

Notes on the Vegetation &c. of Chumba State and British Lahoul; with Descriptions of New Species*. By GEORGE WATT, M.D., C.M., F.L.S., Professor of Botany, Bengal Educational Service.

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(PLATES IX.—XIV.)

Remarks on the Physical Features of the Country traversed.

TOWARDS its western extremity the vast Himalayan chain divides into many approximately parallel ranges. Starting from the upper valley of the Sutlej, and passing from north-west to south-east, these ranges are separated by deep well-defined valleys, from which the Indus obtains its five Punjab streams. To the south of the Indus valley proper, the ranges are collectively known as the Outer or higher Himalayas; and the three visited by me may be conveniently referred to as the First, Second, and Third ranges.

I. THE FIRST RANGE.—Being nearest the plains of India, this is the one upon which the British sanatoria (Dalhousie, Simla, &c.) are situated. From it spurs are given off having a more or less southerly direction, and becoming lower and lower as they approach the plains. So also to the north, or rather north-east, spurs are thrown out, becoming gradually lower and lower into the Ravee valley. The First Range and its spurs and low detached hills thus stand between the Upper Ravee basin and the plains. Having toiled for two or three days, I found myself on the summit of the First Range, which varies in altitude from 8000 to 14,000 feet above the level of the sea. Looking southward, the plains may be seen in the far distance, and the sterile hills of loose conglomerate, fissured by denudation, appear as if thrown away from the whinstone rocks that have burst through them. Looking forward and down into the valley of the Ravee, spur after spur at right angles again and again mingle and intermingle in utter confusion, sinking to the depths of the Ravee basin, and gathering themselves up, rise higher and higher, series above series,

* [This communication, when read, was entitled "Contributions to the Flora of the North-western Himalayas;" but at the suggestion and by leave of the Council its scope has been somewhat modified, and the title changed accordingly.—Ed.]

until lost in the slopes of the snow-capped Second Range. The whole of this panorama of low hills and spurs, filling up the space from the First to the Second Range, constitutes the basin of the Ravee. It extends eastward to a point where these two ranges seem to unite through the lofty spur which forms the Andrar Pass, and separates the head-waters of the Ravee from those of the Bias. From the Andrar Pass the Upper Ravee basin extends north-west to a little below Chumba city, and then turns south-west to Shoojanpore. The whole of this country is designated the Ravee basin in these notes. Having fully admired the bewildering confusion of low hills of the Ravee basin, I commenced the descent to the Ravee and Chumba city. The road leads through magnificent forests of *Cedrus Deodara*, a tree which is extremely rare on the southern slopes of the First Range. In a few hours Chumba city, at an altitude of 3000 feet, was reached; and I began to realize the fact that I was in a new country and amid a new people. The giant Man-Mahesh and his fellows, sifting and purifying the air, intervenes between the damp malarious plains of India; and the nature and condition of the vegetation reminds one that he has advanced one stage away from the excessive rains of India towards the dry regions of the Inner Himalayas. The changes in the vegetation on crossing each of the three successive ranges of this region point conclusively to the great influence exercised by high mountain-ranges in the distribution of plants. It must not be supposed, however, that it is always mere altitude or snow that exercises this influence; for the changes observable on crossing from the southern to the northern slopes of the First Range are quite as great as those observed on crossing from the one side to the other of the Second Range with its perpetual belt of snow. It is much more likely that the degree of humidity has to do with these changes, since they are observable on the sides of a range over which there could be no other difficulty in the way of plants spreading from the one side to the other.

II. THE SECOND RANGE.—From Chumba the road takes the traveller through low hills to the spurs and slopes of the Second Range; and after five or six days march he finds himself in a narrow cutting through the snows, forming one of the many lofty passes (from 15,000 to 19,000 feet in altitude) leading from the Ravee basin into that of the Chundra-Baga, as the Upper Chenab

is here called. The basin of the Chundra-Baga extends from Kistawar in the north-west to the western high mountains of Spiti. It is divided into three portions—namely, Pangî or Chumba, Lower Lahoul, and Upper or British Lahoul.

Pangî.—Inhabited by an Aryan race of people, quite different in their social habits (being polyandrists), speaking a different language and professing a different religion, and altogether isolated from the other hill-tribes of this region. Their summer is short, compelling them to hibernate for nearly half the year, a peculiarity shared in by many of the animal and vegetable inhabitants of the valley. Immediately on the melting of the snow in May nature bursts into life; and the hibernating inhabitants escape from their close dingy houses. Like their goats, they take to eating many of the fresh green leaves. I noticed that my coolies had not got over their greed for green leaves in the latter half of May. While resting on the road they ate the young leaves of one or two umbelliferous plants raw, and also bruised, and baked them in their thick cakes of coarse bread. I was surprised at their refusing to eat *Nasturtium officinale*, preferring the umbelliferous leaves to any thing else. It is noteworthy that the domesticated fowl, however well cared for, cannot survive the winter in Pangî. The atmosphere is dry in summer, infinitely drier than in the Ravee basin; and a comparison of the plants confined to Pangî, or not found in the Ravee basin, will show how visibly this change in the degree of humidity is attended with a change in the vegetation. An equally well-marked boundary-line was observed in the distribution of both birds and butterflies; and it is a singular fact that while several Batrachians are common in the Ravee basin, not one is known to inhabit Pangî or Lahoul. The valley of Pangî is nowhere more than a quarter of a mile in breadth, with snow-capped ridges bounding it on both sides.

Lower Lahoul.—The wildest and most sterile portion of the basin, where the traveller must be constantly on the alert to avoid accidents. For miles the road is utterly impassable to any beast of burden; and even man must be possessed of considerable nerve and agility to accomplish a good day's march in Lower Lahoul. At many points the road is limited to a plank laid across iron crowbars driven into the face of a mural precipice rising 2000 or 3000 feet overhead, with the roaring Chundra-Baga several hundred feet below. At Triloknath the valley widens and becomes more interesting.

British Lahoul.—The inhabitants are Mongolians and Buddhists. At Tandi the Chundra and the Baga join. The former rising to the south-west of the Bura-Lucha Pass, and describing an arc of a circle by south-east to north-west, washes the mountains of Spiti and drains the northern slopes of the Rotang Pass; the Baga, rising almost at the same point, describes also an arc of a circle, passing south-east and south to join the Chundra. At Keylang, on the Baga, I found the good Moravian Missionaries not only able to assist me, but ready and willing to permit me to inspect their interesting collection of Lahoul plants. I shall be pardoned for acknowledging here the great help I received from my kind friends in Keylang, the Rev. Mr. Heyde and the Rev. Mr. Redslöb.

III. THIRD RANGE.—The ascent may be made from Keylang to the Bura-Lucha Pass (17,000 feet), where the Chundra-Baga valley terminates. From the Bura-Lucha Pass the road leads through Zanskar to the capital of Ladak on the northern bank of the Indus.

Climate and Vegetation.

The following remarks on the climate and vegetation should be understood as applying to the route taken by me, rather than to the country generally, though many of them are of general application.

Not only do the three Ranges described divide the Punjab Himalayas into distinct drainage-areas, but they separate three regions with widely different climatic conditions. The First or southern region extends from the Punjab plains to the summits of the First Range. This may be described as very rainy, although it must be remembered that the annual rainfall occurs during part of four months only, and that during the rest of the year this region is dry, hot, and altogether below the line of perpetual snow. The Second region extends from the summit of the First to the summit of the Second Range. This may be characterized as a fairly rainy basin, corresponding to the Ravee, Bias, and the greater part of Kashmir: while the total rainfall is less, the annual and average humidity is greater and, like the temperature, more equable; so that the vegetation of the region is much richer than in the preceding, and contains a much larger proportion of temperate types. The snow-line descends to about 15,000 feet; but during winter months the snow lies as low down in the Ravee

basin as 3500 feet, whereas it never lies much below 7000 feet in the First or southern region. The Third region extends from the summits of the Second Range to the Indus valley. This may be described as almost rainless, only a few inches falling throughout the entire year. The greater part of this region, however, is under snow for about seven months; and consequently trees become extremely rare—herbaceous and annual vegetation rapidly clothing the luxuriant hill-sides during the short summer. While the atmosphere is very dry and mild, the soil is everywhere constantly damp during summer, the hill-sides being permeated by streamlets from the melting snow. I may here mention that the staple product of cultivation in this region is barley. It is cultivated in all the lower, rich, moist fields; while wheat has assigned to it the drier, exposed, poor, rocky soils. In fact, at high altitudes wheat only will yield a good harvest. It is often cultivated in Lahoul up to 14,000 feet.

General Vegetable Features of the First Region.—Without enumerating all the plants found in these regions, and thereby unnecessarily repeating mere lists of names, it may be remarked that on leaving the plains, and for several miles, the loose conglomerate and heavy clay-soil is clad with but scanty vegetation. There are no forests, except dense bamboo-jungles and the usual subtropical bushes and herbaceous plants which accompany the bamboo. At 2500 feet, in the shady hill-sides, scattered clumps or small woods of *Pinus longifolia* first appear, and alternating with these open wooded expanses, chiefly of *Cassia Fistula*, *Acacia Catechu*, *Indigofera purpurea*, and *Grewia oppositifolia*. At 3500 feet these disappear, and *Albizzia Julibrissin* and *A. odoratissima* take their place, along with the extensive scandent bushes *Bauhinia Vahlii*, and ultimately *Rosa moschata*. About the same altitude *Berberis aristata*, *B. Lycium*, and *B. nepalensis* become very abundant, and continue till the higher pine-forests are reached (about 7000 feet). It is remarkable how constant the subtropical or, at most, warm temperate character of this region is kept up from the plains high up into the mountains. Thus, for example, out of 55 species of Ranunculaceæ collected by me in the Punjab Himalayas, only six occur south of the First Range; and these are all almost tropical. Two of them, for example, are common to the plains, viz. *Ranunculus sceleratus* and *R. muricatus*; while the only other *Ranunculus* is so far subtropical as to be almost confined to this region, viz. *R. latus*. It is curious that

while a form of *R. aquatilis* occurs in pools in the Punjab, it entirely disappears until the Himalayas proper have been crossed, when it is again met with in Lahoul. *Anemone rivularis*, which occurs abundantly on the higher slopes of this region, is also much more tropical in its character than any other member of its genus, being the only species which extends to the mountains of Southern India. This same peculiarity might be shown with every other order. Thus, Fumariaceæ 13 species, none in the First region; Cruciferæ 43, with two species in this region common to it and the Second; Caryophyllaceæ 26 species, of which two occur here, one (*Gypsophila cerastioides*) almost confined to the higher slopes of the First Range (a very characteristic and handsome plant), alt. 5000–12,000 feet; Geraniaceæ 19 species, of which *Geranium lucidum* and *G. ocellatum* (the species which extend to the low hills of the Peninsula) are the only Geraniums met with, while only one Balsam appears to occur, viz. *Impatiens amphorata*. Of 52 Papilionaceæ only four were met with, and of 51 Rosaceæ only three species, in the First region. Of Primulaceæ only four species were seen. One of these, *Primula floribunda*, may be considered the subtropical member of this interesting genus, belonging to a group which becomes diffused eastward to China and Japan, and is characterized by having conduplicate vernation and more or less foliaceous bracts. *Androsace incisa* descends to about 3000 feet, and is spread all over this and the Second region; but the higher and snow-capped middle range forms almost an artificial boundary-line in its distribution; for its place is immediately taken, on crossing to the north of this range, by its nearest ally, *A. cordifolia*. *A. sarmentosa* is also confined to the north of the middle range; while *A. lanuginosa* is very abundant on the warm temperate slopes of the First Range. Ferns are extremely rare in the Southern or First region, only four species having been detected; and these are all of a subtropical character, *Asplenium alternans* being the characteristic fern.

Flora of the Second Region.—Immediately on crossing to the north of the First Range a marked change in the vegetation is noticeable. Dense forests of immense *Cedrus Deodara* were entered; and herbaceous plants, which only appeared at 7000–10,000 feet on the south, were here seen to descend to 3000 feet towards Chumba city. I shall not enter into a detailed description of the plants of this region, as it may in a few words be described as inhabited by the typical vegetation of the North-west Himalayas.

It is free from the subtropical types which so largely help to make up the flora to the south of the First Range, as it is also free from those forms which bring to the Third region so much of its Central-Asiatic and Siberian character. Perhaps the most striking exception to this remark is to be had in the appearance of *Geranium divaricatum*, which finds its most eastern station in Kumaon.

With the exception of the forests of *Abies Smithiana*, *A. Webbiana*, and *Cedrus Deodara*, there are no other trees that can be said to form forests. *Æsculus indica* is the largest and most handsome tree of this region, its bark scaling off in long linear patches in a manner peculiar to itself. Near villages *Cedrela Toona*, *Melia Azedarach*, and *Crataeva religiosa*, along with *Bauhinia variegata*, are also sufficiently abundant to attract attention, and, were it not that they are undoubtedly introduced, would form a curious exception to the decided temperate feature of this region. *Euonymus Hamiltonianus*, *Prunus Armeniaca*, *Zizyphus vulgaris*, *Rhamnus purpureus*, *Cornus macrophylla*, and *Andromeda ovalifolia*, with one or two species of Oak, Poplar, and Willow, and occasionally also *Juglans regia*, are the chief deciduous trees of this region. Of bushes and herbs the following are the most abundant—*Zanthoxylum alatum*, *Skimmia Laureola*, *Prunus Padus*, *Viburnum cotinifolium*, *Celastrus paniculata*, various species of *Rubus*, with miles of hill-sides covered with *Rosa moschata* and *Clematis Buchananiana*. At the same time various species of *Berberis* fill up the bushy character of a large portion of this region. It is in fact only in the dark shady tributary valleys that arboreal vegetation seems able to exist; and up these damp and verdant glens many interesting herbaceous plants may be gathered. The bright blue clusters of *Delphinium denudatum*, mingling with various species of *Potentilla*, *Ranunculus*, three or four species of *Hypericum*, Geranium, Balsam, *Spiræa*, and many others, make these charming shady places of peculiar interest. The scarcity, however, of epiphytal and parasitical plants is very striking, and tends largely to deepen the impression that the Western Himalayas, as compared with the Eastern, are much more Siberian in their character. This must be accounted for by the limited amount of rainfall and humidity in the west. At about 7000 to 8000 feet pine and cedar forests commence, and with these a great increase of herbaceous vegetation, chiefly Ranunculaceæ, Cruciferæ, Caryophyllaceæ, Leguminosæ and Rosaceæ, but parti-

cularly also an increased number of species of Compositæ, Primulacæ, Labiateæ, and Ferns. Lichens and Mosses also become very abundant; but, as pointed out to me by Dr. Stirton, they are, in common with those from the plains of India, chiefly in an arrested state, the apothecia being imperfectly developed. *Clematis montana* and a scandent Caryophyllacea (*Cucubalus bacciferus*) are especially abundant. On leaving the belt of pine-forests, stunted Oaks, the Birch, and *Rhododendron campanulatum* were met with. Above these a species of Juniper up to 14,000 feet, becoming ultimately a prostrate woody creeper not six inches above the ground. Along with this, in July and August, a bewildering glow of colours clothes the hill-sides to the foot of the snows, in which the primary colours predominate. The following bright-blue flowers were collected within a radius of 1000 yards—*Delphinium Brunonianum*, *D. vestitum*, *Aconitum Napellus*, *A. heterophyllum*, *Meconopsis aculeata*, Royle (the most handsome N.W. plant), *Corydalis cachemiriana*, *Primula denticulata* (*P. purpurea*), *Gentiana*, sp., and *Myosotis*, sp. With these *Primula rosea*, covering large patches and intermingling with an immense number of yellow flowers, forms a perfectly dazzling flower-bed, relieved by the wreaths of snow amongst which they are found.

Third Region.—On crossing the middle and principal chain into the valley of the Chundra-Baga a much more marked and striking change in the vegetation was noticed. New families appeared; and many but poorly represented in the Second region were here found to suddenly double their number of species. Thus, in Ranunculacæ 6 species are in the First region, 22 in the Second, and 41 in the Third, of which 14 were common to the Second and Third regions. Fumariacæ 13, of which 7 are confined to the Third region, while only 2 seem confined to the Second. Of 43 Cruciferæ, 26 are contained within the Third region, while only 4 species seem peculiar to the Second. Tamariscinæ make their appearance in this region; and, indeed, *Myricaria germanica* is one of the commonest bushes throughout Lahoul. It is, however, in Papilionacæ and Rosacæ that the most marked change takes place: thus, out of 52 Papilionacæ, 27 seem peculiar to the Chenab valley, or were not recorded in the Ravee basin. Of 51 Rosacæ, 25 are found in this region only, with, in addition, 10 which are also found in the second region.

The deciduous forests of the Third region are composed of a number of trees unknown or only introduced in the south of the

middle range, so that in the lower Chundra-Baga (which corresponds to Pangî), they are very striking, viz. *Acer cæsiûm*, *Acer pictum*, *Cratægus Oxyacantha*, *Fraxinus excelsa*, *F. Moorcroftiana*, *Corylus Colurna*; and, mingling with these forests and extending to the exposed hill-sides, the following bushes are very characteristic:—*Abelia triflora*, *Lonicera* (four species), *Parrotia Jacquemontiana*, and three species of *Cotoneaster*, conspicuously absent from the Second region (their place being taken by *Berberis*); four species of *Pyrus*, and particularly *Rosa macrophylla* and *R. Webbiana* taking the place of the very abundant and scandent Rose of the Second region. Three species of *Ribes*, and the appearance of *Deutzia* and *Philadelphus*, are striking characters of this region. It is remarkable, however, that while *Rhododendron campanulatum* is extremely common upon the south, it is nowhere seen in the north, nor indeed any other *Rhododendron*, except in Upper Lahoul, where the minute form makes its appearance. Extensive forests occur in Pangî; but on ascending the Chenab arboreous vegetation gradually disappears, and, except here and there, where *Pinus excelsa* and *Juniperus excelsa* form dense forests, no trees are to be found. The Birch and Juniper also in time disappear, until in Lahoul only a cultivated Willow is met with. This total disappearance of the trees from Lahoul forms perhaps its most noteworthy feature.

In addition to the diminution of humidity, the fall in temperature on passing across these regions must also largely account for the changes in the vegetation; indeed, since Pangî and Lahoul alike depend for their moisture more upon the melting snow than the rainfall, it must be attributed only to the aridity of the climate of Lahoul that arboreous and bushy vegetation disappears from that country.

In conclusion, the existence of marked changes within so limited a territory shows how very important it is, in reporting collections from mountainous countries, to note carefully the river-basin from which the specimens were gathered.

I should mention that I am greatly indebted to my friend Dr. Hutchison for kindly superintending the operations of my native collector in Chumba, and to Mr. Ellis, Forest Officer, Pangî, for adding to my collection much valued material. My sudden recall to India has necessarily prevented my personal revision of the proof-sheets, which Mr. W. B. Hemsley has kindly undertaken for me.

Description of New Species &c.

RANUNCULUS PANGIENSIS, n. sp. (Plate IX. B. figs. 3-9.)

Perennis, repens, ramosus, 1-2½ ped. altus, omnino pilosus, pilis sparsis longis albidis patentissimis. *Radices* carnosæ, claviformes, fasciculatæ, 6-12 lineas longæ. *Caules* e nodis rhizomatis, solitarii, crassiusculi, striati, basi simplices, fistulosi. *Folia* radicalia et caulina inferiora graciliter petiolata, 3-6-pollicaria, subtritermata, segmentis angustis pinnatifidis trifidis vel bifidis, caulina superiora sessilia, tripartita vel simplicia. *Flores* flavi, 9-12 lineas diametro, corymbosi, longe pedunculati; pedunculi striati vel leviter sulcati. *Sepala* ovato-oblonga, recurva. *Petala* obovato-rotundata, infra medium nectarifera. *Receptaculum* maturum elongatum. *Achenia* numerosissima, lævia, glabra, subplana, uncinata. Pangi, 8000 feet.

R. HIRTELLUS, *Royle*.

An exceedingly variable species, averaging from 2 inches to more than a foot in height, and constituting two parallel sets of forms—the one perfectly glabrous and having larger flowers with a more elongated receptacle, the other more or less hairy and often very small-flowered. The former is of a much more alpine character, often growing in the snow, and never descending below 10,000 feet. It is distributed from the northern slopes of the Second Range throughout Pangi, Lahoul, and Ladak, whereas the latter extends southward from the Second Range, at altitudes from 4000-12,000 feet.

R. SCLELERATUS, var. MYOSUROIDES, nov. var. (Plate IX. A. figs. 1, 2*.)

Robustus, 2-3-pedalis, valde ramosus et foliosus. *Folia* caulina 3-5-partita, segmentis latis grosse serratis basi attenuatis. *Flores* minuti. *Receptaculum* post anthesin elongatum, usque 6 lineas longum, arcuatum, glabrum, nudum.

On the ascent to Noorpore, Punjab.

A very singular variety of *R. sceleratus*, in which the oblong receptacle elongates as much as half an inch after shedding the achenes, and becomes quite naked and curved.

R. DIFFUSUS, var. HYDROCOTYLOIDES, *Wall.* (species). Tandi, Lahoul, 10,000-12,000 feet.

A very distinct stemless form, having thick, fleshy, fusiform

* The receptacle is incorrectly represented as being hairy.

roots, and small yellow flowers with hooked styles. The ordinary *R. diffusus* from the same region is a much larger rambling plant, having fibrous roots, white flowers, and straight styles.

AQUILEGIA GLAUCA, var. *NIVALIS*. Northern slopes of the Second Range, 14,000 feet.

Flowers solitary, very large (1-2 inches), deep purple. A very striking plant, not more than 4-6 inches in height.

ARABIS PANGIENSIS, n. sp. (Plate X. figs. 1-11.)

Perennis, cæspitosa, stellato-puberula, caudice crasso ramoso foliis vetustis vestito; caules floriferi graciles, ramosi, 4-6-pollicares. *Folia* crassa, radicalia confertissima, obovato-spathulata, integra vel paucidentata, 1-2-pollicaria, caulina lineari-lanceolata, obtusa, basi attenuata. *Flores* albidi, parvi, numerosissimi, laxe racemoso-paniculati; pedicelli filiformes, adscendentes. *Sepala* oblonga, concava, basi æqualia. *Petala* lineari-spathulata, 2½-3 lineas longa. *Stamina* subæqualia. *Siliqua* glabra, tenuis, linearis, usque ad sesquipollicaris, sæpe plus minusve arcuata. *Semina* oblonga, semialata, uniseriata, cotyledonibus incumbentibus.

Crevices of rocks throughout Pangi, at 8000-10,000 feet.

A. BIJUGA, n. sp. (Plate XII. figs. 1-7.)

Perennis, glabra vel glabrescens, glauca, cæspitosa, a basi ramosa, caulibus gracilibus 9-18-pollicaribus. *Folia* crassa, parcissime pilosula, vel margine tantum ciliolata, radicalia conferta sed vix rosulata, obovato-spathulata, infra medium attenuata, 1½-3-pollicaria, paucidentata, caulina lineari-oblonga, obtusa, basi angusta. *Flores* albi, majusculi, laxissime racemoso-paniculati; pedicelli filiformes, 9-15 lineas longi, arcuato-patentes. *Sepala* ovato-oblonga, petalis triplo breviora, lateralia basi saccata. *Petala* late obovata, per paria divaricata, usque ad 8 lineas longa. *Siliqua* (matura non visa) tenuis, angustissima, 2-2½-pollicaris.

Pangi, 8000-9000 feet.

Allied to *A. alpina*, from which it differs in being almost quite glabrous and glaucous, in having larger flowers in very loose racemes, in the petals diverging in pairs, &c.

SISYMBRIUM THOMSONI, *Hook. f. in Journal Linn. Soc.* v. p. 161. Pangi, Lahoul, 9000 feet.

This species seems to have been overlooked in Hooker's 'Flora of British India.'

VIOLA BIFLORA, *L.* Common in woods on the southern slopes of the First Range, 10,000 feet.

This species is quite distinct from *V. Wallichiana*, which has been united with it in the 'Flora Indica.' The differences are in

the length of the spur and the form of the style, independently of general features.

VIOLA PATRINII, DC. Lower spurs of the First and Second Ranges, 3000–7000 feet.

V. PATRINII, var. *SUAVEOLENS*, *Watt*.

Subcæspitosa, foliis angustioribus obtusis, stipulis sæpissime denticulatis, floribus majoribus fragrantissimis, petalis erectis, caldari longiore, stigmatem oblique triangulari.

Higher southern slopes of the Second Range.

V. CANESCENS, *Wall. in Roxb. Fl. Ind.* ed. 1824, ii. p. 450. (Plate XI. B. figs. 6–10.)

Sarmentosa, foliis confertissimis canescentibus rotundato-cordatis crenato-serratis, sinu angusto, stipulis insigniter laciniato-fimbriatis, sepalis lineari-lanceolatis, caldari brevi lato rotundato, stylo recto deorsum gradatim attenuato, stigmatem terminali truncato integro depresso.—*Wall. Cat.* 1442, *ex parte*.

A smaller plant in all its parts than *V. serpens*, having hoary, olive-green, thick leaves, 6–12 lines across, and white flowers, with the petals 3–4 lines long, not half the size of the purple flowers of *V. serpens*.

From the southern spurs of the First Range to the southern spurs of the Second Range, 3000–8000 feet. Distributed from Kumaon westward to Kashmir, inhabiting dry, exposed situations.

V. SERPENS, *Wall. in Roxb. Fl. Ind.* ed. 1824, ii. p. 449, non *Wall. Cat.* (Plate XI. A. figs. 1–5.)

Caulescens, foliis paucis pilis sparsis appressis conspersis late cordatis acuminatis serratis, sinu lato, stipulis integris vel interdum obsolete denticulatis, sepalis ovato-lanceolatis, caldari elongato subrecurvato, stylo clavato basi subito constricto curvato, stigmatem laterali longe rostrato.—*V. aspera*, Ging.; *V. pilosa*, Bl.; *V. palmaris*, Buch., non Ham.; *V. Hamiltoniana*, Don; *V. repens*, Ham.

V. serpens, as limited in the 'Flora Indica,' includes, in addition to some of the foregoing synonyms, *V. canescens*, *V. Wrightiana*, and *V. Griffithiana*, all of which should be regarded as distinct species. *V. Griffithiana*, if viewed as a variety only, must be placed under *V. serpens*, and not *V. canescens*, as in 'Flora Indica.'

Distributed throughout the slopes of the Second and Third Ranges, 7000–10,000 feet.

[*V. distans*, Wall. Cat. 4022, has also been confused with *V. serpens*, from which it differs in its very stoloniferous habit, fimbriated stipules, straight, thicker styles, terminal three-lobed stigma; the two lateral lobes erect, broad, and flat, the third forming a short beak. The correct synonymy of this species is as follows:—*V. Metziana*, Hohen.; *V. Notoniana*, Wall. Cat.; *V. palmaris*, Ham. non Buch.; *V. repens*, Buch.; and probably *V. Royleana*, Wall.]

VIOLA CANINA, L., var. *SYLVATICA*, *Fries* (species). Extremely common in Pangl, and extending into Lahoul.

V. ARENARIA, DC. Keylang, Lahoul, 10,000–14,000 feet.
Not previously recorded from India.

V. KUNAWARENSIS, *Royle*. Lahoul to Zanskar, 13,000–15,000 feet.

GERANIUM GRANDIFLORUM, *Edgew.* Occasional on the southern slopes of the Second Range, and very abundant in damp deciduous woods in Pangl, and extending to Lahoul.

This is referred to *G. palustre*, L., in the 'Flora Indica,' from which it is quite distinct, though it may be merely a variety of *G. pratense*, L.

G. DIVARICATUM, *Ehrh.* Southern slopes of the Second Range, Ulwas &c., 5000–8000 feet.

The plants referred to in the 'Flora Indica' under *G. molle* all belong to this species, which is readily distinguished from *G. molle* by its very robust habit, palmately-lobed leaves, and setulose carpels. It is a very coarse plant, frequently growing several feet high in bushes and hedges.

G. divaricatum has a wide geographical area, extending from Eastern Europe through Central Asia and Siberia to Soongaria, Kumaon being its most easterly station in India, whereas *G. molle* does not appear to penetrate eastward beyond Asia Minor.

SOPHORA MOLLIS, *Grah.* Lower slopes of the Upper Ravee below Barmour, 6500 feet.

This is a low bush, covering large expanses of the hill-sides, extending for several miles. It is a remarkable fact that every plant exhibited the peculiarity of bearing an abundance of long, filiform, hoary outgrowths proceeding from various parts of the plant, such as the apex, base, and middle of the leaflets, the apex of the rachis, the fruit, etc.

BAUHINIA VAHLII, *Wight & Arn.* Low hills south of the First Range, up to 35,000 feet.

The tendrils of this plant are very interesting, being formed from abortive leaf-buds, and not from inflorescences nor from true leaves. In many instances they appear at first sight as if formed from the two lateral leaflets of a trifoliate leaf; but upon closer examination the petiole of what would in that case be the terminal leaflet will be seen to be jointed and to bear an abortive bud. Should this bud develop, the tendrils then appear to be opposite upon a branch bearing alternate leaves. Both conditions frequently occur, as well as solitary leaves borne upon abortive lateral branches destitute of tendrils. Sometimes, too, when one of the opposite tendrils succeeds in attaching itself to an object, the other ceases elongating and produces a number of abortive leaves, thus exhibiting an effort to become a normal leaf-bearing branch.

ANDROSACE MUCRONIFOLIA, n. sp.* (Plate XIV. B. figs. 3-8.)

Herba caespitosa nana. *Folia* obovato-elliptica, mucronato-uncinata, glabra. *Capsula* ovata; semina 2, anguste alata.

Alpine Himalaya, alt. 13,000 feet. Thibet (*T. Thomson*); Kashmir (*C. B. Clarke*); Lahoul (*Watt*).

PEDICULARIS (verticillata longirostres) EXIMIA, n. sp. (Plate XIII. figs. 1-6.)

Herba annua (?), puberula, caule simplici 9-18-pollicari. *Folia* angusta, pinnatifida vel subbipinnatifida, 3-6-pollicaria. *Flores* lutei, speciosi, numerosissimi, breviter pedicellati. *Calyx* antice fissus. *Corollæ* tubus angustus, calyce vix duplo longior; galeæ rostrum arcuatum, basi bistortum, apice bifidum. *Filamenta* glabra. *Capsula* glabra, cuspidata, 9-14 lineas longa; semina oblonga, punctata.

North-west Himalaya, 8500-13,000 feet (*Thomson*, 23; *Falconer*, 793; *Jeschke*, 200; *Watt*, 49 A, 97 B, 210 G).

ADIANTUM WATTII, *Baker*, n. sp. (Plate XIV. A. figs. 1, 2.)

Stipite elongato gracili nudo castaneo, fronde rhomboidea tripinnata glabra modice firma utrinque viridi, pinnis inferioribus deltoideis distincte petiolatis basi inferiore cuneato-truncatis, segmentis tertiariis integris vel ex apice profunde parce lobatis margine extrorsum leviter crenulato, lateralibus subquadratis, inferioribus brevissime petiolulatis, terminalibus cuneatis, soris ad segmentum 1-3 orbicularibus vel oblongis, involucre angusto firmo glabro persistente.

* A fuller notice of this new plant I hope to give in a future communication on the Indian species of the genus.

Stipes 3-4-pollicaris; lamina 4-5 poll. longa, 2-2½ poll. lata. Pinnæ erecto-patentes, superiores sensim minores, inferiores 1 poll. latæ, petiolo semipollicari; segmenta tertiaria subquadrata 3-4 lin. longa, cuneata, terminalia 2-3 lin. lata. Involucrum ½ lin. latum, ½-1½ lin. longum.

Intermediate between *A. venustum* and *A. Capillus-Veneris*: most like the former in size and general habit, but the outer edge of the barren segments obscurely crenulate, not distinctly toothed, the sori narrower and often confluent, and not distinctly indented into the segment, and the involucre different in size and shape, not nearly so large or so firm in texture.

DESCRIPTION OF THE PLATES.

PLATE IX.

A. 1 & 2. *Ranunculus sceleratus*, L., var. *mysuroides*, Watt.

Fig. 1. Flower and fruit, natural size; 2, elongated receptacle after shedding the achenes (but incorrectly represented hairy).

B. 3-9. *Ranunculus pangiensis*, Watt.

Fig. 3. Portions of a plant, natural size; 4, vertical section of a flower; 5, a sepal; 6, a petal; 7, a stamen; 8, an achene; 9, an achene cut open.

PLATE X.

1-11. *Arabis pangiensis*, Watt.

Fig. 1. Portion of plant, natural size; 2, flower raceme; 3, a flower; 4, a sepal, side view; 5, a petal; 6, a stamen; 7, stigma; 8, a siliqua; 9, a portion of the same with the valve removed, showing the arrangement of the seeds; 10, section of an embryo; 11, stellate hair.

PLATE XI.

A. 1-5. *Viola serpens*, Wall.

Fig. 1. A leaf; 2, stipule; 3, a sepal; 4, spur; 5, a pistil.

B. 6-10. *Viola canescens*, Wall.

Fig. 6. The plant, natural size; 7, stipule; 8, a sepal; 9, stamens; 10, a pistil.

PLATE XII.

1-7. *Arabis bijuga*, Watt.

Fig. 1. A plant, natural size; 2, margin of leaf, enlarged; 3, a sepal; 4, a petal; 5, a stamen; 6, part of siliqua; 7, section of siliqua with ovules.

PLATE XIII.

1-6. *Pedicularis eximia*, Watt.

Fig. 1. Portion of a plant, natural size; 2, the calyx; 3, tip of beak; 4, stamens; 5, a single stamen; 6, capsule.

PLATE XIV.

A. 1 & 2. *Adiantum Wattii*, Baker.

Fig. 1. Portion of frond; 2, a pinnule.

B. 3-7. *Androsace mucronifolia*, Watt.

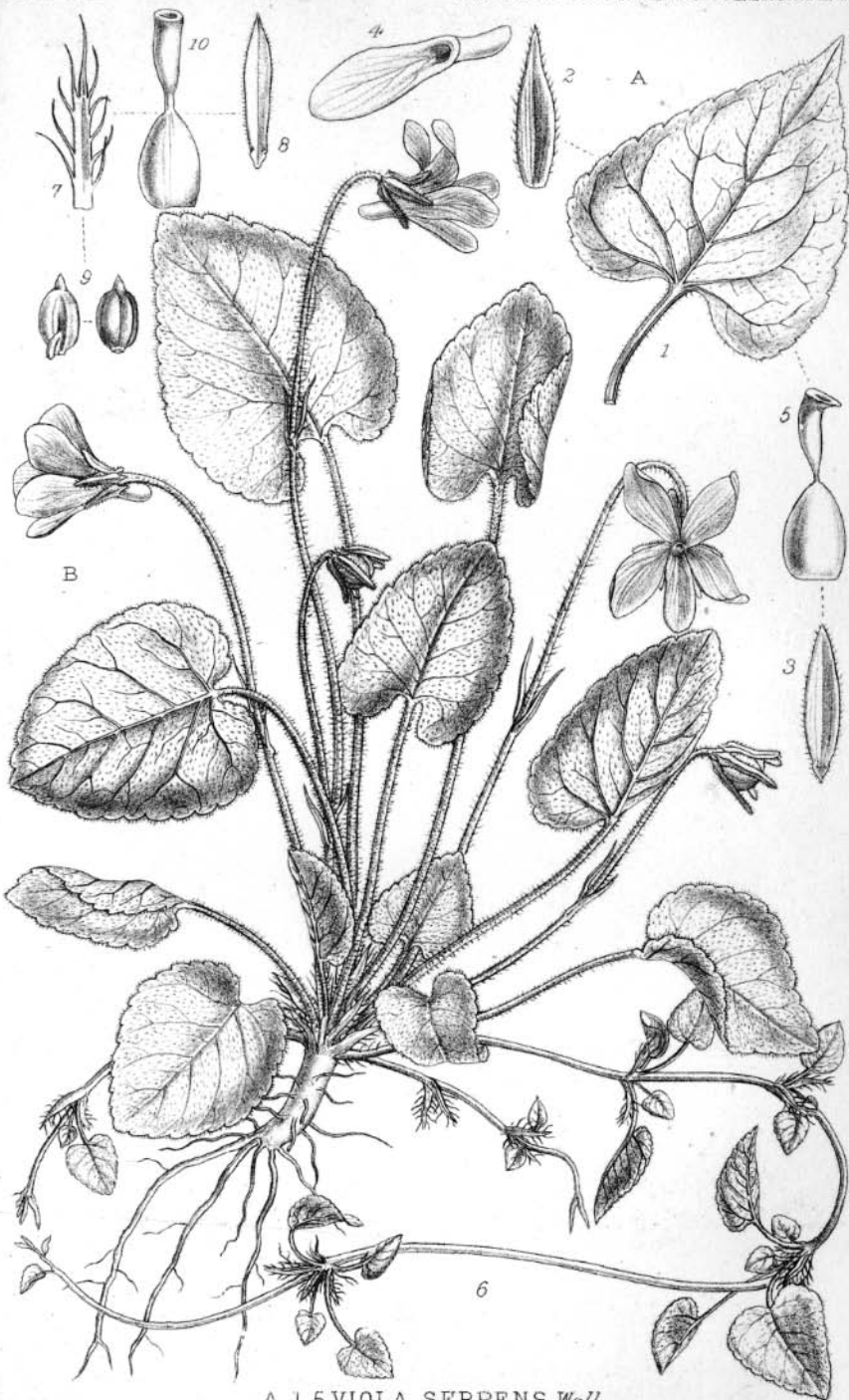
Fig. 3. The plant, natural size; 4, the leaf, enlarged; 5, bract; 6, the calyx; 7, corolla laid open.



A. 1, 2 RANUNCULUS SCELERATUS, L. var. MYOSUROIDES, Wats.
 B. 3, 9 " " PANGIENSIS, Wats.

Fitch lith et imp.





A, 15 VIOLA SERPENS, Wall.
 B, 6, 10 " CANESCENS, Wall.

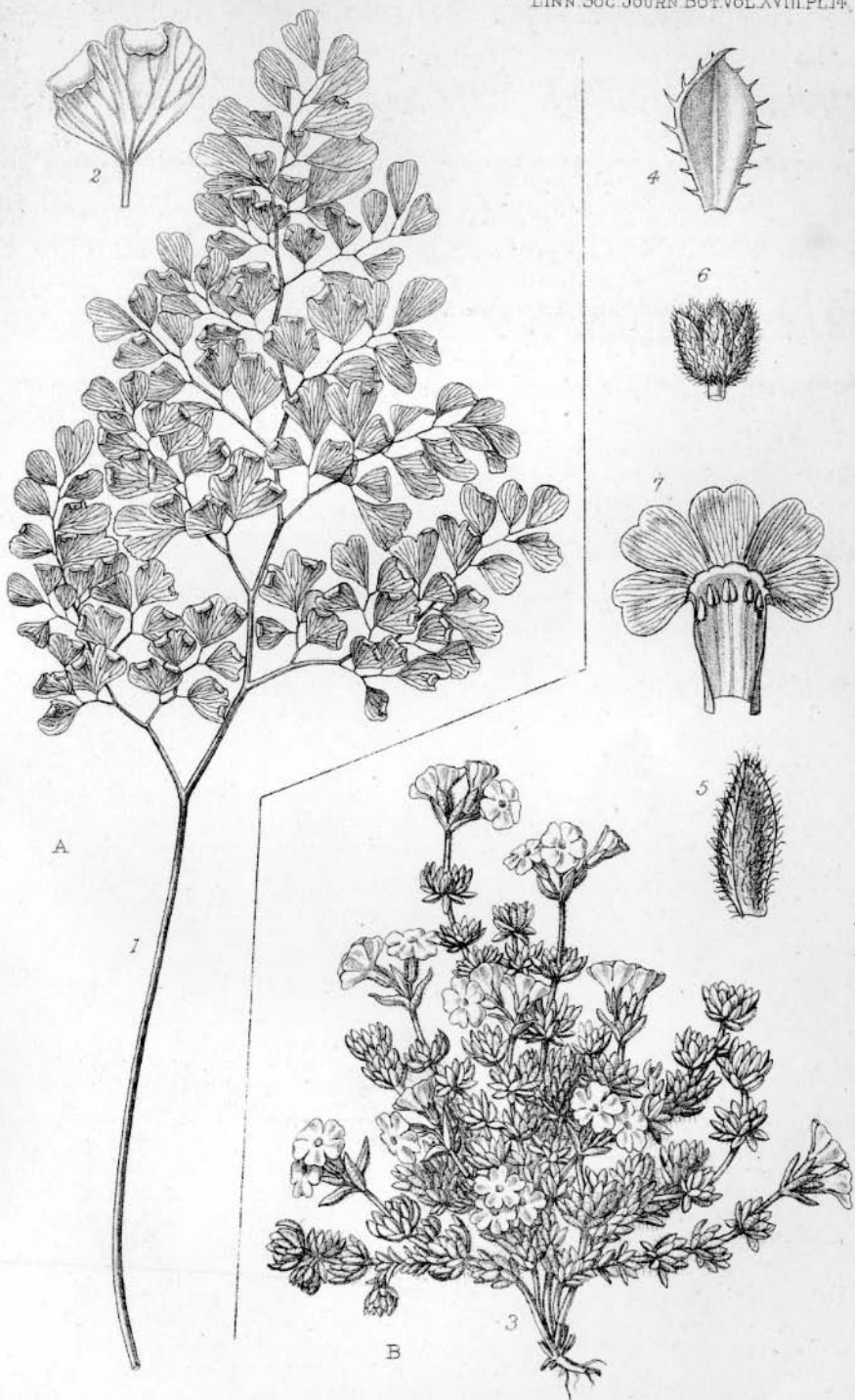




Blair & Fitch lith

PEDICULARIS EXIMIA, Walt.

JNFitch imp.



A 1-2 ADIANTUM WATTII, Baker.
B 3-7 ANDROSACE MUCRONIFOLIA, Watt