometimes made to yield food in times of scarcity. Some of these, however, from their acridity and irritating nature, have been used as vesicatories, *Arum maculatum* has been used medicinally even from the time of Hippocrates; *Typhonium orixense* having exceedingly acrid roots, is, when fresh, applied in India by the natives in cataplasm, to discuss or bring forward tumors; Dr. Roxburgh pronounces it to be certainly a most powerful stimulant; other species are likewise employed, as *A. montanum*, Roxb., (*macrohizon*, Ainslie). The plant called by the latter *Dracontium polyphyllum*, is exhibited internally when its acrimony has been subdued, it is considered antispasmodic, and is also said to be useful in asthmatic cases. An emmenagogue is said to be prepared from it in the Society Islands. *Scindaspus officinalis*, *guj-pippul* of the natives, forms an article of considerable repute in Hindoo Materia Medica; it is described as acrid, diaphoretic, and anodyne, but the statements of authors differ on the subject.

190. TYPHACEÆ.

Typhaceæ, or the Bull-rush tribe, are sometimes united with *Pandanaceæ*, and sometimes made a section of *Aroideæ*, but are now kept separate from both by most botanists. They are found chiefly in the marshes and ditches of the temperate parts of the northern hemisphere, but like many other aquatic plants, they occur also in various parts of the world. *Typha*, common in Europe and N. America, is found also in the West Indies, S. America, and N. Holland. *T. elephantina*, and the species, which Dr. Roxburgh identifies with the European *T. angustifolia*, are found in the most southern, as well as in the northern, parts of India, the latter species is found in Siberia, in the Tauro-Caucasian region, and also in New Holland; Mr. Brown inquires whether it be identical with the species found in St. Domingo. *Sparganium* is found in most parts of the world, as in Europe, N. America, and New Holland, (indeed, the same species,

S. angustifolium,

S. angustifolium, occurs both in N. America and in New Holland). It had not hitherto been found within the limits of the Indian Flora; but my friend, Dr. Falconer, writes me that he has found a species in Cashmere, which he has named *S. carinatum*.

The pollen of *Typha* being abundant, is collected and made use of as an application to ulcers. Mr. Salisbury recommends the leaves of *Typha latifolia* as a substitute for rushes, in making matting, baskets, &c., those of *T. elephantina* (*putera*), and of *T. angustifolia* (*reree*), are employed in Northern India for making mats.

191. PANDANACEÆ.

The *Pandanaceæ*, or Screw-pine tribe, have been well described by Dr. Lindley, as having the aspect of gigantic Bromelias, and bearing the flowers of *Sparganium*, hence they are often combined with *Typhaceæ*. Mr. Brown has remarked, that they have no affinity with Palms beyond their arborescent stems. *Pandanaceæ* are remarkable for their dichotomous branching, as well as for the spiral arrangement of their leaves, whence their English name. The order includes the genera, *Pandanus* and *Freycinetia*, to which the American intratropical *Cyclantheæ* and the Peruvian *Phytelephas*, with the Asiatic Palm-like *Nipa*, have been added by Endlicher as allied genera. Species of *Pandanus* are found in the southern parts of India, as *P. furcatus* in Malabar and Chittagong, extending from the latter place to Pegu, while *P. fœtidus* is common in Bengal, near Calcutta. *P. odoratissimus* is the best known species, but being so much esteemed and cultivated by Asiatics, it is difficult to ascertain where it is indigenous; it is universally diffused in the Indian islands, in China and Arabia, also in gardens in every part of India, but it occurs most abundantly and apparently wild in the southern parts, as in the Peninsula of India, where it is called the Kaldera bush.

A knowledge of the uses of *Pandanaceæ* is derived in a great measure from *Pandanus odoratissimus*, but other species must be available for the purposes for which this is employed, as for hedges, though it takes up much room. The terminal bud, as is the case with that of some of the Palms, is eaten under the name of cabbage; the tender white base of the leaves is also eaten raw, or boiled, during famines. The leaves are composed of tough longitudinal fibres, white and glossy, which enables them to be employed for covering huts, making matting, as well as for cordage in the S. Sea Islands, and in Mauritius, for making sacks for coffee, sugar, and grain (v. Fl. Ind. iii. p. 741); matting, as well as the common kind of umbrellas, are made of them in the Peninsula of India. The branches being soft, spongy and juicy, are eaten by cattle when cut into small pieces; the fusiform roots are composed of tough fibres, which basket-makers split and use to tie their work with; they are also so soft and spongy, as to serve the natives for corks.

Pandanus odoratissimus, derives its specific name and its great celebrity among Asiatics, and especially the Sanscrit poets, from the rich and powerful fragrance of its flowers; Dr. Roxburgh states, that it is the tender white leaves of the flowers, chiefly those of the male, that yield that most delightful fragrance, for which they are so

universally

universally and deservedly esteemed; it is the *Ketaka* of Sanscrit poets, and the *Keora* and *Ketgee* of the Hindoos; it is known to the Arabians by the name *Kazee*, and is the *Armak* of Avicenna. Oil, impregnated with the odour of its flowers, and the distilled water, are called *dohn-al-kazee* and *ark-keora;* both are highly esteemed as stimulants and antispasmodics, and as cures for head-aches, rheumatisms, &c. The fruit of some of the species is described as being eatable, and one is figured in As. Res. iii. p. 161, under the name of *Mellore*, or Nicobar bread-fruit. Dr. Roxburgh specifies the lower pulpy part of the drupes of the *Keora* as being sometimes eaten by the natives of the Peninsula in times of scarcity. The seeds also are said to be eatable, and are occasionally employed for making rosaries.

192. XYRIDEÆ.

Xyrideæ, by some botanists united with *Restiaceæ*, and by others separated into a distinct family, distinguished by their petaloid perianth, and polyspermous fruit, are found in the tropical parts of America, with a few species of *Xyris* in the southern states of North America, also in New Holland both within and beyond the Tropics. The Asiatic species are few in number, and found in India, chiefly in the Peninsula, also in Ceylon, whence *Xyris indica*, and *pauciflora*, extend into Bengal, and from Tavoy to Silhet; and thence, *X. pauciflora*, which, according to Mr. Brown, is found in Tropical New Holland, extends to Nepal, where a new species, *X. schænoides*, also occurs.

Xyris indica, found both in the Peninsula and Bengal, is considered an easy, speedy, and certain cure for ringworms (Rheede): the leaves and root are employed against itch and leprosy (Agardh).

193. ERIOCAULONEÆ.

The *Eriocauloneæ* are, like the *Xyrideæ*, sometimes treated of as a separate family, and sometimes united with *Restiaceæ*. Like the *Xyrideæ*, they occur in tropical America, New Holland, and India, and are found in the islands of Madagascar, and Mauritius; but, like other plants of moist situations, they extend to much higher latitudes, being found in 44° of latitude in N. America, and also in the island of Skye, on the west coast of Scotland. About twenty species are found within the limits of the Indian Flora, chiefly in the Indian and Malayan Peninsulas, extending from the latter into Silhet and to Cheriponjee, on the Jentya Hills, and from that to Nepal; where are found *Eriocaulon oryzetorum, quinquangulare*, and *xeranthemum*. *E. hexangulare* (*Leucocephala*, Roxb.), extends from Ceylon and the Peninsula, also Tavoy and Silhet, as far north as Saharunpore, where it is found in moist situations at the end of the rainy season. *E. Sollyanum*, nob., is a new species from Cashmere, and is allied to *E. luzulæfolium*, Wall. Cat. 6071, which is found on the Jentya mountains.

194. RESTIACEÆ.

Restiaceæ, allied both to *Junceæ,* and *Commelineæ,* resemble *Cyperaceæ* in habit. *Eriocaulon* and *Xyris,* are also sometimes included in *Restiaceæ,* though both now give their names to orders, but the former is still considered by Dr. Lindley as belonging to this. The true *Restiaceæ* are found at the Cape of Good Hope, and in New Holland, as well as in Van Diemen's Land; they are of little use, except that the tough wiry stems of some species are manufactured into baskets, and those of others, as *Willdenowia teres,* for making brooms. *Restio tectorum* is employed at the Cape of Good Hope, both in town and country, for thatching, and sometimes whole huts are built of it. A roof thatched with it will last twenty or thirty years, and it is said would last much longer, if the S.E. wind did not blow dirt into it, which causes it to rot; it seems well worthy of introduction into India, where the thatch is of so perishable a nature.

195. CYPERACEÆ.

The *Cyperaceæ,* so named from *Cyperus,* are, in many respects, allied to Grasses, which they resemble in general appearance, as they also do, *Juncaceæ* and *Restiaceæ.* The Sedges, as they are called in English, may be easily distinguished from Grasses by their stems, being solid, angular, and without any separation at the joints, and by the sheaths of their leaves being entire. Professor Nees von Esenbeck, who has paid such great attention to this order, and defined the genera both fully and clearly, has been good enough to examine the *Cyperaceæ* in my collection, as may be seen in the "Contributions to Indian Botany," by Dr. Wight, where will be found described the greater portion of the Indian *Cyperaceæ,* or those contained in the collections of Drs. Wallich and Wight, as well as those in that of the Author. But the localities which are given to the species in the latter are all incorrect, inasmuch as none were obtained from Nepal, but all from the plains of N. Western India, or from that portion of the Himalayan mountains between the Ganges and Sutlej rivers.

The *Cyperaceæ* are found in wet or moist situations in all parts of the world, whether tropical or polar, as well at the level of the sea as on the tops of mountains: so in India we find them wheresoever there is moisture, both in the hottest parts of the Peninsula and the elevated gorges of the Himalayas, and in either situation several of the same genera and species are found as occur in other parts of the world, where there is similarity of climate.

As in other families, some of the genera of Indian *Cyperaceæ* consist, of only single, or of very few species, and are found only in the hot parts of India; such are *Courtoisia, Anosporum, Hemicarpha, Chætocyperus, Echinolytrum, Malacochaete, Hymenochaete, Limnochloa, Morisia, Cephaloschænus, Cylindropus,* and *Hypoporum;* of these the last is found also in Silhet. *Malacochaete* and *Limnochloa* extend as far north as Saharunpore, and *Morisia* is found in Nepal. With these are also found genera which occur in other tropical parts of the world, as *Diplacrum,* which is found in Ceylon, the Moluccas,

and

and New Holland; *Scleria* and *Remirea* in the intratropical parts, both of the New and the Old, with *Lipocarpha* and *Hypolytrum* in those of the whole world; *Eleogenus* and *Haplostylis* in the hot parts, both of America and Asia. The genera *Fuirena*, *Fimbristylis*, and *Trichelostylis*, as well as *Isolepis* and *Eleocharis*, are found in tropical parts of the world; but all have species in the southern hemisphere, as in New Holland; *Fuirena*, *Trichelostylis*, and *Isolepis*, at the Cape of Good Hope, and also in the northern hemisphere; as all, except *Trichelostylis*, extend into the warm parts of N. America. One species of *Fuirena*, *F. annua*, is found in the S. of Europe, and species of *Isolepis*, *Eleocharis* and *Eleogiton*, (*E. fluitans*, Link.), in the British Isles; so *Rhynchospora*, which has a few species in the southern provinces of the United States, with two in Europe, has also one species in the Himalayas; and that a species (*R. chinensis*), which has also been found in China.

The genera *Scirpus* and *Carex* are the most numerous in species, and are also the most widely diffused, being found in marshy situations, both in hot and cold parts of the world, as well within the tropics as in high latitudes; so do we find species of both genera, as well in the plains as in the mountains of India, and in the Himalayas we have some species which are also found in Europe and America.

Many species of genera which delight only in hot and moist climates are, as we have seen in other families, found in the Himalayas in the rainy season, as species of *Cyperus*, *Mariscus*, *Kyllingia*, *Lipocarpha*, *Fimbristylis*, *Trichelostylis*, *Isolepis*, *Scirpus*, *Eleocharis*, and *Hypoporum*. *Eriophorum* is a genus of which the species are found in Europe and N. America, and one, *E. comosum*, is extensively distributed in the Himalayas, both in low valleys and on elevated mountains, as well as in Kunawur. *Dichostylis Micheliana*, found in the S. of Europe and N. of Africa, extends also to Delhi, in the north-western part of India. *Uncinia* and *Trilepis*, genera with the habit of *Carex*, have each a species in the Himalayas, *U. Nepalensis*, being found in Nepal, as well as in Kunawur; *Trilepis Royleana* in Chango, and Lippa in Kunawur; and the only other species, *T. Lhotzkiana*, is found in the mountains of Brazil; and *Kobresia*, a genus of the mountains of Europe, has a species, *K. laxa*, in Kunawur, found at Rogee and Nachagaon.

The *Carices*, in the Author's collection, described by Professor Nees von Esenbeck, have also been examined by Dr. Boott, who is so well acquainted with the genus. He states that, including the four undescribed species in the E. I. Herbarium, fifty-two species of *Carex* have been found in India; of these seventeen are found in each of the collections made by Drs. Wallich and Wight, and by myself; eleven occur only, in Dr. Wallich's, and five are peculiar to that of Dr. Wight, while twenty belong exclusively to that of the Author, making in all thirty-seven species, all of which were found in the Himalayas, and none in the plains of India. Among these are three which are common to Europe and India, being the only ones yet found in that country which are identical with European species: these are, *C. paludosa* and *C. remota*, found in the Himalayas; the latter also in Kunawur. *C. Vahlii*, obtained from Pungee, in Kunawur,

 differing

differing somewhat from Scotch specimens, but agreeing with those from Arctic America and the Altai mountains. This plant has been omitted by Nees von Esenbeck, but may have been referred, Dr. Boott supposes to *C. infuscata.* As the habitats are incorrectly given in the work of Dr. Wight, it may be stated here that *C. trinervis, parva,* and *Victorialis,* are from Manma, *C. obscura,* from Shalma, *C. punctata,* (*Benthamiana,* Boott.) from Urukta, *C. asperula,* from Choor, *C. nubigena,* and *psychnophila,* from Kedarkanta, *C. lachnosperma, cardiolepis, fusiformis, longicruris, notoleia, myosurus, indica, condensata, meiogyna, cruciata, ligulata,* and *Wallichiana,* from Mussooree, and the neighbouring mountains.

As has been said of the genera, so it may be observed respecting the species of *Cyperaceæ,* that some are found only in the southern parts of India, whilst others are common there as well as in the most northern parts of the country, as *Cyperus mucronatus, aristatus, Haspan, hexastachyus, tenuiflorus, Iria,* and *distans, Mariscus paniceus, cyperinus, umbellatus,* and *dilutus, Kyllingia monocephala, Abildgaardia Rottbolleana, Fimbristylis pallescens, Trichelostylis tetragona, quinquangularis,* and *chætorhiza, Isolepis supina,* and *barbata, Malacochaete pectinata, Scirpus affinis,* and *Javanus, Eleocharis palustris, Limnochloa plantaginea,* &c. Some of the Peninsular species of *Carex* I have only found in the Himalayas, with *Cyperus sanguinolentus, niveus, aristatus,* and *tenuiflorus, Mariscus cyperinus, Kyllingia monocephala,* and *triceps, Lipocarpha lævigata, Fimbristylis schænoides, Trichelostylis junciformis,* and *Scirpus maritimus.*

Besides the above species which occur throughout India, others are common to India with other parts of the world, as *Cyperus pectiniformis,* and *Iria, Mariscus cyperinus, Kyllingia monocephala, Fimbristylis bispicata, podocarpa, tomentosa,* and *diphylla, Isolepis squarrosa,* and *barbata, Rhynchospora chinensis, Haplostylis Meyenii, Trichelostylis miliacea,* and *complanata,* which are also found in China, and some of them in the Indian tropical islands: the last found also at the Cape of Good Hope, and at Acre and Bahia; while others occur also in New Holland, as *Cyperus hexastachyus, venustus,* and *difformis, Fuirena pentagona, Isolepis setacea,* and *supina, Eleogenus capitatus,* with some others.

So the genus *Papyrus,* of which *P. antiquorum* is so celebrated, as having been employed by the ancient Egyptians to make paper, is common to India and Egypt; as are also *Cyperus mucronatus,* and *C. difformis,* which extend even to the S. of Europe; and in Bengal and the Peninsula we have *Papyrus Pangorei,* and *corymbosus. Isolepis setacea,* a European species, occurs also in the Himalayas, as well as *Scirpus maritimus,* which is also found in Africa and America; but several species are common to India and the New World, and of these a few are also found in Africa, as *Cyperus polystachyus, compressus, Haspan, articulatus* and *distans, Fimbristylis ferruginea, Trichelostylis complanata, Eleogenus capitatus. Eleocharis uniglumis* is found in Germany and in N. America.

The *Cyperaceæ,* though so closely allied to the Grasses, differ from them much in utility, inasmuch as the order contains but few plants which are of any importance, and of these the value depends, upon the presence of mucilage and fecula in the roots of

of a few species, accompanied in others with a little bitterness, and some aromatic principle. On this account the tuberous roots of *Cyperus longus*, or Sweet Cyperus, a native of Europe, have long been employed in medicine, and accounted aromatic and stimulant; they are supposed to be the κυπειρον of Hippocrates and Dioscorides, though in the present day less employed in medicine, than by perfumers on account of their fragrance. It is remarkable that a nearly allied species, *C. hexastachyus*, Rottb., is used for the same medicinal purposes in the East; a correspondence in the employment of similar plants, of which we have many other instances, and which we cannot believe to be accidental. In *C. hexastachyus* is now included *C. rotundus* L, of which the tuberous roots are sold in bazars in India, and used in medicine by the name *motha* and *nagur-motha;* for these *sad* is given as the Arabic, and *funarus* as the Greek synonyme; the former is evidently the *sad* of Avicenna, chap. 128, and the latter κυπειρος of Dioscorides, lib. 1. c. iv., where it is arranged with the other aromatics known to the ancients. Both these authors mention an Indian *Cyperus*, resembling ginger in appearance, but which turns the saliva yellow, and is therefore most probably *Turmeric*, which we do not find elsewhere described by Dioscorides. The Indian *Cyperus* is used in medicine as a tonic and stimulant, and was employed in the treatment of cholera morbus (v. Hardwick); Dr. Roxburgh states that hogs are remarkably fond of the roots, and that when dried and powdered, they are used as a perfume at the weddings of the natives. Gen. Hardwick (Cal. Med. Trans. 11. p. 399) describes the species called *nagur-motha* by the natives in Bengal, *C. pertenuis*, Roxb., closely allied to *C. hexastachyus*, as having its aromatic roots employed for perfuming the hair. The roots of *Kyllingia monocephala* being fragrant and aromatic, are also used as substitutes for those of the *Cyperus hexastachyus*, and are sometimes called by the same name *motha*, and likewise accounted an antidote to poison. The roots called *kuseroo* of a *Cyperaceous* plant, are considered edible in North-western India, they are probably those of *Scirpus kysoor*, of Roxb. Fl. Ind. i. p. 230.

The roots of *Cyperus stoloniferus*, are described by Dr. Ainslie as fragrant, and medicinal, but the native names adduced are those of *Nardostachys Jatamansi*, for which it may be used as a substitute. The aromatic principle being absent in the tubers of some species, while fecula is secreted in larger proportion, they are employed as food, as those of *C. esculentus*, a native of the South of Europe, and of the North of Africa, and supposed to be the μαλινοθαλλη of Theophrastus. In addition to fecula, these roots contain a fixed oil, which enables them to be formed into palatable emulsions, which, with the addition of sugar, have been employed as a substitute for coffee and cocoa. The roots of *S. maritima*, also, which are large in some of the varieties, have been ground, and used instead of flour in times of scarcity; in India also the roots of some species are employed as food by the natives of the southern parts of Peninsular India during famines, and when grain is scarce. One, called *sheelandie-aresee*, was discovered by Dr. James Anderson of the Madras Medical Board, in sandy situations near the sea, and requiring but little water. This species is the *Cyperus bulbosus* of Vahl (*C. jemenicus*,

(*C. jemenicus*, Linn.), of which Dr. Roxburgh states *Pure-gaddi*, to be the Telinga name of the plant, and *puri-dumpa* that of the roots, which are roasted or boiled, and then eaten, or, dried in the sun, and ground and made into bread: they are palatable, and taste like roasted potatoes, and would be very valuable if they could by culture be enlarged in size, so as to be less troublesome in gathering and cleaning. The roots of *Scirpus dubius* of Roxb. (Teling. *allike*) are also described by him as being boiled and eaten by the natives, who say that they are as good as yams,—so likewise the round turnip-shaped tubers of *Scirpus tuberosus* of Roxburgh, the *Pi-tsi* of the Chinese, sometimes called *water-chestnut*, which Professor Nees von Esenbeck considers to be only a bulbiferous form of *Limnochloa plantaginea*, and which is mentioned by the Abbé Grosier and others by the name of *Maa-tai* and *Pi-tse*, are highly esteemed by the Chinese, both as an article of diet and as a medicine, and the plant is therefore extensively cultivated in ponds in China, whence it was transmitted from Canton to the Calcutta Botanic Garden by Mr. Duncan, at the desire of the Governor-general.

The roots of some other of the *Cyperaceæ* are employed in Europe for medicinal purposes, as the long-trailing roots of *Carex arenaria*, and the nearly-allied species of *C. disticha*, *C. hirta*, and *C. spicata*, under the name of German Sarsaparilla, which contain about one-sixth of fecula, a small portion of bitter and of aromatic principle.

Closely allied to the Grasses as are the Sedges, it is remarkable that so few of them should be useful, as pasture grasses; none, indeed, are mentioned among those in the "Hortus Gramineus Woburnensis," and they yield in Europe very indifferent fodder, though useful for bedding and litter; but *Scirpus cæspitosus* forms a great portion of the food of cattle and sheep in the Highlands of Scotland in March and till the end of May; and the several varieties of *S. maritimus*, found in different countries, are greedily eaten by cattle. As *Cyperaceæ* are much more abundant in India than in Europe, we have few pastures there free from them, and Dr. Roxburgh enumerates species of *Kyllingia*, *Courtoisia*, *Cyperus*, *Abildgaardia*, *Scirpus*, *Isolepis*, *Fuirena*, *Fimbristylis*, and *Trichelostylis*, as common in pasture grounds in India, though only a few, as *Cyperus dubius*, and *hexastachyus*, are particularly specified as being eaten by cattle.

Papyrus of the banks of the Nile, *Papyrus antiquorum*, of which boats, paper, and ropes were made, is a plant of this family; it is said to be called *babeer* in Syria, and is described by the Arabians (Avic, c. 543) by the name *fafeer* and *burdee*, the former evidently of the same origin as the Greek and Syrian names. A species of the genus *Papyrus*, (*P. corymbosus*, N. ab. E. *P. Pangorei* ex Arnott) is hardly of less use in India, being extensively employed for making the mats so much used there for covering the floors of rooms, and which are also so much esteemed in Europe. Dr. Ainslie says that a species, called *kora* and *toonghi*, which he refers to, *C. textilis* of Thunberg, is employed in the Peninsula for the same purpose. Some of the species of *Scirpus*, especially *S. lacustris*, are sometimes substituted for rushes in making baskets and chair-bottoms, &c.; *Cyperus textilis* is employed

in

in making ropes, and as *Papyrus* of Egypt was by the ancients. The species of *Eriophorum*, called cotton-grass in England, from having their seeds clothed at the base with a silky or cotton-like substance, of which paper, and wicks of candles, have been made, and pillows stuffed, has a species, *E. comosum*, Wall., *cannabinum*, nob., *bhabhur* of the natives, of which the leaves, previous to the plant flowering, are in the Himalayas extensively employed for rope-making. *Cyperus inundatus*, probably with other species, helps much to bind and protect the banks of the Ganges from the rapidity of the streams and the force of the tides; as in Holland *Carex arenaria* is carefully planted on the dikes, where its far-extending roots, by mutually interlacing with each other, fix the sand, and give strength to the embankment.

196. GRAMINEÆ.

Grasses, forming the most natural of orders, are the most extensively diffused, and at the same time the most useful of vegetables; a few species affording the corn which forms a great portion of the daily sustenance of millions of human beings; while others afford pasture for cattle, which are themselves to form the remainder of the food of many, especially of northern nations. They are extremely numerous, nearly two thousand species being at present known, and thus forming nearly one-twentieth of the plants described in systematic works; but if the number of individuals be considered, the proportion is immensely greater. They are found in all parts of the world, both on land and in water, in dry and in moist situations, in hot and cold, tropical and temperate climates, though different tribes, genera and species, inhabit these several situations. Those in tropical situations, such as *Bamboo* and *Saccharum*, with broad foliage, often attain a great height, the former often fifty or sixty feet, and the latter tall enough to conceal herds of elephants, while the verdant turf of northern regions is formed of short and compact grassy tufts. As they are abundant and large in foliage in tropical situations, so do the species which extend along the foot of the Himalayas form a grass jungle sufficiently high to conceal the elephant and rhinoceros, while in ascending, we find many of the same genera and species which are met with in proceeding from the equator to the poles. These have all been examined and named by Professor Nees von Esenbeck, to whom I am indebted for MS. descriptions of the new genera and species.

The Grasses found in the plains of India, some of which are confined to the Peninsula, but many of which are as common in the northern as in the southern plains, belong to genera, of some of which, a few species ascend the mountains, and are found there at considerable elevations in the rainy season of the year. The mass of the species found in the plains belong to the genera *Oryza*, *Hygroryza*, of the tribe *Oryzeæ*; *Coix*, and in northern parts *Phalaris*, of the tribe *Phalarideæ*; *Paspalum*, numerous species of *Panicum*, of *Echinochloa*, *Setaria*, *Pennisetum*, *Penicillaria*, *Cenchrus*, *Trachyozus*, and *Holboellia* (Wall. Hook. Misc. 11. t. 76), of the tribe *Paniceæ*; *Aristida*, and *Chaetaria*, of *Stipaceæ*; *Arundo*, and *Amphidonax*, of *Arundinaceæ*; *Vilfa*, (*Sporobolus*, R. Br.) and

Polypogon,

Polypogon, of *Agrostideæ; Microchloa, Cynodon, Dactyloctenium, Chloris, Leptochloa, Eleusine, Acrachne*, and *Dineba*, Wall. Cat. 3814, of *Chlorideæ; Brandtia*, and *Pommereula*, of the *Avenaceæ;* numerous species abundant in individuals of *Eragrostis;* a *Centotheca*, and *Elytrophorus*, of *Festucaceæ;* with several species of *Bambusa*, and one of *Beesha*. Of the tribe *Rottboëlliaceæ, Oropetium, Ophiurus, Hemanthria, Mnesithea, Manisuris*, and *Ratzeburgia;* and, finally, of *Andropogoneæ, Perotis, Zoysia, Dimeria, Imperata, Saccharum, Pogonatherum, Erianthus, Anthistiria, Apluda, Raphis, Leptotherium, Andropogon, Heteropogon, Bathratherum, Lepeocercis, Spodiopogon, Ischæmum, Apocopis, Meoschium, Arundinella*, and *Sorghum*.

The majority of these genera are Asiatic, and the greater number of their species are contained in, and some of them confined to, India; but some of the genera enumerated are as characteristic of other Floras, as *Olyra, Chloris, Leptochloa*, and *Arundinaria*, tropical American genera, but of which species are found in India. *Spinifex*, with several species on the coasts of New Holland, has one, *S. squarrosus*, on the coasts of India; as also *Zoysia pungens*, which is likewise found in similar situations near Port Jackson. *Dimeria* is another New Holland genus, of which Mr. Brown has a species from India. *Centotheca lappacea*, found in the islands of the Indian Ocean, and also in the Indian and Malayan Peninsula; *Elytrophorus articulatus*, found in both Southern and Northern India, as well as in tropical Africa; *Dactyloctenium ægyptiacum*, found also in Africa, and even America.

Species of these several Indian genera are found in the northern, as in the southern parts of the country, especially in the rainy season; but as these are too many for the whole to be enumerated, a few instances may be mentioned, as *Coix gigantea, Paspalum scrobiculatum;* several species of *Panicum, Echinochloa* (*Oplismenus*) *hispidula, Setaria Rottleri, Cenchrus echinoides* and *montanus, Aristida* (*Chaetaria*) *depressa, Eleusine indica, Chloris decora, Eragrostis verticillata* and *Cynosuroides, Hemanthria fasciculata, Mnesithea lævis, Manisuris granularis; Imperata Kænigii*, found also in the West-Indies, *Saccharum, Sara*, and *Moonja, Erianthus versicolor, Rhaphis muricata, Andropogon pertusus* and *Nardoides, Anthistiria arundinacea* and *ciliata, Apluda communis* and *microstachya, Bathratherum lanceolatum, Lepeocercis digitata, Spodiopogon laniger, Sorghum halipense*.

In the plains of Northern India there are a few species likewise found in European countries, or which belong to genera more like European than those enumerated above, as *Phalaris minor, Vilfa* (*Sporobulus*, R. Br.) *pallida*, and varieties; with *V. diandra*, and a species of *Poa, P. hansiana*, nob., at Hansi and Saharunpore; and *Cynodon Dactylon*, Doob, of the natives, every where in the plains of India, as well as in the mountains. Among the cold weather cultivation of wheat and barley, two European species are very commonly found: one is *Lolium temulentum*, and the other *Avena fatua*.

A few of these species of European genera are found in the plains of India, in the cold weather months, in the same way as we have seen to be the case with some other genera; so does the prevalence of moisture and equability of temperature in the rainy season

season in the Himalayas allow of the existence of species belonging to strictly tropical genera, as *Paspalum*, and *Panicum Royleanum*, at Mussooree; *Oplismenus loliaceus*, a West-India and Phillipine Island plant, is found at Dhunoultee; and *O. indicus*, another species, at Mussooree; *Pennisetum triflorum*, *Eragrostis nigra* and *Amherstiana*, several species of *Bambusa*, and the bamboo-like *Ludolfia falcata*, *Imperata Kænigii*, *Saccharum canaliculatum*, *Erianthus vulpinus*, *Rhaphis microstachys*, *cærulea*, *echinulata*, with some others; and *Leptotherium Royleanum*, *Pogonatherum polystachyum*, *Andropogon tristis* and *Trachypogon*, *Anthistiria ciliata* and *anathera*, *Bathratherum lanceolatum* and *molle*, *Ischæmum speciosum*, *Apocopis Royleanum*, and *Meoschium Royleanum*, in the Deyra Doon and its vicinity, with *Arundinella miliaceum*, and *tenellum*, in the mountains.

Though so many of the *Gramineæ* found in the Himalayas belong to genera of which the greater number of species are found in tropical situations, yet it is only in the rainy season that these occur; and the mass of the grasses, like that of the vegetation in general of these mountains, will be found to be analogous to that of European countries; and many of those very species which are most valued as pasture grasses in England, are found forming the grassy sward of the Himalayas. These belong to the genera *Alopecurus*, *Phleum*, *Chilochloa*, *Phalaris*, and *Hierochloa*, of the tribe *Phalarideæ;* with *Milium*, *Acratherum*, and *Holboellia*, (Wall. Hook. Misc. 11, t. 76), of *Paniceæ;* with *Orthoraphium*, a new *Stipaceous* genus. Of the tribe of *Agrostideæ*, there are *Mühlenbergia* (*Podosaemum*, Kunth.), *Vilfa*, *Agrostis*, *Lachnagrostis*, and *Polypogon;* of *Arundinaceæ*, there are species of *Calamagrostis*, and of *Phragmites;* and of *Chlorideæ*, *Microchloa*, and *Cynodon; C. Dactylon*, is found equally in these mountains and in the plains of India, as well as partially in Europe; of *Avenaceæ*, *Deschampsia*, *Trisetum*, and *Avena;* of *Festucaceæ*, species of *Poa*, *Glyceria*, *Melica*, *Kœleria*, *Dactylis*, *Plagiolytrum*, *Catopodium*, *Festuca*, *Schænodorus*, and *Bromus;* of *Hordeaceæ*, species of *Lolium*, *Agropyrum*, *Brachypodium*, *Triticum*, and *Hordeum*. These genera, it is evident, are those to which the majority of European grasses belong; but many of the species also which are found in the Himalayas, are identical with those common in European countries. Of these may be enumerated *Alopecurus geniculatus*, and *fulvus*, *Phleum pratense*, and *P. alpinum; Chilochloa aspera*, *Phalaris nepalensis*, which is closely allied to *P. canariensis*, *Hierochloa laxa; Milium nepalense*, which Nees von Esenbeck asks in MS. "an *M. effusi* var." *Cynodon Dactylon*, *Agrostis ciliata*, and *nervosa*, *Trisetum airoides*, *Avena pubescens*, *sterilis*, and *hirsuta*, with *A. sativa*, which is mentioned by Dr. Wallich as sent him by Capt. Gerard from the Himalayas. *Eragrostis elegantula* and *Amherstiana* are tropical forms, but the true *Poas* are present in the forms of *Poa pratensis* var. *angustifolia glauca*, and β *angustifolia*, *P. annua* var., β *Americana*, and γ *spiculis glaucis*, *P. nemoralis* var. *firmula*, *P. flexuosa* var. γ *humilis*, *P. procumbens* var. *humilis*, and *P. effusa*, with other Himalayan species. *Kœleria parviflora*, *Dactylis glomerata*, *forma communis*, *Catapodium filiforme*, *Festuca stricta rubra*, and *F. Amherstiana*, nob., *Bromus giganteus*, *japonicus*, *asper* var. *angustifolia* and *depauperata*, *B. mollis* and *squarrosus*, *Lolium temulentum*, *Agropyrum caninum*, with *Triticum vulgare*,

and its varieties, as well as *Hordeum hexastichon, cæleste* and *Ægiceras,* in a cultivated state.

The grasses, forming the greatest portion of the pasture for horses, cattle and sheep, in most parts of the world, at the same time that they yield grain, which forms three-fourths of the food of man, are necessarily the most important class of plants in an economical and political point of view. Their culture forms the greater portion of the agriculture of all countries, and has in Europe been studied to an extent, and with a care, to which the agriculture of the East is a stranger; for besides the preparation of the soil, and the addition of the composts and manures, the most minute attention has been paid, by many scientific farmers, to every point of the culture of each particular cereal grass, so that their cultivation has been of late years greatly improved, their utmost productiveness very carefully ascertained, and new rules obtained for the use of the merely practical farmer. These points embrace a consideration of the species, and varieties, their native country, soil, manure, climate, and season of cultivation, with the preparation of the seed, its quantity, and the mode of sowing, as well as the after-culture, and the harvesting, including the mode of reaping, the threshing, ascertaining the produce, as well as the proportion of flour; besides considering the various uses to which the grain, the flour, chaff, and straw, may be applied. Few of these points have been accurately ascertained with respect to any of the corn or pasture-grasses cultivated in India, though few subjects offer greater inducements for close inquiry, and careful experiment. The many Agricultural Societies now established in different parts of India will find among them very important subjects for experimental investigation, as the slightest enlargement in the size of a grain, or the least increase in the productiveness of an ear of corn, when extended into the agriculture of a country, will so infinitely increase its resources and revenues.

The grains cultivated in Great Britain are chiefly different species, and varieties, of Wheat, Rye, Barley, Oats, and occasionally Maize and Canary Corn (*Phalaris canariensis*); to these have been added, in the S. of Europe, Rice, Maize, and the different kinds of Millet, which have been chiefly introduced from India, as *Panicum miliaceum, Setaria italica,* and *Sorghum vulgare; Setaria germanica,* German millet, and *Digitaria sanguinalis,* or Polish millet. The season of cultivation, in Europe, is confined to the summer, with the exception of wheat, which is sown in autumn; but in India, where the cultivation of wheat and barley forms the agriculture of the country, as much as rice, sugar-cane, and millet, the seasons of cultivation are very different. Wheat, barley, and millet (*Panicum miliaceum*) being cultivated in the months which correspond to the winter of European climates, that is, from October to March; while rice, maize, *joar* and *bajra,* and the other smaller grains, are cultivated in the rainy season, that is, from the middle of June to the middle and end of September.

The grains which are cultivated in N. India are first, different varieties of wheat, *Triticum vulgare* Nees, which are red and white, *lal* and *mukhmee,* awned and awnless, as, first, *lal-gehoon,* var., *autumnale,* or *moondla-gehoon, fusca,* or *peela-gehoon,* and var.,

var., *velutina, kunnee-gehoon;* many other varieties are probably known to the Zumeendars, but these are very distinct from each other, and may be clearly described. Wheat having been one of the earliest cultivated grains, is most probably of Asiatic origin, as Asia was no doubt the earliest civilized, as well as the first peopled country. It is known to the Arabs under the name of *hinteh;* to the Persians as *gundoom;* Hindee, *gehoon* and *kunuk.* The species of barley cultivated in the plains of India, and known by the Hindee and Persian name *juo,* Arabic *shaeer,* is *Hordeum hexastichon.* As both wheat and barley are cultivated in the plains of India in the winter months, where none of the species of these genera are indigenous, it is probable that both have been introduced into India from the north, that is, from the Persian, or perhaps from the Tartarian region, where these, and other species of barley, are most successfully and abundantly cultivated. *Panicum miliaceum,* or common millet, is the only small grain cultivated at this season of the year. It is called *cheena,* by the natives of India; Arab. *dukhun;* Pers. *urzun,* and is, like the preceding, common to the cultivation of Europe, and of India. Oats, *Avena sativa,* are also now cultivated in the same season with wheat, and barley, by some European gentlemen, by whom the grain was introduced on account of their horses. *Avena sterilis* is found, as well as *A. fatua,* in fields of wheat and barley in the plains of North-western India, flowering in March.

Rice is of course the grain most extensively cultivated in India, not only in the southern parts, but also in the northern provinces, as well as in the Himalayas in the rainy season. Numerous varieties are known to, and named by, the Zumeendars or farmers of India, and some of these yield the finest rice, as that cultivated in Pilibeet, though only the inferior kinds are imported into this country; whence it has been inferred that all Indian rice is inferior to the American, notwithstanding that it was first introduced into the latter country from India. It is known to the natives of India by the name *chanwul,* while the plant is called *dhan;* the Persian name of rice is *birunj,* and the Arabic *aruz,* whence probably *oryza,* and the English *rice.* The different kinds of *Sorghum,* commonly called *joar* or *jooar,* and in some works Great, or Indian Millet, constitute an important branch of Indian culture; this is known to the Persians by the name of *jawurs-hindee;* to the Arabs by the name *zurut,* and also to various tribes by that of *durra.* The species commonly grown are, *Sorghum vulgare* and *S. bicolor* (*kala-jooar*), referred by Dr. Roxburgh to *Andropogon,* and which he describes as being cultivated in a rather elevated, good soil; (seed-time October, and harvest-time January), and the produce as being often upwards of an hundred fold. Dr. Roxburgh observes, "It is probable that through the whole of Southern Asia, as many of the inhabitants live on the various kinds of dry, or small grain, as upon rice, and they are reckoned fully as wholesome as that is." *S. cernuum* is a distinct species; a variety of which he describes as being cultivated by the inhabitants of the Munnipore district, and as forming the staff of life of those mountaineers, because one of the few articles of their agriculture. *S. saccharatum* is another species described by him as much cultivated over various parts of India, during the rainy and cold seasons, upon land which is too high

high for rice. The straw of all is much valued as fodder for cattle, being cut up into small pieces, and called *kurbee*.

Zea mays, Maize or Indian corn, a native of S. America, and so extensively cultivated both in Peru and Mexico, has been introduced, not only into the United States of America, but also into Africa and Asia, and even into the southern parts of Europe; its cultivation has been attempted in England, chiefly by the influence of the late Mr. Cobbett. It is calculated that next to rice, it is the grain which supplies food to the greatest number of the human race, and that it is capable of cultivation when the summer temperature equals or exceeds that common to latitude 45°, and even to 48°. This extensive cultivation is remarkable in a plant, originally a native of S. America, and may be ascribed partly to its probably having been a mountain plant of those latitudes, and also to its requiring a less degree of moisture than rice, as well as to some of its varieties coming to maturity in so short a space of time as forty days. It has been introduced into India, and is cultivated both in the plains and in the Himalayas, but not so extensively as its productiveness and value as a grain would warrant; nor are the modes of cultivation adapted to insure the greatest degree of productiveness, either with respect to the quantity of grain or of straw. It is more extensively employed in India with the seeds roasted while still green, than as a grain to be converted into flour; but if cultivated for this purpose, according to the most approved course of agriculture, it would probably be found more productive than some of the grains now cultivated in India. These consist of *Paspalum scrobiculatum* (*koda*), and its varieties, which are much cultivated, and form a great portion of the diet of many of the natives; as also *P. miliare*, which Dr. Roxburgh describes as being extensively cultivated, and as forming the diet of the natives in the Peninsula. *P. frumentaceum*, which is their *sanwuk*, and its varieties, called *mundoo-sanwuk* and *saonkee*, yielding between fifty and sixty fold, and *Pennisetum* (*Setaria*) *italica*, commonly called Italian millet, yielding the former proportion. It is the *kungne* of the natives of India, Arab. *sumak*. *Penicillaria spicata*, Hindee *bajra*, Arab. *jawurus*, which forms much of the diet of the poorer natives. *Eleusine corocana* (*mundooa*), with *E. stricta* of Roxburgh, appear, however, to be the most prolific of the cultivated grasses, as the ordinary product is 120 fold; and he describes one variety as yielding even 500 fold in the Rajamundry Circars. One plant of *E. stricta* he particularly describes as having borne not less than 81,000 seeds. Besides these cultivated species, the grains of others growing in a wild state are collected, and form articles of diet with the poorer classes of the natives of India, as of *Panicum floridum* (*burtee*), *P. Helopus* (*kooree*), *P.* (*Echinochloa*) *hispidulum* (*dhand*).

To the cultivated kinds some others might be easily added, if it were desirable, as *Setaria germanica*, *Digitaria sanguinalis*, *Festuca aquatica*, *Glyceria fluitans*, &c. suited either to the plains or mountains of India.

The cultivation of Pasture-grasses having only so recently formed a part of English agriculture,

agriculture, it cannot be expected that much attention should have been paid to the subject of Hay and Pasture-grasses in India, though some districts, as that of Hurriana,* like the natural pastures and meadows of the British isles, are celebrated for their pastures, and their herds of cattle. The subject is one of the greatest importance, not only as affording pasture for horses and agricultural cattle, but also for improved breeds of sheep, which India is likely to produce, and to export their wool. The plains of India being subject to great heat, with drought at one season, and heavy rains at another, cannot be expected to present any pasture-grounds resembling those of the best parts of Europe; but the temperature of the cold weather months, especially in the northern provinces, being such as to be most favourable for the cultivation of the same cereal grasses as in Europe, it is not surprising that good grass is produced there, and that many European gentlemen prepare very excellent hay. Their rapid growth, great height, and subsequent dryness, render many of the Indian grasses unfit for pasture at the end of the year. This the inhabitants of the tracts at the base of the Himalayas, as well as those within these mountains remedy, by yearly burning down the old and dry grass, so as to allow the young blades, which immediately sprout up, to afford fodder for their cattle. But Europeans in India infinitely prefer, or indeed only give their horses, the creeping stems and leaves, scraped off the ground by the grass-cutter, of that grass, which is known by the name of *doob* or *doorba*, and which flowers, nearly all the year round, and is, fortunately, by far the most common in every part of India. In Northern India it is a common practice to form lawns and pastures of moderate extent, by planting pieces of the creeping stems of this grass, which yields excellent hay in what is the spring of the year in Europe. Dr. Roxburgh, writing in the south of India, also describes it as the most valuable kind, as forming three-fourths of the food of their horses and cows. By the Brahmins of the coast it is held sacred to Ganesha, (the Jonas of the Ancients), under the name of *Doorwall;* it has sometimes been introduced into England, but it is a well-known British species, though not common, being the *Panicum*, or *Cynodon Dactylon*, of botanists. Cattle are also fed on chopped straw (*bhoosa*), as well as on the stalk of the *joar* (*Sorghum vulgare*), cut into small pieces, and then called *kurbee;* of this all kinds are remarkably fond. They are also fond of the straw of many other of the cultivated *Gramineæ*, as of *Paspulum scrobiculatum*, and *Kora*, *Penicillaria spicata*, *Panicum italicum*, *frumentaceum*, *miliare*, and *Eleusine ægyptiaca*. Buffaloes, also, are fed on *kans*, or *Imperata* (*Saccharum*) *spontanea*, and its varieties, which are stacked for this purpose.

India is not, however, destitute of pasture-grasses, but they belong to genera and tribes

* As the district of Hurriana is celebrated for its pasture-grasses, I requested my friend, Col. Colvin, of the Bengal Engineers, to make a collection of the grasses in the neighbourhood of Hansi, which he was good enough to do, and sent me a small collection of very fine specimens, but which, I did not find, differed much in kind from those in the Doab. They belonged to the genera *Panicum*, *Pennisetum*, *Cenchrus*, *Chætaria*, *Vilfa*, *Dactyloctenium*, *Chloris*, *Eleusine*, *Achrachne*, *Poa*, several species of *Eragrostis*, and *Andropogon*.

tribes different from those of Europe, as to *Panicum, Eragrostis, Saccharum, Rottboellia,* &c. Besides the above-mentioned, cattle are also fond of such grasses as *Panicum colonum, setigerum, repens, hirsutum,* and *miliare; Digitaria ciliaris, Rottboellia glabra,* and *Andropogon Martini,** a native of the high lands of Ballaghaut, whence the seeds were brought by the late General Martin, and taken to Lucnow, as well as transmitted to the Botanic Garden at Calcutta. He was induced to take particular notice of this long grass, in consequence of observing how voraciously fond the cattle were of it, notwithstanding its having so strong an aromatic and pungent taste, that, not only the flesh of the animals, but also the milk and butter, have a very strong scent of it. Dr. Malcolmson, to whom I am indebted for specimens of this grass, which he obtained in the Deccan, where it is universally spread over the trap districts, though seldom seen on the ordinary granite of that tract, informs me, that he has by it traced green-stone dikes for great distances across granite soils—the luxuriant growth, of *A. Martini,* contrasting remarkably with the thin and low *A. polystachyus,* of the granite. He also informs me, that the Patans and succeeding Mahomedan Governments valued the pasture of some of the sand-stone hills south of the Kistnah river, where the lemon-grass, (an *Andropogon Nardoides*?), is found, so highly as to reserve it for their own cavalry, or the right to cut and sell it, was rented as a monopoly to the highest bidders; but this was abolished about twenty-five years ago. The pasture of the Nalla Malla Hills, in sight of these, is considered bad, though more luxuriant, growing on a calcareous rock passing into a clay slate. Dr. Malcolmson, with these grasses, also collected specimens of the Nuth, or Nuthoo, grass, of Bellary, and the Ceded Districts, of which an account has been given by Dr. Wight in the Madras Lit. and Scientific Journal; it is remarkable for the great difficulty of eradicating it when once it has taken possession of the soil. Dr. W. has named this grass *Ischæmum pilosum,* but if so widely diffused it can hardly have escaped the notice of all previous botanists; especially as every government that has ruled in these districts has, from time immemorial, been paying large sums for its eradication. It is chiefly found in the "black cotton ground," and differs from nearly all the other herbaceous plants found there, by its widely-spreading, perennial roots, or underground stems, all the others having either fibrous annual roots, or very long tapering perennial ones, with the stem, even when procumbent, generally annual, and altogether above ground. In its creeping habit it resembles *Triticum repens,* in Europe, and some other plants found in sandy soils, which form a valuable provision for binding the loose materials among which they grow. Though rewards have been given and revenue remitted, Dr. Wight is of opinion, that the prevalence of this grass is far from being an unmixed evil, as cattle eat it, and large quantities are daily exposed for sale at Bellary, as food for them; and if it could be raised on less valuable soil, it would probably be thought a useful enough plant: he further says that the necessity of granting remission may be doubted, as it may almost be

* This plant appears to me, from the specimens, to be only a variety of *Andropogon Nardoides,* v. infra.

be considered as a boon, conferred on these districts by the hand of a bountiful Providence.*

The pastures of the various plains of India might probably be much, and at the same time easily improved, by the introduction of some of the pasture-grasses of Brazil, which are of a gigantic stature, and perfectly tender and delicate. Nees von Esenbeck, as quoted by Dr. Lindley, informs us that the *Coapim de Angola* of Brazil, *Panicum spectabile*, grows six or seven feet high; while other equally gigantic species constitute the field crops on the banks of the Amazons.

The base of the Himalayas, we have noticed, is clothed with a dense grass jungle, among which species of *Saccharum*, and *Andropogon*, are the most conspicuous and the tallest, but when full grown, necessarily too coarse to serve either for pasture or for hay; they are, therefore, yearly burnt down, after which the young blade springs up, affording excellent pasture for herds of cattle. As we ascend the mountains, tropical forms gradually disappear, and those of temperate regions take their place, while at certain elevations, where the cold of winter is severe, and the temperature of the rainy season equable and moist, at the same time moderately high, we find many species of grasses, of tropical genera, perfectly at home, in situations which are, in winter, covered with snow; but as those elevations have their own peculiar species belonging to European genera, which are able to withstand the winter's cold, there is at all times abundant pasture in the neighbourhood of most of the Himalayan villages, and according to the season of the year the sheep, and cattle, are driven to different ranges and elevations. The sward upon these mountains is exactly like, though somewhat more luxuriant, than that met with in the mountains of Scotland, or of Wales; and the sheep and cattle fed on them have the fineness and flavour of those fed on grain in the plains of India.

The grasses in the Himalayas we have seen belong to such genera as (*Agrostis*); Fox-tail grass, (*Alopecurus*); Cat's-tail, (*Phleum*); Meadow-grass, (*Poa*); Fescue, *Festuca*, Cock's-foot, (*Dactylis*); Bent-grass, (*Agrostis*); Oat-grass, (*Avena*); *Bromus*, and others, which are equally characteristic of European meadows and pastures; but it is still more important, that many of the *very species*, which are accounted the best pasture-grasses in England, are among those found in the Himalayas; as, for instance, Cock's-foot grass, (*Dactylis glomerata*); Annual, Narrow-leaved, and Smooth-stalked Meadow-grass, *Poa annua*,

* From native information it appears that there are two kinds of *Nuth*, one called *Koondara*, in the *raguda*, or black soil; the other *Gurukor* (*Panicum dactylon*, Lin.) in the *mudub* or mixed soil. The former is styled *pudava* (ship), when the large plough, with twelve bullocks, is required to eradicate it. When in detached spots, it is styled *gumpa* (basket), and may be removed by *wudas*, and other labourers, with pick-axes. The charge for digging out *Nuth*, is from one, to one and a half rupee, for a piece of ground eight yards long, two broad, and four and a half deep. If the Nuth does not exceed one-tenth of the land, no cowle or remission is granted. If one-fourth, the assessment on the Nuth portion is remitted, but no cowle granted. From one-quarter to one-half, besides the remission, a cowle is granted for clearing it. The remission granted on account of waste from Nuth, in one village, in *fuzly* 1242, amounted to Rupees 163. 7.2; *viz. gumpa nuth*, Rupees 97.11; *pudava nuth* 66.6.3.

annua, *P. angustifolia*, and *P. pratensis;* Cat's-tail or Timothy-grass, *Phleum pratense;* Purple Fescue-grass, (*Festuca rubra*), which from its greater produce is considered preferable to the *F. ovina*, specially called Sheep's Fescue-grass. Besides these, there are, as has been already shewn, a number of species, belonging to the same genera, and analogous in nature, some of which may even be superior, to the best grasses of England, where they might be worthy of introduction; shewing, at all events, how easily any other grasses, as biennial rye-grass, might be successfully introduced, though this may not appear to be at all necessary where the natural pasture is already so good. But it would be of considerable importance to find some pasture-grasses suited to the plains of India, or the table-land of the Peninsula, and the Dukhun, and such a series as would afford pasture, in the different seasons of the year, as the cold, the hot, and the rainy; the first might be furnished, perhaps, from the north, and the second, probably from the south of Europe, while tropical countries are alone likely to furnish those fitted for the last. The creeping-rooted, and stoloniferous kinds, grow readily in almost any soil. In Europe attention is paid to hay-grasses, both of temporary, and of permanent duration; also to those adapted for pasturage, and to these, as yielding early or late pasturage, as well as those suited to different kinds of soil. The subject has in England obtained great and deserved attention, but no where so conspicuously as in the experiments instituted on this subject by John, Duke of Bedford, at Woburn, and carried into execution there by Mr. Sinclair, and detailed in the work, entitled "Hortus Gramineus Woburnensis;" for a copy of which I was indebted, when in India, to the late venerable Dr. Carey: a very useful abstract of this work is given in Mr. Loudon's excellent Encyclopedia of Agriculture.

In addition to the foregoing very obvious uses of grasses, a few are remarkable for their aromatic properties, as *Anthoxanthum odoratum*, and *Holcus odoratus*, which, in these plants, according to Vogel, is due to the presence of benzoic acid. The roots also of the *bena* or *punnee*, *Andropogon* (*Rhaphis. Anatherum*) *muricatum*, which are in Hindee called *khus-khus*, and Tamool, *vitivayr*, are delightfully fragrant, especially when moist, and therefore much employed for making the thatched screens or *tatties*, which are placed in the hot weather before the doors and windows of houses in India. Water being thrown upon these, while the dry and heated wind blows through, which causing rapid evaporation, enters the rooms, both cooled and fragrant; the difference of temperature between the outer and the inner air amounts often to between 20° and 30° Fahrenheit. According to Dr. Roxburgh, *Chætaria* (*Aristida*) *setacea*, is employed for this purpose in the Madras Presidency, where the contrivance was introduced from Bengal. In the *vitivayr*, or *khus-khus*, the aroma is dependent, according to Vanquelin and Henry, who both examined the roots of the same plant, though under different names, to the presence of a principle resembling myrrh. Some other species secrete volatile odorous oils, so abundantly, as to be profitably distilled; of these the best known is *Andropogon Schænanthus*, or Lemon-grass, its infusion being often employed in India as a pleasant stomachic: the Lemon-grass oil is probably distilled from it.

Another

Another species, named *A. Nardus*, by Rottler, but with a doubt of its correctness, is called ginger or spice-grass, by Ainslie, 11, p. 401; it is common on the Courtallum hills and in the district of Tinnivelly, where the natives use its infusion as a stomachic, and occasionally prepare from it an essential oil useful in rheumatism. *A. Iwaruncusa*, a native of the country skirting the base of the Himalayas, comes remarkably near *A. Schænanthus*, as observed by Dr. Roxburgh, both in habit and taste. Mr. Blane found it between the Hills and the Rapty; Dr. Boyd near Hurdwar, in which neighbourhood, in the Kheree Pass, and at Mohun, I have also found it. The natives there call it *mirchia gand*, and the Hukeems give it, as the *izkhir* of the Arabs, and the *iskhinos* of the Greeks. It may be the true σχινος of Dioscorides, though the Lemon-grass, *A. Schænanthus*, which is only found in gardens in N. India, being common in the islands and S. of India, became first known to Europeans; and as it possessed the requisite properties, was thought to be, and may possibly have been, the true σχινος.

A species possessing still more remarkable aromatic properties, and far more extensively diffused, is that which yields the fragrant grass-oil of Namur, and which I named *Andropogon Calamus Aromaticus*, from supposing it to be the καλαμος αρομματικος of Dioscorides. This species is found in Central India, extends north as far as Delhi, and south to between the Godavery and Nagpore, where, according to Dr. Malcolmson, it is called Spear-grass; it may be the *A. Martini* of Roxburgh, as I believe, it is also thought to be by Dr. Wight, though it has been named *A. Nardoides* by Nees von Esenbeck.

The καλαμος αρομματικος is described by Dioscorides immediately after σχινος, which is usually translated *Odoratus Juncus*, and generally acknowledged to be *Andropogon Schænanthus*, and is stated by him to be a produce of Africa and Arabia. The Lemon-grass *may* be found in Arabia, and, perhaps, in Africa, as well as in India. *Calamus Aromaticus*, immediately following σχινος, and stated also to be a native of India, appears to me to have been a plant allied to Lemon-grass. It is thought also to be the "sweet cane," and the "rich aromatic reed from a far country" of Scripture. There is no plant which more closely coincides in description with every thing that is required, than the tall grass, which yields the fragrant grass-oil of Central India. This has been considered by Mr. Hatchett, "On the Spikenard of the Ancients," to be both the ναρδος, and the Sweet Calamus, of the Ancients. The former I conceive to be *Nardostachys Jatamansi*, (v. p. 242), and the latter to be the present species of *Andropogon*, which I named *Calamus aromaticus*, (v. l. c.); also my "Essay on the Antiquity of Hindoo Medicine," (p. 33 and 83). Mr. Hatchett has, however, republished the figure of *Andropogon Iwaruncusa*, from the Philos. Trans. vol. 80; though his specimens, which he obtained from Mr. Swinton, and which I have had an opportunity of examining, are identical with mine of *A. Calamus Aromaticus*, from the same part of India.

Sugar is a principle abundantly secreted in grasses, as has been satisfactorily proved in the analysis of the Pasture-grasses, by Sir H. Davy; in *Sorghum* (*Holcus*) *saccharatum*, it is secreted in such quantity, that in Italy this plant has

 been

been cultivated, as a substitute, for the sugar-cane; and, of course, most abundantly in the sugar-cane itself. The cultivation of this plant in India is undoubtedly of great antiquity; the Arabian authors on Materia Medica give *sukkur* and *shukkur*, Av. c. 757, as its names, which are no doubt derived from the same source as the Hindee *jaggery*, Tamool *sakkara*, the Sanscrit *sarkura*. The last contained in the Amera Kosha, already carries us back to the beginning of the Christian era; and Oriental scholars easily prove that the manufacture of sugar was known to the Chinese, as well as to the Hindoos, from very early times. It has been supposed that the *Saccharum* of the Ancients, is not the sugar of the present day; but it would be unaccountable, then, how the term Σακχαρου μελι should be applied to it by Dioscorides, who, iic. 104, describes it as a concrete honey, similar to salt.

The manufacture of sugar of the best quality in India, is a subject of the greatest importance to that country, and one which is quite within its capabilities, and the power of those who, with sufficient capital, pay due attention to the cultivation of the cane, as well as to the manufacture of the sugar. The variety of cane hitherto cultivated in India has been very inferior in quality to that employed elsewhere; so far back as 1796, Dr. Roxburgh, (Fl. Ind. 1, 240), introduced from China, into the Calcutta Botanic Garden, a variety, which he called *Saccharum sinense*, which, from its great hardness, resisting the attacks of the white ant, and the jackal, at the same time that it produced a crop, even in the third year, resisting drought to a great degree, and yielding juice of a richer quality, was hoped would prove superior to the cane, which was common all over India. Within the last few years the Otaheite sugar-cane, probably *Saccharum violaceum*, "Canne de Haiti," of Tussac, has been introduced into India by Capt. Sleeman, and cultivated in the Calcutta Botanic Garden by Dr. Wallich, whence it has spread rapidly over great part of India, as Seringapatam, Bombay, Saharunpore, and the Deyra Doon.

Due attention to the various physical agents which control the secretion of the various juices, good soil, free exposure to air, and light, as well as sufficient irrigation, and only a moderate degree of cold during the winter months, appear to me essential for securing the richest secretion of Saccharine matter; while equal care and attention must be paid by the manufacturer to the Chemistry of the subject. That the utmost success is attainable, is evident from specimens which have been sent to this country from India, and some of which have been pronounced by the best judges to be "fully equal to any sugar brought to the London market." As this subject is of too great importance to be passed slightly over, and too extensive to be comprised within the limits of the present work, the Author intends taking an early opportunity of treating the subject in detail.

Besides the above, and their extensive uses as grain, and as fodder for cattle, many of the Grasses, though delicate in structure, and narrow in leaf, are valuable from their durability, partly from containing so much silex in their cuticle, and are therefore employed for thatching, such as *Imperata Kœnigii*, and *Saccharum canaliculatum*.

Some,

Some, as *Eragrostis cynosuroides,* are employed for rope-making, as *Stipa tenacissima,* the true *Esparto* (*Spartum*) of the Spaniards, as well as *Lygeum Spartum* are in Europe. Some of the species of *Saccharum* are employed by the natives for making their reed pens, and others for their arrows. The *Bamboo,* from its multiplied uses, may rival almost any other produce of the vegetable kingdom, though, from not yielding any portion fitted for food, it is of less importance than some others; the young parts, however, being soft and tasteless, are employed for making both into pickles and preserves. The singular substance secreted within its hollow stem, and near the joints, has long been known in Indian medicine, being the *buns-lochun* of the Hindoos, *tabasheer* of the Arabs; *kshir* or *chir,* means juice, or extract, in Sanscrit. It has been thought by some to be the *Saccharum* of the Ancients, but without sufficient foundation.

The grasses, though humble in appearance, and inconspicuous in inflorescence, are, as we have seen, among the most important of plants; they are among the first to grow upon new or barren soils, and thus moderating the extremes of heat and cold, serve to modify climate, at the same time that they prevent land, which has long been in use from becoming sterile, in consequence of the yearly additions which they make to the soil, of organized matter from their own decay. Their universal diffusion, and great similarity in nature, has rendered easy the colonization of distant lands by man, as well as the transport of herbivorous cattle from one part of the world to another. No plants, therefore, are more worthy of continued and extended experiments in India, as few things can more effectually benefit society, or promote the best interests of the country, than increasing the productiveness of a Cereal grain, or improving the culture of a Pasture-grass, except it be introducing new kinds of each, suited to the different parts of the wide-spread territories, and diversified climates, of that empire, knowing, as expressed in the terse language of Linnæus, that *Gramina, folia pecoribus et jumentis læta pascua, semina minora avibus, majora hominibus esculenta sunt.*

ACOTYLEDONEÆ OR FLOWERLESS PLANTS.

197. FILICES.

Ferns being allied, in some points of structure, to Phænogamic Plants, and being most conspicuous in appearance, and peculiar in structure, at one time trailing their stems on, or below the ground, and, at another, elevating them into the air like the trunk of Palms, may well commence the series of Cryptogamic Plants. Ferns differ much from all living plants, but have numerous representatives in the Fossil Flora. They prevail chiefly where there is a certain degree of moisture; hence they are abundant in insular situations, in the forests of tropical countries, as well as on the mountains of northern latitudes. Heat, though favourable to their development, is less necessary than moisture; but this of itself produces greater equability of temperature, and hence we have Ferns widely diffused; prevalent in islands, and diminishing on continents, but even there, more abundant in the moist, than in the dry parts. This

also explains why they decrease so rapidly from equinoctial regions to a little beyond the tropics; for instance, forming 1-9th of the vegetation of Phænogamous Plants of Jamaica; but only 1-971st of the Flora of Egypt; and though the heat so rapidly diminishes, yet the proportion of Ferns increases, as they form 1-31st of the vegetation of Scotland, 1-10th of Greenland, and 1-7th of North Cape. The further extension of Tree-ferns into the southern hemisphere is thus accounted for, from the greater proportion there, of sea; they exist at the southern extremity of Van Diemen's Land, and even at Dusky Bay in New Zealand, while they are not found beyond St. Helena and Silhet in the northern hemisphere: the former in 20°, and the other in 27° of north latitude. India in the northern parts, Africa, and the Mediterranean region, being dry, are therefore unfavourable to the existence of such plants. Hence we might infer the more moist state of the ancient world, from the great proportion of Ferns and Tree-ferns, which are found in the Fossil Flora. These views are completely borne out in India, whence a large number of Ferns have been obtained; nearly five hundred are enumerated by Dr. Wallich in his Catalogue: many of them certainly from the islands of the Indian Archipelago, but the majority are from the Malayan Peninsula, Silhet, Nepal, and the Himalayas, as well as from the west coast of the Peninsula, where there is considerable moisture. Few are found in the plains of India, where for a great part of the year dryness prevails. In the author's collection there are about eighty species, obtained chiefly from the tract of the Himalayas, between the Ganges and Sutlej rivers, and only one species from the plains of India, that is, *Asplenium radiatum* of Swartz, which is found at Saharunpore and Delhi, and along the banks of the Jumna, often on the sides of wells. This species is also found in Arabia and the Peninsula of India. The only other Fern I found in the plains was *Cheilanthes dealbata;* but even this only near the Rajmahl hills, where there are also a few other species, as *Lygodium microphyllum*, &c.

Among the Ferns, as in several other families, of the geographical distribution of which we have treated, there are several genera, common to both the Old and New World; of these many are found in the southern parts of India, as the Peninsula, Bengal, and Silhet, whence they extend to the lower parts of Nepal, as *Acrostichum, Hemionitis, Antrophyum, Meniscium, Tænitis, Nothoclæna, Blechnum, Lomaria, Vittaria, Lindsæa, Dicksonia, Cyathæa, Ceratopteris, Hymenophyllum, Trichomanes,* and *Angiopteris. Allantodia,* found in the Moluccas and New Holland, extends north on one hand to Madeira, and to Nepal and Japan on the other. The genera of which species extend to the more northern parts of the Himalayas are *Grammitis, Cheilanthes, Adiantum, Pteris, Davallia, Gleichenia,* and *Lygodium.* In these mountains, likewise, occur species of other genera, which are found in most parts of the world, and occurring with the above in other parts of India, such as *Polypodium, Asplenium, Nephrodium, Aspidium,* and *Ophioglossum. Pleopeltis,* though differing little from *Polypodium,* has one species, *P. nuda,* common in the Himalayas; the others being found in Tropical America, at the Cape of Good Hope, and the Mauritius. Besides these, there are also species of *Allosurus* (*Cryptogramma*),

(*Cryptogramma*), found on the lofty mountains of Kemaon, of which the others occur in Europe, Arctic America, and on the Andes; *Woodwardia*, prevalent in the northern hemisphere, chiefly in the New World, and also in Tropical America; *Osmunda* and *Botrychium*, found in the temperate and cold parts of both hemispheres; *Scolopendrium* is stated as being a native of the Himalayas; but Mr. Don, from naming his species, *S. dubium*, appears to be himself doubtful on the subject. *Arthobotrys*, Dr. Wallich suggests, is only a species of *Aspidium;* and *Sphæropteris* is a genus which is peculiar to Nepal.

In extending our view from genera to species we shall find confirmations of the same general principles which we have seen to hold good in other natural families; though many species are of course peculiar to India, others likewise occur elsewhere. Thus some are found in the New World, as *Acrostichum aureum*, L., *Polypodium phymatodes*, L., *Adiantum lunulatum*, Burm., *Aspidium exaltatum*, Sw., *Davallia tenuifolia*, Sw., *Pteris longifolia*, L., *P. biaurita*, Lin., is also considered by some botanists as occurring in India, but the species has been named *P. nemoralis* by Dr. Wallich.

Others, common in the islands of the great ocean, and in the Indian Archipelago, extend into India, as *Polypodium alternifolium*, Willd., *P. quercifolium*, L., *Pteris nemoralis*, *Lomaria scandens*, Willd., *Vittaria elongata*, Sw., *Davallia polypodioides*, Don- which appears to be the same as *D. flaccida*, *Gleichenia Hermanni*, Br., *Lygodium microphyllum*, L., and *semibipinnatum*.

Some Chinese and Japan species are also found in the Himalayas, as *Nothochlæna piloselloides*, Kaulf., which is common in the Archipelago, *Meniscium triphyllum*, *Pteris semipinnata*, Linn., and *P. nervosa*, Thunb., *Blechnum orientale*, and *Lygodium japonicum*. As we have seen the prevalence of European species of other families in the Himalayas, so do we among the Ferns, as *Adiantum Capillus Veneris*, L., *Asplenium Trichomanes*, L., and *A. septentrionale*, Sw., *Woodwardia radicans*, Sw., *A. plebeium*, Br., is near *A. Ruta muraria*, L., and is so named in Dr. Wallich's Catalogue, No. 233. *Pteris læta*, Wall., is thought by Mr. Don to be identical with *P. cretica*, of the south of Europe. *Pleopeltis nuda*, found all along the Himalayas, is very closely allied to *P. ensifolia*, found at the Cape of Good Hope; while *Pteris deltoides*, nob., is very similar to *P. calomelanos*, another Cape of Good Hope species.

Ferns, though extensively diffused, and extremely curious in structure, are of less direct utility to man, than many other families of plants less numerous in species, and individuals. The fronds of some have been burnt for the purposes of yielding alkali, though none is detected in the analysis of male Fern; while those of other species, when young, are cropped by cattle. In a cooked state, they are also employed as a portion of the diet of the inhabitants of Norway and of Scotland, and, as I have seen by the shepherds in the Himalayas; and the roots of *Nephrodium esculentum*, are eaten in Nepal, according to Dr. Hamilton; *Diplazium esculentum*, *Pteris esculenta*, and others, are also employed as food. *P. aquilina* and *Nephrodium Filix Mas*, have been used in the manufacture of beer, and *Aspidium fragrans* as a substitute for tea.

Though

Though not possessed of any very marked properties, some have been used in medicine from very early times, as they are mentioned by Theophrastus and Dioscorides; and it is curious to find many still so employed in India, no doubt owing, in a great measure, to the Persian translations, from the Arabic version of Greek authors being chiefly in use among the Mahomedan practitioners of India. This is evident from the names which are applied to the drugs procurable in the bazars, as *Iskoolikundrion*, evidently intended for *Scolopendrium*, *Doonditarus* for *Dryopteris;* while others are known by their Asiatic names, as *Surkhus* and *Bisfaij;* the former having *Bitarus* or *Pteris* as its Greek synonyme, while the latter has *bulookunboon*, much changed by the errors of transcribers, as its meaning is stated to be *many-footed*, and, therefore, no doubt intended for *Polypodium*. In properties the rhizomes of different Ferns resemble each other very considerably, and may be substituted one for the other; they abound in mucilage, some in fecula, tannin, and volatile oil, on which their virtues principally depend, whence they are employed as mild astringents, tonics, and anthelmintics; and some, as *Polypodium Calaguala*, &c. as diaphoretics; others are fragrant, as *Angiopteris erecta*, and *Aspidium fragrans*, in Peru. In India the rhizomes, or the dried fronds, are given for the above-mentioned officinal Ferns of the Greeks. These are usually procured from Caubul, but they might be more easily obtained, and of as good quality, from the Himalayas. Some of the species indigenous in India are also employed in medicine, as *Asplenium radiatum*, called by the natives in Northern India *Mor-punkhee*, or *peacock's fan*. It is curious also to find among the species employed, *Adiantum Capillus Veneris*, which we have seen is indigenous in the Himalayas, as well as in Europe, and that *Shuer-al-jin*, or *fairy's hair*, should be one of its names; though *Mobarkha* and *Hunsraj* are its common appellations in India, where it is employed as an expectorant. *Pureseoshan* and *Bulootingen*, names attached to it in the Persian works on Materia Medica, seem only to be corruptions of *Perisethion* and *Polytrichum*, by which it was formerly known.

198. EQUISETACEÆ.

The *Equisetaceæ*, named from the single genus which the order contains, are undetermined with respect to their affinity to any existing families of plants, but form a gigantic tribe in the Fossil Flora. Dr. Lindley remarks, that in arrangement and appearance of reproductive organs, they resemble *Zamia*, and in general aspect *Casuarina;* and that they approach *Coniferæ* more closely than any thing else, of which he considers them a degeneration, through *Cycadaceæ*. He accordingly places them following *Taxaceæ*, at the end of the class of *Gymnosperms*. The *Equisetaceæ* are, however, usually placed among Cryptogamic plants, to the germination of which, approaching nearly to that of *Mosses*, theirs is similar.

The *Equisetaceæ*, few in number, and small in stature, are distributed throughout many parts of the world, chiefly in the northern hemisphere, though *E. elongatum* extends to Mauritius, Bourbon, and Southern Africa. A few are found in the hot parts,

parts, both of the Old and New World, but they prevail in the greatest numbers in temperate climates, chiefly in ditches, and on the banks of rivers. *E. palustre*, *E. sylvaticum*, and *E. arvense*, are found in both Europe, N. America, and the two latter also in N. Asia. In India, one species, *E. debile*, has been described by Dr. Roxburgh as indigenous in Bengal, and has been found in Dindygul by Wight, in Burma by Wallich (*E. pallens*), and along the foot of the Himalayas from Silhet to the Deyra Doon, as well as in the Northern Doab along the banks of the Jumna, though some of these vary in appearance from Dr. Roxburgh's Bengal specimens. *E. diffusum* is a species described by Mr. Don from Nepal, and which he informs me is identical with *E. scoparium*, of Wall. Cat. No. 398, and which I have found in the stony beds of hill streams, especially near Sahunsudhar, where, however, there is also another species. *E. Inglisii*, nob., is a new species from Kanum, in Kunawur, on the northern face of the Himalayas. Equisetums were formerly recommended as medicinal agents, but they are now valued only for their mechanical properties, as for polishing different articles, from the quantity of silex (thirteen per cent.), which they contain in their cuticle. Sir D. Brewster (Lind. Nat. Ord. p. 318), observed these siliceous particles beautifully arranged in two lines parallel to the axes of the stem. From these observations, it has been concluded that the crystalline portions of silex and of other earths found in vegetable tissues, are integral parts of the plants themselves.

199. MARSILEACEÆ.

The *Marsileaceæ* which were formerly united with *Salviniaceæ*, now form two orders, which are united into one class, *Hydropterides*, by Endlicher. The order, as at present constituted, contains *Pilularia* and *Marsilea;* the former confined to Europe, but the latter extending north and south, in both hot and temperate climates in the Old World, with a few species in N. America. The *Marsileaceæ* have their representatives also in the Fossil Flora, in the form of *Sphenophyllum* and *Trizygia*, the latter figured in the present work, Tab. 2. fig. 8.

In India there appear to be three distinct species; *M. quadrifolia*, the European species, which is also found in New Holland, and all parts of India; *M. Ægyptiaca*, which is found in the Peninsula, as well as in Egypt, and which appears to be *M. erosa*, Willd.; and *M. coromandeliana* (*M. minuta* of Lamarck) a species apparently peculiar to the most southern part of the Indian Peninsula.

200. SALVINIACEÆ.

The *Salviniaceæ*, which have been usually united with *Marsileaceæ*, chiefly resemble aquatic *Hepaticæ* in habit; they are as extensively diffused as *Marsileaceæ*, in hot and temperate parts, both of the Old and New World. *Salvinia natans*, found in Europe and N. America, was found by Dr. Hamilton in Gorukpore, and obtained by myself from Cashmere. *S. cucullata* is a new species, described by Dr. Roxburgh as being indigenous in Bengal. *Azolla*, the other genus of the order, which is extensively diffused

diffused in the southern hemisphere, being found in New Holland and Van Diemen's Land, as well as in the Straits of Magelhaens, in South and also in North America, occurs also in India, having been found by Dr. Hamilton to the eastward of Bengal, and by myself in Behar. The species appears to be nearly allied to, if not identical with, *A. pinnata,* found in New Holland.

201. LYCOPODIACEÆ.

The *Lycopodiaceæ*, named from *Lycopodium*, or Club-moss, are distinctly characterized by their organs of reproduction. Dr. Lindley says they are intermediate, as it were, between *Ferns*, and *Coniferæ*, on one hand, and *Ferns*, and *Mosses*, on the other; related to the first of these tribes in the want of sexual apparatus, and in the abundance of annular ducts contained in their axes; to the second, in the aspect of the stems, of some of the larger kinds; and to the last, in their whole appearance. The genera usually included in the order are, *Lycopodium*, *Psilotum*, and *Isoetes*. The last is by some referred to *Marsileaceæ*, but Endlicher has formed it into a separate order, which he conjoins, however, in a class with *Lycopodiaceæ*. The species of *Isoetes* are all found submersed, in Europe, Central, and S. Asia, as well as in N. America; they are all considered varieties of *I. palustris* by Sprengel; but *I. setacea*, found in the S. of France, is no doubt a distinct species, and appears identical with *S. indica*, Wall. Cat. 7072, which is probably the same as *I. coromandeliana*. *Psilotum* consists of three or four species, found within the tropics of both worlds, and (*P. truncatum*) in temperate regions of the southern hemisphere. *P. triquetrum*, a species found in Tropical America, the Sandwich Islands, New Holland and Mauritius, was obtained by Dr. Wallich in Nepal, and by myself from Cashmere. The specimens from the three last localities differ in no respect from each other, but those from Penang, Ava, and the Indian Peninsula, differ from the former, as well as the last from the two former, and may form varieties of, if they be not a species distinct from, *P. triquetrum*.

Lycopodium, which forms the great bulk of the order, as consisting of about 150 species, is found in all parts of the world, growing both on the earth and on trees, and in very hot, as well as in very cold, countries, but most abundantly within the tropics, where they are large, and highly ornamental, from the delicate richness of their foliage; but that they are not confined to such situations, is evident, from whole tracts in the north of Europe, being covered with *Lycopodium alpinum* and *selaginoides*. Species are also found on the tops of our coldest mountains; and they occur as far south, as Van Diemen's Land, and the Straits of Magelhaens. In India they are found, both in hot, and cold, parts of the country, though entirely absent from the dry plains. Those obtained in the Peninsula, are chiefly *Lycopodium Phlegmaria*, and *L. cernuum*, which occur also in Mauritius and Penang, as well as in the Delta of the Ganges, and in Silhet. *L. ornithopodioides, canaliculatum*, and *plumosum*, are other Peninsular species. *L. imbricatum* is found in Bengal, and *L. circinatum*, apparently identical with Thunberg's plant, was found by Dr. Hamilton in Behar, and by myself in the Central Range; I have

have apparently the same species from Choras on the Choor Mountain. Several species have been obtained by Drs. Hamilton and Wallich from the Himalayas, and nearly the same species by myself, from those mountains more to the north-west, as *L. tenellum*, (*L. semicordatum* and *subdiaphanum*, Wall. Cat. 126, and 136); *L. subulifolium*, Cat. No. 114, from Nepal, I have from Mussooree. From Kunawur I have *L. Kunawurense*, nob., which is allied to *L. sanguinolentum*, a species found near Lake Baical, and on the wall of China.

202. CHARACEÆ.

From the obscure nature of the reproductive organs of the genera *Chara*, and *Nitella*, which form this order, great uncertainty has prevailed among botanists respecting its location in a natural series. *Chara* was first placed by Linnæus among Cryptogamic, and then among Phænogamic plants. The same difference of opinion has continued among distinguished botanists of the present day, though the *Characeæ* are now generally treated of as a distinct order, and placed near *Mosses* and *Algæ*. The two genera constituting the order are found in water, often stagnant, sometimes salt, in all parts of the world. Several species of *Chara* have been discovered in India, both in the south and north, and one in Nepal; but, as far as an opinion can be formed from specimens in herbaria, the species appear to be in general distinct in the different parts of India. *C. zeylanica*, which is found near Tranquebar, appears, however, with *setosa* and *corallina*, to be the species most widely diffused. *C. filamentosa*, *foliolosa*, and *polyphylla*, are other species so named in Dr. Rottler's Herbarium, while *C. verticillata*, *involucrata*, and *furcata*, are described by Dr. Roxburgh as indigenous in Bengal. Of the species in the E. Indian Herbarium, *C. zeylanica*,, 5186 B. and C., of the Madras Herbarium, and from Sadras, are the same; but 5186, A., found by Dr. Hamilton near Patna, is a distinct species, perhaps a variety of *C. zeylanica;* but the specimens are mixed with the *Zannichellia*, already mentioned under *Fluviales*. *C. fœtida*, Hb. Ham., from Bangri, is a very elegant species. *C. spiralis* and *C. corallina*, Wall. Cat. No. 5188 and 5189, are from the same herbarium and similar locality; *C. hispida*, Wall. Cat. No. 5189, or at least the plant so labelled, is *Caulinia indica;* while the plant so named in the Cat. No. 5183, is a *Chara*, in consequence, probably, of an interchange of the tickets of the two plants. *C. polyclades* is a species described by Mr. Don from Nepal: two other species were obtained by myself, from the north of India; but the identity of these different species, mentioned as Indian, can only be determined by careful examination of perfect specimens.

203. MUSCI.

Musci, or *Mosses*, are familiarly known, though the term is much more extensively applied in popular, than in scientific language. They often escape notice from their diminutive size, but growing as they usually do together, numbers, as in the case of Corals, amply compensate for their individual want of bulk, when they are seen

covering with beautiful verdure the driest rocks, the barks of trees, or the surface of the ground. They are, however, abundant only in temperate climates, where there is some degree of atmospheric moisture: they are also found, but in less variety, within the tropics, notwithstanding the degree of moisture; hence it may be inferred, that it is the heat of such situations which is injurious to their prevalence: their absence, therefore, from the hot and dry parts of India, as well as of the world, might be expected, as heat, unaccompanied by moisture, is there usually so greatly in excess to what is congenial to their habits.

The Muscology of India has been little investigated: none are noticed in Dr. Roxburgh's Flora Indica; 113 species are enumerated in Dr. Wallich's Catalogue, chiefly from Nepal. In the author's collection there are only fifty-five species, almost all from one locality, that is, Mussooree: of these, several are the same as those in the East-Indian Herbarium, but others are peculiar to the author's collection, though all are not new species, being for the most part such as are also found in Great Britain, and other parts of Europe. Mr. Griffith, when in Assam, paid considerable attention to the *Mosses* he found in his journey. The results he has detailed in a paper read before the Linnæan Society, but which, not having yet been published, I can only refer to its abstract in the proceedings of the Society. Most of the species were "gathered in the Khasya Hills, an elevated tract of country, forming part of the eastern frontier of British India. The climate is described to be excessively moist, which will account for the large number of *Mosses* collected in the journey by Mr. Griffith, forming about one-eighth of the entire family, 1324 being the amount of species enumerated by Bridel, in his Bryologia Universa."

The *Mosses* in Dr. Wallich's and my own collection, have had the advantage of being examined, and named, by Sir Wm. Jackson Hooker, whose determinations, from his great knowledge of the subject, and possessing one of the most extensive Herbaria, are of the greatest value, and worthy the entire confidence of botanists. From his investigations, therefore, we find that in the hot parts of India, and places to its south, such as the Malayan Peninsula, Penang, and Singapore, where there is also moisture, species of the genera *Syrrhopodon, Octoblepharum,* and *Hyophila,* have been obtained; and, excepting of the last, solitary species, of such genera as *Trichostomum, Tortula, Dicranum, Bryum,* and *Hypnum.* Of these, *Tortula indica* is found on walls near Calcutta, *Dicranum megalophyllum,* Brid., in Singapore, *Hypnum Tavoyense* in Tavoy, with *H. retroflexum,* and *microcarpum,* in Ava. *Bryum acuminatum,* Hook., in Penang, and the West-Indies. *Octoblepharum albidum,* Hedw., in Singapore, also in the West-Indies, S. America, Mauritius, and Madagascar. *Hypnum spiniforme,* Hedw., at Penang, in Mauritius, the Cape of Good Hope, and the West-Indies. Of the genera of tropical situations, of which species extend into Nepal and the mountains, we may mention *Syrrhopodon, Calymperes, Schlotheimia,* and *Pterogonium. Orthodon* is common to Nepal and the Isle of Bourbon, the same species, *O. serratus,* occurring in both. *Sclerodontum,* found in Brazil and New Holland, has also a species, *S. secundum,* in the Himalayas,

Himalayas, as has *Glyphocarpus,* of which the other species are found at the Cape of Good Hope. *Hookeria,* frequent in tropical, but rare in temperate regions, has one species, *H. acutifolia,* peculiar to Nepal; but the other, *H. rotulata,* Sm., is also found in the West-Indies, New Zealand, and at the Cape of Good Hope.

Genera peculiar to Nepal, but of which only single species have yet been described, are *Hymenostylium, Leptohymenium, Regmatodon,* and *Lyellia:* but the genera, to which the great mass of the species found in these mountains belong, are those which are best known in Europe, and other temperate parts of the world, such as *Gymnostomum, Grimmia, Orthotrichum, Zygodon, Trematodon, Dicranum, Didymodon, Tortula, Brachymenium, Bryum, Pohlia, Bartramia, Funaria, Polytrichum, Hypnum, Leskea, Neckera, Leucodon,* and *Fissidens.*

As we have seen the genera of hot climates prevailing in the southern parts of India, spreading into Nepal, and still further north into the Himalayas, and occurring with an occasional species of a European genus, so do we observe among the species, the prevalence of several which occur in other hot parts of the world, though there are with them a great many which are identical with those of temperate climates, as of Europe and of the British Isles. This mixture of tropical and European forms, we have seen to prevail very frequently even with the genera and species of more highly developed forms of vegetation, and which was ascribed to the equability of temperature and of moisture of the rainy season during which these anomalies occur. It has long been observed by the most distinguished botanists, and among these by Mr. Brown, who holds the first rank among them, that the species of the less highly developed forms have a very wide geographical distribution. Of this several examples are given in the list appended by Mr. Brown to his General Remarks on the Botany of Terra Australis. Many have been adduced in the present work, as well among Phænogamic as among Cryptogamic Plants, and a still greater number in proportion to the new species, are now to be adduced from among the true *Mosses.*

The species of *Mosses* which have been found in Nepal, and the neighbourhood of Mussooree in the Himalayas, and which also occur in other, often very distant countries where the climate is hot, are *Orthodon serratus,* Schwägr., *Dicranum fragile,* Hook., *Didymodon squarrosum,* Hook., which occur in Mauritius; also *Fissidens polypodioides,* Hedw., likewise found in the West-Indies; as are *Bryum coronatum,* Schwägr., *Funaria calvescens,* Schwägr., *Hypnum flexile,* Sm., *Neckera cladorhizans,* Hedw., *N. undulata,* Hedw., *Hookeria rotulata,* Sm. *Neckera dendroides,* Hook., occurs in the Sandwich Isles; *Hypnum flexile,* Sm., and *arbusculum,* Hook., are likewise found in New Zealand; as well as *Hookeria rotulata,* Sm., and *Funaria arborescens,* Schwägr., in New Holland. The European species, many of them British, and some also occurring in N. America, and which have been found in the Himalayas, are *Gymnostomum rufescens,* Hook., *Trematodon longicollis,* Rich., *Dicranum heteromallum,* Hedw., *squarrosum* and *flexuosum,* Hedw., *scoparium,* Hedw., *longifolium,* Ehrh., and *glaucum,* Hedw., *Didymodon purpureum,* Hook.?, *Tortula angustifolia,* Hook., and *fallax,*

Sw., *Bryum julaceum*, Schrad., *cæspititum*, Linn., *argenteum*, Lin., *cuspidatum*, Schreb., *nutans*, Schreb., *elongatum*, var, *rostratum*, Schrad? *roseum*, Schrad? and *turbinatum*, Sw., *Pohlia elongata*, Hedw., *Bartramia Halleriana*, Hedw., and *B. fontana*, Sw., *Polytrichum aloides*, Hedw., *P. undulatum*, Hedw., *P. urnigerum*, Linn., and *P. juniperinum*, Willd., *Hypnum serpens*, Hedw., *H. proliferum*, Linn., *H. prælongum*, Linn., *H. molluscum*, Hedw., *H. cupressiforme*, Linn., *H. ruscifolium*, Neck., and *H. abietinum*, Linn., *Neckera tenuis*, Hook., and *N. pennata*, Hedw., *Fissidens bryoides*, Hedw., and *F. taxifolia*, Hedw. The species found by Mr. Griffith, which are also identical with those indigenous in Europe, were found about a thousand miles to the S.E. of the parts of the Himalayas, whence a great majority of the foregoing were procured. According to the abstract, given in the Proceedings of the Linnean Society, his "collection contains *Sphagnum obtusifolium*, *Polytrichum urnigerum*, and *aloides*, *Weissia Templetoni*, *Dicranum scoparium*, and *glaucum*, *Bartramia fontana*, and several others familiar to the European muscologist; but the far greater number of the species have not been previously described."

204. HEPATICÆ.

The *Hepaticæ*, named originally from their liver-like colour, are intermediate in structure between *Lichenes* and *Musci*. The *Jungermannias* are sometimes separated from the *Marchantias*, at other times they are united together; but in the investigations of Nees von Esenbeck and of Bischoff, adopted by Endlicher, the *Hepaticæ* are distinguished into the smaller orders, *Ricciaceæ*, *Anthoceroteæ*, *Marchantiaceæ*, and *Jungermanniaceæ*, and all of which are found in moist situations on the earth or trees in all parts of the world. These, like other Cryptogamic plants, have been but imperfectly investigated in the Himalayas, or indeed in India in general, and therefore many genera and species will probably be added to the numbers already known, as there are only ten of the former, and about thirty of the latter. Among the genera, *Plagiochosma* is peculiar to Nepal; *Dumortiera* is a wide-spread tropical genus, which has a species in the mountains of Ava; *Blandowia* and *Grimmaldia*, found in the south of Europe and America, have likewise species in Nepal, where are also found species of *Anthoceros*, *Riccia*, *Fimbriaria*, *Hygropyla*, Taylor; *Jungermannia*, and *Marchantia*. The species are chiefly new, and have been named by Lehmann: with these have been found *Jungermannia diclados*, Brid., *J. scorpioides*, N. ab E., *J. juniperina filiformis*, Sw., together with *Marchantia squamosa*, Raddi, and the universally-diffused *M. polymorpha*, which found in Europe, Africa, and even North America, also occurs in the Himalayas.

205. LICHENES.

Lichenes, often called in English *Rock Moss*, have been described by Fries as "types of *Algæ*, born in the air, interrupted in their development by the deficiency of water, and stimulated into forming a nucleus (or receptacle of sporules) by light." Agardh considers

considers them more nearly allied to *Fungi* than to *Algæ*. They are aërial perennial plants, cellular in structure, indefinite in extension, and with no fixed symmetry of form. They are found growing on stones, or on the earth, or on living or dead, but not usually on decaying parts of plants, sometimes on the trunks of trees, and sometimes on the leaves, especially of tropical evergreens. Pulverulent Lichenes are the first plants that clothe the bare rocks of newly-formed islands, then follow foliaceous Lichenes, and then Mosses and Hepaticæ (D'Urville ex Lindley). A certain degree of moisture, though less than that required for other Cryptogamic Plants, is necessary for the growth of *Lichenes:* we, therefore, find them flourishing in comparatively dry climates with moderate temperatures, but attaining perfection in the moist seasons of the year; abounding also, but less frequently forming fructification, in much colder regions, and thus extending from the equator to polar regions, and from the rocky shores of the ocean to the verge of perpetual snow. It has been remarked that the same species are found in very different parts of the world, and that the Lichens of Europe differ little from those of North America; Mr. Brown long ago enumerated the European species in New Holland, and Baron Humboldt, (Syn. Pl. Æquinoct. Orbis Novi,) has since mentioned those in the mountains of South America.

This is observed, but in a still more remarkable manner, in the comparatively few Lichens which I collected in the Himalayas, almost the whole of which are pronounced by Professor Don, who has had the kindness to examine and compare them, to be identical with European species, and I can add my testimony to his, as I am unable to perceive any specific difference in those which I have compared.

Among the most conspicuous of the Himalayan *Lichenes*, are *Usnea barbata* and *U. florida;* the former extending south to Ceylon and the Peninsula of India, especially to Coorg; the latter is found on Chimborazo in S. America, and in New Holland. *Borrera furfuracea* and *B. ciliaris,* equally European species, are both very common, especially the former, in the Himalayas. To this genus belongs the Lichen (*B. Ashneh*, nob.), which is called *chulchelera,* and so extensively employed in India as a dye. *B. ciliaris* is also found in Coorg, and *Roccella fuciformis,* or flat-leaved Orchil, very abundantly in Tranquebar. *Ramalina farinacea* is extremely abundant in the Himalayas, and found also in the Peninsula, in the Hills near Cudalore. Of *Gyrophora,* a species which is closely allied to, if it be not identical with *G. murina;* while of *Peltidea, P. canina,* is found on the Choor mountain; *Parmelia perlata, caperata, physodes,* and *aipolia,* with *Sticta pulmonacea* and *scrobiculata*, are indigenous in the Himalayas, as well as in Europe. Besides these are other species of the former genus, as well in the Himalayas as in the Peninsula. In the former are also found a species of *Alectoria,* an *A. jubata*?, with *Stereocaulon paschale,* and species of *Cladonia* and *Scyphophorus.* Numerous species of crustaceous Lichens may also be seen, both on trees and rocks, on the mountains, as well as in the plains. The few in Herbaria belong to the genera *Lecanora, Lecidea, Lepraria, Pertusaria, Endocarpon, Verrucaria, Opegrapha,* and *Arthonia.* From Bombay specimens have been sent of *Usnea barbata* and *florida,*

with

with a species of *Borrera*, and from Ceylon varieties of *Roccella fuciformis*, with *Ramalina fastigiata* from the Sunderbund or Delta of the Ganges.

Though obscure and apparently insignificant as plants, the Lichens yet serve some important purposes; some are useful as medicines, and others in the arts; several serve as food for herbivorous quadrupeds, as deer and antelopes, and a few for man himself. Those which have been employed as food, contain a starchy substance, called *Lichenin*, which renders them nutritive and demulcent: among these is *Cetraria islandica*, or Iceland Moss, after it has been steeped in water. The several species of *Gyrophora*, as *G. proboscidea* and *G. vellea*, though bitter and nauseous, constitute the *tripe de Roche* of the Canadians, which supported Sir John Franklin and his companions in Arctic America; they are found in cold rocky situations, especially on granite, in almost all parts of the world. *G. cylindrica* is occasionally used in Iceland as food. So, in Lapland, *Alectoria jubata*, according to Linnæus, supplies the rein-deer with food in winter; as does *Cladonia rangiferina*, or rein-deer moss, which grows there in great abundance, and serves to pasture the vast herds of rein-deer, which constitute the sole wealth of the Laplanders. Many others might be edible, if it were not for the bitter principle which they contain along with the fecula. Berzelius has proposed removing this, by macerating them in a weak solution of carbonate of potass (one part to three hundred of water), and afterwards washing them in cold water. This bitter principle has been called *Cetraria*, and imparts tonic properties to several of the species, as to *Borrera furfuracea*, and others which have been used for the same purposes, as *Cetraria Islandica;* and some have been employed as a substitute for hops in the brewing of beer.

Some of the Lichens are, however, more valuable for yielding a fine dye, than for any other purpose: this is developed, as is well known to practical men, by digesting the *lichen*, with the assistance of heat, in a weak solution of ammonia, (v. Visgor in Proc. of Com. Agr. R. As. Soc.) Of all the Lichens, *Roccella tinctoria* is by far the most valuable, being employed for making orchil or archil, and is for this purpose imported from the Canaries, Azores, and Cape-Verd Islands, as well as from Sicily: that obtained from the first is much the most valuable, selling even for £400 a ton. *R. fuciformis*, the other species of the genus, is more widely diffused, being found in Europe, Brazil, as well as in Ceylon, and the Peninsula of India, whence several specimens have been sent to the Royal Asiatic Society, but this is far inferior in quality, containing, indeed, hardly any colouring matter. *Usnea barbata* is described by Humboldt as being employed in South America for a similar purpose; but some of the crustaceous Lichens are also valuable, as *Lecanora Parella*, the Perelle of Auvergne and other parts of France, where it is extensively employed to produce a dye far superior to that of another *Lecanora*, *L. tartarea*, the Cudbear, and equal to that of the *Roccella tinctoria* ex Hooker. So also *Parmelia saxatilis* and *omphalodes* are used in Scotland. Several other of the crustaceous Lichens are employed, though none yield so fine a colour as the *Archil*, or the *Perelle;* but as the colouring matter is not confined to a few only, it is more than probable that some of the Indian and

Himalayan

Himalayan species may be found to yield a valuable dye, and thus become articles of commerce. The dryer climates will probably yield it of a finer quality than the moist, and the secretion seems much influenced by local circumstances. One species is already employed as a dye by the natives of India, that called by them *chulcheleera,* and which appears to be a species of *Borrera.* It is curious that this is described in their works under the name of *Ashneh,* which is no doubt the origin of *Usnea,* and for which Persian authors give *ubryon* as the Greek synonyme. This may be βρυον, mentioned under λειχινος, Diosc. 4. 53. The *Usnea,* which was known to the older writers, as Dillenius and Ray, is described as a filiform lichen, found on trees in the East-Indies: and this is mentioned by Acharius, under the name of *Alectoria Arabum,* though by many it has been considered merely a conjectural species.

This adds another to the many instances already adduced of the correspondence in past times between the early famed East and the later civilized West, both in articles of Materia Medica, and the various natural products employed in the Arts.

206. FUNGI.

The *Fungi* or Mushroom tribe, including the true Mushrooms, Puff Balls, and Mildews, are considered to be most allied to Lichens by some botanists, and by others to Algæ. Some, indeed, have stated that *Fungi* and *Algæ* are rather distinguished by the medium in which they are developed, than by any peculiarity in their organisation. They are found growing in the earth, or on decaying vegetable or animal matter, and are as remarkable for the rapidity of their growth,which frequently takes place during the night, as for their perishable nature and the short space of time (only a few hours) that some of them require to vegetate in, and to attain perfection. Their geographical distribution is but little understood; in fact, the *Fungi* themselves of most countries are but little known, from the difficulty of preserving specimens; so that in many instances, if not completely examined and described, or drawn, on the spot, it is in vain to remedy the deficiency from the contents of an Herbarium. Those of tropical countries are almost unknown; only twenty-five are enumerated by Humboldt and Bonpland from S. America, and only ten (and these European species) by Mr. Brown, as found in New Holland. None are mentioned by Dr. Roxburgh in the Flora Indica, or in the Catalogue of the Calcutta Botanic Garden; and in the Author's collection there are only about forty species from the Himalayan mountains. These have been examined by Professor Don, who finds, as in the Lichens, that the majority have the closest resemblance to European species, but, from the perishable nature of the specimens, their identification is much more difficult.

Of the genus *Agaricus,* the most highly developed of the Mushrooms, and the most numerous in species, there are several in the Himalayas, and among them two which are very like *A. Georgii* and *A. Orcades,* both eatable European species, the former of which, according to some botanists, is only a variety of *A. campestris,* or common Mushroom. There are also species of *Merulius,* and several of both *Boletus* and of *Polyporus;*

among

among those of the latter, *P. fomentarius*, and one which closely resembles *P. versicolor*. Besides these there are species of *Lycoperdon* and *Phallus*, *Geaster* and *Clavaria;* and among the species of the two latter genera, there are *G. rufescens*, with *C. militaris* and *C. digitata*.

Europeans in North-western India often mention Truffles (*Tuber cibarium*) as purchaseable at the Hurdwar Fair; I only obtained specimens of common *Morels*, or *Morchella esculenta*, the *Kana kuchoo* of the natives of India, which are every year brought down for sale from Cashmere; and whence some fine specimens were procured in 1831, by the plant collectors detached from the Saharunpore Botanic Garden. Travellers have also mentioned to me, that the common mushroom is found in the Himalayas; it may be so, but the specimens which came nearest to it in my collection resemble *A. Georgii*, already mentioned, as an edible species.

The *Fungi* vary much in properties, but are comparatively of little use; some certainly are edible, but many are poisonous in nature; the prejudice, however, is greater in England than on the Continent, where many more species are eaten, and even reckoned delicacies. There are, no doubt, good grounds for the distrust entertained respecting them, in consequence of the difficulty of distinguishing the wholesome from the noxious species. It would, however, be desirable to ascertain whether many of the species indigenous in the Himalayas might not be employed as articles of diet, as so many similar species are on the Continent of Europe, paying due attention to the caution with which such experiments can alone be carried on.

Some of the *Fungi* have been employed in medicine from very early times, and a few of the same still continue to be so, as *Boletus purgans* (*B. Laricis*). *Polyporus igniarius* and *fomentarius*, employed as styptics and cathartics, and supposed to be included under the Αγαρικον of the Ancients: these the Arabians (Avic. c. 80) and Persians refer to, and describe as vulnerary and cathartic, under the name of *Gharikoon*, under which name I obtained in the bazars of India a species of *Polyporus*. The *Fungi* described by Dioscorides (περι μυκητων. 4. c. 73) as of two kinds, one edible and the other noxious, are referred to by Avicenna, c. 275, under *Fittur;* and the two kinds are distinguished in Persian works in India, by the names *kuma*, the *esculent*, and *fittur*, the *poisonous Fungi*. The proximate principles of this order, as my friend, Mr. Pereira, has briefly stated, are—"1. *Fungin*, a nitrogenous, highly nutritious woody matter; 2. *Amanitin*, the active ingredient of some of the *Agarici;* 3. *Boletic Acid;* 4. *Fungic Acid*. Mushroom Sugar has been found identical with *Mannite*." Oxalic acid, probably in the state of a *Binoxalate*, has been detected in *Boletus sulphureus*, by Dr. Scott of Dublin. The Fungus, usually called Ergot of Rye, either possesses, or gives origin in the grain, which it stimulates into diseased action, to a very active principle, especially useful as a medicinal agent, and named *Ergotætia abortifaciens* by Mr. Quekett. Something similar to this is, I believe, employed by the Hukeems of India in cases of the same nature; this would be an interesting subject of inquiry for some of the medical service of India.

207. Algæ.

207. ALGÆ.

The *Algæ*, in the extended signification of the term, include not only sea-weeds, but also the articulated salt and fresh water Confervæ, together with the still less highly developed plants, consisting of mere threads or vesicles, or slimy, jelly-like plants, described by Bory de St. Vincent. As the last are found in damp and shady situations, or even on rocks, which are kept constantly moist, and such plants as that called Red Snow, one of the *Nostochinæ*, occur not only near the North Pole, but also in the Alps; they may be found in the Himalayas, together with some of the fresh water Confervæ, which are usually found in temperate climates; while of the true *Fuci*, the *Lemanias* are only found in the fresh water of mountain torrents.

In the numerous families treated of in this work, we have seen that many of the aquatic species, or those delighting in moist situations, have a more extensive distribution, in consequence of the greater equability of temperature produced by moisture, and we might therefore expect many of the same genera and species in the waters of the Indian Ocean, as in those of more northern latitudes; but it has been observed by Lamouroux and Greville, that Confervas are comparatively rare within the tropics, but a few species are found in Dr. Rottler's Herbarium from the neighbourhood of Tranquebar.

The *Fucaceæ* are much more extensively distributed, as some occur in all latitudes, and though the *Ulvas* flourish most in the polar and temperate zones, *Sargassum*, tropic-grape or gulf-weed, floats in immense fields in 40° of latitude. The *Dictyoteæ* increase in numbers as we approach the equator; and *Hypnea, Cystoseria, Sargassum, Zonaria, Sphærococcus, Thaumasia, Acanthophora, Tamnophora, Amansia, Caulerpa,* and *Gelidium,* of which swallows build the so much prized "edible bird's-nests," abound in tropical seas. Few have been described from the Indian Ocean, but several are contained in Dr. Rottler's Herbarium, which the author will take some future opportunity of describing.

The lowest types of *Algæ* serve probably as food for animalcules, which themselves become the prey of more highly developed animals. Many of the sea-weeds are used as food in different countries, and some, as *Laver*, are even considered delicacies at the tables of the rich, whilst others are valued as diet for the sick. *Gracilaria lichenoides* is esteemed as food in Ceylon; *G. tenax* is valued by the Chinese as the basis of an excellent glue and varnish, and the *Gelidium,* collected by swallows for their nests, gives origin to a very extensive commerce. Some of the sea-weeds are employed as manure; others are burnt for the impure carbonate of soda, which they yield; a few are valued as medicinal agents, from containing among their constituents the powerful agent *Iodine,* so much employed in the treatment of scrofula and of goitre. It is curious, as stated by Dr. Greville, "that the stems of a sea-weed are sold in the shops, and chewed by the inhabitants of South America, wherever goitre is prevalent, for the same purpose. This remedy is termed by them *palo coto* (literally

goitre stick); and, from fragments brought by Dr. Gillies, who gave Dr. Greville this information, the plant is decided to belong to the type *Laminaceæ*, and is probably a species of *Laminaria*." It is equally interesting and remarkable, that the natives of India along the foot of the Himalayas, where goitre is prevalent, should employ a leaf, which they describe as being brought from a great distance, and which they call *gillur ke putta*, or goitre-leaf, and consider efficacious for the cure of that complaint; this also seems to be that of a sea-weed, the specimens, which I am at present unable to find, resembled the crumbled fragments of a leaf of *Potamogeton natans*, but they are as likely to be those of a *Fucus*, brought from a distant sea, and which I would suggest as an interesting subject of inquiry to be traced out in India.

Having treated of the various Families of Plants which constitute the Flora of the Plains and Mountains of India; noticed their Geographical distribution, especially as connected with Climate, not only in India, but in other parts of the world; specified the various Genera, and enumerated the several Species which are also found elsewhere; and thence having drawn the necessary inferences respecting the Culture in India of the valuable plants of other countries, similar in climate or vegetation; treated of the Literary History of several Indian Products mentioned by Classical Authors, and in detail of the Cultivation of a few of the more important, as Tea, Cotton, and Tobacco; besides paying especial attention to the Properties of Plants as connected with Structure, and pointing out those which are suitable to an English climate. The Author feels that he has endeavoured to the best of his abilities to fulfil the promises which were held out in the original Prospectus of the Work; as he has thus displayed the vast internal resources of India, as well in what is ornamental as in whatever is useful or necessary for the comforts of the people, or the wants of a great empire. It was then stated, that "in no part of the British dominions were the riches and variety of the productions of nature greater, or the forms more interesting, than in the Himalayan Mountains, which form so stupendous a barrier between the dominions of the British and the territories of the Chinese. Their western bases resting on the arid plains of India abound in all the forms, both of animal and vegetable life, which are characteristic of tropical countries, while their gradually elevated slope, which supports vegetation at the greatest heights known in the world, affords at intermediate elevations all the varieties of temperature adapted to the production of forms, which are considered peculiar to very different latitudes;" and as no connected and illustrated view had been published of the "progressive transitions, from the productions which are characteristic of the plains of India, and which exist at the bases of these mountains, to those found at different elevations on their acclivities, where a gradual approach is made to the forms common in Europe, America, and Japan," it seemed "advisable, while discussing the appearance and distribution of the different

families

families of plants, to notice the soil or rock formation in which they exist, the atmospherical phenomena by which they are surrounded, and the animal forms with which they are associated."

"A further advantage attending such an arrangement," it was stated, "would be the facilities afforded for comparison with the Flora and other productions of countries which approximate in climate, though widely differing in geographical position, while the properties and applications of the more useful plants might be indicated. Frequent opportunities will thus also occur, both of pointing out what useful or ornamental plants might be introduced from India into Europe, or conversely what success would be likely to attend the cultivation in India of the more useful plants of other countries."

These objects have not been accomplished without the sacrifice of much time and labour, as not only did each individual plant require to be separately examined, and often afterwards to be compared with similar species in the collections of the metropolis, but the different subjects and applications pointed out in each family of plants, required to be investigated not only in separate publications, but in such as treated of very different branches of science. To those unacquainted with such subjects, the produce will hardly appear equivalent to the labour bestowed on it, as the results only being given, the investigations which have been gone through do not appear; but it may be mentioned, that the present work is the first published, in which the entire Indian Flora is arranged according to the Natural Families of plants, the only method which enables us to treat systematically of their Geographical distribution, Culture in new situations, or of their Properties, as connected with, or dependent on Structure.

Though yielding to none in his conviction of the imperative necessity of careful research and scrupulous accuracy, both in ascertaining facts and in drawing inferences, the Author feels that errors may have escaped him, for which he relies on the consideration of well-informed criticism. Appreciating fully the pleasures and advantages derived from examining the beauties, and observing the wisdom of Design in all the works of the Creator, and estimating highly the advantages of, as well as the credit attached to scientific investigation, he has yet felt it incumbent upon him to do that, which is often neglected in scientific works, namely, to deduce the legitimate *practical* inferences, from correct scientific data, because these are usually undervalued by many persons, who think only of practical, which are usually *empirical* results, and who, though most interested in the objects to be attained, yet from not understanding, are as unable to perceive the tendency of principles, as to apply them in practice. The Author has, moreover, been induced to do this, because he has felt throughout his labours "*nisi utile sit quod facimus, stulta est gloria.*"

ALPHABETICAL LIST

OF

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† Since the completion of the work, it is observed that the description of these three species of Procris has been accidentally omitted.

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A * preceding a word indicates that the plant or subject referred to is figured in the Work.

The Indexes having been, in many cases, prepared from proof sheets, a few errors will be found in the numbering, seldom, however, exceeding a page, except in the references to the Geological and Meteorological parts, where they were caused by the Index having been completed previous to these parts being set up in sheets, the paging of which, the notes at the end of the Introduction, containing recent information from Mr. Vigne and Dr. Falconer, materially altered. The Meteorology now commences at p. xxx. *

THE END.

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