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## ROYAI BOTANIC GARDEN, CALCUTTA.

## Vol. IX.

PART II.

# THE ORCHIDS OF THE NORTH-WESTERN HMIALAYA 

By<br>J. F. DUTHIE, B.A., F.L.S.,<br>late Director, Botanical Department, Northern India.

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# ORCHIDS 0F THE NORTH-WESTERN HIMALAYA 

By<br>J. F. DUTHIE, B.A., F.L.S.,<br>late Director, Botanical Department, Northern India.

WITH FIFTY-EIGHT PLATES.

## PREFAOE,

Tre attempt here made to give an account of the Orchids of the Western Himalaya may be regarded as a supplement to the splendid work by Sir George King and Mr. R. Pantling on the Orchids of the Sikkim Himalaya, which was published in 1898 as Volume VIII of the Annals of the Royal Botanic Garden, Calcutta. With Sir Joseph Hooker's monograph of the Orchids of British India as a basis, and Sir George King's Sikkim Orchids as a model for a local orchid-flora, the preparation of the present contribution has been very greatly facilitated.

Of the many eminent botanists who contributed largely in by-gone years to the orchidology of the Western Himalaya, the following names should be especially mentioned:--Govan, Royle, Wallich, Jacquemont, Vicary, Falconer, Griffith, Edgeworth, Thomson, Madden, Strachey, Winterbottom, Fleming and Lady Dallousie. The collections made during more recent years by Aitchison, Brandis, Davidson, C. B. Clarke, Mackinnon, Gamble, Lace and others have been the means of adding considerably to our knowledge of the subject.

Since the publication of Sir Joseph Hooker's monograph of the Orchids of British India, in 1890 further important additions have been made to the Orchidflora of the Western Himalaya. Many interesting species were collected during my two botanical tours through Kashmir in 1892 and 1893, and in subsequent years by specially trained native collectors, who were sent to Hazara, Kashmir, Chitral, Pangi, Garhwál, Kumaon and to the Sub-Himalayan tracts of Rohilkhand and N. Oudh.*

In a privately printed list of Simla plants collected by Mr. Babington Smith and Lady Elisabeth Smith thirty-two species of orchids are recorded; and four years later (in 1903) Sir Henry Collett's most excellent book, the "Flora Simlensis," appeared, in which thirty-eight species are described, and seven of these are figured.
'The drawings for the fifty-eight plates contained in the present work were prepared under my supervision by H. Hormusji, for many years artist to the Botanical Department of Northern India. These plates represent only such species as have not already been figured in the Sikkim work, with one exception, viz., Habenaria latilabris, a species which has been so frequently confused with what is now known under the name of $H$. Edycioorthii Hook. f. (Platanthera acuminata

[^0]Ann. Roy. Bot. Gard., Calc., Vol. IX.

Lindl.) that it was considered advisable to have plates of each side by side in this volume for the sake of comparison. It should also be mentioned that plate No. 223 of the Sikkim Orchids does not represent Calanthe tricarinata of Lindley (see plate No. 103 of this volume), and that plate No. 406 of the Sikkim Orchids represents Habenaria ensifolia Lindl., a species quite distinct from H. pectinata Don (see plate No. 130 of this volume).

In conclusion I wish briefly but cordially to express my thanks to all those who have kindly assisted me during the preparation of this work. I am especially glad to avail myself of this opportunity of saying how very much I am indebted to my friend, Mr. Philip Mackinnon, F. L. S., whom I have known in India for many years as an enthusiastic botanist. To turn attention more particularly to the practical results of the interest he has taken in the subject of this memoir, I may mention that no less than nine undescribed species were discovered by him and his native collectors in the neighlbourhood of Mussoorie, also several other rare and interesting species, which lad not previously been recorded as Western Himalayan.

I am very much obliged to all those who have kindly aided me with orchid specimens from various parts of the Western Himalaya, and trust that I may not have failed to mention them by name throughout the pages of this book. From Sir Joseph D. Hooker, who has always taken a great interest in my botanical work in India, I have received very great help and encouragement. To Sir William T. Thiselton-Dyer I am much indebted for having kindly allowed me, when in India, to consult Mr. R. A. Rolfe, the well-known orchid specialist at Kew, concerning some of the more critical species. I wish also to acknowledge the great assistance I have received from Mr. Rolfe since my return to England, as well as from Mr. W. Botting Hemsley, the Keeper of the Royal Herbarium. Lastly, I desire to thank my friend, Major D. Prain, for his willing and valuable help on many occasions, and for the trouble he has taken in supervising the preparation of the lithographs and the printing of the letterpress.

Herbartum, Royal Botanic Gardens, Kew;
J. F. DUTHIE.

10th Felruary 1904.

## INTRODUCTION.

The tract of the Western Himalaya lies between $28^{\circ} 45^{\circ}$ to $36^{\circ} \mathrm{N}$. lat. and between $71^{\circ} 30^{\prime}$ to $80^{\circ} 40^{\prime}$ E. long.* It extends from Kumaon on the east to the North-Weat Frontier territories of Gilgit, Chitral and Hazara, and its total area nearly equals that of California (United States). The outer ranges rise abruptly from the great tropical plain of North-West India, and usually to elevations within the limits of the Temperate Zone; whilst on the higher inner ranges, which extend up to above the level of forest growth, a rich Alpine flora is met with. Beyond, and in the neighbourhood of the main axis of the chain of the West Hinalaya, are the lofty snow-clad peaks, some of which, such as Nanda Devi in Kumaon, and Nanga Parbat between Kashmir and Gilgit, attain an altitude of over 25,000 feet above the sea.

The number of species at present known to occur within the limits of the Western Himalaya is 173. Of these fifty-nine are epiphytes and 114 are terrestrial, and there are 24 endemic species. Forty-five genera are represented, none of which are endemic.

The following table shows the distribution of the genera in other parts of the world:-


[^1]Ann. Roy. But. Gard., Calc., Vol. IX.

The following list gives the number of species contained in each of the forty-five genera:-Habenaria 31; Dendrobiam 15; Liparis and Eulophia 9; Calanthe, Cymbidium and Herminum 7; Ccologyne and Goodyera 6; Lisicra and Orchis 5; Microstylis, Orcorchis, Luisia, Vanda and Pogonia 4; Oberonia, Bulbrplygllam, Cirrhopetalum, Eria, Saccolabium and Epipactis, 3; Pholidota, Arides, Epipogum, Spiranthes and Cypripedium, 2. The remaining eighteen genera are represented by a single species:-Pachystoma, Phaius, Geodorum, Corallorhiza, Doritis, Ornithochilus, Sarcochilus, Rhynchostylis, Cleisostoma, Sarcanthus, Gastrodia, Aphyllorchis, Galcola, Cephalanthera, Zetaine, Ancectochilus, Hemipilia and Satyrium.

The number of W. Himalayan species found in Sikkim is 105 , and the following, thirty-five species extend to China:-Microstylis cylindrostachya, Liparis longipes, Dendrobium chrysanthum, D. clavatum, Caloyyne elata, Calanthe puberula, C. tricarinata, Eulophia flava, E. nuda, Oreorchis fuliosa, Corallorhiza innata, Cymbidium pendulum, C. longifolium, Ornithochilus fuscus, Luisia teretifolia, Erides odoratum, Epipactis consimilis, E. gigantea, Spiranthes australis, Goodycra repens, G. procera, Zeuxine sulcata, Anoctochilus Roxburghii, Orchis Chusua, O. spaihulata, Habenarin Susannce, H. ensifolia, H. intermedia, H. viridis, H. goodyeroides, H. galeandra, Herminium uaguslifolium, H. Monorchis, Satyrium nepalense, Cypripedium himalaicum.

Twelve species are found in Ceylon, viz.-Liparis longipes, Pholidota imbricata, Eulophia nuda, Rhynchostylis retusa, Luisia teretifolia, Vanda parvifora, V. Roxburghii, Goodycra procera, Zeuxine sulcata, Spiranthes australis, Habenaria plantaginea and Satyrium nepalense.

The following ten species extend to Britain:-Listera ovata, Corallorhiza innata, Goodyera repens*, Spiranthes aufumnalis, Epipogum aphyllum*, Epipactis latifolia*, Cephalanthera ensifolia*, Orchis iatifolia, Herminium Monorchis and Habenaria viridis.

Pholidota imbricata and Spiranthes australis extend to Australia, and Epipactis gigantea and Goodyera repens occur in North America.

The following twenty-four species are not at present known to occur outside the area of the Western Himalaya:-

```
\(\dagger\) Nlicrostylis Mackinnoni-Dehra Dun and Mussoorie.
    Liparis diodun-Dehra Dun.
    --rostrata - Kumaon to Simla.
    Oreorchis indica-Garhwál to Simla.
+ _ Rulfei-Garh wál.
\(\ddagger\) Dendrobium Gamblei-Dehra Dun.
+ Girrhopetalum Hookeri-Garhwál.
    Eria alba-Kumaon to Chamba.
§ Euloplia Hormusjit-Dehra Dun and Garhwal to Hazara.
        ——obtusa-Sub-Himalayan.
\(\dagger\) ——Mackinnoni-Sub-Himalayan.
\(\dagger\) Cymoidium Machimoni-Mussoorie range.
\& Epipogum tuberosum-Kashmir.
+ Listera Inayaiti-Hazara.
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[^2]- Listera knahimiriana-Kashmir.
$\dagger$ - microglottis-Museoorie range.
+ Aphyllorchis Gollani-Garhwál.
$\dagger$ Pogonia Mackinnoni-Mussoorie range.
Gastro:tia arobanchoides-Garhwal to Kaehmir.
Orchis Stracheyi-Kumaon.
Herminium Duthei-Kumaon and Brit. Garhwal.
Habenaria Iongifolia-Dehra Dun.
-_pubescens-Dehra Dun and Garhwál.
————arcuata-Kumaon.
Information regarding the distribution of the Western Himalayan orchis at different altitudes above the level of the sea will be found under cach species. The following is an abstract giving the number of species found within each zone:-

| Restricted to the sub-tropical zone | 85 |
| :---: | :---: |
| Exteuding from the sub-tropical into the temperate zone | 16 |
| Restricted to the temperate zone | 59 |
| Extending from the temperate to the alpine zone | $10 \ddagger$ |
| Restricted to the alpine zone | 3 |

In regard to the flowering scasons of the W. Himalayan species, although there is no single month of the year during which one or more species may not be found in flower, there are, however, three distinct flowering periods, viz., (1) before the rainy season, i.e., from March to June; (2) during the rainy season; (3) after the rainy season, i.e., from the middle of September and onwards. The species which come into flower during the first period are:-Dendrobium amonnum and candıdum; Bulloophyllums polyrhizum; Cirrhopetalum maculosum; Pachystoma serile; Eria flava; Cologyne cristata, ochracea and elaia; Calanthe tricarinata, Mannii and plantaginea; Eulophia explanata, campestris and Hormusjii; Doritis tarnialis; Luisia trichorhiza and teretifolia; Vanda pariflora and cristata; Saccolabium calceolare and distichum; Pogonia Mackinnoni and Gammieana; Cephalanthera ensifolia; Epipactis consimilis; Spiranthes australis (at the lower elevations) and autumnalis; Zeuxine sulcata; Habenaria Griffthii; Cypripedium cordigerum. Those of the third period, which come into flower after the rainy season, are:-Oberonia Falconeri, ensiformis and pachyrachis; Liparis cordifolia and longipes; Cologyne ovalis; Cymbidium Mackinnoni, cyperifoliuns and giganteum; Habenaria plantaginea. The flowering of Cymbidium Mackinnoni in mid-winter near Mussoorie at an elevation of about 5,000 feet, and within the region of heary snowfall, is remarkable. An allied species, C. cyperifolium, is found also in similar situations but always under the shelter of trees, where it comes into flower during March and April, though in Sikkim this species is said to flower in November. C. giganteum flowers during November and December. I am, therefore, inclined to regard both C. cyperifolium and Mackinnoni as late-flowering species of the previous season.

[^3]The remaining 130 species belong to the second or rainy season period. A large number of the terrestrial kinds may be said to form a portion of that curious sub-tropical herbaceous vegetation which suddenly makes its appearance on the advent of the moist monsoon weather, and as rupidly withers and disappears as soon as the rains are over and the air becomes drier and colder. The most conspicuous examples of this monsoon herbaceous flora are the epiphytic ferns, which clothe the trunks and branches of the trees, and more especially the onks, with a profuse lice-work of brilliant green. Many of the Scilamince, such as species of Hedychium, Cautleyu, \&c., are frequently found as epiphytes, whilst the rocks and steep banks are gay with the flowers of begonits and gesneraceous species belonging to Chirita, Platystemma, Didymocarpus and Rhynchoglossum. These conditions prevail, of course, to a much greater extent in the Eastern Districts of Kumaon and Garhwál where the rainfall is , Leavier, and more so, and for a similar reason, on the outer than on the inner ranges. Some of the rainy season terrestuial species appear to prefer an epiphytic labit of growth. Iabenaria latilabris, for instance, is more frequently to be found on the trunks of trees than on the ground, whilst H. Edgeworthii is invariably a ground orchid and is usually found growing in open places away from the shelter of trees. Babenaria Elisabetluce is very often met with on the branches of trees, whilst Berminium Muckimnoni has not as yet been seen growing on the ground either at Mussoorie or in its Sikkim locality.

## TRIBE I.-MALAXIDEA:

Pollinia usually 4, waxy, without appoudares, frec or rarcly attached by their bases to a ball of translucent matter.

Sepals and petals widely spreading, lip deflesed or deourved from the bnse, oolumn not prolonged into a foot:-
Lip superior, column very short:-
Leaves equitant, fleshy . . . . . . . . . . . . 1. Oberania.
Leaves not equitant, membranous . . . . . . . . . 2. Dficrostylis.
Lip inferior, oolumn lung . . . . . . . . . . . . . 3. Liparis.
Sopals and petals more or less connivent, lip ereot from the base, column prolonged into a foot:-

Lip not artioulate on the foot . . . . . . . . . . . . 4. Dendrobium.
Lip articulate on the foot:-
Lateral sepals not much exoeeding the dorsal . . . . 5. Bullophyllum.
Lateral sepals muoh exceeding the dorsal . . . . . . 6. Cirrhopetalum.

## 1. Oberonia Lindl.

Epiphytes with usually very short, often tufted, stems. Leaves coriaceous or fleshy, usually ensiform (rarely terete), always distichous and ensiform. Flowers minute, many, sometimes whorled, arranged in a long erect or deflexed spike-like or raceme-liko inforescence, but expanding centrifuga!ly. Sepals subequal, ovate or oblong. Pctals as wide as or narrower than the sepals. Lip larger than the sepals, sessile, rarely entire, usually lobed and often erose-lobular, the hypochile more or loss concave or with a nectar-secreting pit near its base. Column very short, stout, rarely winged. Anther terminal, incumbent; pollinia 4, cohering in pairs.-Species about 60, distributed in the Indo-Malayan region, but exterding also to China, Australia and the islands of the Pacific.

Lip without lateral lobes or basal aurioles ... ... 1. O. pachyrachis.
Lip with lateral lobes:-
Lip oblong, with small lateral lobes ... ... 2. O. Falconeri.
Lip obcordate, with large broad lateral lobes ... ... 3. O. cnsiformis.

1. Oberonia pachyrachis Reichb. f. in Herb. Kew ex Hook. f. Fl. Br. Ind. v., 681.

Stems very short, tufted. Leaves ensiform, slightly falcate, acute, $3-10 \mathrm{~cm}$. long and 7-18 mm. broad. Peduncle of inforescence short, broad, compressed, adnate to a leaf nearly to its apex; the flower-bearing rachis floshy, terete, tapering, erect, equalling or slightly longer than its leaf ; floral brach ovate-rotund, irregularly but deeply serrate. Flowers minute, pale brown, sunk singly in rather distant pits in the fleshy rachis, the sepals and lip lying flat on its surface. Sepals elliptic, obtuse, glandular on the back, not reflexed. Petals smaller, linear-oblong, obtuse, subentire. Lip orbicular-elliptic, obtuse,
concave, eutire or slightly crose at the apex, and with a deep depression at the base just under the column. Capsule short, turgid, often gibbous. King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, p. 4, plate 3 .

Common on the trunks of trees in Dehra Dun, and on the outer ranges from Mussoorie to Kumson, up to 4,000 feet; extending eastwards to Sikkim and the Khasia Bills. It flowers during the cold season.
2. Oufronia Falconeri Hook f. Ic. Plant. t. 1780 ; Fl. Br. Ind. v, 678.

Stems short. Leaves $2.5-7 \mathrm{~cm}$. long, straight or falcate, acute, coriaceous. Peduncle of inforescence much shorter than the leaves, terete, bracteate. Racemes erect or decurved, overtopping the leaves; the rachis stout, deeply grooved in fruit. Floral bract longer than the ovary, oblong or ovate-lanceolate, acuminate, serrulate, membranous, very pale green. Flovers very small, sbortly pedicelled. Sepals ovate, acute, reflexed. Petals falcately lanceolate, obtuse, a little longer and narrower than the sepals, spreading. Lip oblong or subquadrate, upper surface glistening with many scattered gland-like specks; lateral lobes small, with truncate or emarginate tips, the apex with two small incurved obtuse lobes separated by a broad sinus. Anther obovate, its lip emarginate. Capsulcs shortly pedicelled. O. iridifolia Wall. Cat. 1948 (1 and 3).

Common in Dehra Dun, chiefly on mange trees, and on the outer ranges between the Jumna and the Ganges up to 3,500 feet; flowering during September. It extends eastwards to Sikkim and the Khasia Hills, and occurs also in Behar, Chota Nagpur and in the Konkan.

The sepals and petals are brownish-yellow, and the lip is green. Acoording to Sir Joseph Hooker this species is nearly allied to $O$. pyrulifera Lindl, but is more robust, with shorter and broader leaves, and with short lateral lobes or shoulders to the lip, the terminal lobes of which are short and distant.

Plate 94. Oberonia Falconeri Hook. f.-A plant,-of natural size. Fig. 1, front view of a flower; 2, lip; 3, anther; 4, pollinia;-all enlarged.
3. Oberonia ensiformis Lindl. Fol. Orch. Oberonia; p. 4.

Stems 7-8 cm. Leaves linear ensiform, acuminate, falcate, $7-22 \mathrm{~cm}$. long and $1-2 \mathrm{~cm}$. broad. Inflorescence ercct, shorter than the leaves, subtruncate; its peduncle $5-7.6 \mathrm{~cm}$. long and bearing numerous minute lanceolate appressed pale bracteoles; raceme about twice as long as the peduncle, its rachis thick, fleshy, terete; floral bract longer than the ovariy, convolute, ovate-rotund, sub-acute, erose. Flowers 2 mm . long, pale brown, not at all sunk in the rachis. Sepals subequal, broadly ovate, sulb-acute, entire, not ciliolate, reflexed. Petals ovate, sub-acute, stiffly pubescent, the edges entire and ciliolate. Lip twice as long as tho sepals, :3-lobed, with two large rounded entire basal lobes; mesochile sabquadrate, smooth, slightly concave, bearing on its edges two large projecting blister-like processes; terminal lobe obreniform, with two rounded lobules, separated by a broad subquadrate apical sinus; the whole surface and margins of the lip, except the smooth mesochile, clothed with stiff hairs. Hook. f. Fl. Br. Ind v, $67 \boldsymbol{0}$; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. Vol. riii, p. 9, plate 9.
O. acaulıs Hook. Bot. Mag. $50 \grave{6} 6$ (not of Griff.). O. trilobata Griff. Notul. iii, 273. Malaxis ensiformis Smith in Rees' Encycl.; Reichb, f. in Walp. Aun. vi, 212 (excl. вyn.).

Dehra Dun, chiefly ou sial trees, Falconer, King, Mackinnon; and up to 3,000 fcet on the adjacent Himalaya, flowering during November. It extends eastward to Nepal, Sikkim and the Khasia Hills, and has recently been discovered on the Nilgiris by Mr. R. Proudlock.

## 2. Microstylis Nutt.

Terrestrial or epiphytic, rarely saprophytic, often pseudo-bulbous. Leaves one or more, rarely absent, membranous, plicate, continuous with their sheaths. Flowers small, resupinate, in terminal racemes. Sepals spreading or recurved, subequal. Pctals narrower than the sepals but about as long. Lip adnate to the base of the column, usually flat, basal lobes large, sagittate, produced upwards, or cup-shaped with small lobes, or without basal lobes; the apex emarginate, 2-3-lobed, erose or entire. Column. usually very short (long in M. congesta), with two short spreading arms. Anther subterminal, bilocular; pollinia 4, ovoid or obovoid.-Species about 60, in tewperate and tropical regions.

Lip slightly convex, basal auricles sagittate and projecting upwards:-

Leaves 3-4, ovate lanceolate, acuminate
Leaves usually 2, at the base of the scape, ovate or suborbioular, obtuss
Lip concave, ontire, its apex produced into a beak, basal auricles absent :-
Leaf one ... ... ... ... ... 3. M. cylindrostachya
Leaves two ... ... ... ... ... 4. M. muscifera.

1. Microstylis Wallichir Lindl. in Wall. Cat. 1938.

Stem about 7.5 cm . long, with a few sheaths below. Lcaves three or four, 7.5 to 11.5 cm . in length and 3.5 to 6.5 cm . broad, thinly membranous, ovate-lanceolate, acute or acuminate, narrowed to the sheathing base, the upper ones sessile, the lower with sheathing petioles, edges undulate. Inforescence $2-3 \mathrm{dm}$. long ; peduncle shorter than the raceme, ribbed; raceme laxly many-flowered; floral bracts lanceolate, half the length of the stalked ovaries. Flowers yellowish-green, often tinged with purple, about 13 mm . long. Sepals oblong, the dorsal subacute, the lateral broader and obtuse. Petals linear, obtuse, with recurved margins like those of the sepals. Lip slightly convex, narrowly ovate in general outline; basal lobes or auricles lanceolate, their inner edges straight, and with an intervening space. Lip not constricted so as to form a distinct anterior lobe, its apex fat or slightly incurved at the notch. Column with very fleshy rounded arms. Lindl. Gev. and Sp. Orch. 20; Hook. f. Fl. Br. Iud. v, 686; in Ann. Roy. Bot. Gard. Calc. vol. v, part 1, t. 2, figures 1 and 2 (excl. woyn. M. biloba); King \& Pantl. in Ann. Roy. Bot. Gard. Calc. vol. viii, p. 16, plate 18; Collett in Fl. SimL 491, fig. 162. Laiauis ctuminala Don Prod. 29.

Western Llimalaya from Pángi to Kumaon between 4,000 and 7,000 leat, becoming wore abundant eastwards, flowering during the rainy suason. It extends eastwards to Sikkim and the Khasia Hills, and is found also in Ceylou,

Var. biloba Hook. f. Fl. Br. Ind. l. c.; in Ano. Roy. Bot. Gard. Calc. vol. y, part 1, p. 2, plate 2, fig. D.
Basal lobes of lip slightly falcate, converging and sometimes overlapping, apical portion of lip abruptly bent forward and forming an obovate-oblong or subquadrate apical lobe divided at tho extremity into two rounded parallel oblong blunt lobules; arms of the column only slighty fleshy; anther with a small subacute emarginate lip; leaves thicker in texture than in typical M. Wallichii, less acute and less undulate. M. biloba Lindl. in Wall. Cat. 1940 ; Gen. and Sp. Orch. 20; Ridl. in Journ. Limn. Soc. xxiv. 337 ; King \& Pantl. l.c., plate 19.

Simla, Barclay; N..W. India, Iferb. Royle; Garhwál, King; extending eastwards to Nepal, Sikkin and the Khasia Hills.
2. Microstylis Mackinnoni Duthie in Journ. As. Soc. Beng. Ixxi, part 2, p. 37.

Whole plant $1-1.7 \mathrm{dm}$. high. Stom swollen below and rising from the buse of the previous year's pseudo-bulb; lower portion enclosed within the leaf-sheaths. Leaves 2 or 3 , horizontal, unequal in size, the larger one about 6 cm . long and 4 cm . broad, ovate, obtuse, cordate and amplexicaul at the base, fleshy; upper surface dark brownish green; main uerres 3-7, prominent beneath; lower surface purple-coloured, the inter-spaces raised above and giving the leaf a bullate appearance. Scape reddishpurple, sharply quadrangular. Riaceme shorter than the scape; bracts subulate, persistent, reflesed, longer than the ovary. Flowers sessile, very small, reddish purple. Dorsal sepal ovate-lancęolate, subacute; lateral shorter, subfalcate, edges of all reflexed. Petals linear, shorter than the sepals, much reflexed. Basal and apical portions of lip divided by a raised rim; basal lobes falcately ovate-lanceolate, often contiguous or overlapping at the tips; apical portion of lip deeply bifid and protruded, crimson-purple. Column with fleshy rounded arms. Anther with a truncate or emarginate lip. Ovary clavate, not twisted.

Near Mussoorie on southern slopes, 5,500 to 6,000 feet, Mackinnon Nos. 21,779 and 22974; Dehra Dun on the Kalanga Hill, 2-3,000 feet, Mackinnon's collector No. 25429; flowering in July.

Although most nearly related to Mr. Wallichii, the very different leaves at once distinguish this ${ }^{\circ}$ plant from any of the numerous forms of that species. It has also much smaller flowers and a very differently shaped lip.

Plate 95. Microstylis Mackinnoni Duthie.-Entire plant,—of natural size. Fig. 1, a single flower, front view; 2, ditto, seen from behind; 3, column and ovary with sepals, petals and half the lip removed; 4, column and upper portion of ovary; 5, anther; 6, pollinia;-all enlarged.
j. Microstylis cylindrostachyn Reichb. f. in Walp. Ann. vi, 207.

Stem proceeding from the base of the small conical tuber of the previous year, up to 15 cm . long, and bearing one or two wide-mouthed sheaths. Leaf solitary, 3.5 to 10 cm . long and 2 to 4 cm . wide, elliptic, subacute, attached to a long
tubular petiole. Inflorescence 7.6 to 25.4 cm .; pedunclo long, ebracteate; raceme cylindric, boaring many crowded yellowish-green flowers. Floral bract lanceolate, shorter than the ovary. Sepals subequal, ovate, acuminate. Petals linear-lanceolate, acute. Lip fleshy, broadly ovate, excavated, the margins thickened, angled and denticulate, the apex produced into a fleshy point; upper surface with a raised central line from base to apex, and two convexities immediately under the column. Pollinia divergent, subovoid, their points convergent under the corners of the stigma. Ridl. in Journ. Linn. Soc. xxiv, 333 ; Hook. f. Flor. Br. Ind. v, 689 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 20, plate 24 ; Collett Flor. Siml. 492. Dicnia cylindrostachya Lindl. in Wall. Cat. 1934 ; Gen. and Sp. Orch. 22 ; Wight, Ic. 1830.

Kashmir, C. B. Clarke No. 31478 ; Simla 7-8,000 feet, Lady Dallousic, T. Thonson, Barclay, Collett and others; Bashahr, Lace; Garhwal 6-7,000 feet; Falconer, Duthie No. 4430, Muckinuon No. 21777; Kumaon 7-8,600 feet, Strachey \& Winterbottom No. 4 (Dienia), Cob. Davidson; Káli Valley 12,000 feet, Duthie No. 341. Eastwards to Nepal, Sikkim and Bhutau, and thence to China, occurring usually at higher elevations. It has been found also in Central India by Hope, fide C. B. Clarke under his number 16879. Flowers in July and August.
4. Microstylis muscifera Ridley in Jouru. Linn. Soc. xxiv. 333.

Stem 2.5 to 12.8 cm . long, from the apex of a small ovoid pseudo-bulb, bearing one or more tubular sheaths. Leaves usually two, approximate, unequal, ovate-rotund to ovate-lanceolate, obtuse or subacute, somewhat narrowed at the base to the sheathing petiole; blade 5 to 10 cm . in length. Inforescence 7.5 to 25.5 cm .; peduncles terete, ebracteate; raceme about equalling the peduncle, rather lax. Flowers minute, yellowishgreen; floral bract shorter than or equal to the pedicelled ovary. Sepals subequal, broadly oblong-lanceolate, sulacute, longer than the linear petals. Lip broadly ovate, fleshy and excavated at the base; side lobes obscure, convex, thickened. Column very short, fleshy. Hook. f. Flor. Br. Ind. v, 689 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, p. 20, t. 25; Collett Fl. Siml. 491. Dienia mustifera Lindl. in Wall. Cat. 1935 ; Gen. and Sp. Orch. 23.

Abundant on the outer ranges from Hazara to Kumaon, between 8,000 and 12,000 feet flowering during July and August. It extends eastwards to Nepal and Sikkim, and it is also found in the Kurram Valley.

## 3. Liparis Richard.

Terrestrial or epiphytal, pseudo-bulbous. Leaves one or more, membranous or coriaceous, continuous with the sheath, or thickened and jointed at the base. Fluwers small, in terminal racemes, resupinate or not. Sepals spreading or recurved, the margins usually revolute. Pctals much narrower than the sepals. Lip adnate to the base of the column, usually broad, flat, or deflexed from the middle, sometimes concave, often with calli uear the base. Column elongate, often arched, usually winged near the apex, and tumid and compressed at the base. Anther terminal; pollinia 4.-Species about 100, in temperate and tropical regions.

Leaves large, membranous, contracted at the base into and continuous with a long sheath:-
Lip abruptly deflexed from the very base:-
Leaf solitary, cordate; bracts minute

1. L. cordifoliu.
Leaves 2, bracts defexed
2. L. deflexa.

Lip defiexed from about the middle:-

> Leaf solitary :-

> Leaf thin, bracts long and slender
> 3. L. Glossula.
> Leaf fleshy, bracts minute
> 4. L. diodon.
> Leaves 2; bracts very minute; lip broadly obcordate, apioulate, orenulate
> 5. L. rostrata.
> Leaves 2-5; lip ounentely obovate, 2-tubercled at the base :-
> Leaves 2-3; floral bract ovate-lanceolate
> 6. L. paradoxa.
> Leaves 4 or 5 ; floral bract minute
> 7. L. bituber-
> culata.

Leaves ooriaceous or subcoriaceous, jointed to the sheath or pseudo-bulb:-
Pseudo-bulb elongate; leaves 2
8. L. lonyipes.

Pseudo-bulb short, ovoid; leaf solitary
9. L. Duthiei.

1. Liparis cordifolia Hook. f. Ic. Plant. t. 1811.

Terrestrial, the whole plant of a uniform deep green colour. P'seudo-bulbs crowded, much compressed, ovoid, pointed, with a few scattered fibres at the base, 3.5 cm . long. $\Sigma t e m$ short, stout, enveloped by the leaf-sheath. Leaf 5 to $12 \cdot 5 \mathrm{~cm}$. long and $3.5-10 \mathrm{~cm}$. broad. Inflorcscence about as long as the leaf; peduncle elongate, ebracteate. Raceme 2.5 to 5 cm ; floral bract triangular, minute, the pedicelled ovary long and filiform. Flowers 1.5 cm . long. Sepals linear-lanceolate, acute; the dorsal spreading, the lateral pair lying under the lip and almost concealed by it. Petals linear, spreading. Lip broadly triangular or obovate-deltoid, flat, with a slight concavity at the base, and with a minute tooth on each side, a central grooved ridge and two lateral branching nerves; the edges minutely erose-crenulate; the apex broad, subtruncate and apiculate. Column curved, much swollen at the base, and produced into two polished knobs, apex with two short rounded wings. Pollinia elongate, 3 -angled, each pair resting on a distinct rostellum which is tipped with a ball of transparent viscus. Hook. f. Flor. Br. Ind. v, 692 ; King \& Pantl. in Ann. Koy. Bot. Gard. Calc. viii, p. 24, plate 28.

Dehra Dun, Royle; extending eastwards to Sikkin and the Khasia Hills, up to 6,000 feet. Royle's specimens were in flower in October.
2. Liparis deflexa Hook. f. Flor. Br. Ind. v, 697.

Terrestrial. Stem cylindric, as thick as a goose-quill, 5 to 6.5 cm . long, covered by two or three tight short subacute sheaths, springing from a cylindric tuber. Leaves two, from near the top of the stem, subopposite, and with short unequal petioles, elliptic, acuminate, membranous, plicate, 7 -nerved, 15 to 18 cm . long, and about 6 cm . broad. Inflorescence longer than the leaves, erect, striate; the peduncle with a few lanceolate deflexed bracts. Raceme lax; Roral bract half as long as the pedicelled ovary, reflexed. Flowers about 8 mm . across, yellow. Sepals narrowly oblong, the dorsal acute, the lateral ones obtuse. Petals narrowly oblong, obtuse and, like the sepals, reflexed and with recurved margins. Lip flat, orbicular-reniform, contracted at its junction with the column, the margins minutely erose except near the base; apex broad, lightly
emarginate and nucrouate; the upper surfuce with a narrowly oblong meaial glistening and nectar-exuding patch extending from the base to the middle; calli two, just under the column. Column slightly curved, with narrow rounded wings near the spex, the base somewhat swollen. Hook. f. Ic. Plant. 2008; King \& Pantl. in Ann. Roy. Bot. Gard. viii, 25, plate 31.

Kumaon, in the Káli Valley, Duthie's Collsctor No. 24113; flowering in August. Previously known only from Sikkim.
3. Liparis Glossula Reichb. f. in Linnæa sli, 43.

Terrestrial. Pseudo-bulbs ovoid, tufted, 35 to 5 cm . long. Leaf solitary, obloug, subacute, sudacnly contracted into a sheath at the base, sometimes stalked, 5 to 10 cm . long, and up to nearly $2 \cdot 5 \mathrm{~cm}$. broad. Inforescence erect, longer than the leaf; raceme lax-flowered; foral bract linear, obtuse, shorter than the pedicelled ovary. Flower 1.9 cm. long, green, the lip purplish. Sepals oblong-lanceolate, acute, dorsal spreading, the lateral ones lying parallel under the lip, all with revolute margins. Petals linear, reflexed. Lip oblong, with a broad rounded ciliolate cuspidate apex, deflexed about the middle, concave and with a shining fluted line running from base to apex, without calli at the non-deflexed base, the whole lip veined and purple with olive-green edges. Column with two short wings near the apex, the base dilated into two large purple knob-like convexities. Anther with a beaked apex. Ridl. in Journ. Linn. Soc. xxii. 268 ; Hook. f. Ic. Plant. 1809 ; Flor. Br. Ind. v, 693 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii. 26, t. 33.

Mussoorie range, 6,000 to 7,000 feet, Mackimon, Duthie, Nos. 21772, 22734, 24179; Landour, 5,000 to 7,000 feet, Edgeworth; British Garhwál, 6,000 to 7,000 feet, Duthie No. $4427(a) ;$ Kumaon, 7,000 to 8,000 feet, Slrachey $\mathcal{G}$. Winterbottom No. 1, Colonel Davidson, Duthie. Flowers in August. It extends eastwards to Nepal and Sikkim.
4. Liparis diodon Reichb. f. in Linnaea xli, 43.

Leaf elongate, spathulate, obtuse, membranous, fleshy. Scape angled, naked; bracts minute. Scpals lincar. Petals filiform. Lip cuneate and angled on both sides at the base, then dilated, sub-quadrate and crenulate at the end, apiculate. Column slender, curved, 2-toothed at the base. Anther not rostrate. Ridl. in Journ. Linn. Soc. xxii, 278; Hook. f. Flor. Br. Ind. v, 693.

Delira Dun, Hort W. Sanders. I have seen no specimens of this plant.

## 5. Liparis rostrata Reichb. f. in Linnæa ali, 44.

Terrestrial. Seetdo-bulb ovoid, sulcate, $12-20 \mathrm{~mm}$. long, tufted ou a short rootstock. Stem from the base of the pseudo-bulb, bearing two obtuse sheaths. Leaves two, opposite, sub-sessile or petioled, broadly ovate, subacute, about 1 dm . long and $3-5 \mathrm{~cm}$. broad, tapering gradually into sheathing petioles. Scape a little longer than the leaves; peduncle quadrangular, angles winged; raceme laxly flusered, 5 - 10 cm . long; bracis small, broad-based. Flowers 19 mm . across. Sepals 3-nerved, narrowly lanceolate or
spathulate, dorsal with a cordate base. Pctals linear, reflesed. Lip flat, quadrate, obcordate, with a minute mucro in the sinus, green tinged with lilac, margins minutely crenulate, claw channelled above. Column long, slender, winged on the sides. Anther with a broad triangular beak. Hook. f. Ic. Plant. 1813 ; Fl. Br. Ind. v, 694 ; Collett Fl. Siml. 492. L. olivacea (in part) Herb. Ind. Or. Hook. f. \& Thoms. (not of Lindl.); Royle Ill. 364. L. rupestris (in part) Ridl. in Journ. Linn. Soc. xxii, 145 (not of Griffith).

Simla to Kumaon at elevations between 5 and 8,000 feet. Simla, T. Thomson, Gamble; Jaunsar, Gamble No. 27163, Osmaston (Duthic's No. 21774); N.-W. India, Royle (L. olivacea); Mussoorie, Falconer, Mackinnon, Duthie Nos. 637(a), 21773, 21774, 22971. In flower during July.

Plate 96. Liparis rostrata Reichb. f.-A plant,-of natural size. 1, front view of flower; 2, back view of ditto; 3, column; 4, anther; 5, pollinia;-all enlarged.
6. Liparis paradoxa Reichb. f. in Walp. Anm. vi, 218.

Terrestrial. Pseudo-bulbs narrowly ovoid. Stems about 15 cm . high, slightly bulbous at the base, bearing several sheaths. Leaves two or three, $12-13 \mathrm{~cm}$. loug and about 25 cm . broad, alternate, narrowly elliptic-lanceolate, acute, narrowed to the amplexicaul sheath, plicate, 5 -uerved. Infloresconce longer than the leaves, the peduncle finely striate with one or two lincar spreading bracts; racenze as long as or longer than its peduncle few-flowered; floral bract ovate-lanceolate, shorter than the twisted stalked ovary. Flower's 1.3 cm . long, green, the lip dull-purple. Dorsal sepal lidear, blunt, spreading, its margins recurved; lateral broadly ovate, j -nerved, recurved. Lip quadrate, abruptly deflexed from the middle, concave, and bearing two erect tooth-like calli; the edges entire; apex broad, emarginate, erose, and shortly apiculate. Column not curved, its upper half hood-like from the large rounded crenulate wings. Anther acuminate. Ridl. in Journ. Linn. Soc. xxiio, 261 ; Hook. f. Fl. Br. Ind. $\nabla$, 698 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 27, plate 34 ; Collett FI. Siml. 492. L. odorata Lindl. Gen. and Sp. Orch. 26 ; Thwaites Enum. Il. Ceyl. 295. Empusa paradoxa Lindl. in Wall. Cat. 1937A (in part); Bot. Reg. sub. t. $8 さ 5$; Gen. and Sp. Orch. 17; Royle 1ll. 364 ; Miq. Prolus. Fl. Japon. 135; Thwaites Enum. Pl. Ceyl. 426. Malaxis lancifolia Smith in Rees' Encycl.

Abundant on the outer ranges from Simla to Kumaon, up to 7,000 feet, flowering during the rainy season. This species extends eastwards to Nepal, Sikkim, the Naga and Khasia Hills and Bengal, and southwards through Central and Southern India to Ceylon; it occurs also in Burma, Siam, China, Japan and Java.

## 7. Liparis bituberculata Lindl. Bot. Reg. sub. 882.

Terrestrial. Stems tall, tufted, erect, robust, fleshy, 2 to $2 \cdot 5 \mathrm{dm}$. Leaves four or five, 1 to 2 dm. long, obliquely ovate or elliptic-lanceolate, shortly acuminate, 7 -nerved, plicate, membranous, polished, the base tapering into the broad sheathing petiole. Infarescence erect, stout, striate, much longer than the leaves; peduncle without bracts; raceme about 15 cm . long, rather few-flowered; floral bract minute, cordate, acute,
deflexed. Flowers about 8 mm . long, brownish-purple. Dorsal sepal linear-oblong, obtuse, reflexed; lateral pair similar in shape but broader and spreading. Petals linear spreading, their margins, like those of dorsal sepal, recurved. Lip oblong. very concave, deflexed from about the middle, revolute, beuring two sharp tooth-like calli at its base; edges entire or slightly crenulate, the apex blunt with a small triangular apiculus. Column curverl, slightly winged near the apex. Ridl. in Journ. Linn. Soc. xxii, 263; Hook. f. Fl. Br. Ind. v, 693; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 28, plate 35. Empusa paradoxa Wall. Cat. 1937 B; Lindl. Gen. and Sp. Orch. 17. Cymbidium? bituberculatum Hook. Exot. Fl. t. 116. Sturmia bitulerculata Reichb. f. in Bonplandia ii, 22.

Kumaon, Blinkworth; extending to Nepal, the Sikkim Himalaya and the Khasia Hills. Flowers in July.

## 8. Liparis longipes Lindl. in Wall. PI, As. Rar. i, 31, t. 35.

Epiphytal. Pseudo-bulbs close together in a row, cylindric and stem-like, or swollen at the base, 7.5 to 15 cm . long, with a few vertical strix and tightly clasping sheaths. Leaves two, oblanceolate-oblong, subacute to acuminate, sometimes aristate, 10 to 10 cm . long and 2 cm . broad. Inforescence erect, shorter or longer than the leaves; peduncle slender, terete, ebracteate; raceme twice as long as the peduncle, many-flowered; floral bract linear-lanceolate, shorter than the pedicelled ovary. Flowers 7 mm . long, pale yellowish-green. Sepals linear-oblong, subacute. Petals shorter than sepals, linear, obtuse, reflexed and with recurved edges as are the sepals. Lip broadly oblong, recurved from about the middle, the inner margins at the base much thickened so as to form triangular processes; no true calli, sides entire, the apex broad and shortly apiculate. Column slightly curved, with very small rounded wings. Wall. Cat. 1943 (in part); Lindl. Gen. and Sp. Orch. 40 ; Wight Ic. t. 906; Thwaites Enum. Pl. Cegl. 295 ; Benth. Fl. Hongkong 352; Ridl. in Journ. Linn. Soc. xxii, 293 (excl. L. clegans Lindl.) ; Hook. f. Fi. Br. Ind. v, 703 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 29, plate 37 Rolfe in Journ. Linn. Soc. xxxvi, 7 L. pendulx Lindl. in Bot. Reg. 1838, Misc. 180. ?L. nesophila Reichb. f. Ot. Hamb. i, 56. L. spathulata Lindl. in Bot. Reg. 1842, Misc. 189, p. 81. Liparis longipes var. spathulara Ridley l. c.; King \& Pantl. l. c. 30 , plate 38.

Tropical Himalaya, from Dehra Dun to Kumaon, up to 3,000 feet, flowering in September and October. This species extends eastwards to Sikkim, Bhutan and the Khasia Hills, and southwards to the Nilgiris and Ceylon; it is also found in Chins and in the Malay and Pacific Islands.
L. longipes is a widely distributed and polymorphic species. The Dehra Dun plant agrees best with Lindley's L. spathutata, which has shorter and thicker pseudo-bulbe, rather broader leaves and shorter racemes than in the type. Sir Joseph Hooker observes (in Fl. Br. Ind. I. c.) that it occurs everywhere along with the form having long pseudo-bulbs, and that intermediates aboand.
9. Liparis Duthiei Hook. f. Ic. Plant. 1857B.

Epiphytal. Pscudo-oulbs tufted, ovoid, 8 to 12 mm . long. Lcaf linear-oblanceolate tapering to the base, petioled or sessile, $2 \cdot 5$ to $7 \cdot 5 \mathrm{~cm}$. long by 5 to 10 mm . broad, Inforescence as long as the leaf, peduncle winged, a little longer than the raceme,
ebracteate. Baccme rather laxly flowered; floral bract linear-lanceolate, equal to or exceeding the stalked ovary. Flower's minute, palegreen. Sepals elliptic-oblong, blunt, reflexed. Petals linear, reourved, longer than the sepals. Lip quadrate, slightly narrowed to the bnse, decurved about the middle, the edges near the base with two thickened processes; true calli none, the sides of the lip entire, apex broad, subtruncate, slightly emarginate, minutely erose. Column slightly curved, rather long, obscurely winged, not thickened at the base. Hook. f. Fl. Br. Ind. v, 701; King \& Pantl. in Ann. Roy. Bot. Gard. Calc., viii, 32, plate 42.

Gori Valley in Eastern Kumaon, 2-3,000 feet, Duthic Nos. 5991, 24111; flowering in August. It was subsequently found by Mr. Pantling in the Teesta Valley, Sikkim Himalaya, at an eleration of 1,000 feet.

## 4. Dendrobium Swartz.

Epiphytal. Pseudo-bulbs short and fleshy or elongate and stem-like, usually tufted. Leaves never plicate, usually sessile and with sheathing bases. Flowers solitary, or in fascicles or racemes, often large. Sepals subequal, the lateral pair obliquely adnate to the foot of the column and forming with it a sac or mentum. Lip sessile or clawed at the base, adnate to and incumbent on the foot of the column; side lobes embracing the column, or spreading, or absent; the terminal lobe broad or narrow, flat, convex, concave or saccate; disk sometimes lamellate. Column short, with a long or short foot which usually has a nectar-secreting cavity at its extremity, the apex angled or 2-toothed; anther 2-celled. Pollinia 4, equal in length, sometimes in free pairs but usually all slightly coherent, ovoid or oblong, sligbtly compressed.-Species about 300, in Tropical Asia, Australasia and Polynesia.
§ 1. Breviflores.-Stems tufted, long, terete or clavate. Leaves membranous, persistent. Flowers small, in short racemes or heads, yellow, often dingy; mentum large, saccate; lip very short, deeply concave or urceolate, truncate or with short lobes.

> 1. D. bicameratum.
§ 2. Stachyobium.-Pseudo-bulbs short, tufted, with 2 or 3 leaves, or stems elongate and leafy. Leaves narrow, membranous, deciduous or persistent. Flowers in slender terminal or lateral racemes, small or medium-sized, pale green or yellowish, or white with red veins; mentum rather long, conical, incurved, or short and obtuse; lip often with a flat keel on the disk terminating in a truncate crenate callus on the mid-lobe.

Racemes many-flowered, drooping

> 2. D. denudms.
> 3. D. alpestre.

Soape short, erect, 3-5-flowered.
§3. Eudendrobium.-Stems elongated, stout or slender, cylindric, clavate or nodose. Leaves membranous or coriaceous, persistent or deciduous. Flowers usually large, $i^{\text {n }}$ lateral pairs, fascicles or racemes, rarely solitary, variousìy coloured, white, yellow or purple.

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Lip not forming a pouch :-
    Flowers pale yellow, or white with fellow, lilao or purple markings:-
            Posterior portion of lip convolute:-
            Lip about as broad as long, without side lobes:-
                Lip strongly ciliate on the margina, apical portion pale
                    yellow
                            4. D. primulinum.
                    Lip minutely oiliate on the anterior margin, pale yellow with
                    purple radiating lines
                            5. D. Pierardi.
            Lip longer than broad, with convolute side lobes:-
                Mentum awollen at the apex, bracts small, sepals obtuse . . 6. D. amanum.
            Mentum conical, bracts large, sepals acute
                            7. D. transparens.
    Lip convolute throughout its length, pale yellow with reddish-
                    purple veins
                            8. I. Gamblei.
    Lip not convolute:-
            Lip without side lobes
                            9. D. crepidatum.
            Lip with short erect side lobes
                    10. D. candidum.
    Flowers large, yellow, often with purplish blotches on the lip:-
    Petals and lip not fimbriate on the margins, stems erect:-
        \(\mathrm{Li} \mathrm{p}^{\prime}\) convolute at the base, and with a large purple blotoh on
            the disk
                            11. D. clatatum.
            Lip not convolute; petale and lip all similar and concolorous
                            12. D. normalo.
    Petals and lip with fimbriate margins :-
        Sterns erect:-
            ILip concolorous
                            13. D. fimbriatum.
            Lip with a large patch of reddish-brown on the upper
                surface
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13(a). D. fimbriatum
ver, oculata.
Stem penduloas, lip with 2 large suborbicular spots of brownishpurple.
14. D. chrysanthum.

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Lip forming a distinct pouch, flowers dull yellow with orange or reddish veins
15. D. moschatum.
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1. Dendrobium bicameratum Lindl. in Bot. Reg. 1839, Misc. 80 .

Stems clavate or fusiform, 7.5 to 45 cm . long. Leaves elliptic-oblong to ellipticlanceolate, 3.6 to 7.5 cm . long and 2 to 2.5 cm . broad; apex acute, obliquely and minutely bifid. Flowers about 1 cm . across, yellow marked with red, densely clustered on a short rachis and forming a capitate lateral or subterminal raceme; floral bract sheathing the shortly stalked ovary. Dorsal sepal broadly ovate-oblong; lateral pair triangular, all concave and subacute. Petals broadly elliptic, obtuse, about as long as the sepala. Lip small, fleshy, very concave, broadly triangular (when flattened out) and 3-lobed; side lobes triangular, acute, erect; terminal very short, truncate; the disk fleshy and swooth. Column very short, with two large oblong nectar-secreting cells. Mentün urceolate. Anther fleshy. Saunder's Kefug. Bot. t. 143; Hook. f. Fl. Br. Ind. v, 729 ; King \& Pantl, in Ann. Roy. Bot. Gard. Calc. vii, 42, t. 56. D. breviflorum Lindl. in Journ. Linn. Soc. iii, 14. D. bulloflorum Falc. Mss. ex Hook. f. in Fl. Br. Ind. l.c.; Ic. Plant. t. 2028.

On the southern slopes of the outer ranges; below Mussoorie between 3,000 and 4,000 feet, Mackinnon, No. 21744; above Dehra Dun in Garhwál, Gamble; Lanadowne in

Brit. Garhwál, Capt. Roberts; Thákil Hill in E. Kumaon, Inayat Khán (Duthie'.s No. 24092). Flowers in August. It extends eastwards to the Sikkim Hinalaya and Upper Burma, and south to the hilly parts of the Ganjam district.

## 2. Dendrobium denudans Don Prod. Fil. Nepal. 34.

Stems 15 to 25.5 cm . long, tercte, suberect, many-leaved, the lower leaves often early deciduous. Leaves aarrowly oblong, acute or subacute, sometimes obliquely notched, not narrowed to the sheathing base, $\dot{\boldsymbol{j}}$ to 10 cm . long. Racemes leaf-opposed, slender, decurved, longer than the leaves, many-flowered. Flowers 12 to 20 mm . long; floral bract minute. Sepals subequal, not wide-spreading, linear, acuminate, falcate. Petals like the sepals, but smaller. Lip much shorter than the sepals, decurved from the base, lower part subquadrate (when spread out), with two long narrow laciniate side lobes; terminal lobe strongly recurved, serrate and crisped; apex triangular; the disk with an obscurely 3 -lined smooth surfacc. Column rather long, the margin of the clinandrium denticulate; foot of column long, curved, stout, concave, hispid near its extremity, without a nectary. Anther with its lower margin ciliolate. Wall. Cat. 2014 (in part); Lindl. Gen. and Sp. Orch. 84; Bot. Keg. 1838, Misc. 156, and 1844, 61 ; Journ. Linn. Soc. iii, 19 ; Hook. f. Fl. Br. Ind. v, 715 ; King \& Pantl. in Ann. Roy. Bot. Gurd. Calc. viii, 45, plate 62.

British Garhwál, 5-6,000 feet, on rocks, Duthie No. 4416(a); Kumaon, 4-5,000 feet, Strachey $\mathcal{f}$ Winterbottom No. 5; Duthie Nos. 3403, 5992, 8019, 24094. Flowers towards the end of the rainy season. It extends eastwards to Sikkim.

The flowers are pale green or whitish, the lip is veined with red, and the foot of the column is tinged with red.
3. Dendrobium alpestre Royle Ill. Him. Bot. 370, t. 88, fig. 2.

Pscudo-buibs elongate, polynodal, tapering from the base, $3-4 \mathrm{~cm}$. long. Leaves $3-5 \mathrm{~cm}$. long and 5.10 mm . in breadth, linear-lanceolate, acuminate, often notched just below the apex, many-nerved, thinly coriaceous. Racemes 3-7-flowered, leaf-opposed, slender, erect. Flower's about 16 mm . across; floral bract subalate, subpersistent, less than half the length of the stalked ovary. Dorsal sepal 9.10 mm ., lanceolate, acuminate, 3-nerved, erect; the lateral pair a little longer and broader, falcately lanceolate, acuminate, 5 -nerved, spreading. Fetuls about 8 mm . long, linear-lanceolate, acuminate, 3-nerved, erect. Lip decurved, coucave, oblong-obovate beyond the narrow claw (when flattened out), yellowishgreen with dark purple veins, side lobes crect, acuminate, deeply inciso serrate along the edges; mid-lobe small, triangular, acute, much recurved, with undulate edges; disk with a thickened 3-lamellate mesial crest extending from the base of the lip to the insertion of the terminal lobe. Column long, its foot elongating to a right angle, anterior surface more or less blotched with purple, edges minutely papillose, the excavation at its apex partially concealed by a truncate inflated plate. Mentum short, obtuse. Anther with a denticulate lip. stigma a viscid orbicular cavity below the anther. Lindl. in Bot. Reg. 1844, Misc. 61 ; Walp. Ann. vi, 300 ; Hook. f. Fl. Br. Ind. v, 715. D. denudans Wall. Cat. 2014 (in part). ? D. pusillum Don Prod. 35.

Not uncommon in Garliwál and Kumann at elevations between 4,000 and 6,000 feet, usually on rocks, flowering during the latter part of the miny кеаноn. It extends castwards to Nepal.

Plate 97. Dendrolium alpestre Roylf.-Portion of plant, -of natural size. 1, a single flower; 2, ditto with sepals and petals rewored; 3 , lip, fattoned ont; 4, column; 5, summit of column with anther removed; 6 , front view of unther; 7 , sidu view of ditto; 8, polinia;-all enlaryed.

## 4. Dendrobium lrimulinum Lindl. in Gard. Chron. 1858, 223.

Stems up to 3 dm. loug and abont $1 \cdot 5 \mathrm{~cm}$. in diam., pendulous. Leaves about 1 dm . long, the upper ones smaller, broadly oblong, coriaceous. Flowers solitary from the nodes of the leafless stems, shortly pedicelled, $6^{\circ} \mathrm{\sigma} \mathrm{~cm}$. across; floral bract minute, emarginate. Sepals and pritals white or pink. Sepals narrowly lanceolate, acuminate, spreadiog or reflexed. Petals rather smaller, linear-lanceolatc, acute, erect or sprending. Lip broadly oblong (when spread out), very shortly clawed, aloout 3 cm . in length and nearly as broad, convolute towards the base, strongly ciliate on the margins, the basal portion white, the apical portion pale primrose-yellow and puberulous. Column with two horn-like processes at the apex. Mentum rounded. Anther puberulous, its lip toothed. Capsules sessile or nearly so. Lindl. in Journ. Linn. Soc. iii, 12; Traus. Russ. Hort. Soc. 1861, 268, t. 52 ; Regel Gartenfl. 1801, 158, t. 326 ; Williams' Orch. Alb. vi, t. 286; Veitch Man. Dendrob. 70, with fig. and var. gigantea 71; Hook. f. Fl. Br. Ind. v, 735. D. nolile var. pallidiflora Hook. Bot. Mag. t. 5003.

Dehra Due at Nálapáni; and on the southern face of Budraj near Mussoorie, up to 3,000 feet, Mackinnon (Duthie's No. 2j405); Garhwál, Falconer; in the Rámganga Valley, British Garhwál, Duthic No. 25841. Flowers in April.

There has been considerable misconoeption in regard to the distribution of this specios. Under D. cropidatum in the Fl. Br. Ind. v, 740, Sir Joseph Hooker remarks. "A specimen in Hort. Kem, marked 'Garhwail, Falooner,' is perhaps a cultivated one." This evidently refers to the two specimens of $D$. crepidatum glued down on the same sheet with Falconer's specimens of D. ppimulinan, and all of them named $D$. crefaceum on the Kow Distrib. ticket No. 1005 by Reichenbach $f$. subsequently. There is also on the same sheet an original ticket of Falconer's referring to the specimens of D. primulinum, and bearing the manuscript nane of 'D. petrocarpum.' Both D. primulinum and D. crepiciatun were found by Falconer in Gurbwál, and they were no doubt cultivated in the Saharanpur Garden, and eent thenoe to Kew under one name. The supposition that D. primulinum was ever found wild in Sikkin is probably an arror.

Plate 98. Dendrobium primulinum Lindl.-Portion of plant, —of natural size. 1, a single flower; $\boldsymbol{2}$, ditto with sepals and petals removed; 3, lip, fattened out; 4, column; 5, summit of column; 6, front view of anther; 7, side view of ditto; 8, pollinia; all enlarged.

## 5. Dendrobium rierardi Roxb. in Hook. Exot. Flora t. 9.

Stems slender, pendulous, 6.12 dm . long. Leaves sessile, 5.10 cm . long and 2.5 to 3.5 cm. broad, lanceolate to ovate-lanceolate, subacuminate, caducous. Flowers $\mathbf{3 . 4} \mathbf{~ c m}$. across,
solitary or two or three together from very short minutely bracteate peduncles which proceed from the slightly swollen nodes of the leafless stems, rose-coloured or pale purple, the lip yellow with purple radiating lines at the base. Sepals subequal, oblonglanceolate, subacute. Potals as long as the sepals but much broader, elliptic, blunt. Lip suborbicular (when spread out), without side lobes, the claw very short; edges shortly ciliate on the anterior half; posterior portion convolute, upper surface pubescent. Column and its foot about equal in length, the latter with a nectary at its extremity. Anther with a curved erose lip. Capsule 5 cm . long, clavate. Roxb. Fl. Ind. iii, 483; Lindl. Gen. and Sp. Orch. 79; in Bot. Reg. t. 1756; Wall. Cat. 2007; Bot. Mag. t. 2584; Wight Ic. t. 908 ; Lodd. Bot. Cab. t. 750 ; Veitch Man. Dendrob. 69; Hook. f. Fl. Br. Ind. v, 738; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 51, plate 72.

Eastern parts of Dehra Dun, in forests by the banks of the Song river, Gamble and Mackinnon ; flowering in May. Extends to Nepal, Sikkim and China; it is also found in Assam, in Bengal, and southwards to Tenasserim and S. India.
6. Dendrobium amenum Wall. in Lindl. Gen. and Spec. Orch. 78 (exl. syn. D. aphyllum).

Stems slender, pendulous, up to $7 \cdot 5$ du. long, slightly thickened at the nodes. Lsaves 6.5 to 10 cm . long, oblong-lanceolate with an obliquely acute apex. Flowers about $3 \cdot 5 \mathrm{~cm}$, across, 2 or 3 from very short bracteate peduncles springing from the nodes of leafless stems. Sepals oblong-lanceolate, obtuse or acute. Petals larger, ovate, Lip equalling the sepals, oblong-obovate (when spread out), shortly clawed; side lobes broad, rounded, convolute; terminal lobe orbicular with undulate edges, disk villous. Column broad at the apex; nectary large, its upper margin erose, and its lower with two calli, the centre occupied by a thickened line. Anther minutely papillose. Lindl. in Bot. Reg. 1844, 49 ; Journ. Linn. Soc. iii, 12; Bot. Mag. t. 6199 ; Reichb. f. in Gard. Chron. 1875, i, 305, figs. 57 and 58 ; 1881, ii, 6Ј5, fig. 126; Veitch Man. Dendrob. 17 ; Hook. f. Fl. Br. Ind. v, 738 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 49, plate, 69. D. mesochlorum Lindl. in Bot. Reg. 1847, under t. 36 ; Paxt. FI. Gard. i, 63, fig. 43. D. Egertonice Lindl. I. c.; Paxt. l. c., fig. 44.

Dehra Dun, Gamble; southern slopes of Mussoorie hills up to 5,000 feet, Falconer, Mackinnon; Garhwál, Duthie Nos. 20 8542 to 2.5848; Kumaon, Col. Davidson. Usually on trees May and June. It extends eastwards to Sikkim, Bhutan, Sylhet and Burma.

The flowers of this beautiful species are violet-scented. The sepals and petals are white tipped with violet, the lip is white tinged with yellow and has a purple spot near the apex, and the lower portion of the column and the mentum are violet-colured.

## 7. Dendrobiom transparens Wall. Cat. 2008-1.

Stems slender, erect, 3-6 dm. long, slightly thickened at the nodes. Leaves linearlanceolate, $7 \cdot 5$ to 10 cm . long and up to 1.3 cm . broad, the apex oblique and acute. Flowers about 3.5 cm . across, in pairs from the nodes of the leafless stems; foral bract
broadly lanceolato, scarious, much shorter than the stalked ovary. Scpals subequa, lanceolate, acute. Petals about as long as the sepals, but ovate and not so acute. Lip as long as the sepals, broadly elliptic-obovate (when spread out), clawed; sido lobes broad, erose, convolute, terwinal suborbicular, undulate; the upper surface pubescent. Column with two horn-like processes at the apex, the font narrowed and with a mal 1 nectar-secreting cavity at its apex. Mentum short, conical, obtusc. Lindl. Gen. and Spec. Orch. 79 ; Bot. Keg. 1844, Misc. 62; in Journ. Linn. Soc. iii, 12; Bot. Mag. t. 4663 ; Paxt. Fl. Gard. i, 134, t. 27 ; Veiteh Man. Dendrob. 81 ; Hook. f. Fl. Br. Ind. v, 738; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 50, plate 70. D. Henshalli Reichb. f. in Bonplandia iii, 226. Dendrol. Griff. Notul. 198, No. 1135, p. 198.

Kumaon, near Naini Tál, up to :3,00u feet; flowering in May. It extends eastwarde to Nepal, Sikkim and the Khasia Hills.

The flowers are white or pinkish, the lip is blotched with purple down the ceutre and has purple lines towards the base.
8. Dendrobium Gamblei King \& Pantl. in Journ. As. Soc. Beng. lxvi, part 2, 584.

Stems pendulous, slender, 3-6 dm. long, with short scarious sheaths at the nodes. Leaves sessile, $3-8 \mathrm{~cm}$. long and 1 to 2.5 cm . broad, subfalcately ovate-lanccolate subacuminate, thick, caducous, veins obscure. Peduncles solitary or in pairs frou the nodes of the leafless stems; floral bracts very small, lanceolate, acuminate. Flowers $1 \cdot 5 \mathrm{~cm}$. across, inodorous. Sepals and petals about equal, lanceolate, scuminate, with reflexed tips, pale greenish-yellow, $\overline{5}$-nerved. $L i p 1.9 \mathrm{~cm}$. long, convolute throughout its entire length, the edges fimbriate-serrate except towards tho base and at the very apex, subquadrate when flattened out, blunt at the apex and narrowing into a long claw at the base; upper surface with a broad grooved thickened band from base to apex, densely villous on its apical half; veins reddish-purple, bifurcating towards the margin Column 10 mm . long, its foot elongated and with a small ovate-lacerate nectary at it base. Mentum elongate, slightly curved and spur-like. Anther minutely papillose outside, its lip denticulate.

Dehra Dun, Gamble, Mackimon (Duthie's Nos. 22983 and 24156); flowering from June to August. It has been found also on the Nilgiris by Mr. Proudlock.

This species is nearly related to D. macrostachyum Lindl., but the pedunoles of the latter are much lrancled, the lip is convolute at the base only and is not ciliate on the margins, the leaver are membranous, and the flowers are soented.

Plate 99. Dendrobium Gamblei King \& Pantl.—A plant,—of natural size. 1, side view of single flower; 2, side view of lip; 3 , lip flattened out; 4 , column with ovary attached; 5, front view of column; 6, side view of ditto; 7, anther; 8, pollinia; -all enlarged.
9. Dendrobium crepidatum Lindl. in Paxt. Fl. Gard. i, 63, fig. 45.

Stems pendulous, $1 \cdot 5$ to 4.5 dm . long, tapering to the base, striated green aud white, covered when dry with the long scarious sbeaths of fallen leaves. Leaves
linear-lanceolate, acuminate, $5-10 \mathrm{~cm}$. long. Flowers 2 to 2.5 cm . across, solitary or two or three together on very short bracteate peduncles from the slightly swollen nodes of the leafloss stems, white or pinkish, with a large yellow blotch on the lip; pericels 3.5 cm . long. Sepals subequal, broadly oblong, subobtuse. Petals not exceeding the sepals, broadly ovate. Lip broadly obovate, pubescent, the edges undulate; apex broad, often retuse; base narrowed to a short claw, with a short transverse ridge in front of it and a sunall pit behind. Column very short and broad; mentam short, obtuse. Anther very convex. Ovary long-peduncled, divergent, purple. Capsuie clavate, 4 cm . long. Bot. Mag. tt. 4993, 5011 ; Veitch Man. Dendrob. 33; Hook. f. Fl. Br. Ind. v, 740; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 48, plate 66. D. Lawanum Lindl. in Journ. Linn. Soc. iii, 10; Dalz. \& Gibs. Bomb. Fl. 261. Dendrochilum rosetum Dalz. in Honk. Kew Journ. iv (1852), 291.

Dehra Dun near Rajpur, W. Gollan (Duthie's No. 2j404); Garhwál, Falconer. In flower during May. It extends eastwards to Sikkim, Assam, the Khasia Hills and Upper Buraa; it is also found in the Bombay Presidency and in S. India.

The flowers of the Sikbim form are lese attraotive than those of the form found in issam and on the Khasia Hills, aud Sir George King has reason to believe that this species is usually self-fertile, and that it may represent a stage in the transition towerds cleistogamy.
10. Dendrobium candidum Wall. in Lindl. Bot. Reg. 1838, 36; 1844, Misc. 32.

Stenss erect, slender, $1 \cdot 5$ to 3 dm . long, cylindric. Leaves 5 to $7 \cdot 5$ cm., uarrowly lanceolate; apex obtuse, obliquely bifid. Peduncles with short hyaline sheaths, 1-3 flowered, from the nodes of the leafless stems. Flowei's white, 2.5 cm . long. Sepals broadly lanceolate, obtuse or subacute. Pctals like the sepals, but more acute. Lip as long as the sepals, oblong-lanceolate; the apex suddenly acute; side lobes rounded, incurved, the disk between them with an elongated callus. Column short, with a very broad and deeply excavated foot. Mentum short, broad and rounded. Anther large, suborbicular, papillose. Paxt. Fl. Gard. i, 63, fig. 41 ; Walp. Ann. vi, 286 ; Hook. f. Fl. Br. Ind. v, 735, in Ann. Roy. Bot. Gard., Calc. v, part 1, 12, t. 19 ; King and Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 49, t. 68. D. spathaceum Lindl. in Journ. Linn. Soc. iii, 15 ; Hook, f. Fl. Br. Ind. v, 737.

Garhwál near Tebri at g.bout 5,000 feet, Mackinnon's collector (Duthie's No. 24155); Kumaon at 3,000 feet, Strachey \& Winterbottonc flowering in April and May. It extends eastwards to Nepal, Sikkim and the Khasia Hills.

With the exception of a yellow spot near the base of the lip the flowers are pure white. Iu other respects it closely resembles $D$. amicenum.
11. Dendrobium clavatum Wall. Cat. 2004.

Stens stout, slightly clavate, 4.5 to 7.5 dm . long, the leaf-bearing ones smooth, the leafless sulcate. Leaves 9 to 12 cm . long, narrowly oblong, coriaceous, the apex blunt or subacute, slightly notched. Peduncle 5 to 7.5 cm . long, bearing many
tubular membranous sheaths. Raceme twice or three times as long as the peduncle, horizontal or decurved. Flowers four to six on ench peduncle, rather distant, is to $7 \cdot 5$ cm. across; floral bract membranous, oblong, subacute, shorter than the slender pedicelled ovary. Sepals oblong, obtuse or subacute. Petals broadly uvate, subacute. Lip narrowed to the convolute base; anterior portion expanded, concave, orbicular-reniform, its margins near the base slightly fimbriate; apex undulate; upper surface tomentose. Column and its foot short, the latter with a nectary near the base; mentum short. Lindl. in Paxt. Fl. Gard. ii, 104, fig. 189 ; Bot. Mag. t. 699:3; Reichb. f. in Walp. Ann. vi, 293; Hook. f. Fl. Br. Ind. v, 746 ; King \& Pentl. in Ann. Roy. Bot. Gard. Calc. viii, 53, t. 60.

Kumaon, Slrachey of Winterbottom, Stewart; Gori Valley, Duthie No. 24096 ; flowering in May and June. It extends eastwarda to Nepal, Sikkim, the Khasia Hills, Upper Burma and China, but is not abundant anywhere.

The flowers are dark yellow, and near the centre of the lip there is a large reddieh-browu bloteh, the edges of the lip being of a paler oolour than the rest of the Hower.
12. Dendrobium normale Falconer in Anm. Nat. Hist. iii, 196 (uame only); Proc. Linn. Soc. i (1839), 14.

Stems 3 to 4 dm . long, erect, terete, sulcate; internodes $2 \cdot 5$ to 3.5 cm . long Leaves linear-lanceolate, acuminate, $7 \cdot 5$ to $12 \cdot 5$ long, thin; sheaths tubular. Fiowers 6.5 cm . in diam., subracemose on a lateral peduncle, golden yellow, sweet-scented; peduncle 2.5 to 3.0 cm . long, with tubular sheaths at the base; bracts embracing the slender ovary, about half its length. Sepals equal in length, their margins 'entire; dorsal acute, lateral oltuse or emarginate, all three mucronate just below the apex on the outside. Petals and lip similar and about as long as the sepals, but a little broader, their margins minutely serrulate except towards their basee. Colunin sbort, rotundate, divided at the apes into six divisions, of which the larger ones are subobovate subcarinate, tooth-like and opposite the petals. Anther firm, with a slender filament (occasionally there are three anthers unequally developed, the largest being anticous). Pollinia 4, connate in pairs. Griff. Notul. iii, 25j; Ic. Pl. As. t. 284; Lindl. in Joura. Linn. Soc. iii, 10 ; Royle Ill. Him. Bot. 363; Hook. f. Fl. Br. Ind. v, 748.

Mussoorie range, in shady ravines on the southern slopes, 3,000 to 6,000 feet Vicary, Falconer, Edgeworth, Mackinnon (Duthie's Nos. 22707, 24157); British Garhwál near P'eori, T. Thomson. Flowers in June.

Tbis remarkable plant which, as Lindley pointed out, is no doubt a peloriste state or variety of some allied speoies, has given riee to much disoussion as to the normal position of the supplementary anthers in the orchid ramily. Falconer, in his note published in the Proceedings of the Liunean Society, vol. i., p. 14, eays:-"In my plant it is most distinctly ovident both by a decurrent ridge on eaoh filament and by transerse 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 Lindley's formula." It was suggested by Lindley that D. normale might prove to be monstrous condition of D. fimbriatum, but the inflorescence of the former is more ike that of $D$. chacatum, whilst the learee almost exactly resemble those of D. chrysan:hum.

Plate 100. Dendrobium normale Fulc.-Portions of leafy and flowering stems,-nf natural size. Fig. 1, single flower; 2, column; 3, ditto, with anther partially detached; 4, anther; 5 , pollinia; -all enlarged.

## 13. Dindrobium fimbriatum Hook. Exot. Fl. t. 71.

Stcms suberect, $7 \cdot 5$ to 15 dm . long, tapering upwards from the base, sulcate, slightly thickened at the nodes. Leaves 9 to 15 cm . long, oblong-lanceolate, acuminate, narrowed to the base. Racemes usually on the leafy stems, lateral, pendulous, 7-12flowered, 15 to 20 cm . long, the peduncle with several sheathing bracts at the base. Flowers 5 to 7.5 cm . across, yellow; floral lract minute. Sepals broadly oblong, blunt, entire. Petals bronder than the sepals, their apices slightly emarginate, erose. Lip orbicular, with an undulate deeply fringed margiu, the base shortly clawed. Column with its foot short and broad and with a suborbicular nectary near the base of the former. Anther obliquely and bluntly conical; pollinia compressed. Wall. Cat. 2001; Lindl. Gen. and Sp. Orch. 83 (not 76); Paxt. Mag. ii, 172; Floral Cab. t. 109; Veitch Man. Dendrob. 42, with fig.; Walp. Ann. vi, 293; Hook. f. Fl. Br. Ind. v. $\mathbf{7 4 5}$; King \& Pantl. in Ann. Roy. Bot. Gard. viii, 58. Dendrobium sp. Griff. Notul. iii, 113.

Near Lansdowne in British Garhwál, collected by Captain Roberts ; flowering in May. This plant was originally discovered in 1820 by Wallich, or by one of his collectors, on one of the outer ranges of the Nepal Hiwalaya.

Var. oculata Hook. Bot. Mag. t. 4160.
Flowers bright yellow, with a large round reddish-brown patch on the lip. Ill. Hortic. i, t. 15; Warner Sel. Orch. ii, t. 19 ; Paxton Fl. Gard. iii, t. 84; Jard. Fleur. 314 ; Hook. f. Fl. Br. Ind. v, 745; King \& Pantl., l. c. 59, t. 82. D. Paxtoni Paxt. Mag. vi, 169 (not of Lindl.); Fl. des Serres vii, t. 725.

Outer ranges of the Garhwál and Kumaon Himalaya up to 5,500 feet; Mussoorie range, Vicary, Mackinnon and others; Kumaon, Strachcy \& Winterbottom No. 6. Flowers in April and May. It extends eastwards to Nepal, Sikkim, Bhutan, Assam and Khasia Hills, Chittagong, Upper Burma, and also in Perak. In consideration of its much wider distribution it might very properly be regarded as the type instead of a variety of the so-called type.

## 14. Dendrobium chrysanthom Wall. Cat. 2012.

Stems pendulous, 6 to 9 dm . long, tapering towards the base and apex, dark green, clothed with scarious white-lined tubuiar sheaths. Leaves 7.6 to 16.5 cm . long, and from 2.5 to 3.5 cm . wide, lanceolate, acuminate, the base rounded and sheathing. Flowers 3.4 cm . in diam., rather flesky, arranged in fascicles of 2 to 4 on very short bracteolate peduncles from leafy or leafless stems. Sepals subequal, broadly ovate, obtuse, concave, keeled, fleshy, the lateral pair slightly falcate. Petals a little longer than the sepals, concave, ovate-orbicular, entire or minutely erose. Lip transversely orbicular-oblong or reniform (when flattened out), concave, tomentose towards the fimbriate margin, abruptly clawed at the base. Column broad, concave, the foot
with a transverse ridge towards the lower end, and a large nectary below it; stigma emarginate at the lower edge. Mentum short and blunt. Anther 3-ridged on the anterior surface; pollinia oblong. Capsule subovoid or pyriform, 35 to 5 cm . long. Lindl. Gen. and Sp. Orch. 80; in Journ. Linn. Soc. iii, 8; in Bot. Reg. t. 1290; Gartenf. t. 446 ; Veitch Man. Dendrob. 28 ; Hook. f. Fl. Br. Ind. v, 747 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, ij5, t. 77. D. Paxtoni Lindl. in Bot. Reg. 1839 (Mise. 56), Fl. des Serres vii, t. 72 j.

Garhwál, Duthie No. 25807 ; Kumaon, in the Rámganga Valley, 4-5,000 feet, Duthie No. 3404; Gori Valley, Duthic No. 24095. Flowers during August and September. It extends to Nepal, Sikkim, Bhutan, the Khasia Hilln, Burma and China.

The flowers are yellow, and the lip has two suborbioular spots of hrownish-purple.
15. Dendrobium moschatum Wall. in Don Prod. (1825), 34.

Stems stout, erect, tufted, 9 to 18 dm. long, terete, striate. Leaves 7.5 to 15 cm . long and 3 to 5 cm . broad, oblong ovate-oblong or lanceolate, acute or minutely and obliquely notched, slightly narrowed to the base. Racemes one or two from near the apex of a leafless or leafy stem, $2 \cdot 3$ to 3 dm . long, deflexed, laxly 8 . to 16 flowered; base of peduncle stout and covered with many sheathing imbricate bracts. Flowers 5 to 7.5 cm . across, usually dull yellow, tinged with pink, and with orange or reddish veins; fioral bract lanceolate. Scpals subequal, up to 5 cm . long, oblong. elliptic, obtuse, sheathing. Petals larger than the sepals, broadly ovate, obtuse. Lip shorter than the petals, forming a subglobular or pyriform open-mouthed pouch with incurved margins, outer surface and edges pubescent, often with two large brownishpurple spots inside the cup. Column short and broad, the foot widening downwards, nectary transversely oblong. Anther with an erose lip. Capsule 5 cm . long, fusiform. Wall. Pl. As. Rar. ii, 83, t. 195; Lindl. Gen. and Sp. Orch. 82, in Bot. Reg. 1844, Misc. 37 ; in Journ. Linn. Soc. iii, 8; Bot. Mag. t. 3837 ; Paxt. Mag. ii, t. 241 (excl. syn. clavatum) ; Veitch Man. Dendrob. 61; Warner Orch. Alb. t. 165 (var. cuprea) Walp. Ann. vi, 296; King \& l'antl. in Ann. Roy. Bot. Gard. Calc. viii, 60, t. 84. D. Calcolaria Carey in Hook. Exot. Fl. t. 184 ; Lindl. Gen. and Sp. Orch. 83; Hook. f. Fl. Br. Ind. v, 744. D. cuprcum Herb. in Bot. Reg. t. 1779. Epidendrum moschatum Buch. \& Banks in Syme's Eınbassy to Ava, ed. 1 (1800); 4.78 with fig.; ed. 2, vol. iii, 315 with fig.

Kumaon, Strachey $\mathcal{F}$. Winterbottom No. 9. Flowers during the early part of the rainy season. It extends eastwards to Sibkim, Bhutan, Assam, the Khasia Hills and Chittagong, also in Tenasserim.

## 5. Bulbophyllum Thouars.

Epiphytal; pseluciobulbs from a creeping rhizome, rarely none. Leaves solitary, thick, persistent (deciduous in B. polyrhizum), or in pairs and thin and deciduous. Scape from the rhizome near the base of the pseudo-bulb, rarely distant from it. Flowers
solitary, cipitate, umbellate, spicate or racemose. Sepals subequal or the lateral pair longer than the dorsal (rarely twice as long); the lateral pair adnate to the foot of the column. Pctals various, usualiy much smaller than the dorsal sepal. Lip jointed on the foot of the column, mobile, usually suall and strongly recurved. Column very short, often 2 -aristate at the apex. Anther 2-celled; pollinia 4, the two inuer reduced in size.-Species about 2.50, tropical and subtropical, chiefly Asiatic, a few in Africa, Australia and America.

$$
\begin{aligned}
& \text { Flowers solitary, on a long pedicel, scape very short . 1. B. affiue. } \\
& \text { Flowers racemose or spicate :- } \\
& \text { Rhizome short, pseudo-bulbs usually crowded, leafless when } \\
& \text { in Hower . . . . . . . . . . . . . . }
\end{aligned}
$$

1. Bulbophyllum affine Lindl. in Wall. Cat. 1982.

Rhizome long, stout, densely rooting. Pseudo-bulbs about $7 \cdot 5 \mathrm{~cm}$. apart, 3 to 4 cm . long, cylindric, slightly thickened at the base. Leaf narrowly oblong, obtuse, tapering to the base, 7.5 to 17.75 cm . long, shortly petioled. Scape very short, bracteate, from the sides of the base of a pseudo bulb, or from the rhizome between the pseudo-bulbs, bearing a single flower. Flowers 2 to 2.5 cm . long, pedicelled, pale green streaked with red, smooth. Sepals subequal, lanceolate, subacute, 5 -nerved, not reflexed, the lateral pair falcate. l'etals a little shorter than the sepals, 3-nerved. Lip shorter than the petals, lanceolate, thickened and concave at the base, the margins of the upper surface dark purple. Column greenish-yellow, rather stout, its foot short. Anther. conical, scabrid; pollinia curved. Lindl. Gen. and Sp. Orch. 48 ; Reichb. f. in Walp. Ann. vi, 246 ; Hook. f. Fl. Br. Ind. v, 756 ; King \& Pantl. in Ann. Roy Bot. Gard. Calc. viii, 67, t. 91. Sarcopodium affine Lindl, in Paxt. Fl. Gard. i, lès̄ Fol. Orch., Sarcopodium 5.

Kunsoon, in the Gori Valley between 4,000 and 5,000 feet; Duthie No. 24101; flowering in June and July. It extends eastwards to Nepal, Sikkim and the Khasia and Naga Hills.
2. Bulbophyllum polyrhizum Liudl. Gen. and Sp. Orch. 53.

Rhizone thread-like, branching; pseudo-bulbs crowded or distant, globular or ovoid, with a broad base, smooth. Leaf 6.5 cm . long, narrowly oblong, subacute, slightly marrowed to the sessile base, deciduous before the flowers open. Scape filiform, about 1 dm . long, its suberect peduncle longer than the raceme, bearing one or two uinute bracts, raceme inclined. Flowers about 6, distant, secund, pale yellow, 8 mm . long; floral bract minute, oblong, about equalling the short stalk of the ovary. Sepals spreading, subacute; the dorsal ovate, concave; the lateral pair longer, oblong-lanceolate, subacute, 3 -nerved. Petals much shorter than the sepals, broadly ovate, acute, 1-nerved. Lip stipitate, deflexed from the base, oblong, obtuso, scaberulous, the basal
half grooved. Column with very short sharp teeth; its foot short, slightly curved. Anther papillose, its lip acute. Hook. f. Fl. Br. Ind. v, 767; in Ano. Roy Bot. Gard. v, pt. 1, 15, t. 23 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 70, t. '95.

Dehra Dun, Gamble, Mackinnon (Duthie's No. 24147); Garhwal, up to 4,000 feet, Mackinnon; flowering in March. It was found by Wallich in Nepal, and occurs also in Sikkim in the valley of the Teesta at an elevation of 1,500 feet.

## 3. Bulbopeyllum reptang Lindl. in Wall. Cat. 1988.

Rhizome thin, wiry, naked, branching; pseudo-bulbs distant, obpyriform, smooth, up to 2 cm . in length. Leaf 9 to 15 cm . long, linear-oblong, subacute, obliquely notehed at the apex, slightly narrowed at the base to the very short petiole. Scapes shorter or longer than the leaves, often in pairs, slender and more or less decurved; peduncle sheathed at the base, bracteate, longer or shorter than the laxly-flowered raceme; floral bract of the lower flowers of the spike longer than those of the upper, oblong-lanceolate, usually longer than the shortly-stalked ovary. Flowers $7-9 \mathrm{~mm}$. long, yellowish with purple spots. Sepals subequal, lanceolate, 3 -nerved, sperading, the lateral pair with dilated bases. Petala much shortor than the sepals, oblong, blunt, 1 -nerved, spreading. Lip about as long as the petals, stipitate, delexed from the middle, oblong, expanded and grooved at the base, apex narrowed and subacute, margins more or less winged. Column with filiform apical processes and short lateral wings; the foot short and curved, tumid near the stigma. Pollinia subglobose, the two inner small. Lindl. Gen. and Sp. Orch. 51 ; Hook. f. Fll. Br. Ind. v, 768; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 77, t. 106. B. Clarkei Reichb. f. in Journ. Linn. Soc. xxv, ; 72. Tribrachia reptans Lindl. Coll. Bot. t. 41A.

Garhwál, east of Telri, at about 5,000 feet, Mackinnon; flowering at the beginning of the cold season. The species extends eastwards to Nepal, Sikkim and the Khasia and Naga Hills.

## 6. Cirrhopetalum Lindi.

Epiphytal. Rhizome creeping, but sometimes cæspitose; pseudo-bulbs 1- rarely 2 leaved. Leaves coriaceous and persistent, rarely membranous and deciduous. Scape rising from the base of a pseudo-bulb. Flowers usually in whorled umbels, ar capitate, rarely racemose, often dorsally compressed. Dorsal sepal concave, short, rarely half as long as the lateral pair, usually much shorter; lateral sepals usually much elongate and acuminate, oblique, often cohering by their edges, the bases ednate to the sides of the column or of its foot. Petals shorter than the dorsal sepal. Lip small, tumid, usually entire, always shorter than the dorsal sepal, jointed to the end of the foot of the column and more or less mobile. Column short; its apex with two (rarely four) tooth-like appendages; the foot more or less produced. Anther 2-celled; pollinia 4, cohering in a singie mass and sometimes attached by their lower ends to a mass of viscid tissue: the inner two usually small and lamelliform. - Species about 40 , chiofly Indo-Malayan.

This genus is bost distinguished from Bialbophyllum by the shortness of the dorsal sepal and ibe great length of the lateral sepals; also by the flowers being usually in umbele, rarely in racemes or beads.

$$
\begin{aligned}
& \text { Pollinia attaohed to a viscus; lateral sepals quite free, } \\
& \text { umbels ereot . . . . . . . . . . . . . . 1. C. maculosum. } \\
& \text { Pollinia without a viscus, lateral sepals cohering:- } \\
& \text { Lateral sepals cohering at their bases, umbels erect . 2. C. Huokeri. } \\
& \text { Lateral sepals oohering exoept at their bases, racemes } \\
& \text { drooping . . . . . . . . . . . . . . . . 3. C. refractum. }
\end{aligned}
$$

1. Cirrgopetalum maculobum Lindl. in Bot. Keg. 1841, Misc. 81; 1843 under t. 49 .

Rhizomes with fibrous sheaths and many roots; psaudo-bulbs contiguous or as much as 1.3 cm . apart, ovoid, wrinkled at flowering time, 2 to 2.5 cm . long. Leaf sessile, 11.5 to 15 cm . long, nerrowly oblong, obtuse and notched at the apex, narrowed at the base, thick. Scape about twice as long as the pseudo-bulb, with a sheath at the base, the umbel $2-4$-flowered; floral bract lanceolate, shorter than the stalked ovary. Flowers about 5 mm . long. Sepals and petals cream-coloured and spotted with red. Dorsal sepal free at its base from the lateral pair, broadly ovate, acute, aubdepressed; lateral sepals about twice as long as the dorsal, free, ovate-lanceolate from a broad base, sub-acute, falcate, their upper margins curved inwards. Petals broadly ovate, very obtuse. Lip oblong with a broad base, tapering to the sub-acute apex, green, the upper surface grooved. Column broadly winged, short; the apical teeth short, curved, blunt; its foot narrowed, rectangularly curved below the apex. Follinia all cohering to a viscus, the outer two much the longer. Hook. f. Fl. Br. Ind. v, 776 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 95, t. 132. C. bootanense Griff. Notul. iii, 297 ; Ic. Pl. t. 299. Bulbophyllopsis maculosa Reichb. f. in Walp. Ann. vi, 243. B. morphologorum Reichb. f. in Bot. Zeit. 1852, 933.

Below Muesoorie, Duthie; Garhwal, Falconer, Mackinnoit (Duthie's No. 2t151); Knmaon, 3-4,000 feet, Strachey \& Winterbottom. Flowers in May. It extends eastwards to Nepal, Sikkim and the Khasia Hills.
2. Cirriopetalum Hooreri Duthie in Journ. As. Soc. Beng. lexi, part 2, 38.

Cæspitose. Pseudo-lulbs crowded, 1.5 to 1.7 cm . long, ovoid, obtuse, grooved, greyish-green, one-leaved. Leaf 3 to 4 cm . long and 1 to $1 \cdot 2 \mathrm{~cm}$. broad, elliptic-oblong or lanceolate, often subfalcate, very sbortly petioled, notched at the obliquely obtuse or acute apex, coriaceous, dark green above, paler beneath, narrowly hyaline along the margins. Peduncle slender, equalling or exceeding the leaves, bracteate. Umbel 3-10flowered; floral bracts 5 mm . long, whorled, lanceolate, acuminate, membranous, shorter than the pedicelled ovary, margins incurved. Dorsal sepal 5 mm . long, quite free at its base from the lateral pair, ovate, emarginate, concave and embracing the column, pale jellow, and with three broad reddish-purple veins; lateral sepais $2 \cdot 1 \mathrm{~cm}$. long, conering at their base and adnate to the frot of the column, auricled at the base linear-lancolate, acuminate and with cucullate tips, sellow with three to four reddish reins, which become indistinct upwards. Petals shorter wan the dorsal sopal, broad)y
and obliquely ovate, rounded at the apex, yellow tinged with reddish-purple at the base. Lip deflexed from about the middle, oblong, with the margina incurved and forming a deep furrow on the upper sarface, thick and fleshy, yellow with reddishpurple spots on the raised margins of the basal portion. Column with a long incurved foot; apical processes two, triangular, setaceous. Hook. f. in Bot. Mag. t. 7860.

Garhwál near Tehri, opiphytic on Rhododendron arboreum at elevations between 5 and 6,000 feet, Mackinnon's collector (Duthic's No. 25402).

This species is most nearly related to C. caspitosum Wall., a native of the Bikkim Himalaya and the Khasia Hille, from which it differs by its larger size, more reunded pseudo-bulbe and much longer soapes. The lateral sepale adhere at the base only, and the petals are obtuse and quite entire; the shape of the lip is also different. The Botanical Magazine plate, alluded to above, was prepared from living apeoimons sent to Kew early in 1902.

Plate 101. Cirrhopetalum Hookeri Duthie.-Portion of plant,—of natural size. Fig. 1, single flower, side view; 2, the same, seen from the front; 3, dorsal sepal; 4 and 5 , lip; 6, column and ovary with lip attached; 7, column with lip rensoved; 8, anther; 9, pollinia; all enlarged.
3. Cirehopetalum refractum Zollinger in Flora (1847), 456.

Cæspitose ; pseudo-bulbs crowded, conical and with broad bases, short, wrinkled at flowering time. Leaves in pairs from the apex of a pseudo-bulb, deciduous at flowering time, $5 \cdot 5$ to 12.5 cm . long, narrowly oblong, acute, contracted at the base, sessile. Peduncle 10 to 15 cm. long, erect, slender, sheathed at the base and with two ovate. acuminate bracts; raceme drooping, $3 \cdot 5$ to 9 cm . long, 4-12-flowered; floral bract ovate-acuminate, much longer than the short subsessile ovary. Flowers 4 to 6.5 cm . long, decurved. Dorsal sepal free at the base from the lateral pair, lanceolate, apex awned; margins ciliate, depressed; lateral pair about five or six times as long as the dorsal, cohering except at the base. Petals rather fleahy, triangular, more densely ciliate than the dorsal and about half as long. Lip shorter than the dorsal sepal, oblong, obtuse, very fleshy; lower surface convex, the upper smooth, deflexed from below the middle, the basal half with upturned edges, the anterior balf with tufts of purple glandular hairs. Column ahort, with slender decurved apical teeth, the foot short and abruptly contracted about the middle. Anther papillose; pollinia obovoid, subequal. Walp. Azn. i, 776; Hook. f. Fl. Br. Ind. v, 779; in Ann. Roy. Bot. Gard. Calc. $\quad$, 19, t. 28; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 87, t. 119. C. Wallichii Lindl. in Wall. Cat. 1980; Bot. Reg. 1839, Misc. 72; and 1843 sub. t. 49 (not of Wall. Pl. As. Rar.). C. tripudians Par. \& Reichb. f. in Gard. Chron. 1876, 816. Bullophyllum refractum Reichb. f. in Walp. Ann. vi, 259. B. tipudians Par. \& Reichb. f. in Trans. Linn. Soc. xxx, 154.

Kumaon, in the Sarju valley at 3,700 feet, Strachey \& Winterbottom No. 11 ; flowering after the rainy season is over. It extends eastwards to Sikkim, and is found also in Burma and Java.

The lateral sepals, whioh form the most conspicuous part of the flower, are pale green waen young and become brownish with age. The dorsal sepal and the petale and lip are pale yellow, spottod with purple.

## TRIBE II.-EPIDENDREA.

Pollinia 4 or 8 , waxy, attached by their bases or by their backs to a single or double granular or translucent appendage, but without any gland derived from the stigma.

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Terrestrial, without pseudo-bulbs:-
    Scapes from a stout rhizome, flowering before the leaves
    Stems leafy; flowers large, appearing with the leaves . . 8. Phaius.
Epiphytal, pseudo-bulbous or with jointed steme:-
    Column with a long foot, pollinia 8 . . . . . . . 9. Eria.
    Column without a foot, pollinia 4 :-
        Pseudo-bulbous, flowering bracts deciduous . . . . 10. Calngyne.
        Stems composed of elongate pseudo-bulb-like joints . 11. Pholidota.
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## 7. Pachystoma Blume.

Terrestrial, with thick rhizomes. Leaves solitary or in pairs, appearing after the flowers, long, narrow, many-nerved. Scapcs pale, with many sheaths. Flowers in crowded racemes, rather small, white or pale purple, puberulous. Lip sessile on the base of the column, erect, with oblong acute side lobes and a small terminal lobc. Column short, dilated at the apex. Anther dorsal. Pollinia 8, pyriform, adhering to a single membrane.-Species 6 to 8, Asiatic or African.

Pachystoma senile Reichb. f. in Bonplandia iii, 251.
Terrestrial, leafless at flowering time. Rhizome rather stout; producing leaves at intervals of 2 to 5 cm . Leaf succeeding the flowers, solitary, longer than the scape, linear, membranous, 4 - or 5 -nerved. Scapes about 3 dm . high, clothed with many pale membranous clasping striate sheaths, each 2.5 to 5 cm . long; raceme many-flowered. Flowers about 13 mm . across, greenish-white tinged with pink or purple, glandularpuberulous; floral bract longer than the curved stalked pubescent ovary, erect, lanceolate, acuminate. Sepals unequal; the dorsal oblong, rounded at the apex; the lateral pair spreading, oblong•lanceolate, subacute. Petals narrowly spathulate, recurved, puberulous like the sepals. Lip sessile on the base of the column, 3-lobed, erect, broadly oblong, gibbous at the base, pubescent, side lobes with acute falcate apices, the terminal lobe suborbicular recurved and abruptly acuminate at the apex, disk of whole lip with 5 stoutly-crested ridges extending from base to apex. Column dilated at the apex, puberulous. Anther on the back of the column, indistinctly 8-celled. Pollinia 8, sabclavate, cohering to a single cylindric appendage. Reichb. f. in Walp. Ann. vi, 463 ; Hook, f. Fl. Br. Ind. v, 812; King \& Pantl. in Aun. Roy. Bot. Gard. Calc.
viii, 101, t. 140. $P$. Smithianum, $P$. montanum and $P$. Lindleyanum Reichb. f. l.c.; and in Walp. Ann. vi, 462, 463. P. Edgeworthii Reichb. f. in Walp. Ann. vi, 463. Apaturia senilis, A. Smithiana and A. montana Lindl. in Wall. Cat. 3739, 3737, 3738; Gen. and Sp. Orch. 130, 131. A. Lindleyana Wight Ic. 1662.

Dehra Dun, T. Thomson, Mackinnon; Garhwal, Falconer; flowering in April. It is found also in many places within the northern border of the Gangetic Plain from the Jumna to Moradabad and N. Oudh, and extends southwards to the hilly parts of tho Peninsula and Ceylon. Eastwards it extends to Sikkim, the Khasia Hills, Manipur, the Nicobar Islands, the Malay Archipelago and S. China.

## 8. Phajus Lour.

Terrestrial or epiphytal, with or without pseudo-bulbs, usually of large size. Lenves membranous, usually plicate. Flowers large, racemose on a scape rising from the base of the stem or pseudo-bulb, or from the axil of a leaf or at the apex of the stem. Sepals and petals subequal, suberect, rarely spreading. Lip adnate to the base of the long footless column, gibbous or spurred. Anthers incompletely 4 -celled. Pollinia 8, altached by fours to a granular membrane.-Species about 30 , in the tropics of Asiu and of the Pacific.

Phajus albug Lindl. in Wall. Cat. 3749.
Pseudo-bulb none. Stcms stout, erect, tufted, 3 to 9 dm . long, bearing many tubular sheaths at the base and numerous leaves. Leaves distichous, sessile, 1.5 to 3 dm. long, narrowly elliptic-lanceolate or oblong•lanceolate, acuminate, membranous, glaucous beneath. Racence terminal, drooping, $4-6$-flowered, 10 to 15 cm . long, on a short peduncle with a single elongate sheath. Flowers 5 to 6.5 cm . long, the bract equalling or exceeding the long-stalked ovary, oblong, cymbiform, acute, nearly white. Sepals free, subequal, narrowly oblong, acute. Lip broadly oblong-panduriform when spread out; lower balf convolute into a tube; the anterior cucullate, forming a rounded shell-like mouth slightly acuminate, the edges undulate and unequally dentate, the upper surface with seven to nine dentate crested ridges; spur short, horizontal, slightly bifid. Column somewhat winged near the apex, with a very short foot. Pollinia 8, unequal, elongate. Capsule 3 cm . long, narrowly elliptic. Wall. Pl. As. Rar. ii, t. 198; Lindl. Gen. and Sp. Orch. 128; Bot. Reg. 1838, t. 33; Paxt. Mag. v, t. 125 ; Bot. Mag. t. 3991; Grah. Cat. Bomb. Pl. 205; Blume Mus. Bot. Lugd. Bat. ii, 181; Hook. f. Fl. Br. Ind. v, 818 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 110, t. 153. P. Marshalliana Reichb. f. in Linnæe xli, 65; Regel Gartenfl. t. 1098. T'hunia alba Reichb. f. in Bot. Zeit. 1852, 764. T. pulchra Reichb, f. in Gard, Chron. 1881, ii, 166. Limodorum bracteatum Roxb. Fl. Ind. iii, 466.

Dehra Dun, often epiphytal on sál trees, Gamble, Mackinnon; Garhwál, Falconer, T. Thomson; Mussoorie range up to 4,600 feet, Vicary, Edgeworth; Kumaon at 3,200 feet, Strachey \& Winterbotlom No. 18. Flowers in June. It extends eastwards to Sikkim, the Khasia Hills and Burma, and is found also on the Western Ghats. A very handsome species, with pure white sepals and petals, and usually a yellow or orange-coloured lip.

## 9. Eria Lindl.

Epiphytes, usually pseudo-bulbous, the pseudo-bulbs often elongated and stem-like. Flowers never large, rarely bright-coloured, often pubescent or tomentose, in racemes spikes or heads, or on 1-2-flowered pedicels. Scpals free, adnate to the long foot of the column, and with it forming a spur-like or saccate mentum. Lip sessile on the foot of the column and incumbent. Column short and straight, or long and somewhat curved. Anther imperfectly 4 . or 8 -celled. Pollinia 8 , pyriform or broadly obovoid, attached in fours by their bases to a granular membrane, or the whole occasionally attached to a single viscus.-Species about 160, all tropical Asiatic.

| ers glabrous or pubescent, not woolly :Flowers sulbglobose, in dense spikes . Flowers few, in lax spikes |  |
| :---: | :---: |
|  |  |
|  |  |
|  |  |

1. Eria convallarioides Lindl. in Wall. Cat. 1975.

Pseudo-bulbs tufted, flattened, $7 \cdot 5$ to 17 cm . long, covered when young with Jarge loose sheaths. Leaves four to six, 10 to 17.5 cm . long, elliptic-lanceolate or oblanceolate, acute, subcoriaceous, many-nerved, not plicate. Spilces produced on the young growths and proceeding from the axils of the bracts and leaven, cylindric, decurved, the peduncles short and naked. Flovers many and densely crowded, subglobose, 7 mm . in dinm., inodorous; floral bract equalling the sessile pubescent ovary, ovate-lanceolate, concave, those at the base of the spike largest. Sepals broadly ovate, obtuse, the lateral pair very concave. Petals oblauceolate-oblong, spreading, nearly as long as the sepals, but much narrower. Lip obscurely 3 -lobed, cuneate, concave, apex subacute, the disk without lamellæ. Column rather slender, with a long much-carved foot. Pollinia clavate, attached to a large translucent viscus. Capsule oblong, obtuse, not winged. Lindl. Gen. and Sp. Orch. 70; in Bot. Reg. 1841, t. 62, Misc. 58 ; in Journ. Linn. Soc. iii, 53; Reichb. f. in Walp. Ann. vi, 276; Hook. f. Fl. Br. Ind. v, 791 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 118, t. 161. Octomeria spicata Don. Prod. 31. O. convallarioides Wall. MSS. Pinalia alba Herb. Ham.

Dehra Dun, Mackinnon; Mussoorie range up to 4,000 feet; Garhwál, Duthie No. 25813; Lansdowne in Brit. Garhwál, Capt. Roberts; Kumaon at 4,000 feet, Strachey \& Winterbottom No. 13; Gori Valley 2-3,000 feet, Duthie No. 5990. Flowers in August and September. It extends eastwards to Nepal, Sikkim, the Khasia and Naga Hills; also in Tenasserim.

The flowern are white or straw-coloured, the lip being tinged with yoliow and the column with red. Sir George King remarks that epecimens growing at low elevations have often more slender pseudo-bulbs, narrower leaves and laxer flower-spikes than those from oooler places.

## 2. Ebia alba Lindl. Gen, and Sp. Orch. 67.

Pscuảo.bulbs about 3 cm . long, crowded, ovoid, tapering at each end, not elongating; marked (when fresh) with many distinct vertical lines and a few concentric scars. Lcuves $3-5$, overtopping the flowering spikes, $1 \cdot 5$ to 2 dm . long and 2 to $2 \cdot 5 \mathrm{~cm}$. broad, itianceolate, acute, strongly nerved, rather rigid. Scape 4 -6-flowered, pubescent.

Flowers sweel.scented; floral bract lanceolate, acuminate, shorter than the pubescent ovary. Sepals $10-12 \mathrm{~nm}$. long, ovate-lanceolato, 3 -5-nerved, glabrescent. Petals a little shorter than the dorsal sepal. narrowly lanceolate, acute, 3 -nerved. Lip oblong, with a broad sharply curved claw; side lobes pointing forwards, rounded, tinged with reddishpurple; midlobe orbicular, apiculate, yellow; disk with usually two thick obtuse ridges between the side lobes and a central one extending along the rough midlobe. Colamn short, about 2 mm . in length. Mentum rounded, somewhat curved and spur-like. Pollinia clavate, attached to a single small viscus. Capsuls about 2 cm . long, linear-oblong and tapering to the base. Lindl. in Journ. Linn. Soc. iii, 53, var. B; Royle III. Him. Bot. 364 ; Hook. f. Ic. Pl. t. 1845; Fl. Br. Ind. v, 795. Octomeria alla Wall. MSS.

Plentiful along the outer ranges of Garhwál and Kumaon at elevations between 3,000 and 7,000 feet; Edgeworth, Royle, Strachey \& Winterbotton, \& c.; found abundantly on oak trees in the neighbourhood of Mussoorie; also on the Punjab Himalaga in Chamba, Duthie No. 23345. Flowers during June and July.

This species is closely allied to E. excavata Lindl., with which it has often been confounded. The psoudo-bulbs of the former are stouter and more distinctly marbed with vertical lines; the lip is contraoted at the base, so that the side lobes are not basal, and the meuturn is more prolonged. The sepals and petals are white with a tiage of red externally towards their bases; the side lobes of the lip are tipped with a bread band of reddish-purple, and the upper surface of the terminal lobe is yellow spotted with red.

Plate 102. Eria alba Lindl.-A plant, - of natural size. Fig. 1, side view of flower; 2, ditto with sepals and petals removed; 3, lip spread out; 4, front view of column; 5, pollinia; -all enlarged.

## 3. Eria flaya Lindl. in Wall. Cat. 1973 (in part).

Rhizome stout, clothed with imbricating tubular sheaths. Pseudobulbs vertically furrowed, slieathed at the base, much compressed, $7 \cdot 8$ to 10 cm . long and 3 cm . in diam. Leaves three to five, more or less narrowly oblong, acuminate, tapering to the base, 1.5 to 2.3 dm . long and 2 to 3 cm . broad. Raceme from the base of the pseudobulb, about as long as the leaves, covered with dense pale soft tomentum and with several sheaths at the base. Flowers distant, yellow, 1.5 cm . long; floral bract lanceolate, much shorter than the tomentose, stalked ovary, shrivelled when the flowers open. Sepals tomentose outside, the dorsal one small and lanceolate; the lateral pair much larger, trinngular, spreading. Petals smaller than the dorsal sepal, lying parallel over the column, narrowly oblong, tapering to the base and the apex. Lip oblong, 3-lobed; side lobes narrow, with truncate apices, puberulous and with two long tapering ridges at their junction with the disk; terminal lobe oblong, acute, deflexed, slightly 2 -ridged, glabrous. Column erect, its foot at right angles to and longer than its budy. Lip of anther with a smull quadrate appendage. Pollinia small, compressed, attached to two granular membranes. Capsole 3.5 to 4 cm . long, narrowly cylindric. Lindl. Gon. and Sp. Orch. 65; in Journ. Linn. Soc. iii, 49 (excl. var. B.): Hook. f. Fl. Br. Iud. v. 801 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 120, t. 175. E. lauceps Reichl. f. in Llamo. Gartenzeit. xix, 10. Dcndrobium pubescens Hook. Exot. Fl. t. 194. Octomeria flaca TVall. MSS. O. pubescens Spreng. Syst. iv, elo

Dehra Dun and up to 4,000 feet towards Mussoorie, Mackinnon No. 24158 ; Garhwál Hills, Duthic's collector Nos. 25804, 25805, 25806. Flowers in April. It extends eastwards to Bengal, Sikkim and Bhutan.

## 10. Cœlogyne Lindl.

Epiphytes; pseudo-bulbs cœspitose or attached to a rhizome, 2- (or rarely 1-) leaved. Leaves coriaceous, or membranous and plicate. Inflorescence racemose, from the apex or base of the adult pseudo-bulb. Flowers with neither mentum nor spur; foral bract large, deciduous. Sepals subequal, spreading, more or less lanceolate or oblong. Petals narrower, sometimes linear. Lip sessile on the base of the column, rarely clawed, sometimes saccate at the base, oblong and 3-lobed or suborbicular and without lateral lobes. Column long erect, straight or curved, winged and often hooded in its upper part, foot none. Anther more or less 2-celled. Pollina 4, cohering in pairs to a single 2 -lobed granular appendage.-Species about 90, Indian, Malayan and one in China.
I.-Encølogyne. Lip oblong, 3-lobed ; flowers and leaves contemporaneous, the latter persistent; flowers in racemes.
Inflorescence from the base of the pseudo-bulb; leaves in pairs, petals lanceolate or oblong:-

Racemes erect . . . . . . . . . . . . . . . . 1. C. ochracea.
Raoomes drooping . . . . . . . . . . . . . . . 2. C. cristata.
Inflorescence from between the pairs of leaves on the apex of $\mathfrak{a}$
fully developed pseudo-bulb; petals linear:-
Flowering axis braoteate at ite base; lip fimbriate . . . . 3. C. ovalis.
Flowering axis naked below; edges of lip erose . . . . 4. C. elata.!
II.-Pleione. Lip more or less orbicular or reniform, without side lobes.

Flowers and solitary leaf contemporaneous . . . . . . . . 5. C. Hookeriana.
Flowers and leaves not oontemporaneous, the latter in pairs and
deciduous . . . . . . . . . . . . . . . . . . . 6. C. pracox.

## 1. Cglogyne ochracea Lindl. in Bot. Reg. 1846, t. 69.

Pseudo-bulbs on a stout rhizome, ovate-oblong to cylindric, furrowed, $7 \cdot 5$ to 10 cm . long. Leaves narrowly oblong, acute, narrowed to the channelled petiole, 15 to 20.5 cm . long. Raceme from the base of the previous year's pscudo-bulb, erect, shorter than the leaves (elongating in fruit), 6-8-flowered; its peduncle stout and with several large imbricating sheaths. Flowers white, 3.5 cm . long; bract oblong, convolute, sheathing, longer than the slender stalked ovary, caducous. Sepals subequal, oblong-lanceolate to ovate-lanceolate, obtuse, spreading. Pctals narrower. Lip oblong, constricted near the middle; lateral lobes large, rounded, incurved, edges serrulate; terminal lobe broadly ovate, obtuse, entire or very slightly notched at the apex, the disk with two ridges. Column broadly winged towards the apex. Poilinia broadly oblong, compressed. Capsule narrowly clavate, 4 cm. long. Lindl. Fol. Orch. 5 Bot. Mag. t. 4661; Walp. Ann. vi, 226; Hook. f. Fl. Br. Ind. v, 831 ; King \& Pantl. in Ann. Roy. Bot. Gard. Caic. viii, 132, t. 182.
'「ehri Garhwál 5-6,000 feet, Mackinnon; Brit. Garbwál, Capt. Roberts; alser in Kumaon, Edgeworth; flowering in May. It exiends eastwards to Nepal, Sikikim, Bhutan and the Assaw hill ranges.

The flowere are fragrant. The sepals and petals are pure whito; the upper surface of the lip has clearly defined blotches of yellow margined with red, and the side lobes are marked with reddish oblique lines; the face of the column is yellowish-brown.

## 2. Celogyne cristata Lindl. Coll. Bot. t. 33.

Pendulous. Pseudo-bulbs from a long stout rhizome, rather distant, ovoid-cylindric, polished, sheathed at the base, 5 to 7.8 cm . long. Leaves in pairs, 15 to 25.5 cm . long, linear-oblong, acute, narrowed to the sessile base. Racemes from the base of the pseudobulbs, pendulous, about as long as the leaves, few-flowered, with many small sheathing bracts at their bases. Flowers large, pure white, 5 to 8 cm . long; bract oblong, concave, acute, about as long as the long-stalked ovary. Sepals and petals sub-equal, erectopatent, obtuse or sub-acute, with entire undulate edges. Lip oblong, with large rounded lateral lobes, terminal lobe distinct, short, broad, crenate, with two broad square yellow lamellæ on its upper surface; disk between the lateral lobes with four yellow fimbriate lamellæ. Column long, its apex hooded and crenate. Anther with a sub-acute lip. Pollinia 4, narrowly oblong, compressed. Capsule narrowly clavate, 5 cm . long. Lindl. in Wall. Cat. 1958; Gen. and Sp. Orch. 39; Bol. Reg. 1841, t. 57; Fol. Orch. 8; Walp. Ann. vi, 229 ; Paxt. Fl. Gard. iii, 171, f. 312; Fl. des. Serres t. 1807; Percatoria i, t. 25 ; Warner's Sel. Orch. i, t. 35 ; Orch. Alb. t. 54 ; Jennings' Orch. t. 7; Gartenf. viii, t. 24 º ; Houk. f. Fl. Br. lud. v, 829 ; King \& Pantl. in Ann. Roy. Bot. Gard. viii, 133, t. 184.

Not uncommon on the outer ranges of Garhwál and Kumaon between 4,000 and 6,000 feet, usually on damp rocks and especially in the vicinity of waterfalls; flowering in March and April. It extends eastwards to Nepal, Sikkim; Bhutan aud the Khasia Hills.
3. Celogyne ovalis Lindl. in Bot. Reg. 1838, Misc. 91.

Pscudo-bulbs long, cylindric, rather stouter towards the sheathed base, polished, rising at intervals of 5 to 10 cm . from a rather stout imbricately sheathed rnizome. Leaves in pairs, 10 to 12.5 cm . long, elliptic-oblong, acute, tapering at the base into the short petiole, thinly coriaceous. Inforescence terminal, bearing three flowers whish expand singly. Flowers 5 cm . across, pale brown; floral bract 3 cm . long, ovate-lauceolate, convolute, coriaceous, caducous. Sepals sub-equal, ovate-lanceolate, acute, spreading. Petals linear, blunt, spreading or reflexed. Lip oblong; lateral lobes narrow; terminal lobe broadly oblong, with stiff black hairs on its upper surface and edges; disk with two crisped lamella from base to apex. Column curved, broadly winged along its upper half. Pollinia dinidiately obovate. Lindl. Fol. Orch. 12; Walp. Ann. vi, 232; Hook. f. Fl. Br. Ind. $\nabla$, 830 ; Ann. Roy. Bot. Gard. Calc. v, 28, t. 41 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 135, t. 187. C. fimbriata Lindl. in Wall. Cat. 1957. C. fimbriata? Griff. in Notul. iii, 281; Ic. Pl. As. 291, tig. 1? C. pilosissina Planch. Hort. Donat. 104. Broughtonia linearis Wall. MSS.

Dehra Dun, Wallich, Gamble No. 23142; below Mussoorie, up to 3,500 feet, Mackinnon; Brit. Gurhwál, Duthie's collector Nos. 25808, 25819, 25820, 25821 ; Kü̈aon in the Gori Valley, Duthie's collector Nos. 24099, 24100; flowering in October. Extends castwards to Nepal, Sikkiu and the Khasia Hills.
4. Celogyne elata Lindl. in Wall. Cat. 1959.

Pscudo-bulls oblong-cylindric, rising at distances of about 5 cm . from a very stout sheathed rhizome, 7.3 to 12.8 cm . long and 3.8 to 7 cm . broad, polished and sheathed at the base. Leaves in pairs, the blade 1.75 to 3.5 cm . long, narrowly elliptic-oblong, acute, tapering into the long petiole, thinly curiaceous. Pcduncle from the apex of the adult preudo-bulb between the leaves and rather shorter than them, bearing many short imbricate sheaths just under the raceme. Racemes 10 to 15 cm . long, distichous, laxly many-flowered. Foucrs 3 cm . across, rather fæetid; floral bract subrhomboid, acute, conduplicate, slightly longer than the stalked ovary, caducous. Sepals subequal, oblong, sub-acute, spreading. Petals as long as the sepals, but much narrower, sub-acute. Lip elongate, the lower part oblong and with narrow entire side lobes; terminal lobe suborbicular, undulate and irregularly erose; disk with two erose-crenulate lamellæ from the base nearly to the apex. Colamn winged above, the wing erose at the apex. Pollinia dimidiately ovate. Capsuls clavate, 35 cm . long. Lindl. Gen. and Sp. Orch. 40 ; in Wall. Pl. As. Kar. iii, 12, t. 218 ; Bot. Reg. 1830, Misc. 92; Fol. Orch. 9 ; Bot. Mag. t. 5001 ; Walp. Ann. vi, 250 ; Hook. f. Il. Br. Ind. v, 838; King \& Pantl. in Ann. Roy. bot. Gard. Calc. viii, 136, t. 188 ; Rolfe in Journ. Linn. Soc. xxxvi, 22. Calogyne sp., Griff. Ic. Pl. As. t. 290.

Garhwál 4-5,000 feet, Falconer, Mackinnon; Kumaon in the Sarju Valley 3-4,000 feet, Strachoy \& Winterbottom No. 14, Duthie's collector Nos. 24131, 24132; flowering during April and May. Eastwards to Nepal, Sikkim, Upper Burma and China.
5. Calogyne Hooreriana Lindl. Fol. Orch. 14.

Preudo-bulls cœspitose, oval, with a few lax sheaths, smooth, not mottled, 2 to $2 \cdot 5$ om. long. Leaf solitary, from the base of the adult pseudo-bulb, petioled; the blade 5 to 6.5 cm . long, narrowly elliptic; petiole 2 to 3 cm . long, enclosed in tubular imbricate sheaths. Peduncle enveloped in the same sheaths which surround the base of the undeveloped leaf and longer than the latter. Flower solitury, 5 cm . across, pale rosepurple or white; fleral bract about as long as the stalked ovary, obroadly obovate-elliptic, very obtuse, convolute, persistent. Sepals spreading, sub-equal, elliptic-oblong, blunt; the dorsal one narrower than the lateral pair. Petals spreading, as long as the sepals, oblanceolate, obtuse. Lip white tinged with yollow towards the apex and blotched with reddish-brown, abb-reniform, cordate at the base and entire, somewhat lobulate and minutely erose along the apical portion, apex rctuse; disk with five to seven slender ciliate ridges from the base nearly to the apex. Column long, curved, broadly winged in its upper half, its apex truncate and erose. Pollinia obliquely elliptic. Bot. Mag. t. 6388; Hook. f. Fl. Br. Ind, v, 842; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 139, t. 193.

Dwáli in Kumaon at 9,000 feet, Collett; flowering in June. Eastwards to Sikkim.

## 6. Celogyne pracox Lindl, Coll. Bot. 37.

Pscudo-bulbs cœspitose, flask-shaped, turbinate or shortly cylindric, umbonate, surfoce mottled with brown or purple, and loosely shenthed by a network of brown fibres.

Leaves in pairs, 1 to 2 dm . long, elliptic or elliptic-oblong or sometimes oblanceolate, sub-acute, many-nerved; petiole 255 to 5 cm . long. Pcduncle from the base of and aboat as long as the mature pseudo-bulb; its lower half enveloped in tight tubular mottled sheaths, 1 - or 2 -flowered. Flowers 7.8 to 10 cm , across, rose-coloured or occasionally white; foral bract obovoid, very obtuse, as long as or longer than the stalked ovary, convolate. Sepals sub-oqual, spreading, oblanceolate. Petals as long es, but narrower then the sepals, spreading. Lip ovate-orbicular, without side lobes, convolute round the column at the base, anterior portion concave, the open wide repand mouth with lobulate laciniate edges, the apex slightly bifid; disk with a white patch traversed by five jellow crested lamellæ. Column very long, with a short sac at the base, the apex cxpanded into a wide undulate irregularly lobulate hood. Pollinia clavate. Lindl. in Wall. Cat. 1985; Fol. Orch. 16; Bot. Mag. t. 4496 ; Paxt. Mag. t. 7; Hock. f. Fl. Br. Ind. v, 840 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii 141 t. 196. C. Wallichiana Lindl. Gen. and Sp. Orch. 43 ; in Wall. Pl. As. Rar. i, 46, t. 54 ; Bot. Reg. xxip, Misc. 85 Paxt. Mag. vi, t. 25 ; Gartenf. t. 283; Jennings' Orch. t. 47 ; Griff. Notul. iii, 402. Pleione pracox Don. Prod. Fl. Nep. 37. P. Wallichii Lindl. in Paxt. Fl. Gard. sub. t. 51. P. birmanica Reichb. f. in Gard. Chron. 1882, ii, 840. Epidendrum precox Smith Exot. Fl. t. 97.

Garhwál and Kumaon at 5 to 8,000 feet (fide Fl. Br. Ind.), but I have seen no specimens from the Western Himalaya. It extends eastwards to Nepal, Sikkim, Bhutan, the Khasia Hills and Burma.

## 11. Pholidota Lindl.

Epiphytes with jointed, often branching stems with internodes like pseudo-bulbs, or with tufted pseudo-bulbs. Leaves usually in pairs (solitary in P. imbricata), membranous. many-nerved. Racemes on ebracteate peduncles, terminal or from the base of a pseuda bulb or sometimes from below the leaves, usually drooping and distichous; floral bract large and persistent. Flowers small, subglobose, expanding from ubove downwards. Sepals concave. Petals narrower than the sepals. Lip usually without side lobes, more or less cymbiform and saccate. Column short, the apex shortly hooded or winged. Anthercells subglobose. Pollinia 4, suloglobose or clavate, cohering by pairs to one or two membranes.-Species about 20, Indian, Malayan or Chinese.


## 1. Phglidota imbricata Lindl. in Hook. Fl. Exot. t. 138.

l'scudo-bulbs cospitose, cylindric, thickened at the base, 5 to 7.5 cm . long, or shorter and more ovoid, usually partly enveloped in large fibrous sheaths. Leaf solitary, 1.5 to 3 dm . long, elliptic-oblanceolate or lanceolate-acute, tapering to the stout petiole, Inflorcsconce from the base of a pseudo-bulb, drooping, 2 to 2.5 dm . long, lengthening in fruit. Pcduncle slender, as long as or longer than the dense manyffowered distichous raceme. Flowers 13 mm . long, pale brown; floral bract large, convolute, subrctund, minutely apiculate, many-nerved, longer than the slender stalked ovary, peristent.

Dorsal sepal orbicular; the lateral pair connate at the base, cymbiform, with a winged keel. Petals oblong, sub-acute. Lip 3-lobed; the lateral lobes large and rounded ; terminal lobe divided at the apex into two small oblong lobules separated by a broad sinus. Column broad, its upper half winged. Pollinia clavate, attached by pairs to two small membranes. Capsule ellipsoid, about 2 cm . long. Lindl. in Wall. Cat. 1991 ; Gen. and Sp. Orch. 37; in Bot. Reg. tt. 1213 and 1777; Lod. Bot. Cab. t. 1934; Wight Ic. 907 ; Dalz. \& Gibs. Bomb. Fl. 262; Hook. f. Fl. Br. Ind. v, 845; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 144, t. 201. P. pallida Lindl. in Bot. Reg. xxi, sub. t. 1777. Cologyne imbricata and C. pallida Reichb. f. in Walp. Ann. vi, 238. Ptilocnema bracteatum Don. Prod. 33. Cymbidium imbricatum Roxb. Fl. Ind. iii, 460. Ornithidium imbricatum Wall. MSS.

Debra Dun and up to 4,000 feet on the Mussoorie range, Mackinnon (Duthie's No. 24192); Kumaon, in the Gori and Kali Valleys 2-4,000 feet, Duthue No. 5988 ; Duthie's collector Nos. 24123 and 24124; Ramganga Valley at 3,500 feet, Strachey $\&$ Winterbottom No. 16. Flowers from June to August. It extonds castwards to Nepal, Sikkim, Bhutan, Khasia Hills, Chittagong, Burma; also to the Deccan Peninsula and southwards to Ceylon, the Andaman Islands, Malay Peninsula, Pacific Islands and Australia.

## 2. Pholidota articulata Lindl. in Wall. Cat. 1992.

Stem jointed, branching; internodes terete, furrowed, 5 to 10 cm . long, the nodes with a few short scarious sheaths. Leaves 7.6 to 10.5 cm . long, narrowly oblong, tapering to each end, many-nerved, thickly membranous. Raceme from the top of the pseudo-bulb between the leaves and about equal in length to the latter, drooping, many- and densely-flowered. Flowers 7 mm . long; bracts longer than the flowers, rhomboid-ovate, acute, convolute, caducous. Dorsal sapal suborbicular; lateral ovate, keeled. Petals ovate-orbicular, blunt. Lip about as long as the sepuls, broadly cymbiform, with five lamellate nerves on its disk; the midlobe transversely oblong, 2-lobed, involute at the base. Column slightiy winged towards the apex, the clinandrium irregularly toothed; rostellum large, erect, acuminate. Pollinia subglobose, attached to a cuneiform membrane. Capsule about 2 cm . long. Lindl. Gen. and Sp. Orch. 38 ; in Jurn. Linn. Soc. i, 173 ; in Bot. Reg. for 1839, Misc. 44; Hook. f. Fl. Br. Ind. v, 8tt; King \& Pantl, in Ann. Roy. Bot. Gard. Calc. viii, 146, t. 205. $P$. Khasiana Reichb. f. in Walp. Ann. vi, 238; in Bonplandia iv, 329. Coelogyne articul.ta Reichb. f. in Walp. Ann. vi, 233. C. Khasiana Reichb. f. 1. c. 238.

Below Mussoorie up to 4,500 feet, Edgeworth, Vicary; Lansdowne in Brit. Garhwál, Capt. Roberts; below Naini Tal in Kumaon at 3,000 feet, Strachey $\oint$ Winterbettom No. 17. Flowers in July and August. It extends eastwards to Sikkim, Bhutan, the Khasia Hills and Burma.

The inodorous flowers are white tinged with brownish-pink, and the floral braots are pale brown,
Var. Griffithil King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii., 147, t. 204. Like the type in most respects, but smaller in all its parts, the internodes less furrowed and with narrower leaves; flowers much smaller; floral bract and dorsal sepal suborbicular, blunt; petals elliptic-lanceolate. Pholidota Grifthii Hook. f. Ic. Pl. 1831 ; F'l. Br. Iud. v, 84j~ Wall. Cat. No. 1992 (in part).

Dehra Dun, on sâl trees, Gamble No. 27039, Mackinnon; Mussoorie range up to 4,000 feet, Duthie No. 21780. It extends eastwards to Sikkim and the Khasia Hills.

## TRIBE III.--VANDEE.

Pollinia 2, 4, or rarely 8, attached singly or in pairs or in fours by a caudicle (rarely by two caudicles) to a viscid gland derived from the stigma (in a fow doubtfully from the stigma).

> Terrestrial, leaves (when present) plioate:Pollinia $8 \ldots \ldots$.

Lip not spurred:-
Leaves terete; flowers few, in very short racemes or solitary; stems elongate
20. Luisia.

Leaves (when present) flat; stems 0 ; flowers in long racemes
21. Sarcochitus.

Lip spurred (gibbous in Vanda alpina):-
Column with a long foot produced into a long spur which has no callus or septum inside..
Column without a foot or with only a short one:-
Spur without callus or septum inside:-
Spur deep, much compressed laterall/, pubescent at the mouth; lip without side lobes . . . . . . . . . . . . . 2
23. Rhynchostylis,

Base of lip usually with a widely funnelshaped opur (gibbous in Vanda alpina), glabrous at the mouth, not compressed, side lobes large; apical lobe fleshy, with many glabrous carunoled ridges, flowers large, caudiole of pollinia broad
24. Vanda.

Base of lip with a long narrow oylindric or short wide sacoate spur, not oompressed, side lobes not present (in the $W$. Himalayan species) or small; apical lobe either amall and smooth or large and carunoulate or fimbriate, flowers small, caudicle of pollinia narrow
25. Saccolalium.

Interior of spur oocluded by a dorsal scale or by calli on the front and back walls, but with no septum
26. Cleisostoma.

Interior of spur with calli and a vertioal septum dividing it into two vertioal chambers
27. Sarcantluts.

## 12. Calanthe Lindl.

Terrestrial, usually pseudo-bulbous. Pseudo-stems variable in length, often tall, sometimes absent. Leaves membranous, plaited. Inflorescence usually from the leaf-axils, or from the side of the stem or pseudo-bulb. Flowers in erect racemes, usually conspicuous. Sepals sub-equal, usually spreading, rarely connivent. Petals usually narrower than the sepals. Lip variously attached to the column either to its base or to its whole length, usually 3 -lobed, the apical lobe often bifid, the disk usually lamellate. Column short, sometimes dilated at the base or apex. Anther usually conical, with an acuminate lip, 2-celled. Poilinia 8, waxy, often unequal, cohering in fours to a granular caudicle or all of them inserted on a single caudicle and attached to a gland. Capsules ellipsoid, drooping.-Species about 80, tropical or subtropical.

Flowers without a spur:-
Sepals and petals green; lip orange-red, its apical lobe with 3 prominent ridges

1. C. tricarinata.

Flowers lavender-ooloured; apical lobe of lip without ridges
2. C. puberula.

Flowere with a very short straight conical spur:-
Lip attached to whole length of column; flowers small, sepals and petals dhocolate-brown
3. C. Dfannit.

Lip attached to column for half its leagth; flowers large, dull purple
4. C. brevicornu.

Spur as long or nearly as long as the ovary :-
Lateral lobes of lip incumbent on the termisal lobe; flowers white, the lip with a violet blotoh at the base, spur shorter than the ovary
5. C. alisincefolia.

Lateral lobes of lip spreading, not incumbent on the apical one; spur slender as long as the ovary :-

Flowers small, crowded, greenieh-yellow . . . 6. C. pachystalix.
Flowers larger, distant, violet-coloured . . . . 7. C. plantaginea.

1. Calanthe thicarinata Lindl. in Wall. Cat. 7339.

Pseudo-bulb 2 to 2.5 cm , broadly ovoid, marked with distinct concentric rings. Ieaves two to four, 2 to 3.8 dm . long and 5 to 7.5 cm . in breadth, oblanceolate, acute, usually stalked. Inforescence from the developing pseudo-bulb, skeathed by tho young leaves, and rising from the axil of one of them, longer than the adult leaves; raceme laxly flowered, shorter than the peduncle; rachis and stulked ovaries puberulous. Flowers 2 to 2.5 cm . across; bracts about half as long as the ovary with pedicel. Sepals lanccolate, acuminate, 5-7-nerved, green, spreading. Petals clawed, lanceolatc, acuminate, a little smaller than the sepals. Lip olnate to the whole length of the column, 3-lobed, broadly oblong, decurved, saccate at the base, the mouth of the san clothed with long white deflexed hairs; basal lobes suborbicular or obliquely spathulate, white tinged with orange-red towards their apices; terminal lobe 10 mm . long, orangered, margins deflexed, much undulate and erose; the disk with a fleshy callus divided into three prominent crenulate ridges. Column short, thick, anterior surface hispid, Lindl. Gen. and Sp. Orch. 18; Fol. Orch. 2; Walp. Ann. vi, 912; Hook. f. Fl. Br. Ind. v, 847 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 166 (excl. t. 223); Collett Fl. Siml. 491; Rolfe in Journ. Linu. Soc. xxxi, 26. C. occidentalis Lindl. Fol. Orch. 3; Walp. Ann. l. c. 848.

Abundant in the temperate parts of the Western Himalaya from Hazára to Kumaon, at elevations between 5,003 and 9,000 feet, especially in forests. Flowers April to June. It extends eastwards to Nepal, and is also found in China.

Plate 103. Calanthe tricarinata Lindl.-Inflorescence and one leaf,-of natural size. Fig. 1, lower portion of plant (reduced); 2, single flower; 3, ditto with sepals and petals removed; 4, lip; 5, column; 6, anther; 7, pollinia;-all enlarged.
2. Calanthe puberula Lindl. in Wall. Cat. 7342.

Pseudo-bulb small, conical from a broadly ovoid base, about $2 \cdot 5 \mathrm{~cm}$. long. Lenves Give to seven, very unequal in size, the lower often reduced to sheaths; upper ones elliptic or elliptic-oblong, acuminate, slightly narrowed to the broad loosely sheathing base, 10 to 15 cm . long. Inforescence nuch longer than the leaves, the peduncle with many scattered lanceolate acuminate bracts; raceme 7.5 to 15 cm . long. laxly flowered, the rachis puberulous. Flowers 2.75 cm . across, lavender-coloured, puberulous externally; bract lanceolate, acuminate, not longer than the stalked ovary. Sepals spreading, ovate-lanceolate. Petals spreading, narrowly falcate. acute. Lip adnate to the baso of the column, 3 -lobed, shortly clawed; basal lobes flat, falcately oblong, blunt, with two narrow calli on the disk between them, their apices pointing forward; terminal lobe without calli, connected with the basal by a straight nurrow isthmus, ovate-orbicular, apiculate, its edges coarsely erose. Culumn short, thick. Anther pointed; pollinia 8, clavate, attached in fours to two caudicles and these to a triangular gland. Capsule namowly elliptic, 3 cm . long. Lindl. Gen. and Sp. Orch. 352; Fol. Orch. 2; Walp. Ann. vi, 912; Hook. f. Fl. Br. Ind, v, 848; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 166, t. 224; Collett Fl. Siml. 494; Rolfe in Journ. Linn. Soc. xxxi, 26. Bletia sp., Griff. Ic. Pl. As. t. 313A.

Simla Hills; below Nágkanda, T. Thomson; Cháchpur Valley 5-6,000 feet, Duthic No. 21076; Jaunsár, Osmaston; Garbwál, Falconer; Kulni Valley, Duthie; Bok Hill,

Dithie's collector No. 24150; mostly in damp shady forests at elevations between 4,000 and 6,000 feet. Flowers during July and August. I have seen no specimens frous Kumaon or Nepal, but it is found in Sikkim, Bhutan, on the Kbasia and Naga Hills, in Assam and eastwards to China.
3. Calantel Mannii Hook. f. Fl. Br. Ind. v, 950.

Pseudo-bulb small; pseudo-stem about 75 cm . long. Leaves two or three, oblanceolateoblong, acute, tapering gradually into the long petiole, the lowermost one sheathed at the base; length of adult blade up to 2.55 du., its breadth $3 \cdot 5$ to 5 cm . Peduncle from the axil of a young leaf, pubescent, about 2.3 dm . long; racome half as long as the peduncle, few-flowered, lax. Flowers only about 13 mm . long, deflexed after expansion; floral bract minute, lanceolate, shorter than the pedicel of the stalked ovary. Sepals and petals chocolate-brown. Sepals sub-equal, connivent, ovate-lanceolate, sub-acute, concave, pubescent externally. Petals linear-spathulate, not spreading, glabrous. Lip yellow with a blotch of red at the apex of the terminal lobe, a little shorter than the sepals, adhering to the column almost to its apex and forming with it a long sac, 3 -lobed; basal lobes erect, large, broad, truncate; terminal lobe sub-reniform, entire; upper surface with three or four continuous tubercled ridges extending from the base to the middle of the terminal lobe; spur very short. Column short, dilated towards the apex. Anther pointed; pollinia clavate, attached in fours to two caudicles and these to a trianorular gland. King \& Pantl. in Ann. Roy. But. Gard. Calc. viii, 167, t. 225.

In the neighbourhood of 'Teliri in Garhwál at 6,000 feet, Mackinnon's collector; below Ranikhet in Kuman, $5 \cdot 6,000$ feet, Duthie No. 5996. Flowers in May. It is found also in Sikkim and on the Khasia Hills between 4,000 and 7,000 feet.

The pollinia, described above, were obtained from young flowers. This species may, as Sir George King suggeste, be eelf-furtile.

## 4. Calanthe brevicornu Lindl. in Wall. Cat. 7338.

Pscudo bulbs small, ovoid, pointed, about 2.5 cm . long. Pseudo-stem 5 to 10 cm . stout, with wide sheaths. Leaves usually three, sub-equal, oblong-elliptic, shortly acuminate, slightly tapering to the wide sheathing base, stalked when adult; length of blade 2.3 to 5 dm ., breadth 6.5 to 9 cas. Inflorescence longer than the leaves, the peduncle with a few short scattered bracts; raceme 3 dm . long, laxly flowered; rachis, ovaries and outside of sepals puberulous. Flowers 3.5 to 4 cm . across; floral bract narrowly lanceolate, balf as long as the stalked ovary. Scpals sub-equal, oblong lanceolate, acute, spreading. Petals shorter than the sepals, lanceolate. Lip 3-lobed, attached to the lower half of the column; basal lobes oblong, blunt, diverging; terminal lobe sub-obovate with a broad emarginate apiculate apex and irregularly toothed edges, contracted at its junction with the basal lobes; upper surface with three tubercled fleshy lamellæ running from the base and increasing in height to mear the apex; spur short, broad, blunt, straight, its mouth lined with retroflexed hairs. Column short. Anther beaked; pollinia clavate, attached to a common pedicel and gland. Lindl. Gen. and Sp. Orch. 251; Sert. Orch. t. 9; Fol. Orch. 3; Walp. Anu. vi, 912;

Hook. f. Fl. Br. Ind. v, 848 ; King \& Pantl. in Ann. Roy. Bot. Gard. Celc. viii, 168, t. 227.

Garhwál at 5,000 to 6,000 feet, Duthie No. 126j (1879); Mackinnon's collector [Duthic's No. 24150 (a)]; Bok Hill, Duthie's collector No. 24150; Kumaon, 2. Anderson. Flowers during May and June. Extends eastwards to Nepal, Sikkim, Bhutan and the Naga Hills.

The colour of the flowers is dull purple or briok red, relieved by lines of white on the midribs of the sepals and petale and on the edges of the lip, the lamellm of the lip are streaked with yellow. The outer surfeoes of the parts of the perianth are all strongly fushed with white.
5. Calanthe alismaefolia Lindl. Fol. Orch. 8.

Pseudo-bulbs thin, cylindric, tapering to the apex, marked with several concentric rings, somewhat curved, 2.5 to 5 cm . long. Leaves 1.2 to 1.8 dm. long. broadly elliptic, acuminate, rather abruptly narrowed into the long channelled periole, edges undulate. Scape about as long as the leaves, clothed with a few distant sheathing bracts. Inforescence corymbose in flower and becoming racemose as the fruit ripens, puberulous. Flowers 2 cm . long, floral bract large, ovate, acuminate, shorter than the shortly stalked ovary. Sepals sub-eąual, suborbicular erecto-patent, clothed outside with short coarse purple hairs. Petals about as large as the sepals, subrhomboidal, subacute. Lip obovate, adnate by its base to the whole length of the column, 3 -lobed; basal lobes narrowly oblong-oblanceolate, obtuse, somewhat falcate, resting on the terminal lobe and pointing forwards; terminal lobe broad and with a large yellow callus at its base; its apex bilobulate, the lobules broad, rounded, and with crenulate edges, the sinus deep and apiculate at its base; spur nearly as loug as the ovary and lying parallel to it, cylindric. Column very short, with the callosities of the lip closely applied to it. Anther acuminate; pollinia clavate, attached directly to an ovate acute gland. Stigma divided into two halves by the entrance to the spur. Capsule with pedicel 4 cm . long, clavate, prominently ridged. Walp. Ann. vi, 918 ; Hook. f. Fl. Br. Ind. v, 849 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 170, t. 230.

Below Mussoorie in hot valleys, Falconer Nos. 10.55, 1056 (Kew Distrib.), Duthie No. 24148. Flowers during July and August. Found eastwards in the Sikkim Terai and on the Khasia Hills.

The colour of the perianth is white, except for a tinge of green on the tips of the sepals outside aud a patch of pale violet at the base of the lip.
6. Calantee packystalix Reichb. f. in Hook. f. Fl. Br. Ind. y, 850.

Stem short, swollen at the base, giving off many stout fibrous roots. Leaves many, $3-6 \mathrm{dm}$. long, linear-lanceolate, acuminate, tapering gradually into the sheath, plicate, nerres prominent. Inflorescence from the axil of a sheath, usually overtopping the leaves, the flowering portion $2-3 \mathrm{dm}$. long, rachis and pedicels puberulons; bracts lanceolate, deflexed, about 8 mm . long, the upper ones sinaller. Flowers in rather dense racemes, 2 cn. across, greenish yellow, subsecund, deflezed after expansion. Calyz lobes reflexed; dorsal o-nerved, broader than the lateral ones and the petals. Pctals spathulate, obtuse, 3 -nerved, 9 mm . long. Lip adnate to the whole length of
the column, 3-lobed; basal lobes falcately ovate, obtuse; midlobe rather shorter, deeply bifid, with three rows of prominent warts on its disk: spur cylindric, a little louger than the pedicelled ovary, puberulous and with a few white hairs at its entrance. Column broad. Pollinia 8, cohering in fours to a gramular viscus. Stigma divided into two segments at the entrance to the spur. Ovary minutely pubescent.

Western Himalaya, Falconcr (Kew Distrib. No. 1054); near Mussoorie in shady forest at about 6,000 feet, Mackinnon (Duthie's Nos. 21742 and 22714).

Falconer's specimen in the Kew Herbarium is very imperfeot and in bud only.
Plate 104. Calanthe pachystalix Reichb. f.-A plant,—of natural siae. Fig. 1, a single tower seen from above; 2, ditto with the sepals and petals removed; 3, the lip; 4, column ; 5 and 6, back and front views of anther; 7, pollinia; -all enlarged.
7. Calanthe plantaginea Lindl. in Wall. Cat. 7346.

Stem $7 \cdot 5$ to 25 cm ., enclosed within long tubular sheaths. Leaves $2-3 \mathrm{dm}$. long and $\pm$ to 9 cm . broad, usually enlarging as the fruit ripens, oblanceolate or elliptic-lanceolate, tapering below into the long petioles. Peduncle from, the axil of one of the developing leaves and overtopping them, stout, many-flowered; pedicel with ovary about 2.5 cm ., very slender; bracts small, lanceolate. Flowers drooping, about 3 cm. across, lilac or white, sweet-scented. Scpals oblanceolate, acuminate, 3-j nerved, glabrous. Petals similar to the sepals but smaller, 3-nerved. Lip about as long as the sepals, purple, the disk with 3 slender lamellæ; side lobes rhomboid-obovate, subfalcate; midlobe cuneately reniform, apiculate. Spur very slender, as long as or longer than the ovary. Rostellum of two projecting plates. Lindl. Gen. and Sp . Orch. 250 ; Sert. Orch. t. 24 ; Fol. Orech. 9 ; Walp. Ann. vi, 920 ; Royle Ill. Him. Bot. 366 ; Hook. f. Fl. Br. Ind. v, 853 ; Collett Fl. Siml. 494.

Punjab Himalaya in Chamba at 7,000 feet, Lace No. 1328 ; Garhwál at 9,000 feet, Royle Herb.; Mussoorie range, Falconer; in shady forest below Mussoorie from 4,000 to 6,00̃0 feet, Mackunon (Duthie's Nos. 21741, 22716); Tonse Valley at 6,500 feet, Duthie 24149 ; Kumaon at 9,000 feet, Strackey $\&$ Winterbottom No. 17. Flowers in March and April. It extends eastwards to Nepal and Bhutan.

Plate 105. Calanthe plantaginea Lindl.-A plant,—of natural size. Fig. 1, a single flower; 2, lip; 3, column with lower part of lip aiad upper portions of ovary and spur attached; 4, pollinia; -all enlarged.

## 13. Eulophia R. Brown.

Terrestrial glabrous herbs with fleshy tubers or rhizomes, rarely pseudobulbous. Lcaves appearing with or after the flowers, usually plaited. Scape generally lateral. Flowers in racemes, rarely panicled. Sepals and petals free, spreading, often sub-equal. Lip adnate to the base of the column or to its foot, saccate or shortly spurred at the base, usually 3 -lobed, the lateral lobes erect and embracing the column, disk usually ridged or crested. Column with or without a foot, its apex entire and often oblique, the margins sometimes winged or lobed. Anther terminal, often with two apical processes, and its lip often toothed, 2-colled. Poilinia 2, globose, attached by
a caudicle to the flat gland of the rostellum.-Species about 100 , tropicul or sabtropical, chiefly Asiatic.

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Column not or only slightly produced into a foot:-
    Leaves and flowers coetaneous or nearly so:-
        Lip with a short geniculate spur, bracts as long as or
                longer then the ovary:-
            Sepals spreading, linear-lanceolate, acuminate, green
            Sepale erect, ovateoblong, obtuse, yellowish . . .
            Lip saccate at the base, bracts shorter than the
                ovary
                    3. E. explanata.
        Flowers appearing before the leaves:-
            Flowers in condensed racemes, terminal lobo of lip
                yellow
                    4. E. Hиrmusiii,
            Flowers smaller, in lax racemes.
                            5. E. campestris.
Column produoed into a distinct foot:-
    Lateral sepals inserted on the epur, baeal lobes of lip
        obsoure.
    6. E. nuda.
    Lateral sepals inserted on the foot of the oolumn, lip with
        distinot basal lobes:-
            Flowers not exceeding 2.5 om , in dism., greenish-
                yellow tinged with purple . . . . . . . . . . 7. E. bicarinata.
            Flowers large, bright yellow:-
                Terminal lobe of lip half as long as the basal
                lobes, 3-lemallate ; spur q8ooste, blunt : . . . 8. E. flava.
                Terminal lobe of lip twice as long as the rounded
                        basal obes, many-lemellate; spur short, ourved,
                    acute
                            9. E. obtusa.
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1. Eulophia herbacea Lindl. Geu. and Sp. Orcl. 182.

Psetdio-bulbs 4 cm . long, broadly ovate. Pseudo-stem 1 to 1.5 dm . long. Leavcs 1.5 to 2 dm . long, linear-lanceolate, variable in breadth, many-nerved, plicate. Scape $6-9$ dm., with a few sheathing bracts towards the base. Flowers appearing with the leaves, 5.5 cm . across, fragrant; floral bract long, often exceeding the ovary, lanceolate, acuminate, scarious. Scpals linear-lunceolate, acuminate, spreading, green with pale margins, the lateral oues adnate to the base of the column. Petals shorter than the sepals, pure white, elliptic or lanceolate, obtuse or acute. Lip obovate-oblong, white with a tinge of green towards the base; nerves many, the median ending in five fimbriate lamellæ within the terminal lobe; side lobes small, rounded; midlobe oblong and rounded at the apex when flattened out. Spur very short, somewhat geniculate, rounded. Colunn stout, curved, slightly winged. Auther retuse at the apex, and with a small linear projection on each side of its lip; pollinia 2, transversely oblong, attached by a short broad caudicle to a triaggular gland. Lindl. in Journ. Linn. Soc. iii, 24 ; Royle Ill. Him. Bot. 366 ; Dalz. \& Gibs. Boob. Fl. 265 ; Hook. f. Fl. Br. Ind. vi, 2. E. brachypetala Lindl. in Journ. Linn. Soc. iii, 24. E. bicolor Lindl. in Journ. Linu. Soc. iii, 24 (not of Dalz.). Limodoruin bicolor Rosb. Fl. Ind. iii, 469.

Dehra Dun, Mackinnon; Siwalik range, Visary; Giri Valley west of the Jumna, Royle; Mussoorie range up to 5,000 feet, Mackinnon; Garlıwál 4.7,000 feet, Holy,

Falconer, Edgeworth, \&c.; Lansdowne in Brit. Garhwál, 5-6,000 feet, Capt. Roberts; Kumaon below Naini Tal, Colonel Davidson. Flowers during June and July. It extends eastwards to Bengal, and southwards to Kanara, the Konkan and Mysore.

The specimens from Western and S. India have usually muoh smaller flowers, the petale often have purple veins, and the spur is longer. This is no doubt Lindley's E. bicolor.

Plate 106. Eulophia herbacea Lindl.-An entire plant;-reduced to half size. Portion of a flowering stem, 一of natural size. Fig. 1, single flower; 2, ditto with sepals and petals removed; 3, lip spread out; 4, column front view; 5, side view of ditto ; 6, front view of anther; 7, side view of ditto; 8 and 9 , pollinia ;-all enlarged.
2. Eulopita Mackinnosi Duthie in Journ. As. Soc. Beng. lxxi, pt. ii, 40.

Rhizome composed of a series of flattened triangular-shaped tubers. Pseudo-stem about 2 dm. long, proceeding from the summit of the bulb-like current year's tuber (pseudobulb). Leaces usually two, appearing with the flowers, 7 to 8 dm . long and 5 to 8 cm . broad, broadly lanceolate, acuminate, tupering into long sheaths and with a few leafless sheaths below, prominently nerved and plicate. Scape shorter than the leaves, arising from the side of the pseudo-bulb, bearing three or four loosely sheathing bracts. Fiowers rather large, spreading or deflexed; florab bract equalling or exceeding the ovary, linear-lanceolate, acuminate, persistent. Sepats and petals erect, fleshy, yellow tinged with reddish-brown, the veins prominent outside. Dorsal sepal 1.7 cm . long, ovate, obtuse, subcordate at the base, 9 -veined, the margin at the apex inflexed; lateral a little longer than the dorsal, unequal at the base. Petals shorter than the sepals, oblong-obovate, obtuse, their margins overlapping and reflexed at the apex. Lip 3-lobed, with long erect rather shallow side lubes, its body with 5-7 parallel purple-coloured ridges which extend into a carunculate area within the terminal lobe; terminal lobe broad, rounded and with undulate edges. Spur short, geniculate. Column short, broadly winged, its foot very slightly produced. Anther bicornute at the apex, its lip 2 -toothed; pollinia transversely oval, attached by a broad caudicle to a shallow crescent-shaped gland. E. bicolor Falc. MSS. (not of Lindl. nor of Dalz.).
N..W. India, Royle (named E. bicolor Falc. MSS.); Siwalik range, Vicary; Dehra Dun, Mackinnon, Duthie's collector Nos. 21748, 22723, 21161; Pátli Dun in Garhwál, Duthie's collector No. 25789; Bahraich district in N. Oudh, Duthie's collector No. 22799. It has also been found by Mr. J. Marten of the Forest Survey Dept. in the Raipur district of the Central Provinces. It flowers during July and August.

This plant appears to be most nearly related to E. geniculata King \& Pantl., an extremely rare Sik'im species. It differs, however, in the shape of the rhizome, the very muoh broader leaves, and in the shape and colour of the lip. It also resembles $E$. bracteosa Lindl., but the bracts are not so long, the leaves are much broador, and the lip is distinctly 3 -lobed.

Plate 107. Eulophia Mackinnoni Duthie.-An entire plant,--one-fifth of natural sizc. A leaf and portion of flowering scape, -of natural size. Fig. 1, single flower seen from Lelow; 2, side view of ditto, with sepals and petals removed; 3 , column and spur; 4. lip; flattened out; 5, lip and anther in situ seen from above; 6, front view of auther; 7, back viow of ditto; 8, pollinia;-all enlarged.
3. Eulophia explanata Lindl. Gen. and Sp. Orch. 180.

Height of plant 2 to 2.5 dm . Pseudo-bulb ovoid, about 5 cm . long, annulated. Pseudo-stem 4 to 5 cm . long. Leaves young at the time of flowering, lanceolate, acuminate, plicate, attaining 3 dm . in length and 1 dm . in breadth when fully growd, broadly elliptic-lanceolate, acuminate, tapering into a short petiole, 7 -veined. Scape 2 to 2.5 dm ., arising from below the summit of the pseudo-bulb and bearing two loose sheathe at its base. Raceme laxly many-flowered; flowering bract shorter than the slender ovary, lanceolate, acuminate. Flowers about 2.5 cmi . across. Sepals and petals about equal in length, spreading, yellow with purple lines und blotches, $\tilde{0}$-nerved, the nerves with transverse connecting veinlets. Scpals spathulate-lanceolate, acute. Petals broader, oblong and rourded at the apex. Lip a little shorter than the sepals and petals, 3 -lobed, subpanduriform when flattened out, adnate by its base to the lateral sepals; basal lobes rounded, erect and forming a conical sac at their base; terminal lobe oblong, with a rounded emarginate apex, the edges deflexed; disk with two very prominent crenate lamellæ and with a shorter interposed one, all tbree abruptly terminating within the margin of the apical lobe. Column short, its foot very slightly produced. Anther emarginate at the apex; pollinia 2, subglobose, attached to a short broad caudicle, and this to a conical gland. Hook. Ic. Pl. 1882; Hook. f. Fl. Br. Ind. vi, 3. Dipodium scariosum Herb. Ham.
N.W. India, Fulconer; Dehra Dun and up to 3,000 feet on the Mussoorie range, Mackinnon (Duthe's No. 22710); Sub-Himalayan tracts of Pilibhit and N. Oudh, Duthie's collector Nos. 22794, 22801, 23859, 23860; Nepal Terai, Duthie's collector No. 23858; Garhwál, Duthie's collector Nos. 25791, 25792. Flowers during May. Also in Nepal at Maghada in the Morung, Buchanan-Humilton.

Sir Joseph Hooker regards this plant as an anomalous species with the habit of an Australian Dipodium. The upper surface of the lip is white tinged with yellow and beautifully marked with reddish-purple veins.

Plate 108. Eulophia explanats Lindl.-An entire plant and a full-grown leaf,of natural size. Fig. 1, a single flower; 2, ditto, with the sepals and petals removed; 3, lip, flattened out; 4, columu; 5, anther; 6 and 7, pollinia;-all enlarged.

## 4. Eulophia Hormusji Duthie.

Pseudo-stem about 1 din. long, bearing two tightly-fitting sulcate subacute sheaths. Leaves two, developisg late, 3 to $3 \cdot 6 \mathrm{dm}$. long, and $1 \cdot 5$ to 3 cm . in breadth, narrowly elliptic-lanceolate, acuminate, plicate. Scape stout, 2 to 3.3 dm . long, rising from the summit of a depressed tuber, clothed at intervals with loose membranous lanceolate acuminate sheathing bracts, many and rather densely flowered. Flowers about 2.5 cm. across, spreading and at length deflexed; floral bract variable in length, lunceolate, acuminate, membranous, brownish. Sepals and potals attached to the column, erectopatent, 12 mm . long, narrowly oblong or oblanceolate, bluntly mucronate, pale green with purple veins. Lip with spur a little longer than the sepals and petals; basal portion and side lobes deep purple; side lobes erect, rounded, eutire; terminal lobe orbicular, obscurely bifid, yellow, with an undulate erose margin; basal purtion of
disk with three parallel lamellæ ending in a coarsely fimbriate patch on the terminal lobe; spur slender, curved, cylindric, obtuse, about half as long as the column. Culumn without a foot, curved, constricted in the middle, grooved in front. Pollinia oval, attached by a short stout conical caudicle to a sinall flat gland.

Dehra Dun, Mackinnon (Duthic's Nos. 22708(a), 22724); Kheri district of N. Oudh, Duthic's collector No. 22797; Mussoorie range up to 6,000 feet, Mackinnon (Duthic's No. 22708); common in the pine forests of Jaunsar and Tehri-Garhwál up to 6,000 feet; Bashabr at 7,000 feet, Lace No. 880 ; banks of the Siran river near Albbottabad in Hazára at about. 3,000 feet, Colonel Barrett; Gujar Valley in the Chitral district, found by Sir W. Gatacre iu 1805. It towers during March and April.

This species is olosely allied to E. campostris. It diffors obiefly by its shorter soapes, larger flowers and the shorter and more dense ravemes; the shape of the lip and the general colouring of the flower are also very different. E. campestris is essentially a species of the plains of Indie, whereas $E$. Hormusjii estends up to the temperate region of the Himalaya, where the olimatio conditions are more favourable for leaf development. I have named this speoies after Mr. H. Hormusji Deboo, who bas worked for many years as artist in the Botanical Department of Northern Iudia, and by whom all the drawings for this volume have been prepared.

Plate 109. Eulophia Hormusjii Duthic.-A flowering plant, -of natural size; a plant with leaves, reduced to $\frac{1}{2}$ size. Fig. 1, single flower; 2, ditto, with sepals and petals removed; 3, lip spread out; 4, column and upper portion of ovary; 5, summit of column with anther; 6 , side view of anther; 7, pollinia; -all enlarged.

## 5. Eulopela campestris Wall. Cat. 7367.

Tuber irregularly oblong, often lobed. Leaves two, developing if at all long after the flowers, linear, acuminate, plicate, 2.5 to 4 dm . long, rising from the apex of a slender sbeathed pseudo-stem. Scape 2.5 to 3 dm ., stout or slender, sheathed at intervals by loose membranous acute bracts; raceme laxly many-flowered. Flowers subsecund, drooping, pink, about 2.5 cm . across; bract membranous, linear or lanceolate, acuminate, asually longer than the slenderly-stalked ovary. Sopals slightly attached to the base of the lip, linear-lanceolate, acute or acuminate, 5 - 7 -nerved, yellow or green striped with pink. Petals narrower, spreading, oblanceolate, 3-5-nerved. Lip as long as the sepals, cuneate-obovate or oblong; side lobes short, rounded or subacute, incurved round the column, the margins of a deep rose colour; midlobe orbicular quadrate or oblong, crenulate, usually purple; basal portion of disk with three median lamellate nerves ending in a fimbriate or tabercled patch on the terminal lobe; spur short, conical subclavate or subacute. Cotumn as long as the lip, slender, without a foot. Poilinia broad; caudicle stout; gland elongate. Capsule about 2 cm . long, ellipsoid. Lindl Gen. and Sp. Orch. 185; in Journ. Linn. Soc. iii, 24 (excl. syn. Wight); Royle Ill. 366 ; Reichb. f. in Walp. Ann. vi., $6 \pm 7$; Hook. f. Fl. Br. Ind. vi, 4 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 178, t. 241. E. rupestris and ramentacea Lindl. in Wall. Cat. 7368, 7370; Gen. and Sp. Orch. 185; in Journ. Linn. Soc. iii, 25. E. hemileuca Lindl. in Journ. Linu. Soc. iii, 25. E. vera Royle Ill. 370. Limodorum ramentaceum Rosb. Hort. Beng. 63 ; Fl. Ind. iii, 467. L. dubium Ham. MSS. Bletia Dabia Don Prod. Fl. Nep. 30.

Abundant in many places along the base of the Westera Himalaya, Flowers from March till May. It extends throughout the plains of Upper India, southwards to the Deccan and eastwards to Nepal, Sikkim, Bengal and Upper Burma. It occurs also in Afghanistan and Baluchistan.

The wide distribution of this species in India, extending, as it does, from the arid districte of the N.-W. Frontier to the moist regions of Bengal, Sikkim and Upper Burma, accounts for the great variety of forms met with throughout its area. As a rule the specimen from N.-W. India are niltogether more robust than those met with farther east. Plate 24 of the Sikkim Orohids represents the more elender condition of the species, and the plant is figured as producing leaves, which rarely develop in the drier parts of Indie. The tubers of this plant are largely collected in N.-W. India, and are believed to form the bulk of the commercial product known as Salep-misri.
6. Eulopeis nuda Lindl. in Wall. Cat. 7371.

Tubers large, spherical, smooth. Leaves from the side of a tuber, forming by their sheaths a short pseudo-stem, elliptic-lanceolate, acute, 2.5 to 3.5 dm . long, the breadth variable, many-nerved, sheath long and tubular. Scape 6 to 9 dm . long, fro mthe base of the pseudo-stem, with a few wide sheaths at the base and several distant ones above. Raceme long, laxly flowered. Flowers about 3 cm . long, usually pale green variegated with brown and pink; floral bract lanceolate, balf the length of the stalked ovary. Scpals erect, oblong, asute, the lateral pair falcate. Petals shorter than the sepals, ovateoblong, bluat, the outer nerves branching. $L i p$ as long as the sepals, deflexed from below the middle, oblong; basal lobes obscure, terminal lobe oblong, obtuse, undulate, the upper surface with many vertical thickened lines disappearing towards the apex; spur short, flattened, its mouth ribbed. Column short, produced at the base into a long foot dilated at the margins. Anther small, its apex with two small conical processes and a third depressed one in front; pollinia 2, transversely oblong, attached by a very broad caudicle to a narrow gland. Lindl. Gen, and Sp. Orch. 180; Hook. f. Fl. Br. Ind, vi, 5 ; in Ann. Roy. Bot. Gard. Calc. v, 32, tt. 47 to 50 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 180, t. 243 ; Rolfe in Journ. Linn. Soc. xxxi, 29. E. bicolor Dalz. in Hook. Kew Journ. Bot. iii (1851), 3ł3; Dalz. \& Gibs. Bomb. Fl. 264; Walp. Ann. vi. 647. Cyrtopera fusca Wight Ic. ${ }^{\prime} 1690$; Lindl. in Journ. Linn. Soc. iii, 31 ; Thwaites Enum. 429; Walp. Ann. l. c. 668. Cyrtopera plicata Lindl. in Wall. Cat. 7362 ; Gen. and Sp. Orch. 190. C. nuda Reichb. f. in Flora (1872) 274. C. Gardneri Thwaites Enum. 302. C. mysorensis Lindl. in Journ. Linn. Soc. iii., 32. C. laxifora Gard. MSS. ex Thwaites Enum. 302. Dipodium Roniata and D. plicatum Herb. Ham.

Northern Oudh, in the districts of Kheri and Gonda, Duthie's collector Nos. 22793, 24143 , 24144. Flowers April to June. It extends southwards to Bombay, Central and S. India aud Ceylon, and eastwards to Sikkim, Assam, Burma and China; it is found also in Moulmein.
7. Eulophia bicarinata Hook. f. Fl. Br. Ind. vi, 6.

Tubcr oblong, irregularly lobed, compressed, about 5 cm . long. Leaves absent at the flowering tine, linear, acuminate, long-petioled, length of blade 1.8 to 3 du. long.

Scape erect, $\cdot 5$ to 5 dm . high with two tubular closely-fitting sheathe at the base and two shorter loose ones higher up. Raceme 7.5 to 12.5 cm . long, rather densely flowered. Flowers 2.5 cm . in diam., pale yellowish-green, the lip tinged with pale purple; floral bract membranous, lanceolate, shorter than the stalked ovary. Sepals oblong, acute, keeled, their edges reflexed; lateral pair wider than the dorsal and free from it at their bases. Petals elliptic, subacute, shorter but wider than the sepals. Lip adnate to the foot of the column, longer than the sepals, slightly saccate at the base, 3-lobed; lateral lobes shallow, with blunt apices; terminal lobe transversely oblong, emarginate, the edges slightly crisped; the disk between the side lobes with two short smooth thickened lines half as long as the latter and ending in a free triangular tooth in front of which rise five carunculate unequal ridges extending to the base of the terminal lobe. Column with a foot half as long as itself and at right angles, edges lubed opposite the stigma. Anther apiculate in front; pollinia broadly triangular, divergent, altached by a broad caudicle to a thin angular gland. King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 180, t. 244. Cyrtopera bicarinata Lindl. in Wall. Cat. 7363 ; Gen. and Sp. Orch. 189 ; Journ. Linn. Soc. iii, 31 (excl. cit. Ic. Griff.). Epipactis bicurinata Buch.-Ham. ex Wall. Cat. 7363. Cymbidium sp. Griff. Notul. iii, 343, No. 9.

In the Sub-Himalayan tracts of Pilibhit in Rohilkhund, and of the Kheri district of N. Oudh, Duthie's collector Nos. 22798 and 25803. Flowers during March and April. It extends eastwards to Sikkim, the Khasia Hills, Assam, Manipur and Upper Burma.
8. Eulopaia flava Hook. f. Fl. Br. Ind. vi, 7.

A tall robust plant with a tuberous rhizome. Leaves about 3, forming when young a short pseudo-stem by their sheathing bases, developing later than the flowers, attaining when fully grown 12 dm . in length and about 10 cm . in width. Scape stout, 6 to 15 dm . high, clothed at the bese with a few distant close-fitting sheaths, emerging from a tuber alongside the leaf-bearing pseudo-stem. Racense 3 to 6 dm. ; bracts much shorter than the ovary, 1 to 2 cm . long, ovate-lanceolate, acuminate. Flowers numerous, lurge, drooping, lemon-coloured. Sepals about 3 cm . long, oblong-lanceolate, acuminate. Petals a little shorter than the sepals and much broader, obtuse or emarginate, many-nerved. Lip as long as the sepals; side lobes large, rounded, spotted with purple at the base, their margins recurved; midlobe oblong, the disk with two small pyriform basal calli and three crenate lamellæ. Spur a short blunt sac. Column about 2 cru . long, produced at the base into a short foot. Anther with en emarginate apex and a long anterior process; pollinia obtusely angled, attached by a stout broad-based caudicle to a broad shaliow gland. Cystopera flava Liadl. in Wall. Cat. 7361 ; Gen. and Sp. Orch. 189 ; Royle 111. 370 , t. 88, fig. 1 ; Reichb. f. in Gard Chron. (1870), 1407 ; Rolfe in Journ. Linn. Soc. xaxvi, 28. C. Culleni Wight Ic. 1754 ; Walp. Ann. vi, 667. Dipodium flavuin Herb. Haw.

Dehra Dun, Royle, Mackinnon (Duthic's No. 22725) ; Sub-Himalayan tracts in Rohilkhund and N. Oudh, Duthe's collector Nos. 22795, 24142; outer ranges of Garhwal, Dathie's collector Nos. $25790,25804,25805,25806$; Kumaon, below Ahnora 4,500 feet, Strachey $\oint$ Winterbottom No. 20; Surju Valley, T. I'homson. Flowers in June and July. It extends eastwards to Nepal, and is found also in Travancore and Hongkong.

Plate 110. Eulophia flava Hook. f.-Entire plant, reduced to $\frac{1}{5}$ in size. Portion of inflorescence,-of natural size. Fig. 1, single flower; 2, ditto, with sepals and petals removed; 3, lip, spead out; 4, front view of column; 5 , front view of anther; 6 , side view of ditto ; 7, pollinia;-all enlarged.
9. Eulophia obtusa Hook. f. Fl. Br. Ind. vi, 3.

Height of plant 9 to 15 dw., the leaves and scape rising from a horizontal oblong tuber. Pseudostem formed by the sheaths enclosing the bases of the leaves and scape. Leaves two or three, 3 to 4.5 dm . long, linear, acuminate, plicate, veias sharply prominent. Scape exceeding the leaves, with a few long tight-fitting acuminate sheaths towards the base. Flowers 6 to 10 , in a lax raceme, appearing with the leaves, 2.5 cm . across, erect in bud, drooping and campanulate when open; floral bract lanceolate, acuminate, less than half the length of the ovary. Sepals and petals prominently veined on the back, bright yellow outside and pale lemoncoloured within. Dorsal sepal obovate acute, $\mathfrak{2} \mathrm{cm}$. long; lateral rather shorter, falcately oblong, obtuse or subacute, adnate to the base of the column. Petals obovate, obtuse, about as long as the lateral sepals. Lip 3-lobed, longer than the sepals, with a short curved.subacute spur at the base; side lobes large, erect, rounded, pale yellow tinged with lilac; midlobe bent upwards, and with a reflexed undulate margin, suborbicular when flattened out; disk with 5 to 8 prominent ridges terminating within the margin of the apical lobe in an oblong grooved callus, and prolonged at the base into two sets of finger-like projections. Column about 1 cm . long, oblong, narrowly winged, curving into a short foot at the base. Anther with a rounded or slightly emarginate apex and a long anterior projection; pollinia subglobose, attached by a cylindric caudicle to a subfimbriate triangular gland. E. arundinacea Falc. Jc. No. 46 (ined,) in Herb. Kew. E. campanulata Duthie in Journ. As. Soc. Beng. lxxi, part 2 (1902), 39. Cyrtopera obtusa Lindl. Gen. and Sp. Orch. 190.

Valleys in the neighbourhood of Mussoorie, Royle; Dehra Dun in swamps, W. Bell, Mackinnon (Duthie's No. 22722), Duthie ; Pilibhit district in Rohilkhand, Duthie's collector Nos. 205793 to 25801 ; Chandanpur in the Gonda district of N. Oudl, Duthie's collector 22793. Flowers during July and August.

Since my return from India this year, I have had an opportunity of examining at the Royal Herbarium, Kew, the single type-specimen of Lindley's Cyrtopera obtusa, as well as Falconer's excellent drawing of the same plant under his manuseript name of Eulophia arundinacea, and I have now no besitation in reforring to it the E. campanulata Duthie, published last year in the Journal of the Asiatic Sociaty of Bengal. Lindley described the column correctly as heving a produoed foot, and I bave therefore placed it here in the Cyrtopara section of the genus. It is olosely allied to E. farva, differing chiely by its muoh narrower leaves, smaller flowers and in the shape of the spur. It somewhat reesmbles E. Mannii Hook f., whioh, in regard to the length of the foot of the column, might well hare been placed in the Cyrtoperc seotioc. In both of these species the narrow leaves, the short, neute spur, as well as the anther, pollinia and gland are very similar. Tha loosilty "nd ripas fluminis Tonse prope Deokhutal," micnticned in Liudley's Gen. and Sp. Oroh. 19v, refera to $E$. fava and not to $E$. obtusa.

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Plate 111. Eulophia obtusa Hook. f.-Entire plant, reduced to $\frac{1}{4}$. Portion of flowering stem, -of natural size. Fig. 1, single flower; 2, ditto, with sepals and petals romoved; 3, lip, spread out ; 4, column; 5, anther, front and side views; 6, pollinia, front and back views;-all enlarged.

## 14. Geodorum Jackson.

Terrestriai herbs with underground subglobose rhizomes. Leavcs elliptic, plicate, their sheaths forming a pseudo-stem. Scape from the base of the pseudo-stem, stout, erect, sheathed, bearing a decurved corymbose raceme. Fluwers rather crowded and narrow, about 15 mm . long. Sepals, equal, oblong, subacute, erect. Petals as long as the sepals, but broader and blunt. Lip seasile on the base of the column, broadly ventricose at the callas-bearing base, without side lobes; aper broad, rounded bifid or emarginate. Column shorter than the lip. Anther broad, 2 -celled; pollinia 2 , broadly and dimidiately ovoid, attached by a slender tapering caudicle to a small orbicular gland.Species about 10 ; Indian, Malayan, Chinese and Australian.

Geodordm purporeum R. Brown in Ait. Hort. Kew. ed. 2, v, 207.
Tuber globose, apiculate, about 3 cm . in diam. Pseudo-stcm 7.5 to 15 cm . long. Leaves broadly elliptic, acute, tapering to the long sheath, $1 \cdot 5$ to 3 dm . long and 7.5 to 10 cm . broad. Iuflorescence shorter than the leaves; raceme short, corymbose, drooping when in flower, but erect in fruit; floral bract large, lanceolate, longer than the ovary. Flowers white or pale purple about 15 mm . long. Sepals linear-oblong, acute, 3-nerved. Petals broader, 5-nerved, with thickened midribs. Lip very ventricose at the base and much thickened, the rounded minutely notched apical lobe also much thickened; disk with a conspicuous yellow callus at the base from which extends a broad channelled ridge towards the granulated apex. Anther with a 3 -lobed apex, puberulous; pollinia 2 , with elongate pits on their posterior surface, caudicle broad. Lindl. Gen. and Sp. Orch. 175 ; Dalz. \& Gibs. Bombay Fl. 266; Hook. f. Fl. Br. Ind. vi, 16; Kiug \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 181, t. 24j. G. dilatatum Wall. Cat. 7376. Limodorum nutans Roxb. Cor. Pl. i, t. 40; Fl. Ind. iii, 470. Malaxis nutuns Willd. Sp. Pl. iv, 93.

Dehra Dun, Mackinnon's collector. Flowers during June and July. It extends eastwards to Nepal, Sikkim and Bhutan, and south to Malabar and the Konkan, also in the Andamen Islauds and the Malay Peninsule.

## 15. Oreorchis Lindl.

Terrestrial; pseudo-bulb corm-like, broadly ovoid, 1- or 2-leaved. Leaves long, narrow. Scape tall, slender, produced from the side of the pseudo-bulb. Flowers rather small, in racemes. Sepals ovate-lanceolate. Petals subsimilar and slightly spreading or subconnivent. Lip more or less oblong, attached to the base of the column by a short narrow claw, gibbous at the base or not, anterior part 3-lobed; side lobes short, entire; terminal lobe broad, more or less bifid. Column elongated, stout, ore mor less curved, the apex subtruncate. Anther l-celled. Pollinia 4, globose,
united to a short common caudicle ending in a gland derived from the stigma (sessile in 0 . indica). -Species 5 ; all inhabiting Northern Asia.

> Leaf solitary, flowers reddish:-
> Flowers stalked, lip saooate at the base . . . . 1. O. foliona.
> Flowers larger und sersile, lip not aaccate at the base 2. 0 . indica.
> Leaves 2 or 3, flowers white or pale yellow:-
> Lip not eacoate at the base, basal callua lidear . . 3. O. micrantha.
> Lip saccate at the base, basal callos oval . . . . 4. O. Rolfei.

## 1. Oreorchis foliosa Lindl. in Journ. Linn, Soc. iii, 27.

$P_{\text {seudo-bulb }}$ about 1.5 cm . long, broad-based and bearing a few lax root-fibres. Leaf solitary, terminal, 1 to 2.3 dm . long, oblong-lanceolate, acuminate, narrowed at the base to a short petiole, with two or three prominent nerves and a few slender ones between. Scape 3 to $4 \frac{1}{2} \mathrm{dm}$. long, the peduncle with two or three tubular closely-fitting sheaths 2.5 to 5 cm . long. Raceme 7.5 to 20 cm . long, laxly few-flowered; foral bract small, equalling the short pedicel of the ovary. Flowers 13 mm . across, suhsecund, yellowish tinged with red. Sepals ovate-lanceolate, suberate, the lateral pair produced at the base on to the sac of the lip. Petals shorter but broader than the sepals, all more or less connivent. Lip longer than the sepals, deflexed from below the middle, clawed and shortly saccate at the base; side lobes broadly and obliquely oblong, obtuse, entire, 3 -nerved, terminal lobe subreniform (when flattened out), shortly lifid, the margin thickened and erose; disk with five stout branching nerver, but not lamellate. Columb slightly curved; the sides thickened, especially towards the base and passing into the short sac of the lip. Hook. f. Fl. Br. Ind. v, 709 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 183, t. 137; Collett FI. Siml. 493; Rolfe in Journ. Linn. Soc. xxxvi, 9. Corallorhiza sp. Lindl. in Royle Ill. Him. Bot. 362.

Simla Hills 7-9,000 feet, StoliczKa, Gamble Nos. 4429, 6251; Lace No. 2160, Collett; Jaunsar, Osmaston (Duthie's No. 24188), Gleadow; Garhwál, Royle; flowering in July. It extends eastwards to Sikkim, and occurs also in China, in Western Szechuen rad on the Tibetan frontier.
2. Oreorchis indica Hook. f. Fl. Br. Ind. v, 709.

Rhizome bearing one or two ovoid annulated pseudobulbs from the bases of which several stout fibrous roots are given off. Leaf solitary, narrowly lanceolate, about 2.5 cm . broad, developing later than the flowers. Scape about 2 dm . long, rather stont, the peduncle bearing a few loose acuminate sheaths; floral bract lanceolate, acuminate, shorter than the ovary. Flowers many, sessile, about 17 mm . long. Sepals and petals yellow veined and blotched with reddish-purple. Dorsal sepal linear-lanceolate, 11 mm . long, lateral subfalcately lanceolate, 10 mm . long. Petals a little shorter than the $s$ epals, subfa cately blong, obtuse. Lip deflesed from the middle, clawed, not saccato at the base; side lobes ear-shaped, incurved, obtuse; midlobe rounded, entire or 2 . loberl; the disk with a raised lamella midway between the side lobes. Column dilated at the liase and apex, curved, shorter than the lip, yellow with raddish-purple spots. lip of anther with two projecting teeth; pollinia sessile on the gland, obovoid,
subcompressed. Collett Fl. Siml. 493. Corallorhiza indica Lindl. in Journ. Linn. Soc. iii, 26 (not of Dcne.).

Hattu near Simla 7,000 feet, T. Thomson No. 1724, Gamble; Chachpur Valley the Simla Hills 6,000 feet, Duthie No. 21074; Jaunsar 8-9,000 feet, Edgeworth No. 61 ; 6.7,000 feet, Duthie No. 14592; Garhwál 8-9,000 feet, Royle. Flowers in August.

The shape of the pollinia in this species and the absence of a onudicle are remarkable. The claw of the lip and the lamella are pale yellow, the side lobes are marked with purple lines and apots, and the apioal lobe is white and often tinged with pale purple.

Plate 112. Oreorchis indica Hook. f.-A plant,—of natural size. Fig. 1, single Hower; 2, ditto with lip removed; 3, flower with sepals and petals removed; 4, lip spread out; 5, anther; 6, pollinia;-all enlarged.
3. Oreorchis micrantha Lindl. Journ. Linn. Soc. iii, 27.

Pseuao-bulb about 2 cm . long, ovoid-conic, the base with a few fibres. Leaves two or three, 1.5 to 3 dm . long, linear, prominently 1- or 2 -nerved. Scape from the side of the pseudo-bulb, the peduncle with two or three tubular sheaths; raceme few-flowered, lax, 5 to 10 cm . long; floral bract minute, subulate, hairy, much shorter than the ofary. Flowers almost sessile, 1 cm . in length, pale yellow, the lip being white spotted with purple. Sepals linear-lanceolate, acute, slightly spreading, the lateral pair a little shorter and broader than the dorsal and subfalcate. Petals shorter than the lateral sepals, sometimes spotted with purple. Lip obovate-oblong, not saccate at the base, deflexed from the top of the very short claw; side lobes narrowly oblong, erect; terminal lobe broadly obovate, 2-lobulate; disk with a thick, linear channelled callus. Column much curved, the base dilated and concave. Pollinia globular, united to a short thick caudicle. Hook. f. Fl. Br. Ind. v, 709 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. 183, t. 138; Collett Fl. Siml. 493.

Simla Hills 7 to 8,000 feet, Gamble Nos. 4427, 6250, Lace 2159, Babington-Smith; Jaunsar, Osmaston; Mussoorie Hills 5 to 6,000 feet, King, Mackinnon; Kumaon, $T$. Thomson No. 214, Strachey \& Winterbottom No. 56. Flowers during June.
4. Oreorchis Rolfei Duthie in Journ. As. Soc. Beng. lxxi, part 2, 38

Pseudo-bulb globose. Leaves two or three, about 2 dm . long, linear-lanceolate, deflexee at the tips, $3-5$-nerved, plicate. Scape about as long as the leaves, rising from near the top of the pseudo-bulb; peduncle firm, clothed with three or four closely-fitting tubular sheaths. Raceme many-flowered, 6 to 7 cm . long. Flowers sessile, rather crowded, about 1.4 cm . across; floral braci minute, less than half the length of the ovary. Sepals about equal, 1.4 cm . long, lanceolate, subacute, pale yellowish-green, slightly spreading. Petals as long as the sepals bat narrower, oblanceolate, subacute, pure white with a few dark purple blotches. Lip obovate-oblong (when spread out), narrowed at the base into a sac-like claw; side lobes linear, fleshy, white, half the length of the midlobe and free almost to their bases; midlobe deflexed, white and blotched like the petals with dark
purple spots, the apex with a shallow sinus, the disk with a prominent flesby oval callus at its base. Column curved, dilated at the base, concave in front. Pollnia globular, united to a short thick conical caudicle.

Nág Tiba in Tehri-Garbwál at an elevation of about 8,000 feet, Mackinnon's coilector. Flowers in June.

This species is most nearly allied to 0 . micrantha, but the lip is sacoate at the base, and the beas callus is oval and not linear; both the lip and the petals are pure white apotted with purple, and the side lobes of the lip are free to the base. The spike is shorter and the flowers are more crowded. At preest this plant is known only from a single locality, in the neighbourhood of Mussoorie.

Plate 113. Oreorchis Rolfei Duthie.-Plant,—of natural size. Fig. 1, single flower; 2, ditto, with sepals and petals removed; 3, lip, spread out; 4, column, with portion of ovary; 5 , front view of ditto; 6, anther; 7, pollinia;-all enlarged.

## 16. Corallorhiza R. Brown.

Leafless reddish-brown erect terrestrial herbs with jointed coralloid rhizomes. Scape simple, sheathed. Flowers small, whitish or pale yellow, in a terminal spike or raceme. Sepals and petals subequal, linear; petals ascending incurved. Lip clawed, adnate to the base of the column, erect, eutire or 3 -lobed; spur minute or absent. Column erect, incurved. Anther 4 -celled; pollinia 4 ovoid, soft, cohering by a viscus.-Species about 12 , in N . temperate regions.

Corallorhiza innata R. Brown in Hort. Kew. v, 209.
A rootless parasite with a flattened reddish-brcwn succulent rbizome. Scape 6.10 in long, slender, few-flowered, clothed with loose sheaths. Flower nearly sessile, about 7 mm . long; bracts minute. Sepals ovate-lanceolate, the lateral ones deflextd. Lip deflexed, 3 -lobed, with a shallow nectary at the base; side lobes narrow, mid-lobe retuse. Anther dehiscing transversely, each cell containing an unequal pair of waxy pollinia. Capsules large, deflexed. Lindl. Gen. and Sp. Orch. 533 ; Reichb. Ic. Pl. Germ. siii, 490 ; Houk. f. Fl. Br. Ind. v, 710; Rolfe in Journ. Linn. Soc. xexvi, 9. C. Jacquemontii Dcne. in Jacquem. Voy. Bot. 165, t. 165.

Kashmir; Jacquemont, C. B. Clarke No. 28943, up to 11,500 feet, extending to Europe, N. Asia \& N. America.

## 17. Cymbidium Swartz.

Epiphytes, rarely terrestrial or with an elongated leaf-bearing stom. Leaves usually very long, narrow and coriaceous, rarely none or rudimentary at the time of Howering. Inflorescence from the side of the pseudo-stem; scape loosely sheathed. Flowers one to many, often large, in suberect or drooping racewes. Sepals aud potals subequal, free, spreading or erect. Lip adnate to the base of the column and embracing it by its convolute side lobes; apical lobe decurved, often with undulate edges, the disk usually with two ridges or lamellæ. Column long, without a foot. Anther 1- or imperfectly 2 -celled; pollinia 2, ovoid pyriform cuneiform or globular, more or lees
partite, sessile on a swall or large often strap-shaped gland.-Species about 60, in temperate, tropical or sultropical Asia, a few in Africa and in Australia.

Terrestrial :-
Leaflees and parasitio

1. C. macrorhison.

Leeves linear, their bases forming a short pseudo-stem : -
Flowers solitary
Flowers in ravemas
2. C. Mackinnoni.
3. C. cyperifolium.

Epiphytal, infloresoence deourved:-
Flowers not exceeding 35 om . aoross:-
Inflorescenee less than half the length of the leaves, leaves entire at the aper
Inflorescence nearly as long as the leaves, leaves notohed
at the apex . . . . . . . . . . . . . . .
Flowers much larger:-
Leaves narrowly linear
Leaves lanceolate, acuminate
4. C. pendulum.
5. C. aloifolium.
6. C. longifoliun.
7. C. giganteum.

1. Cymbidium macrorhizon Lindl. Gen. and Spec. Orch. 162.

A terrestrial parasite without leaves. Rootstock as thick as a goose-quill, creeping, branched and jointed. Scape very short, basal sheaths short, or elongating to 5 cm . and narrowly subfoliaceous. Raceme 6-8-flowered, $1 \cdot 5$ to $2 \cdot 3 \mathrm{dm}$. long; bracts 7 to 12 mm ., narrow, membranous. Flowers 3 to 4 cm . in diam. Sepals about 2 cm . long, linear-lanceolate, acuminate, pale yellow tinged with pink, spreading or reflexed. Petals erect, slightly shorter and broader, whitish streaked with pink. Lip 1.7 cm ., white spoited with crimson; side lobes narrow, erect, rounded and with inflexed margins: midlobe oblong or subpanduriform; disk with two thick ridges between the side lobes. Column elongate, curved, about 12 mm . long, inner surface streaked with crimson. Anther papillose outside; pollinia 4 , plano-convex, sessile on the crescent-shaped gland. Koyle Ill. Him. Bot. 366; Hook. f. Fl. Br. Ind. vi, 9.
N.-W. India; Royle, Falconer; Debra Dun; on Kalanga Hill, Mackinnon's collector; Mussoorie on Banog Hill 7,000 feet, Mackinnon (Duthie's No. 22717); Garhwál east of Tebri, Mackinnon's collector (Duthe's No. 25̄403); Sarju Yalley in Kumaon, Duthie's collector No. 24098; reported also from Kashmir. Flowers during July and August. It extends eastwards to Assam and to the Khasia and Naga Hills. In Sikkim it bas been collected in the Ranjit Valley, but not since 1879.

Plate 114. Cymbidium macrorhizon Lindl.-A plant,-of natural size. Fig. 1, single fower 2, column and lip; 3, lip; 4, front view of column; 5 , anther; 6 and 7, pollinia; -ull enlargea
2. Cymbidium Mackinnoni Duthie in Journ. As. Soc. Beng. lxxi, pt. 2, 41.

Terrestrial, cœspitose. Pseudo-stem short, emitting many thick spongy roots. Leaves linear, acuminate, 3 to 4 dm , long and about 1.3 cm . broad, the lowest reduced to membranous sheaths, margins not serrulate. Scape 1 -flowered, much shorter than the leaves, clothed to the base with loose lanceolate acuminate cymbiform hyaline sheaths. Floral bract longer than the much curved ovary, pale yellow with purple veins. Flower's
about 5 cai. across, nodding. Sepals and petals apreading, green. Sepals lanceolate, obtuse, a little longer tinur the petals. Petals elliptic-lanceolate, obtuse, $\overline{0}$-nerved. Lip about as long as the petals, obovate-oblong (when spread out), 3 -lubed, succate at the base, palc yellow, blotched with purple; lataral lobes narrow, erect; the terminal one abruplly deflexed, rounded at the apex and nearly entire; disk with two raised incurved smooth lamellar flaps extending from the base to a little beyond the side lobes, their edges nearly parallel but not meeting. Column short, stout, auricled at the base, concave in front marked with purple blotches like the lip. Pollinia 4, obliquely obovoid, plano-convex, attached to a hemispherical gland. Ripe capsule 1.5 dm . long (including the long pedicel), ellipsoid clavate, prominently ribbed.

Discovered by Mr. P. W. Mackinnon, near Mussoorie, at an elevation of ubout 5,500 feet, growing under trees and flowering during the month of February; Duthie's Nos. 22709, 24152.

This speoies is very vearly allied to C. virescens Lindl., a native of Japan. In the latter, however, the margins of the leaves are distinctly serrulate, the flowers are larger and the bracts ou the scape are more numerous and more tinted; the lamella on the disk of the lip are much curved and uearly parailel to the margins of the lateral lobes. Of Indian speoies it most nearly reesembles C. cyperifolium. The latter, however, is a muoh larger plant, the saape is more than 1 -flowered, and the colouring of the lip and the shape of the pollinia and that of gland are very different; also the margins of the leaves are serrulate, and the sheaths on the scape as well as the Horal bract are green.

Plate 115. Cymbidium Mackinnoni Duthie.-Portion of plant,-of natural size. Fig. 1, side view of flower, with sepals and petals removed; 2, lip and column; 3, pollinia;-all enlurged ; 4, ripe capsule,-of natural size.

## 3. Cymbidium cyperifolium Wall. Cat. 7353 (in part).

Terrestrial; pseudo-stem thin, short. Leaves up to 7.5 dm . long, linear, finely acuminate, slightly expanded towards the sheathing base, the lowest ones short and sheath-like, margins serrulate. Inflorescence from the base of the pseudo-stem, erect, about 3 dm . long, the peduncle clothed with long acuminate sheaths up to the base of the raceme. Flowers green, with dull purple markings on the lip and column, 2.5 cm . long, and about 3.5 cm . across; floral bract green, lanceolate, acuminate, longer than the stalked ovary. Scpals subequal, linear-lanceolate, acute, spreading. Petals ratior shorter and somewhat broader. Lip as long as the petals, oblong (when spread out), glabrous, 3 -lobed; lateral lobes long, narrow, erect; terminal lobe abruptly deflexed, ovate or oblong-ovate, entire, the disk between the side lobes with two smooth lamellar incurved flaps, their edges parallel but not touching. Column rather stout. Anther broad; pollinia obliquely ovoid, divergent, cleft nearly to the base, sessile on a very narrow clongate gland. Capsule ellipsoid-clavate, about 6 cm . long. Lindl. Gen. and Sp . Orch. 163; in Journ. Linn. Soc. iii, 28; Hook. f. Fl. Br. Ind. vi, 13 (excl. syn. Limodorum longifolium Roxb.); King \& Pantlivg in Ann. Roy. Bot. Gard. Calc. viii, 186, t. 248. C. viridiforum Griff. Itin. Notes 126, No. 454.

Near Mussoorie, growing amongst dense undergrowth at about 6,000 feet, Mackinnon (Duthie's Nos. 21743, 22719), flowering during March and April; Garbwál and Kumuon at 5,000 feet, Edgeworth. It extends eastwards to Sikkim, the Khasia and Naga Hills, Manipur and Upper Burma, and is found also in Perak and Java.
4. Cymbidicm pendulum Swartz in Nov. Act. Upsal. vi, 73.

Pseudo.stem stout, 7.6 cm . long. Leaves linear-oblong, acute, not notched, up to 7.5 dm . long and from 1.5 to 2 cm . broad, expanding into basal sheaths. Inflorescence 2.5 to 3 dm ., decurved from the base, the peduncle about $7 \cdot 5$ cm., clothed with many imbricate sheaths. Flowers many, not crowded, dark purplish-brown, about 3 cm . across; floral bract minute, triangular, the ovary with stalk 1.3 cm . Sepals equal, oblong, slightly dilated near their blunt apices. Petals nearly as long as the sepals and a little wider, margined with yellow as are the repals. Lip adnate to the short foot of the column, oblong, dilated and subsaccate at the base; side lobes narrow, their apices blunt and directed forwards; terminal lobe oblong, blunt, emarginate, much decurved; disk between the side lobes with two jarallel continuous lamellæ divergent at the base, meeting in the middle and slightly reparating at their clavate apices. Column erect, narrower above, with a very short foot. Anther broad, depressed, minutely papillose; pollinia ovoid, acute, diverging, essile on a broad thin shallow gland. Roxb. Fl. Ind. iii, 458 ; Lindl. Gen. and Sp. Orch. 165; Walp. Ann. vi, 642 (excl. cit. Bot. Reg.); King \& Pant. in Ann. Roy. Bot. Gard. Calc. viii, 188, t. 251 ; Rolfe in Journ. Linn. Soc. xxxvi, 31. C. aloifolium Hook. f. Fl. Br. Ind. vi, 10 (in part). C. crassifolium Wall. Cat. 7357. C. Mannii Reichb. f. in Flora 1872, 274. Epidendrum pendulum Roxb. Cor. Pl. i, 35, t. 44.

Káli Valley in Kumaon at a low elevation, Duthie's collector No. 24097. Flowers in May or June. It extends eastwards to Bengal, Sikkim, Assam, Sylhet, Burma and China; and is found also in S. India, the Andaman Islouds and Perak.
5. Cymbidium aloifolium Swartz in Nov. Act. Upsal. vi, 73.

Pseudo-stsm short. Leaves 3 to $5 \cdot 5 \mathrm{dm}$. long and about 3 cm . broad, linear-oblong, curved, obtuse, fleshy, obliquely notched at the apes, slightly expanded at the sheathing base. Inflorescence from the base of the smail pseudo-stem, somewhat shorter than the leaves, peduncle $7 \cdot 5$ to 10 cm . long, bearing severul tubular acute scarious sheaths near the base; raceme many-flowered, decurved, 3 to 4 dm . long. Flowers 3.5 cm . across; floral bract minute, ovate, the stalked ovary about 12 mm . long. Sepals subequal, oblong or slightly oblanceolate, blunt. Petals as long as the sepals, ovate-oblanceolate, blunt. Lip as long as the sepals, oblong, 3-lobed, its upper surface with two lamellæ broken and disconnected in the middle; the lateral lobes long, narrow, their apices blunt, entire, pointing forwards; apical lobe ovate-oblong, much decurved. Column slightly thickened at the apexAnther subquadrate, papillose, the gland of the pollinia small. Capsule elliptic, 8 to 9 cm. long. Swartz in Schrad. Journ. Bot. 1779, ii., 218 ; Roxb. Fl. Ind. iii, 458 ; Lindl. Gen. and Sp. Orch. 165 ; Lodd. But. Cab. t. 967 ; Walp. Ann. vi, 624 (excl. Ic. Wight); Hook. f. Fl. Br. Ind. vi, 10 ; King \& Pantl. in Ann. Roy. Bot Gard. Calc. viii, $1 \leqslant 9$, t. 252. Epidendrum aloifolium Linn. Ep. Pl. 953. ? Aerides Borassi Smith in Rees Cyclop. Suppl. (Ju part). Epidendrum aloides Bot. Mag. t. 387.

Bahraich district of N. Oudh near the Nepal frontier, Duthic's collector No. 23865: dowering during April and May. It extends eastwards to Bengal, Sikkim and Assam, and occure also in S. Iudia, Ceylon, the Andaman Islands and Parak.
6. Ctmbidium longifolidm Don Prod. 36.

Pseudo-stem short. Leaves 6 to 9 dm . long and only 13 to 15 mm . wide, linear, acuminate, channelled below, dilated and equitant at the very base. Inflorescence very stout, sub-erect in the lower but decurved in the upper half, shorter than the leaves, the peduncle sheathed nearly to the apex, sheaths larger upwards, all loose and acute. Raceme 10- to 15 -flowered. Flowers 6.4 to 7.6 cm . across; floral bract minute, triangular. Nepuls subequal, oblong, subacute, thedorsal broader and iucurved, lateral pair spreading. Petuls as loug as the sepals, but narrower, spreading. Lip oblong, shortly clawed; side lobes long, narrow, acute, directed forwards; terminal lobe decurved, orbicular, acute, the edges slightly undulate, pubescent on its upper surface. Column erect, slightly saccate at the base. Aniler broad, dome-like; pollinia ovale, diverging, sessile on a quadrate gland the lower corners of which are elongated into narrow points. Ovary stalked, about $2 \cdot 5 \mathrm{cu}$. long. Wall. Cat. 1356 ; Lindl. Gen. and Sp. Orch. 163 ; in Journ. Linn. Soc. iii, 29; Reichb. f. in Gard. Chron. 1874 i, 14; Hook. f. Fl. Br. Ind. vi, 13 ; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 191, t. 2̄̄4; Rolfe in Journ. Linn. Sos. xxxvi, 31. C. erythraum Lindl. in Journ. Linn. Soc. iii, 30. Limodorum angustifolium Herb. Ham.

Kumaon at 5 to 0,000 feet, Blinkworth. Eastwards to Sikkim, Bhutan and the Khasia and Naga Hills; also in China. In Sikkim it flowers during September and October.

In this plant the sepals and petals are brownish-purple on a pale green ground, the dorsal sepals being dark green outside and faiutly striped with purple; the disk and apical lobe of lip are pure white spotted with purple, the side lobes being of a dull yellow closely lined with purple.

## 7. Cymbidium giganteum Wall. Cat. 7355.

Pseudo-stem very short. Leaves 4 to 6 dm . long, and 2 to 3 cm . broad, linearoblong, acute, entire, narrowed towards the base and then dilated and equitant. Inflorescence from the base of the pseudo-stem, as long as or longer than the leaves, decurved; peduncle stout, enveloped at the base in :numerous imbricate acuminate sheaths; racene laxly 10 - to 20 -flowered. Flowers 6.4 to 7.6 cm . across; floral bract minute, broad. Sepals subequal, elliptic-oblong, subacute, the dorsal ous incurved, lateral pair spreading. Petals as long as the sepals but narrower, oblong, sulucute. Lip shorter than the sepals, 3-lobed, more or less puberulous; lateral lobes larga, their apices elliptic and directed forward; apical lobe deflexed, ovate-oblong, subacute, the edges undulate crenate; upper surface with two parallel ridges running from the base nearly to the apex, hairy and separated by a small groove. Culumn somewhat curved, its base below the insertion of the lip with a small nectar-bearing sar, Arther slightly scabrid. Pollinia ovoid, acute, diverging, sessile on a ruadrate gland, Capsule 7.5 cm . long, elliptic, pointed at each end, prominently ridged. Jisdl. Gen. and Sp. Orch. 163; Sert. Orch. t. 4; Bot. Mag. 亿. 4844; Paxt. Mag. Bot. 241, and Fl. Gard. ii, 14, fig. 143; Griff. Notul. iii, 341: Walp. Amn. vi, 626; Warner Orch. Alb. vi, t. 284 ; Hook. f. Fl. Br. Ind. vi, 12; King if Pantl. in Ann. Roy. Bot. Gard., Calc. viii, 191, t. 255. Iridorchis gigantea Blume Orch. Archipel. Ind. 76, t. 26. Limodorum longifoliun Is. Ham.

Gorhwál at 4,000 fect, Mackimon; Kumnon 4,000 iect, Strachey of Winferboltom No. 26, flowering from October to December. It extends eastwards to Nepal, Sikkim, shutan and the Khasia Hills.

The flowers are of a dingy yellow colour with vertical lines of brown, and the lip bas broad traneverse dark brown blotohes; the sepals are greevish externally.

## 18. Doritis Lindl.

Epiphytic, with short stems and no pseudo-bulbs. Le ves flat, coriaceous. Infloriscence from the side of the stem or axillary, erect or pendulous. Flowers in loose racemes. Sepals and petals widely spreading. Lip clawed or sessile, adnate to the foot of the column, spurred, more or less lobed, side lobes crect, disk usually with a forked plate or callus. Colimn narrowly winged, its foot long and forming with the sides of the lip a conical sac bearing the lateral and apical lobes at its mouth.Speries 5, Indian, Chinese mud Malayan.

Doritis tefialis Bentl. in Gen. Plant. iii, 574.
Roots numerous, long and flat, forming large tufts. Leaves few, pendulous, often solitary, sometimes absent, $7 \cdot 6$ to 12.6 cm . long, narrowly elliptic-oblong, acute, tapering to the sessile base. Racemes 6- to 8 -flowered, longer than the leaves, pendulous. Flowers about 2 cm . across, purple or occasionally pure white; bract mintie, broadly triangular. Sepals unequal, blunt, the dorsal one oblong or slightly oblanccolate; lateral pair broader, elliptic, blunt. Petals shorter than the sepals, obovate, blunt. Lip adoate to the foot of the column, shorter than the petals; hypochile produced below into a stout subeylindric spur, and sending upwards two long narrow falcate backwardpointing lobes; epichile spathulate-oblong, entire, attarhed to the hypochile near its base, parallel to it for part of its length and then curving forwards, its upper surface with a forked appendage. Column dilated towards the long foot; stigma large, rostellum long and narrow. Pollinia subglobose, attached by a long curved tapering flat caudicle to a small triangular glaud. Hook. f. Fl. Br. Ind. vi, 31; King \& Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 199, t. 266. D. Braceana Hook. f. in Ann. Roy. Bot. Gard. Calc. v, 40, t. 60. AErides tceniale Lindl. Gen. and Sp. Orch. 239 ; in Journ. Linn. Soc. iii, 41. AE. carnosum Griff. Notul. iii, 265 ; Ic. Pl. As. t. 338A.
N.W. Himalaya, Mudden; Dehra Dun, Gamble Ni. $\overline{2786}$; Jaunsar, Gamble No. 25788; Garhwál in the Tonse Valley 5,000 feet, Duthie; Telıri Garhwal Mackinnon; Kumaon near Ranikhet 5-6,000 feet, Duthie No. 5997; near Almora at 3,500 feet, Strachey $\&$ Winterbottom No. 23. Flowers during April and May. It exteuds enstwards to Nepal, Sikkim, Bhutan, Khasia Hills, Manipur and Lizrma.

## 19. Ornithochilus Wall.

Epiphytic, without pseudo-bulbs. Stern very short. Lcaves iew, cropded, broadly Wong, flat, softly coriuccous. Inflorescence supra-axillary, racemose or panicled. Sepals
subequal, spreading, incurved at the apex, lateral obliquely obovate. 'Petals amaller, cuneate oblong, blunt. Lip much longer than the sepals, adnate to the foot of the column by a long broad claw, the claw with a rectangularly bent sub cylindric spur at its junction with the apical lobe; side lobes shallow, sub-quadrate; apical lobe with three lobules, the two lateral recurved and pectinate, the central triangular, entire or infolded; the mouth of the spur closed by two calli projecting from its back and front walls, the latter hairy. Column short, cylindric, stout, with a short foot; rostellum forked; stigma circular, surrounded by a hairy rim. Anther oblong; pollinia 2, sub-globose, caudicle very broad, obcuneate, gland large.-Species 1 or 2 , Indian or Chinese.

Ornithochlus fuscus Wall. in Lindl. Gein. and Sp. Orch. 242.
Lecives 7.5 to 15 cm ., ollong or ovate-lancoolate, obliquely tupering to the acute apex and narrowed to the sessile sheathing base, fleshy, shining on both surfaces when young, nerves inconspicuous Irflocscence two or three times longer than the leazes. Flowers 1 cm . across; floral bract lanceolate, much shorter than the lonsetalkel ovary. Sepuls and petals greenish-yellow, the former with fuur, and the latier with two, broad brown vertical bands. The two pectinate lateral lobules of the midlobe of the lip are also brown passing into purple below. Capale fusiform, 2.5 cm . long. Hook, f. Fl. Br. Ind. vi, $\mathbf{7 6}$; King \& Pantling in Ann. R. Bot. Garí. Calc. viii, 200, t. 268; Rolfe in Journ. Linn. Soc. xxxvi, 38. O. eublepharon IIance in Journ. Bot. xxii (1884), 864. Aerides difforme Wall. in Lindl. Gon. and Sp. Orch. 212; Sert. Orch. frontisp. fig. 7; Reichb. f. in Gard. Chron. (1865), 698; Lindl. in Jouru. Linu. Soc. iii, 41; Walp. Ann. vi, 899. A. Hystrix Lindl., in Journ. Linn. Soc. iii, 42 (not of Gen. and Sp. Orch.).

Dehra Dun and up to 3,000 feet on the adjacent Mussoorie range, Mackinnoriz, collector (Duthie's No. 24190); near the village of Chamussonrie below Landour, Vicary; Garhwál, Falconer; Gori Valley in Kumaon, Duthie's collector No. 24121. Flowers in July. It extends eastwards to Siksim, Bhutan, the Khasia Hills and Burma. It is found also in Moulmein and in China.

## 20. Luisia Gaud.

Epiphytes with rigid terete sheathed stems woody below and usually erect. Leaves terete, fleshy, distant, spreading. Flowers usually sinall and dull coloured, in short extraaxillary spikes with stout axes; foral bract short, scarious, persistent. Sepals sub-equal, or the decurved dorsal one, smatler. Petals equalling the sepals or much longer, spreading. Lip sessile on the base of the column, divided into two parts; the hypochile saccate concave or flat; the epichile decurved, broad and ridged, entire crenate or undulate, more or less blunt. Column much shorter than the lip, stout. Stigma usually large. Aather broad, 2-celled; pollinia 2, ovoid or subglobose, attached by a broad caudicle to a subquadrate or elongate gland. Cupsule narrow, ridged, suberect, - Species about $1 \mathbf{j}$, mostly in Tropical Asia, a few Australian:-

Loares long and stout, about $\overline{\mathrm{j}} \mathrm{m}$ ra. in thickness
Flowers 10 mm . long . . . . . . . . . . . . . . . 1. L. trichorhisa.
Flowers 6 mm. loug . . . . . . . . . . . . . . . . 2. L. terctifolia.
Leaves slender, 3 mm . or less in thickness.
Flowers $\boldsymbol{r} \mathrm{m}$ m. long, lip nenrly fat . . . . . . . . . . 3. L. bruchystachys.
Flowers 4 man. long, lip with a saccate lypochile . . . . . 4. L. inconspicua.

And. Roy. Bot. Gard., Calc., Vil. IX.

## 1. Luisia tricioreiza Blume Mus. Bot. Lugd. Bat. i., 63.

Stom 1 to 25 dm . long, very stout, not branched. Leaves fleshy, very slightly tapering to the apex, 1 to 1.8 dm . long and about 5 mm . thick. Spikes 4 . or 5 -flowered, stout. Flowers 1 cm . long, placed on short thick tubercles; floral bract broad, with au acuminate point, persistent. Sepals unequal, green with faint purple lines; the dorsal one oblong, blunt; lateral pair shorter, obliquely ovate, acute, kecled. Petals longer and nurrower than the lateral sepals, ublong, blunt, all spreading. Lip larger than the sepals, dark dull purple on a greenish ground, basal half deeply concave and with erect rounded edgee, the apical portion broadly cordate, tapering to the subtruncate emarginate apex, upper surface with short blunt vertical ridges. Column stout, half as long as the lip, purple. Auther subquadrate, compressed, rostellum broad; pollinia ovoid, attached by a broad caudicle to the quadrate gland. Lindl. Fol. Orch. 2; Reichb. f. Xen. Orch., t. 77, figs. 8 to 18 ; Hook. f. Fl. Br. Ind. vi, 23; Kins \& Pantling in Ann. R. Bot. Gard. Calc. viii, 202, t. 270. Vanda? trichorhiea Hook. Exot. Fl. i, t. 72.

Dehra Dun chiefly on sal trees, Gamble No. 2569.), Mackinnon No. 24189 ; Garhwál, Falconer, Mackinnon (Duthie's Nos. 23004, 汭28), Duthie's collector Nos. 25836, 25s37. Flowers during March and April. It extends eastwards to Sikkim.

A much stouter plant than $L$. terectifulia and with blunter leaves.

## 2. Luibia teretifolia Gaud. Bot. Freyc. Voy. 426, t. 37.

Stem 1.5 to 3 dm . long, stout, sometimes branching. Leaves 6.5 to 15 cm . long and from 4 to $\overline{5} \mathrm{~mm}$. thick, terete, spreading. Spikes very short, 2- or 3 -flowered. Flowers 7 mm . long; floral bract broad, pointed. Sepals and petals subequal, green, the petals slightly longer, narrowly oblong, blunt, spreading. Lip longer and broader than the sepals, with a square sub-saccate base; apical lobe deflexed, rhomboid, sub-truncate, its upper surface witn fire or six vertical lines. Column very short and stout. Anther depressed; pollinia 2, ovoid, attached by a stout caudicle to a broadly oblong gland. Blume Rumphia iv, t. 194, t. 197 D; Mus. Bot. Lugd. Bat. i, 63; Liudl. Fol. Orch. 2 (excluding from all the synonym Ep. triste); Hook. f. Fl. Br. Ind. vi., 22; King \& J'antling in Ann. Roy. Bot. Gard. Calc. viii, 202, t. 270; Rolfe in Journ. Linn. Soc. xxxvi, 33. L. brachystachys, var. faveola. Par. \& Reichb. f. in Trans. Linn. Soc. xxx, 14t. L. burmanica Lindl. Fol. Orch. 3. L. platyglossa Reichb. f. in Walp. Anu. vi, 622. L. zeylanica Lindl. Fol. Orch. 3. Cymbidiun triste Roxb. Fl. Ind. iii, 4bl; Bot. Mag. t. 3648 ; Wight Ic. 911 (text only); Griff. Notul. iii, 340 (the Mergui plant). C. tenuifolium Wight Ic. 1689 (excl. text).

Garhwál 4,000 feet, Mackinnon. Nlowers in April. It extends eastwards to Sikkim, the Khasia Hills, Bengal (in the Sunderbuns), Burma, the Andaman Islands and China; it is found also in the Western Ghats, Ceylon and Malaya.

The flowers are smaller and the stem and leaves are more slender than in $L$. trichorhiza.
3. Luicia brachystachys Blume Rumplis iv, 50.

Stem long, branching. Leaves slender, 7 to 18 cm . long. Flowers 7 mm , on slender pedicels. Sepals aud petals subequal; the petals narrowly obleng, blunt, spreading. Lip
oborate-oblong, nearly flat, grooved, hardly constricted at the base of the broadly ovate epichile, dark purple with a yellow base. Column very short. Poliinia oval, attuched to a conical caudicle. Capsule $2 \cdot 5$ to 3 cm . long. Blume Mus. Bot. i., 64 ; Reichb. f. Xen. Orch. i, 204, t. 78, fig. 1 ; Lindl. Fol. Orch. 3; Hook. f. Fl. Br. Iud. vi, 23. Me80. clastes brachystachys Lindl. in Wall. Cat. 1994; Gen. nud Sp. Orch. 45.

Garhwál, Falconer; Kumaon 2,600 to 2,800 feet, Slewart No. 641. It extends eastwards to Sylhet and the Khasia Hills, and to Bengal at Jessore, Dacca und the Sunderbuns; it is found also in Tenasserim. It flowers during March and apilat.

Mr. C. B. Clarke describes the eepals as green outside and robe-parple within; the petals as greenish at the apex and base aud rose-purple in the m:ddle, aud the lip baok purple with a yellow base.
4. Luibia inconspicua Hook. f. MSS. in Herb. Hort. Calc.

Stem 1 to 1.5 dm . long, slender, not branching. Leaves 3 to 6.5 cm long and about 3 mm . in diam. Spikes 1 - to 3 -flowered, 4 to 5 mm . long. Flowers pale yellowish.green, 4 mm . long; floral bract membranous, triangular, acuminate. Sepals ovate-lanceolate, sub. ucute, spreading. Petals oblong, taporing slightly to the blunt apex. Lip as long as the sepals, the hypochile hemispherically saccate, green spotted with purplo; epichile decurved, flat, sub-reniform, notched at the apex, its upper surface minutely hispid and with 5 or 6 vertical lines. Column half as long as the lip, purple. Anther depressed, rostellum large; pollinia broadly ovoid, attached by a slender caudicle to an oblongquadrate gland. Capsule 1 cm . long. King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 203, t. 272. Succolabium? ineonspicuum Hook. f. Fl. Br. Ind. vi, 56 ; in. Ann. R. Bot. Gard. Calc. v, 46, t. 69. Cymbidium inconspicuum Wall. MSS.

Garhwál, east of Tehri, Mackinnon's collector (Duthie's No. 25427); Tejarn in Kumaon, Duthie's collector No. 24114; Sarju Valley in Kumaon, Duthe's collector No. 24114(a). It extends eastwards to Sikkim and Assam, at low elevations, flowening during June and July.

This epecies resembles $L$. brachystachys, but is more slender and smaller in all its parts.

## 21. Sarcochilus R. Brown.

Epiphytal. Stem none or very short. Leaves narrowly oblong or absent. Flowers usually in pendulous racemes. Sepals and petals subequal, free, spreading; the dorsal sepal concave, the lateral pair broader and partly adnate to the foot of the colume. Lip jointed or adnate to the long produced foot of the column, without a spur; the side lobes rery large, erect; the apical lobe minute, tooth-like; tho disk with hairy ridges and calli. Column thick, shorter than its foot, wingless, rostellum short. Anther terminal, depressed, shortly beaked in front, sumetimes bearing two lateral setx; foliinis 4, in pairs, compressed; the caudicle sleuder, flattened, the gland s:uall.-Species about 10, Indian, Chinese and Australiau.

Sarcoceldus osneoides Reichb. f. in Walp. Ann. vi, 497.
Foots densely tufted, tortuous. Stem none. Raceme 7.5 to 15 cm . long, manyflowered; peduncle brownish, bearing a few amplexicaul orate acute membrano

Jeciduous bracts; the rachis flexuous. Flowers 13 mm . in diam., white or rose-culoured. Sep.ls spreading, oblong, obtuse. Petals broador, spreading. Lip gibbous or slightly saccate at the base, with a long claw; side lobes linear-oblong, obtuse, disk between the side lobos pubescent; midlube truncate, emarginate. Column very short; restellum indistinct. Antler broadly ovate, furnished with 2 or 3 slender setæ; pollinia two, こl-lobed, caudicle very short, gland large. Capsuse $3.5 \mathrm{~cm} .$, slender, slightly curved, glabrous. Hook. f. Fl. Br. Ind. vi, 37. Chioschista usneoides Lindl. in Wall. Cat. 7330 ; Gen \& Sp. Orch. 219; Bot. Reg. under t. 1522; Sert. Orch. frontisp. f. 4; in Journ. Linn. Soc. iii, 43 ; Gard. Chron. (1846), 135. Thrisspernum usneoides Reichb. f. Selia ii, 120. Epidendram usneoiles Don. Prod. 37.

On oak trees near the village of Chamassoorie in Garhwal at an elevation of hiout 5,000 feet, found by (olonel Vicary in 183.3. Previously discovered in Nepal by Dr. Wallich.

## 

Epiphytic, with leafy stems. Leaves linear or terete, coriaceous. Flowers usually numerous and brightly coloured, in decurved racemes, sometimes solitary; florab bract minute. Scpals and petals broad, spreading, the lateral sepals adnate to the base or foot (If the column. Lip adnate to the column, spurred; the side lobes large or small, sometimes absent; the mid-lobe larger than the side lobes, or smallor anl incarved. Column short, its foot short or long; roslellum short or long, bifid. Anther 2-celled, with of without a beak; poilinia 2, giobose, sulcate; caudicle long or short, gland various. Species about 50, Eastern Asiatic.

$$
\begin{aligned}
& \text { Terminal lobe of lip large, hastate, acute. } \\
& \text { Terminal lobe of lip small, narrowly oblong. }
\end{aligned} \text {. } \quad . \quad . \quad . \quad . \quad . \quad \text {. } . \text {. mulifforum. }
$$

1. Ærides multiflorum Roxb. Corom. Pl. iii, 63, t. 271.

Slem 1 to 2.5 dm . long, stout. Leaves 1.5 to 2.5 dm . long and 2 to 3 cm . broad, narrowly oblong, conduplicate, recurved, slightly tapering to the oblique bifid apex, not narrowed to the base, often tinged with red. Ruemes longer than the leaves, simple, axillary, densely many-flowered; peduncle long, clothed with short distant sheaths. Flowers 2 cm . across, rose-coloured. Sepals and petals subequal, oblong, blunt. Lip twice as long as the sepals, triangular, entire, adnate to tho base of the column, acute or oltuse at the apex, margins erose, its basal portion thick and with a retrorse tooth or calius across the mouth of the rectangularly bent spur. Column without a foot, its margins thickened and slightly winged near the base. Anther depressed and with a long curved beak in front; pollinia globular, caudicle tiliform, gland uarrow. Roxb. Fl. Ind. iii, 475 ; Belg. Hortic. (1876), 286 ; Reichb. f. in Walp. Ann. vi, 897 ; Hook. f. Fl. Br. Jnd. vi, 44 ; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 212, t. 233. A. affine Wall. Cat. 7316 ; Lindl. Gen. and Sp. Orch. 239 ; Sert. Orch. t. 15; in Jours. Limn. Snc. iii, 41 ; Bot. Mag. t. 4049 ; Warner Sel. Orch. Ser. i, t. 2l. R. rosum Lodtl ex Paxt. Fl. Garl. ii. 109, t. 60; Regel Gartenf. viii, 2ã3, t. 267 AT. Lallii Hort. ex Ill. Hort. (1868) t. 559. AR. Veitchii Hort. ex Morven in Bel.g. 1 Iortic. (1876), 201. A. trigonum Klotzch in Ctto. \& Diet. Allgem. Gartenz (1845), 1:7.

Siwalik range, Ring; Dehra Dun, very common on mango trees; plentiful up to 4,000 fact on the outer ranges of the Western Himalaya, from the Kangra Valley in the Punjab to Kumaon, flowering during June and July. It extends eastwards to Nepal Sikkim and Assam.

## 2. Alrides odoratum Lour. Fi. Cochin. 52j.

Stom very stout. Leaves 1.5 to 3 dm . long and 4 to 5.5 cm . broad, oblong, flat, keeled, tapering slightly to the blunt unequally bilobed apex, not contracted at the sheathing base. Racemes supra-axillary, doflexed, as long as or longer than tho leaven, many-flowered; peduncle short, stout, with short distant shenths. Flowers about 2.5 cm . long, white spotted with pink, very fragrant; foral bract broud, shoathing, blunt, much shorter than the stalked ovary. Sepals unequal, obtuse, spreading, tho dorsal one ellipticovate; the lateral parr somewhat larger. Pctals oblong, falcate, shorter than the sepals. Lip adnate to the short foot of the column; spur large, funnel-shaped, curved forwards; lateral lobes very shallow, truncate, erose; terminal lobe linear, emerginate, lyin! between the edges of the lateral lobes. Anther triangular, depressed, beaked; pollinia globose, caudicle linear, gland quadrate. Capsulc fusiform, about 3 cm . long. Lindl. Gen. \& Sp. Orch. 239 ; in Journ. Linn. Soc. iii, 41 ; Bot. Mag. 4130 ; Walp. Amn. vi, 898; Lindenia t. 14 (var.); Hook. f. Fl. Br. Ind. vi, 47 ; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 212, t. 282; Rolfo in Journ. Limn. Soc. xxxvi, 35. Arides cornutum Roxb. Hort. Beng. 63; Fl. Ind. iii, 472 ; Bot. Reg. t. 148.j.

Western Himalaya, T. Thomson; Dehra Dun, King, Gamble, Mackinnon; suls. montane truct of Balraich district in N. Oudh, Duthie's Collector No. 23868; Gerhwál, Falconer, Duthie's collector Nos. 2.5810, 25818; Kumaon, Colonel Davidson. Flowers during June and July. This speciea extends eastwards to Nepul, Sikkim and E. Bengul ; it is found also in Malaya and China.

## 23. Rhynchostylis Blume.

Epiphytic. Stem elongate, stout, leafy. Leaves very coriacenus, lincar-oblons, truncately or bluntly bilobed at the apex. Racemes pendulous, many-flowered. Flowers brightly coloured. Scpals and petals spreading, broad, obtuse, the petals narrower than the sepals. Lip adnate to the short foot of the column, the hypochits forming a deep wide pubescent sac without side lobes; the epichile obovate, acute, concave, the margins erect. Column short, stout, dilated at the base and with a very short foot. Stigma small. Anther termiual, rounded; pollinia 2, elliptic, attached by a slender long caudicle to a swall oblorg gland.-Species 2 or 3, Iudian and Maiayan.

Rhyitchoeners retusa Blume. Bijdr. 29e, t. 49.
Stem stout 1 to 2 dm . long, enveloped in the shathis of decayed leaves. Leaves $\mathrm{i} \cdot \mathrm{j}$ to 4.5 dm . long and about $2 . j \mathrm{~cm}$. broad, curved, keeled, premorise or bluntly bilobed. Racemes longer than the leaves, cylindric, densely nowered; peduncle shurt vith a few smull scatiered sheaths. Flomers 2 mm . suross, whito or pink with purple or pink markings. Lateral eepals broadly ovate, obtuse or apiculate, the dorsel one ob'ong.

Lip very variable in shape ; spur compressed, as long as the lip. Capsulc clavate, 2.5 to 3.5 cm . long. Hook. f. Fl. Br. Ind. vi, 32 ; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 213, t. 284. R. premorsa Blume Bijdr. 286. R. guttata Reichb. f. in Bonplandia ii, 03. R. garwalica Reichb. f. in Walp. Ann. vi, 888. Saccolabium guttatum Lindl. in Wall. Cat. 7308; Gen. \& Sp. Orch. 220; in Journ. Linn. Soc. iii, 32 ; Bot. Mag. t. 4108 ; Wight Ic. tt. 1745-6; Dalz. \& Gibs. Bomb. Fl. 2 ib ; De Vriese Orch. t. 14 ; Griff. Ic. Pl. Asiat. Notul. 22, t. 8 \& 9. S. preemarsum Liudl. Gen. \& Sp. Orch. 221. S. Rheedii Wight Ic. r, 19. S. vetusum Fl. des Serres tt. 146;3-4. S. Heathii Hort. ex Gard. Ciron. (1885), ii, 369. S. Blumei Lindl. Sert. t. 47 ; Bot. Reg. (1841), misc. 55. S. gurwalicum Lindl. in Journ. Linn. Soc. iii, 32 ; in Gard. Chron. (1879), ii, 102. Sarcanthus guttatus Lindl. in Bot. Reg. t. 1443. Erides guttatum Roxb. Fl. Ind. iii, 471 ; Regel Gartenfl. (1863), 415. FE. retusum Swartz in Schrad. Üar. (1799), 130 ; Willd. Sp. Pl. iv, 130 ; Grah. Cat. Bomb. Pl. 264. Limodorum retusum Swartz in Nov. Act. Upsal. vi, 80. Epidendrum retusum, Linn. Sp. Pl. 953.

Kangra Valley, Punjab Hiwalaya, Edgeworth; Siwalik range, Royle; Dehra Dun, King, Mackinnon, \&c., and up to 4,000 feet on the Mussoorie range; Garbwàl, Falconer, Duthic's collector Nos. 25828, 25830, 2.5840 ; Sub-Hiwalayan tract in the Gonda district of N. Oudh, Duthie's collector No. 22800; Kumaon, T. Thomson, T. Anderson, \&c. Flowers in June and July. It extends eastwards to Nepal, Sikkim, Bhutan, Assam, the Khasia Hills and Burma, and occurs also in S. India, Ceylon and the Malay Archipelago.

## 24. Vanda R. Brown.

Epiphytes with leafy stems. Leaves thickly coriaceous or fleshy, flat and keeled or terete. Flowers usually large and bandsome, in axillary simple racemes, sometimes solitary; floral bract much smaller than the ovary. Sepals and petals subequal, spreading or connivent, narrowed at the base. Lip large, its base usually saccate or spurred, the side lobes large or small, rarely absent, adnate to the short foot of the column or to the sides of the sac or spur; apical lobe fleshy, varying in shape, the disk usually ridged or lamellate, sometimes carunculate. Column short, stout, foot short or none. Anther 2-celled, rostellum small; pollinia 2, didgmous, subglobose or obovoid; caudicle broad and short, or long and geniculate, gland usually large.-Species about 30, in 'i'ropic.l Asia and Australia.

> Lip spurred at the base:-
> Sepals and petals spreadiog:-
Flowers small, disk of lip without ridges . . . . . . 1. V. partiftora.
Flowers 3.5 to 5 cm in diam., disk of lip with fleshy
ridges . . . . . . . . . . . . . . . . . 2. V. Rosburghii.
epals and petals incurved . . . . . . . . . . . . 3. V. cristat.
ibbous, not epurred or sacate at the base . . . . . . 4. V. alpina.

1. Vanda parviflora Lindl. in Bot. Reg. xxx (1844), Misc. 45.

S'em stout, 1 to 3 din . long, enveloped in the sheath-bases of fallen leaves. Lacves 7.5 to 10 cm . long and 1 to 1.3 cm . broad (whes fattened out), lincar-oblong,
conduplicate, keeled, unequally and obtusely 2 -lobed at the apex, not narrowed at the base. Inforescance from below the leaves and about as long; peducle us long as the raceme, bearing a few small seattered sheaths; roceme few-flowered; forad bract ovate, acute, deciduous. Flowers 1.5 cm . in diam. Sepals and pelals yellow. Sepals spathulate, obtuse, spreading, the lateral pair shorter than the dorsal. Petals spathulate-obloner, falcate, as long as the lateral sepals, spreading. Lip adnate to the font of the column, spurred; side lobes erect, oblong, rounded or subncute; terminal loje decurved, fleshy, oblong or cuneate-obovate, with a dilated truncate or retuse erose apex; the upper surface blue, caruncled and with a deep groove down the centre; spur slender, conical, half as long as the lip. Colunn short and thick, with a very short fout. Anther depressed, slightly beaked in front; pollinia subglobose, bifid, attached to a short caudicle. Capsule about 2 cm . long, fusifora, with winged ridges. Wight Ic. 1669 ; Reichb. f. in Gard. Chron. 1877, ii, 166; Hook, f. Fl. Br. Ind. vi, 50; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 215, t. 286. Arides Wightianum Lindl. in Wall. Cat. 7320 ; Gen. and Sp. Orch. 238 ; in Journ. Linn. Soc. iii, 40 ; Bot. Mag. 138; Wight Ic. v, p. 8; Dalz. \& Gibs., Bomb. Fl. 265.

Dehra Dun, Mackinnon; and along the bases of the outer ranges of Garhwal and Kumaon, Edgeworth, Duthic's collector Nos. 25824 to 25826. Flowers in May. This species extends eastwarls to Nepal, Sikkim, Assam and Burma; also southwards through Central, W. and S. India to Ceylon.
2. Vanda Roxburgimi R. Br. in But. Reg. t. 506.

Stem climbing, 36 dm . long, emitting wany thick white fleshy roots. Leaves bifarious, approxinate, $1 \cdot \bar{i}$ to $\overline{\mathcal{Z}}$ din. long, narrow, complicate, keeled, the apex pramorse. Racemes 3 -10-flowered, longer than the leaves; peduncle $\mathrm{b}^{6} \mathrm{j}$ to 2 dm . long. Flowers 3.5 to 5 cm . in diam. Sepals and petal subequal, spreading, clawed, obovate, undulate, yellowish-green or bluish tessallated with brown, their claws and outer surfaces white. Lip about half as long as the sepals; side lobes small, acute; apical lobe panduxiform, with a purple dilated truncate 2 -lobed apex, the margins deflexed; disk convex, with fleshy ridges. Spur conical, hairy inside. Pollinia globose; candicle broad, attached to a subquadrate gland. Capsulc clavate, sharply ridged. Lindl. Gen. \& Sp. Orch. 215; Fol. Orch. 3; Wight Ic. t. 916; Fl. des Serres ii, t. 11; l'axt. Fl, Gard. t. 42, f. 2 ; Reichb. Fl. Exot. t. 121 ; Ill. Hort. t. 185 (var.) ; Hook. f. Fl. Br. Ind. vi, 52. V. tesselloides Reichb. f. in Walp. Ann. vi, 864. Cymbidium tesselloides Roxb. Fl. Ind. iii, 463. C. tesscllatum Swartz in Nov. Act. Upsal. vi, 75 ; Willd. Sp. Pl. ir, 102; Rexb. Fl. Ind. 1. c. C. Allagnatea Herb. Ham. Epidendrum tessellatum Roxb. Cor. Pl. i, 34, t. 42. Aerides tessellatum Wight in Wall. Cat. 7318 ; Lindl. Gen. \& Sp. Orch. 240. Vanda Jones in Asiat. Res. iv, 302.

Forests in the Sub-Himalayan tracts of Oudh, R. Thompson; Bahraich district wear the Nepal frontier, Duthic's collector No. 23867 ( $\mathrm{a} \& \mathrm{~b}$ ); northern portion of the Gonda district, Duthe's collector Nos. $22792 \& 23867$. Often found on the branches of mango trees and of Bassia lutifolia. Flowers during the rains. It is also found in Belgal, Beinar, the Central Provinces and westwards to Guzerat and the Konkan, extending southwards to Travancore, Ceylon and Tenasserim. In thr Chanda district the roots, called rasna or nai, are used medicinally.

Ann. Roy. Bot. Gard., Calc., Yol. IX.

Plate 116. Vanda Roxburghii R. Br. Portion of plant,-of natural size. Fig. 1, a flower; 2, ditto with sepals and petals removed; 3, vertical section of column and lip; 4, front view of column; 5 , anther ; 6 , pollinia; -all enlarged.
3. Vanda cristata Lindl. in Wall. Cat. 7328.

Stem 7.8 to 1.5 cm ., stout, covered with the remains of old sheaths. Leaves bifarious, crowded, 7.5 to 10 cm . long, narrowly oblong, conduplicate, truncately and unequally bilobed at the apex, dilated at the sheathing base. Racemes not exceeding the leaves, axillary, 2-5-flowered. Flowers 3.5 to 5 cm . across. Sepals and petals incurved, pale olive-green or yellowish. Sepals subequal, oblong, oituse. Petals narrower than the sepals, oblong. Lip adnate to the base of the column, longer than the sepals, green blotched with dull purplish-brown, basal lobes erect, triangular, terminal lobe oblong, with two divaricate oblong lobules and a horn-like fleshy beak pointing downwards from under the apex, upper surface with fire carunculate ridges. Column short, without a foot. Anther depressed, with a prominent central ridge, pollinia oroid, attached by a sloort broad caudicle to a quadrate gland. Capsule narrowly clarate, 5 to 6.5 cm . long. Liudl. Gen. \& Sp. Orch. 216; Sert. Orch. frontisp. fig. 3; in Bot. Reg. (1842), t. 48; Fol. Orch. 10; Bot. Mag. 4304; Walp. Ann. vi, 8,69 ; Warner's Orch. Alb. vii, t. 290; Gartenfl. t. 680; Hook. f. Fl. Br. Ind. vi, 53; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 216, t. 287. AErides cristatum Wall. MSS. AE. sp. Griff. It. Notes, 203, No. 1188.

Dehra Dun and Mussoorie range up to 4,000 feet, Mackinnon (Duthie's No. 21785); Garhwál, Duthie's collector No. 25827 ; Kumaon 3 to 4,000 feet, Strachey \& Winterbottom No. 21, Colonel Davidson. Flower's in May. It exteuds eastwards to Sikkim, Bhutan and Sylhet.
4. Vanda alpina Lindl. Fol. Orch. 10.

Stem and leaves as in V. cristata. Racemes much shorter than the leaves. Fiowers solitary or in pairs, nodding, about 2 cm . long. Sepals and petals subequal, connivent, oblong, blunt, the colouring as in $V$. cristata. Lip adnate to the column, gibbous but not saccate or spurred at the base; side lobes shallow, rounded; terminal lobe retuse, its upper surface with shallow ridges. Column short, stout, with no foot. Anther flattened; pollinia ovoid, caudicle subquadrate, gland transversely oblong. Capsule $7 \cdot 5 \mathrm{~cm}$. long, narrowly clavate. Hook. f. Fl. Br. Ind. vi, 53; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 217, t. 289. V. Grifflhii Lindl. in Paxt. Fl. Gard. ii, 22; Fol. Orch. 10 (excl. cit. Griff.). Lnisia alpina Lindl. in Bot. Reg. 1838 . Misc. 56.

Garlwál, T. Thomson; Kuuaon 3,500 feet, Strachey \& Winterbottom No. 22. Flowers during June and July. It extends eastwards to Nepal, Sikkin and the Khasia Hills.

## 25. Saccolabium Blume.

Epiphytes without pseudo-bulbs. Laves coriaceous, flat or conduplicate, often keeled. Flowers usually small, in leaf-opposed or supra-axillary racemes corymbs umbels or panicles, floral bract minute. Sepals and petals adnate to the column, subequal, spreading or reflexed. Lip sessile on the footless column, consisting of a cylindtic or saccate spur, without calli and non-septate, with or without small lateral
lobes; the apical loies small, without a scale or callus under tho short broad truncate column, often hairy. Anther 1- or imperfectly 2-celled; pollinia 2, entire or bipartite. Species about 55, inhabiting Eastern Asia.

Spur oylindrio, straight ... ... ... 1. S. papillosum.
Spur short, wide, saccate, at right angles to the ovary.
Apes of leaves not setulose, terminal lobe of lip papillose-hairy ... ... ... Aprox of leaves betulose, terminal lobe of lip deshy and glabrous
2. S. calceolare.
3. S. distichum.

1. Saccolabiem papillosum Lindl. in Bot. Reg. t. 1552 (excl. syn.).

Stems erect, clustered, rigid, stout, bearing many nearly horizontal leaves. Leaves coriaceous, 7.5 to 10 cm . long. and about 1.5 cm . broad (when flattened out). conduplicate, curved, the apex truncate or deeply notched. Peduncle leaf-opposed, about 13 mm . long, bearing a sub-corymbose 4- to 8 . flowered raceme. Flowers 9 mm . across, oral bract triangular. Sepals and petals jellow, barred and blotched with brown. Sepals subequal, oblong, subacute, spreading. Petals narrower than the sepals, subspathulate. Lip longer than the sepals, adnate to the base of the column, side lobes none, terminal lobe decurved, ovate-oblong, obtuse, crenate, upper surface transversely rugulose, white with transverse purple bars, spur half as long as the ovary and parallel to it, cylindric or slightly tapering, pale yellow, hairy within. Column short. Anther broadly conical; pollinia 2, deeply bipartite, subovoid; caudicle slender, tapering downwards to the small oblong glaud. Capsule about 3 cm . long, fusiform, ridged, Lindl. Gen, and Sp. Orch. 222 ; Hook. f. Pl. Br. Ind. vi, 63 ; King \& Pantling in Ann. R. Bot. Gard. Calc viii, 219, t. 290. S. carinatum Griff. Notul. iii, 354. Acampe papillosa Lindl. Fol. Orch. 2; Walp. Ann. vi, 873.

Dehra Dun in the Narkaunda swamp, Gamble No. 23272, Mackinnon; Garhwál, Duthie's collector Nos. 25815, 2ō823; Kumaon, Duthie's collcctor No. 24126. Flowers during the cold season. It extends eastwards to Sikkim, Khasia, Assam, Chittagong, the Bengal Sunderbuns and Burma.
2. Saccolabium calceolare Lindl. in Wall. Cat. 7302.

Stem short, pendulous. Leaves 1 to $2 \cdot 8 \mathrm{dm}$. long, narrowly oblong, unequally bifid at the apex, slightly narrowed to the base. Racemes much slorter than the leaves, corymbose, many-flowered, the peduncle bearing several short sheaths. Flowers 1.6 cm . across, crowded; flural bract small, broad and blunt. Sepals and petals pale green with large roundish brown spots. Sepals unequal, spreading; the dorsal one obovate-oblong; the lateral pair oblong, falcate, narrower than the dorsal. Petals shorter than the sepals, oblong-obovate. Lip adnate to the lower half of the column, the base forming a short wide yellow sac about half as long as the ovary; side lobes absent; terminal lobe at right angles to the sac, semicircular; its upper surface, except a triangular yellow patch at the base, pure white and covered with hair-like papillæ, Culemn very short and thick. Anther depressed, shortly beaked; pollinia broadly ovoid-elliptic, attached by a sleader caudicle to a swall cordate gland. Lindl. Gen. and Sp. Orch. 233 ; Sert. Orch., Frontisp. 6 ; iu Bot. Reg. 1838, Misc. 139 ; in Journ. Linn. Soc. iii, 33 (ercl. syn.); Griff. Notal.
iii, 356 ; Itin. Notes 170 , No. 869 ; Ic. Pl. As. t. 334 ; Walp. Ann. vi, 883 ; Hook. f. Fl. Br. Ind. vi, 60 ; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 225, t. 300. Frides calerolare Smith in Rees Cyclop., Suppl. AE. leoparãorum Wall, MSS. Gastrochilus calccolaris Don. Prod. 32. Sarcochilus nepalensis Spreng. Syst. Veg. iii, 721. Epidenarum calceolare Ham. MSS.

Dehra Dun, Gamble No. 25589, Mackinnon; Garhwál, Falconer, Duthie's collector No. 25814. Flowers during April and May. It extends eastwards to Nepal, Sikkio and the Khasia Hills.
3. Saccolabium disticeum Lindl, in Journ. Linn. Soc. iii, 64.

Stems $1 \cdot 5$ to $2 \cdot 5 \mathrm{dm}$. long, pendulous, branching, slender, leafy. Leaves 2 to 25 cm. long, narrowly lanceolate, acuminate, with two, rarely three, fine setre; the base sessile and slightly oblique. Peduncles leaf-opposed, about equalling the leaves in length. Flowers two to four in a lax raceme, 12 mm . across, green, irregularly spotted with brown; floral bract oblong, subacute. Scpals and petals subequal, oblong-elliptic, obtuse. Lip about as long as the sepals, adnate to the lower half of the column, the base with a wide blunt sac at right angles to the ovary, its inner surface without hairs or calli; side lobes none; terminal lobe yellow, semicircular, entire, smooth, fleshy, its margins deflexed, the base with two blunt conical calli. Column broad; rostellum short, broad. Anther shortly beaked in front; pollinia 2, elliptic; caudicle long, slender, cylindric; gland elongate, bifid. Capsule fusiform, about 1.5 cm . long. Reichb. f. in Ot. Hamb. 43 ; Hook. f. Fl. Br. Ind. vi, 64 ; in Aun. R. Bot. Gard. Calc. v, 49, t. 7 is (in part) ; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 227, t. 303.

Garhwál, near 'Tehri, 6,000 feet, Mackinnon's collector (Duthie's No. 24196); Sub. Himalayan tract of the Bahraich district in N. Oudh, Duthie's collector No. 23869. Flowers in April and May. It estends eastwards to Sikkim and Manipur.

## 26. Cleisostoma Blume.

Epiphytes without pseudo-bulbs. Stems more or less elongated, leafy. Leaved coriaceous or fleshy, flat or semiterete. Inflorescence leaf-opposed, racemose or paniculate. Sipals and petals adnate to the column, subequal, spreading. Lip sessile on the footless column, the base with a large saccate or infundibuliform spur, sometimes dilated at the apex, its cavity more or less closed by two calli the posterior of which is often bifid, and sometimes also by a dorsal scale, but never by a septum; lateral lobes small or absent; apical lobe thickened, concave. Column short, thick, without a foot. Anther depressed ; pollinia 2, often bifid, caudicle single.-Species about 40, Eastern Asiatic and Australian.

Cleisostoma micranthum King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 234́4, t. 312.

Stem stout, compressed, 7.5 to 20 cm . long, enveloped in leaf-sheaths. Leaves $0 \cdot 5$ to 3 cm . long, narrowly oblong, keeled, obliquely truncate and slightly bifid, the base shortly sheathed. Racemes leaf-opposed, longer than the leaves, peduncle and rachis stout. Ilowers many, 5 mm . across; floral bract broad, blunt, less than half as long as
the short sessile ovary. Sepals and petals white with large purple spots. Sepals broadly ovate, obtuse, spreading. Petals smaller than the sepals, oblong, spreading. Lip fleshy, pink or purple, as long as the sepals; the base with a wide blunt spur adpressed to and as long as the ovary, its interior with two calli near the mouth, one on the back wall and a larger one on the anterior wall; dorsal scale absent; lateral lobes small; the terminnl lobe oblong, convex, blunt, its edges thin and erose, upper surface smooth. Column very short, stout, without a foot, but with a large protaberanco on either side of the rostellum. Anther depressed, with a long pointed beak; pollinia 2, obovoid, caudicle triangular, cordate or oblong, attached to a small triangular gland. Saccolabium micranlhum Lindl. in Wall. Cat. 7300 ; Gen. and Sp. Orch. 220; Saunder's Refug. Bot. t. 110; Hook. f. Fl. Br. Ind. vi, 59.

Dehra Dun, Vicary, Mackinnon; Gurhwál Falconer, Duthie's collector No. 25809; Kumaon in the Gori Valley 2-3,, 00 feet, Duthie. Flowers during June and July. It extends eastwards to Sikkim, the Naga and Khasia Hills; also in T'enasserim.

## 27. Sarcanthus Lindl.

Epiphytes without pseudo-bulbs. Stems usually elongate. Luaves fleshy, terete or flat. Inflorescence extra-axillary, racemose or paniculate. Sepals subequal, all spreading or reflexed, or the dorsal concave and connivent over the column. Petals smaller than the sepals, spreading. Lip adnate to the base of the column or of its foot, rarely jointed; the base with an infundibuliform spur sometines dilated at the apex, the interior with a callus both on the anterior and posterior wall, and always divided into two lateral compartments by a vertical antero-posterior septum; lateral lobes small, more or less triangular and acute; apical lobe small, triaugular or hastate. Column short, stout, often with a foot as long as or longer than itself. Anther depressed ; pollinia 2, bifid.-Species about 35, in Eastern Tropical Asia.

Sarcanthus insectifrr Reichb, f. in Bot. Zeit. (1857), 159.
Stem 3 dm . or more in length, scandent, robust, flexuous, giving off on all sides elongate fibres. Leaves crowded and almost imbricate, $3 \cdot 5$ to 5 cm . long, distichously spreading, oblong, amplexicaul, obtusely 2-lobed, rigidly coriaceous. Kacemes nearly sessile, shorter than the leaves, few-flowered, decurved, rachis thick; floral bracts minute, deciduous. Flowers 13 mm . across. Sepals and petals 3 -nerved, yellowish-green stristed with red. Sepals ovate-oblong, obtuse or subacute. Petals oblong. Lip broadly funnel shaped, with a ring of hairs at its mouth, tapering into a conical spur, white to rose or purple; side lobes short; terminal lobe larger than the sepals, triangular-ovate or cordate, thickened under the attenuated apex; spur septate. Column very short. Anther hemispheric; poliniz sulcate, attached to a short quadrate stipe broader than long; gland transverse membranous. Hook. f. Fl. Br. Ind, vi, 68.

Outer Garhpial bills near the Rámganga Valley, Duthic's collector No. 25817; SubHimalayan tract of the Babraich district of N. Oudh, Duthie's collector No. 23969. Flowers in September. It extends eastwards to Behar, Cachar and Chittagong aud is found also in 'Tenasserim.

## TRIBE IV.-LISTEREE.

Anther terminal (dorsal in Epipactis), pollinia 2 or 4, cohering by their sides, with. cut candicles (except in Epipogum), polleu powdery.

28. Epipogum Gmelin.
'rerrestrial leafless brown-coloured saprophytes with tuberous or coralloid roots. Scape erect, bearing a few sheathing membranous bracts. Flowers few, laxly racemose. Sepals and petals subequal, free, narrowly oblong, erect or connivent. Lip adnate to the base of the column, ovate, entire or 3 -lobed, the base broad and spurred, disk with? papilose ridges. Column short, without a foot. Stigma broad, prominent. Anther thickcoed, convex, 2 -celled; pollinia 2, broad, bifid, each attached to a short rudimentary caudicle, gland sone. Species 3, all found in India.

| Root coralloid, lip 3-lobed | ... ... | ... | L. | E. aphyllum. |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Root tuberous, lip entire | ... | .. | .. | 2. | E. tuberoosum. |

1. E. aphyllum Swartz Sumn. Veg. Scand. 32.

Whole plant 1 to 2 dm . high, glabrous. Root branching, coralloid. Scape stout often swollen above the base, bearing two or three unequal sheathing bracts. Raceme 3.5 cm . long, 3 - to 6 -flowered. Flowers about 2 cm . across, pale yellow, floral bract longer than the stalked tumid ovary, concare, oblong-elliptic, membranous. Sepals and petals erect, connivent, narrowly cblong-laveoolate, subacute. Lip large, 3 -lobed; side lobes large, rounded, erose at the apex; terminal lobe deflexed, ovate, acute, concave, its upper surface with line of red gland-like warts. Spur as long as the lip, thick, blunt, dursally
flattened. Column stout, curved, the edges of the clinandrium lobulate. Stigma vely large, occupying the anterior face of the column. Anther globose; pollinia obliquely obovoid, compressed, caudicles very slender. Boiss. Fl. Or. v, 93 ; Reichb. Ic. Fl. Germ. xiii, t. 468 ; Honk. f. Fl. Br. Ind. vi, 12s; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 252, 334; Collett Fl. Siml. 497. E. Gmelini Rich. Orch. Eur. Annot. 36; Lindl. Gen. \& Sp. Orch. 383 ; in Journ. Linn. Soc. i, 176 ; Bot. Mag. 4321. Satyrium Epipogium Linn. Syst. Veg. 676; Jacq. Fl. Austr. i, t. 84.

Kasinnir in the Liddar Valley $8-9,000$ feet, C. B. Clarke No. 31102, Duthie's collector No. 25385 and A; Sind Valley 8,500 feet, C. B. Clarke No. 30980 ; on the Chor near Simla 8,000 feet, T'. Thomson No. 124, Collelt; near Gangotri in the Bhagirathi Valley, Dullic's collector No. 1194; near Naini 'Tal in Kumaon, Colonel Davidson. Flowers during September. It is found also in Sikkim and extends wertwards to Europe and W. Asia.
2. Epipogum tubehosum Duthie, new species.

Whole plant 1 to 3 dm . high, glabrous. Root tuberous, not coralloid. Scape usually swollen above the base and tapering upwards, bearing a few membranous broad-based bracts. Raceme laxly $3-5$-flowered, floral bruct ovate-lanceolate, acuminate, entire, longer than the slenderly stalked subglobose ovary, 5-nerved. Sepuls and petals 8 mm. long, broader than those of E. aphyllum, all 3-nerved. Lip without side lobes, 9 mm . long, ito upper surface with three carunculate ridges, maryins not erose. Spur as in $E$. ophyllum, but more slender and with a less rounded apex. Stigma occupying a deep cavity un tho anterior face of the column. I'ollinia globose, with caudicles equal to them in lengti, glands minute globular.

Kashmir, in the Sind Valley at (6,000 fent, C. B. Clarke No. 31230; Liddar Valley $8.9,000$ feet, Liuthe's collector No. 29.386 \& A. Elowers in September.

Very similar to the preceding in gederal appearance, but spacifically distinct by reason of its tuberous non-coralloid root, its entire lip and by the very different pollivia and column.

## 29. Listera R. Brown.

Terrestrial, erect, 2-leaved or leafless herbs, witu fibrous roots. Leuvcs when preseat opposite or subopposite, rarely alternate, membranous, sessile or subsessile. Flowers small, racemose. Sepals and petals subequal, free, spreading or reflesed. Lip adnaie to the base of the column, usually pendulous and longer than the stpals, narrow, the apex usually bifd, sometimes 3.fid. or entire (erect and similar to the petuls in L. microglottis). Column stout, cyhndric, usually curved forwards. Anther depressed, its lip obtust; polinia 2 or 4 , cohering in pairs, rostelluin short. Species about 20, inbatit. ing $N$. temperate regions and high elevations on the Himalaya.

Leaves 2, large, sub-opposite ... ... ... 1. L. ovata.
Leares none.
Lip nuch longer than the sepals and petals.
Lip ${ }^{\text {endulous. }}$

> Pelals spathulate, subacute; ovary subglobose ... 2. L. Inayatı.

Yetals small, linear; ovary obliquely obovate ... 3. L. Lindieyank.
Lip spreading almist parallel with the curved
column ... ... ... ... 4. L. kashmirian".
Lip erect and sivilar to the petals ... ... ... 5. L. micloglottis.

1. Listera ovata R. Biown in Ait. Hort. Kew. ed. 2, v, 201.

Rhizome short, giving off numerous thick root-fibres. Stem 1 to 1.5 lm . long, enclosed within the leaf-sieaths, and with one empty sheath at the base. Leaves sessile, sub-opposi'e, $\bar{j}$ to 10 cm . long, broadly elliptic, apiculate, many-nerved. Scape terete, 1 1o 1.5 dm . long, puberulous, bearing a few scattered ovate acuminate bracts below the raceme. Raceme 8 to 15 cm . long, laxly many-flowered; floral bract about as long as the pedicel, ovate, acuminate. Flowers 13 mm . long. Sepals and petals subequal in length, connivent. Sepals ovate, subacute, deep green. Petals linearoblong, pale green. Lip sharply deflexed, twice as long as the sapals, yellowish, linearobovate, deeply bifid, with a minute apiculus in the sinus, upper surface with a linear nectar-secreting groove towards the base. Column stout, arching forward over the back of the anther. Rostellum prominently projecting between the anther and the fertile stigma. Lindl. Gen. and Sp. Orch. $4 \grave{5} 5$; Boiss. Fl. Or. v, 92 ; Ledeb. Fl. Ross. iv, 80 ; Reicibb. Ic. Fl. Germ. xiii, 147, t. 479; Hook. f. Fl. Br. Ind. vi, 10 t. Ophrys ovata Linn. Sp. Pl. 1340. Epipactis ovata Swartz Act. Holm. 232. Neotia latifolia Rich. Orch. Annot. 37.

Mozae Juyen in Hazara, Falconer's collector; Gurais Valley in Kashmir, 7 to 8,000 feet. Duthie's collecior No. 253§9; Sind Valley in Kushmir, Duthie's collector No. $25389(a)$. Flowers during June and July. Distributed throughout Europe to the Ural and Caucasus Mts.

Falconer's Hazara specimens were gathered on the 10th of June 1839, and sixty-tbree years afterwards this species was rediscovered by Iuayat Khan of the Botanical Department of $\mathbf{N}$. India.

Plate 117. Listera ovata R. Brown. A plant,-of natural size. Fig. 1, single flower; 2, lip; 3, side view of column with ovary and bract; 4, front view of column with ovary; 5, anther; 6, pollinia;-all enlarged.

## 2. Listera Inayati Duthie in Journ. As. Soc. Bengal lxxi, part 2, 41.

Whole plant 1.5 to 2 dm , high, yellowish-brown. Rootstock emitting from its base many upturned wiry rather stout fibres. Stem stout, bearing four to six large loose llunt sheaths, those of the upper pair opposite and sub-foliaceous but not green. Raceme 6 to $9 \mathrm{~cm} .$, densely flowered, its machis gldndular-pubescent; floral bract longer than the pedicel, lanceolate, acuminate, with involute margins. Sepals and petals about 2 mm , long, connivent; dorsal sopal oval, concave, the lateral pair slightly longer than the dorsal one, obliquely ovate, tapering to an ubtuse apex. Petals about as long as the dorsal sepal, spathulate, subacute. Lip pendulous, twice as long as the lateral sepals, narrowly obovate-oblong, deeply cleft into two slightly spreading obtuse lobes; upper surface with a raised linear callus extending to the sinus. Column short and stout, dilated above and below. Rostellum projecting over the fertile stigma. Anther suborbicular, its apex bifid; pollinia narruwly obovoid. Ovary subylobose, about as long as its stalk, glandular-pubescent.

Discovered in 1897 by Inayat Khan at Bhurj in the Kagan Valley, Hazara, No. 22596. It flowers during July.

A shorter and muoh stouter plant than L. Lindleyana, and with ehorter and more densely flowered racemes; the etruoture of tho flower is also very different. The sub-opposite position and leaf-like appearance of the upper sheaths of this plant suggest an affinity towards Litera proper.

Plate 119. Listera Inagati Duthie. Single plant,-of natural size. Fig. 1, pingle flower, side view; 2, front view of flower, with lip ramoved; 3, side view of ditto with sepals and petals removed; 4 and 5, column; 6, anther; 7, pollinis ;-all enlarged.
3. Libtera Lindleyana King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 258, t. 343.

Whole plant 2 to 3.5 dm . high. Root.fibres rather stout and brittle, ofteu forming a congested mass at the end of the root-stock. Stem longer than the raceme, stout or slender, bearing three or four looss blunt sheaths about 2.5 cm . long, nearly glabrous below, its upper portion together with the raceme glandularpubescent. Leaves none. Flowers dull yellowish-green, 8 to 12 mm . long, lax; foral bract ovate-oblong, varying in length. Sepals elliptic-ovate, sulacute, concave, the lateral ones somewhat falcate. Petals much narrower. Lip two or thrce times as long as the sepals, narrowly obovate-oblong, brown, the apex cleft into two oblong or lanceolate acute lobules; the sinus broad and with a small triangular process at its apex; upper surface minutely puberulous, and with a greenish-coioured linear groove which forms a ridge on the back. Column much curved, dilated at the base and apex. Capsule 8 mw. long, broadly elliptic, often obliquely so, its pedicel about as long. Neottia listeroides Lindl. in Royle Ill. Him. Bot. 368, Gen. \& Sp. Orch. 458 ; in Journ. Linn. Soc. i, 176 ; Hook. f. Fl. Br. Ind. vi, 103 ; Collett Fl. Siml. 495. N. Lindleyana Dene in Jacquem. Voy. Bot. 163, t. 163.

Distributed throughout the Western Himalaya from Hazara to Kumaon at elevations between 5,000 and 11,000 feet, flowering from July to September. It extends eastwards to Nepal and Sikkim, and north-westwards to the district of Chitral.

## 4. Listera kashmiriana Duthie.

Whole plant about 3.6 dm . high. Root-fibres stout, crowded and intricate. Lower portion of glabrous stem stout, enveloped by three or four large loose blunt sheathf, Liaves none. Raceme laxly many-flowered, with a few linear-oblong acute bracts below the lowest flowers, its rachis minutely puberulous. Flowers spreading, 8 mm . long from the base of the slender pedicel to the summits of the sepals and petals, yellowish-brown; floral bract broadly ovate, acute, longer than the pedicel, clothed with minute spreading hairs. Sepals and pelals 2 mm . in length, connivent, sparsely hairy. Lateral sepals obliquely ovate, acuminate. Petals rather obliquely spathulate, rounded at the apex. Lip twice as long as the sepals, spreading almust parallel with the much-curved ovary and column, divided at the apex into two divergent obtuse lobules, the margins ciliate except towards the tapering bese; upper surface with a stout central callus projecting into the sinus. Column l ma. Jang, arched forwards and overlapping the base of the antier. Rostellum wide and prorainent, projecing over the fertile stigma. Anther sub-quadrate, 2-celled, the dividing
septum projecting beyond the emarginate apex; pollinia each with a sunall globular basal gland. Ovary curved, ovate, glandular-hniry.

Liddar Valley in Kashmir between 8,000 and 9,000 feet, Inayat Khan No. 25372, flowering in August.

This plant has the general appearanoe of L. Lindleyana, but the shape of the petals and the direotion of the lip is very different. It agrees with $L$. Inayati as regards the shape of the sepals, and petals, but the raceme is not nearly so dense, the ovary is not globose, and the rostellum is very differeut. As to the existence of the polliniar glund in this species I should mention that fig. 7 of the plate is an exact representation of a pollinium after removal from tho anther, in whioh the impressions of both glands may be seen on referring to fig. 5 of the same plate.

Plate 118. Listera kashmiriana Duthic. Entire plant, -of natural size. Fig. 1, side view of single flower; 2, ditto with sepals and petals removed; 3, a petal; 4, column with anther and rostellum ; 5 , front view of anther; 6, anther seen from behind; 7, pollinium; ald fularged.
5. Listera microglottis Duthie in Journ. As. Soc. Beng. Ixxi, part 2, p. 42.

Whole plant 2 to 3.3 dm . high. Root-fibres thick, cylindrical, brittle, pale yellowish. brown. Stem firm, stout, pale yellow or white, bearing 2 to 4 loose obtuse pale sheaths. Leaves none. Raceme 1 to 2 dm . long; its rachis and the bracts and pedicels glandularpubescent. Flowers crowded, about 7 mm . in diam., pale green ; pedicel a little longer than the ovary; floral bract equalling or exceeding the pedicel, oblong, obtuse or subacute. Sepals 4 mm . long, ovate, subacute, sparsely clothed with stiff spreading hairs, the lateral pair somewhat oblique. Petals as long as the sepals, linear-spathulate, margins reflexed. Lip erect, linear-oblong, equalling the petals in length, apex entire, margins reflexed. Column erect, a little shorter than the petals, dilated at its base and apex, overlapping ine auther, rostcllum prominent. Pollinia \&, obliquely obovate-oblong. Ovary with pedicel 8 mm . long. C'upsule obovate, sparsely hairy; its ridges thick and often denticulate.

Discovered by Mr. Mackinnon's collector in Garhwál on the eastern side of Tehri, growing under rhododendrons and oaks at elevations between 5,000 and 6,000 feet, (Duthie's Nos. 24181, 25426 (a); also on the wooded hillsides below Mussoorie at similar elevations (No. 25426). Flowers during August and September.

This plant differs from any known species of the Neottia section by its erect and very remarkably restricted lip. It buars a certain resemblance to $N$. micrantha Lindl., but the sepals, petals sad lip are quite different.

Plate 120. Listera microglotis Duthie. A plant,-of natural size. Fig. 1, a single flower ; 2, ditto with the sepals and petals removed; 3 and 4 , the petals flattented out; 5 , lips flattened out; 6, front view of column showing the anther in situ and the rostellum; 7 , side view of ditto; 8 , empty anther ; 9 , pollinia;-all enlarged.

## 30. Gastrodia R. Brown.

Terrestrial leafless parasitic herbs of a brownish colour, with rizomes and elongated roots. Stem erect, sheathed. Flowers in a lax raceme. Sepals connate with the petals into a ventricose 5 -lobed tube slit anteriorly. Lip short, its base
adnate to the foot of the column and to the perianth, blado entire. Column usually long, narrowly winged, its foot short or none; rostellum small, stigma large. Anther terminal, convex, tumid; pollinia 2, subclavate, without caudicle or gland.-Species 9, Asiatic and Australian.

Gastrodia onobanchoides Benth. in Gen. PI. iii, 617.
Ront a large oblong or ellipsoid often annulate tuber, parasitic by a small fibroug base to the roots of other plants. Stem 2.5 to 6 dm . long, usually very stout; sheath distant, short, loose, the lowest one almust truncate, the upper acute or acuminate Racente 2 to 3 dm . long, laxly many-flowered; floral bract linear-lanceolate, acuminate; often longer than the ovary, 3 -nerved. Flowers sub-erect, light reddish-brown tinged with yellow. Perianth about 12 mm . long, ventricose and slightly gibbous, slit half-way down in front on either side of the lip to the level of the insertion of the latter. Sepuls all equal, obtuse. Petals sub-orbicular, inserted within the sinuses of the sepals and a little shorter than them. Lip longer than the sepals and about half the length of the perianth, ovate, its edges undulate, the apex concave and reflexed. Pollinia obovate. bipartite, coassely granulate. Capsule about 2 cm . long, erect, turgid. Hook. f. Ic. Pl. t. 1852 ; Fl. Br. Ind. vi, 122; Collett Fl. Siml. 497. Gamoplexiz Falc. in Royle III., 364; Lindl. Gen. and Sp. Orch. 35t. G. orobanchoides Falc. in Trans. Linn. Soc. xx, 293, t. i3.

Kashmir and on the Murree Hills at about 7,000 feet, Aitchison; Chenab Valley, Baden-Powell; Bashahr Hills at about 7,000 feet, Lace No. 978 ; Simla Hills 7,000 to 8,000 feet, T. Thomson, Gamble No. 6217; Babington-Smith; Kángra district, Duthie's Collector No. 23343; Deoban in Jaunsar at 9,000 feet, Gamble No. 27284; Garhwál, Falconer; Mussoorie Hills, Mackinnon (Duthie's No. 2:984), Duthie's collector No. 24163; dear Naini Tal in Kumaon, F. W. Seers. Flowers in July and August.

Plate 1:2. Gastrodia orobanchoides Benth. Upper and lower portions of plant,—of natural size. Fig. 1, single flower; 2, perianth, spread out; 3, side view of columu and ovary; 4, front view of ditto; 5 and 6 , anther ; 7, pollinia; 8 , capsule; 9 , transverse section of ditto;-all enlarged.

## 31. Aphyllorchis Blume.

Terrestrial leafless herbs with rhizomes and thick roots. Stem simple, sheathed. Flowers in racemes, brown-coloured. Sepals subequal, free, erect or spreading. Petals, smaller than the sepals. Lip sessile on the base of the columen, or attached to it by a short claw, as long as the sepals, oblong, sometimes auricled at the base, entire or 3 -lobed. Column usually rather long, not winged. Stigma anticous, concave, ovate or oblong or clavate.-Species about 6, Indian and Malayan.

Apiyllorchis Gollani Duthie in Journ. As. Soc. Beng. laxi, part 2, p. 42.
A tall scapigerous parasite. Rhizome with far-extending thick fleshy roots, not scaly Scape 4 to 5 dm . high, erect, stout, bearing several unequal tubular blunt sheaths Raceinc about 1 dm . long. Flowers 8 to 10 , crowded, 3.3 cm . long ; foral bract longer
than the slender clavate ovary, elliptic-lanceolate, acuminate, 5-7-nerved, at first deflexed, but afterwards erect. Sepals as long as the bracts, erect, ovate-lanceolate, acuminate, with spreading tips, their nerves dark reddish-brown on a pale-green ground. Pctals shorter than the sepals, lanceolate, acuminate, pale-green veined with purple, the midrios thickened on the back. Lip slightly shorter than the petals, pale yellowishgreen, attached to the base of the column by the concave winged claw; its apical portion ovate and bluntly acuminate, the margins towards the base reflexed, erosel the apex without any concavity. Column 1.2 cm . long, stout, curved and narrowed towards the base. Anther 2-celled, ite cells parallel. Pollinia ovate-oblong, stigma with an overlapping irregularly lobulate border.

Tehri-Garhwál on Nág Tiba at elevations between 8,000 and 10,000 feet, W. Gollan (Duthie's No. 2062), Duthi's collector No. 23000. Flowers in August.

The original specimens discorored in 1881 by Mr. W. Gollan, after whom I have named the species, were in too young a condition even for determining the genus. Its nearest known ally is A. alpina King \& Puntling, a high-level Sikkim species. It differs from the Sikkim plant in the rhizome not being scaly, the bracts become erect as the flowers expand, the racemes are much shorter, the lip is attached to the base of the column and does not form a pouch, and the epichile has no conoavity at its apex.

Plate 122. Aphyllorchis Gollani Duthie. A plant,一of natural size. Fig. 1, floral bract; 2, side view of flower; 3, ditto, with the sepals and petals removed; 4, lip; 5, front view of column; 6 , side view of ditto ; 7 , anther ; 8, pollinia ; all enlarged.

## 32. Gaieola Lour.

Leafless, yellow or brown, climbing or erect herbs. Flowers rather large, in racemes or panicles on the ends of the stem-branches. Sopals subequal, concave, free, connivent or spreading. Petals as large as the sepals, or narrower or broader. Lip adnate to the base of the column and convolute round it, broad, concare, with or without lateral lobes; apical lobe large, broad. Column dilated towards the apex. Anther conical, 2-celled; pollinia 2, broad, often compressed, powdery.-Species 12; Indian, Chinese, Malayan and Australian.

Galeola Falconeri Hook. f. Fl. Br. Ind. vi, 88.
Rhizome 3.5 to 6.5 cm . thick, branching, bearing large fleshy triangular scales. Stems 18 to 30 dm . in height and about 6.5 cm . thick at the base, clothed at intervals with large ovate-lanceolate acute bracts. Panicle 6 to 9 dm . long, with lax drooping branches. Flowers bright yellow, about 4.5 cm . across, of a spongy texture; floral bract shorter than the short stalk of the ovary, lanceolate, concave. Sepals subequal, broadly ovate, subacute, sparsely furfuraceous like the ovary. Petals ovate, acute, edges erose. Lip sessile, without side lobes, deeply concare, with a small fold under the column, apex rounded, the margins undulate and ciliolate; the upper surface papillose, but with a broad glabrous patch near the centre. Column stout, slightly bent forward. Anther fleshy, glabrous, its lip entire; pollinia 2, much compressed, obliquely ovate. Capsule oblong, subfalcate, sharply angled, $2 \cdot 2$ dm. long, somewhat furfuraceous. King \& lantling in Ann. R. Bot. Gard. Calc. viii, 265, t. 3j3. Pogochilus sp. F'alc. in Hook. Journ. Bot. (1842), 73.

Garhwál, Falconer ; below Mussoorie at about 6,000 feet in wet ground, Mackinnon (Duthie's No. 22726) ; Jaunsar in the Tonse Valley at 4,000 feet, Gleadow. Flowers in July. Found also in Sikkim, but rare.

## 33. Pogonia Juss.

Terrestrial 1-leaved herbs; the flower-scapes from the same tuber as the leaf and appearing before it or contemporaneously; tuber emitting, just below the surface of the ground, 2 or 3 runners, each producing at its extremity a tuber smaller than that of the parent. Leaf broadly cordate or orbicular, strongly plicate. Flowers solitary or in racemes, often pendulous. Sepals and petals subequal, narrow, connivent or spreading. Iap sonuetimes saccate at the base, adnate to the base of the column, rather narrow, the lower part convolute round the column; the lateral lobes small, usually triangular; the terminal lobe flat, ovate or orbicular, entire or fimbriate. Colunin elongate, clavate upwards; stigma anticous, oblong to orbicular. Pollinia 2 or 4, elongate, often cohering, but without either caudicle or gland.-Species about 70, in Asia and America, and a few West Indian.


1. Pogonia Mackinnoni Duthie in Journ. As. Soc. Beng. lxxi, part 2, p. 43.

Tuber globose, annular and warted, about 1.2 cm . in diam. Leaf and scape frequently from the same tuber, but not contemporaneous. Leaf about 5 cm . long and broad, with a cordate base, 7-lobed; terminal lobe acute, the others rounded; principal veins terminating at the ends of the lobes, with many less conspicuous intermediate ones; petiole 2.5 cm . long. Scape 1 flowered, about 10 cm . long when in flower, elongating till fruiting, enclosed within two or three rather loose tubular sheaths. Flowers spreading, shortly pedicelled, 18 mm . long; bract erect, shorter than the cylindrical truncate ovary. Sepals 17 mm . long, linear-lanceolate, acuminate, light green blotched with reddish-brown outside. Petals very similar to the sepals, but a little shorter and not so acute at the apex. Lip shoiter than the petals, oblong when spread out, strongly 3 -nerved, white tinged with green towards the base; side-lobes erect, acute; terminal lobe irregularly spotted with purple. Column slender, 7 mm . long. Anther broad, margins of cells toothed. Pollinia 2, narrowly clavate, connate above their slender tapering bases.

Near Mussoorie between 5,000 and 6,000 feet, Mackinnon (Duthie's Nos. 21781, 22705). Flowers during May and June, and the leaves appear about three weeks later.

This species is very eimilar in habit to P. macroglossa King \& Pantling, but the leaves ars more distinctly lobed; the fowers are smaller aud spreading, and the shape of the lip is ver Jifferent.

Plate 123. Pogonia Mackinnoni Dutiie. A flowering plant and a leaf-bearing plant, -of natural size. Fig. 1, a flower; 2 ditto, with sopals and petals removed; 3 lip, spread out; 4 columu aud ovary; 5 anther ; 6 pollinia ;-all enlarged.

## 2. Pogonia Gammieana Hook. f. in Bot. Mag. t. 6671.

Tuber about 3 cm . in diam., globular, warted. Leaf 1.2 to 1.5 dm . in length and breadth, reniform, abruptly apiculato, glabrous, many-nerved, its edges much undulate; petiole about as long as the blade, sheathed at the base. Scape 1.5 to 2 dm . high, stout, bearing two or three long tubular bracts with acute and sometimes bifid apices. Raceme laxly 5 to 8 -fowered. Flowers 2.5 cm . long, drooping, pink streaked with white, foral bract deflexed, longer than the truncate stalked ovary, linear-lanceolate, acumiante; stalk and ridges of ovary winged. Spals and petals subequal, spathulately oblanceolate, acuminate. sub-comnivent. Lip slightly saccate at the base, elliptic-obovate when spread out, pale green; lower half convolute round the column and with two short triangular forward-pointing side lobes, the disk bearing two parallel ridges; cpichile spreading, its edges deeply crenulate, the disk hairy and bearing three parallel central ridges. Hook. f. Fl. Br. Ind. vi, 120; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 269, t. 359.

Siwalik range, Duthie's collector No. 24194; Dehra Dun, Mackinnon, Duthie's collector No. 2419j; Garhwál, Falconer, Duthic's collector No. 25829. Below Mussoorie at about 3,0n0 feet, Mackinnon (Duthie's No. 22975); Kumaon at Bagesar 3,500 feet, strachey $\$$ Winterbottom No. 19 (Eulophia). Flowers in May and the leaves are full grown düring July. It is found also in Sikkim, in hot valleys.

## 3. Pogonia flabelliformis Lindl. in Wall. Cat. 7400.

T'uber globose, about 2 cm . in diam., annulated, often warted. Leaf 4 to 10 cm. in diam., appearing after the flowers, orbicular-cordate, cuspidate, many-nerved, often blotched with reddish-purple, hairy on the veins when young; margin undulate, petiole 1 to 2 dm . long, sheathed at the base. Scape stont, 1.5 to 3 dm , high, its lower portion enclosed within loose tubular blunt hyaline sleaths. Raceme laxly 4-6-flowered; floral bract linear-lanceolate, acuminate, more than twice as long as the ovary, reflexed, persistent, lygaline. Flowers about 2.2 cm . long, pedicelled, drooping. Sepals and petals linear-lanceolate, acuminate, somewhat recurved, pale green veined with reddish-purple; the petals rather shorter than the sepals, Lip 15 mm . lons, 3 -lobed near the middle, white tinged with yellow towards the base and cmspicunosly veined with purple; the upper surface with many hairs on the raised central ridges ; side lobes erect, obtuse; terminal lobe defiexed, ovate, obtuse, the margins slightly undulate. Column 7 mm. long, curved from near the base, dilated upwards. Ouary 4 mm . long, oval-oblong. Capsula about 13 mm . long, the ridges winged. Lindl. Gen. and Sp. Orch. 415 ; in Journ. Linn. Soc. iii, 45 ; Hock. f. Fl. Br. Ind. vi, 121. I' Nervilia Blume Mus. Bot. i, 32. P. carinata. - Wight J.c. 1720 (not of Lindl.). Nervilia Aragoana Gaud. in Freyc. Voy. Bot. 422, t. 30.

Near Mussoorie at elevalions between 4,000 and 6,000 feet, Mackinnon, Duthie Nos. 21782, 22704, 22976; Tehri-Garhwál 4 to 5,000 feet. Falconer, Duthe No. 588. Flowers during June and July. It extends eastwards to Parasnath in Bengal and to Burma, and is found also in the Marianne Islands and in Timor

The plant mentioned by Dalzell and Gibson in Bomb. Fl. $2 i 0$ under the name of $P$. fabelliformis as growing "in the densest and shadiest thickets of the Konkan, as well as near Dharwar" is probably $P$. carinata.

Plate 125. Pogonia flabelliformis Lindl. A flowering plant and a foliage plant, -of natural size. Fig. 1, side view of single flower; 2, ditto, with the sepals and potals removed; 3, lip, spread out; 4, column and ovary; 5, upper portion of column; 6, anther; 7, pollinia;-all enlarged.
4. Pogonia carinata Lindl. Gen. and Sp. Orch. 414.

Tuber glohose or obovate, aiont 17 cm . in diam., annulated and warted. Leaf 3.5 to 65 cm . in diam., ovate, acute or cuspidate, cordate or cuneate at the base, 7 -9-nerved, glabrous; petiole 25 to 5 cm . long, sheathed at the base. Scape up to 3 din. high, bearing three or four loose tubular acute or acuminate sheaths. Raceme laxly few- or many-flowered, foral bract twice as long as the pedicelled ovary, erect, lanceolate, acuminate, 5 -nervech. Flowers about 2.5 cm . long. S'pals and petals about equal, spreading, linear-lanceolate, acuminate, green. Lip 18 mm . long, straight, trough-shaped, not saccate at the base, 3-lobed above the middle, white tinged with yellowish-green, veins pink; upper surface hairy on the central ridges and veins; side lobes erect, rather sballow, terminal lobe not deflexed, ovate, acuminate, its margin irregularly toothed. Column 6 mm . long, very slightly curved, dilated at its apex. Anther triangular, beaked in front. Lindl. in Journ. Linn. Soc. iii, 45 (excl. syn. Griff.). P. Aabelliformis Dalz. and Gibs. Bomb. Fl. 270 (not of Lindley). Epipactis carinata, Roxb. Fl. Ind. iii, 454.

In the Sub-Himalayan tracts of Northern Oudh in the districts of Bahraich and Gonda, Duthic's collector Nos. 23864, 23864(a), Rámganga Valley in Kumaon, T. Thomson. Flowers during May, and the leaves appear about a mouth later. This species extends eastwards to Bengal and Burrua and southwards to Bombay and S . India.

Plate 124. Pogonia carinata Lindl. A flowering plant and a foliage plant,-of natural size. Fig. 1, side view of flower; 2, lip, spread out; 3, side view of lip and ovary; 4, column and ovary; 5 , upper portion of column, with the nalher in situ; 6 , anther;-all enlarged.

## 34. Cephalanthera Richard.

Terrestrial leafy herbs with fibrous roots, or leafless and with tuberous roots. Leaves sessile, plicate. Flow is in spikes or racemes, suberect. Sepals and petals subsimilar, free, connivent. Lip shorter than and concealed by tho sepals and petals, aduate to the base of the column, the basal portion concave or saccate and embracing the column; anterior portion short and ribked. Column semiterete; rostellum short or almost obsolete. Anther erect; pollinia 2, bipartite. Stigma onticous. Capsule erect.Species about 10, in temperate regions of the Northern Hemisphera.

Cephalanthera ensifolia Rich. Orch. Annot. 29.
Stem rising from a thin creeping rhizome, $1 \cdot 5$ to 4 dm . high, sheathed at the base. Leaves lanceolate or ovate-lanceolate, conduplicate, 5 to 10 dw . long, upper longer and narrower than the lower. Peduncle 2.5 to 3.8 cm . long. Raceme longer than the peduncle, 8. or more-flowered, glabrous. Flowers white, about 12 mm . long; floral bract ovate-lanceolate, acumiuate or acute, shorter than the ovary. Sepals ovatelanceolate, acuite. Petals somewhat smaller, elliptic, obtuse. Lip oblong, white with yellow spots, distinctly divided across the middle by an oblique sinus into a hypochile and epichile, the former convolute and slightly ribbed; the latter concave and prominently ribbed. Column long, terete. Pollinia livear-oblong, grooved. LindlGen. and Sp. Orch. 412; in Journ. Linn. Soc. i, 172, 175; Boiss. Fl. Or. v, 85 ; Hook. f. Fl. Br. Ind. vi, $12 \overline{0}$; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 271, t. 362 ; Collett Fl. Siml. 497. C. Xyphophyllum Reichb. Ic. Fl. Germ. xiii, t. 470. C. acuninata, Lindl. in Wall. Cat. 7405 ; Gen. and Sp. Orch. 412 ; Wight Ic. 1721 ; Dene in Jacquem. Voy. Bot. 164, t. 164.

Abundant all over the Western Himalaya from Kashmir to Kumaon at elevations between 6,000 and 12,000 feet. It flowers from May to July, and extends eastwards to Nepal, Sikkim and Bhután.

## 35. Epipactis Adans.

Terrestrial herbs with green leaves and fibrous roots. Leaves sessile, plicate. Flowers racemose, drooping; floral bracts elongating and often leafy. Sepals and petals broadly lanceolate, acuminate, strongly nerved. Lip adnate to the base of the column, distinctly divided into hypochile and epichile, the hypochile strongly deflesed, concave or saccate, jointed to the epichile at a right angle, both entire. Column short; stigma large, anticous; rostellum broad, prominent. Anther erect, obtuse, its cells contiguous; pollinia 2 , bipartite, very narrow.-Species about 10, in the Northern 'Temperate Hemisphere.

| lowers usually in dense racemes, hypochile globul ovate-oordate |  | .. | 1. E. latifolia. |
| :---: | :---: | :---: | :---: |
| Flowers distant. |  |  |  |
| Hypoohile trough-shaped, epichile lanceolate |  |  | 2. E. consimilis. |
| Hypochile broadly sacoate, epiohile ovate-lanceolate | cuminat |  | 3. E. gigantea |

1. Epipactis látifolia All. Fl. Pedem. ii, 152.

Stem up to 9 dm . in height, slender, glabrous below, the uppor portion including the peduncle and raceme puberulous. Leaves $7 \cdot 5$ to 13 cm . long and from 5 to $7 \cdot 5 \mathrm{~cm}$. in breadth, smaller upwards, orbicular to ovate-lanceolate or ovate-elliptic, acute, manynerved, glabrous, but the margins often ciliolate. Raceme 1 to 3 dm . long, manyflowered, usually dense. Flowers subsecund, $1 \cdot 3$ to 2 cm . across, green; foral bracts linearlanceolate, acuminate, the lowermost large and leaf-like. Sepals lanceolate, acuminate. Petals like the sepals but smaller. Lip shorter than the petals; the hypochile forming a subglobose sac, reddish-brown inside; epichile broadly cordate, with erose edges, upper surface with usually two globose calli ncar its base. Column short and broad, white; stigma broad. Staminodes triangular. Swartz in Act. Holm. for 1800, 232 ; Lindl. Gen.
and Sp. Orch. 461 ; Boiss. Fl. Or. v, 87 ; Reichb. Ie. Fl. Germ. xiii, p. 146, tt. $184-$ 186 ; Hook. f. Fl. Br. Ind. vi, 125; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 271, t. 363. E. macrostachya Lindl. in Wall. Cat. 7404. E. consimilis Don. Prod. Fl. Nep. 28, not of Wall. E. Dalhousice Wight Ic. 1723.

Common throughout the Western Himalaya at elevations between 5,000 and 11,000 feet. Flowers during July and August. It extends eastwards to Nepal and Sikkim, and is found also in N. Asia, Japan, Hongkong, Europe and N. Africa.

Var. 1. lerbacea Hook. f. in Fl. Br. Ind. l.c.; smaller; leaves elliptic, acute; raceme, short, dense-flowered; flowers 1.3 cm . in diam., glabrous, pale greenisl.white. E. lerbacea Lindl. in Royle Ill. 368 ; Gen. and Sp. Orch. 462.

Near Mussoorie, Royle; also in Upper Burma.
Var. 2. Thomsoni Hook. f. in Fl. Br. Ind. vi, 126; a small slender plant with lanceolate leaves, the margins not ciliolate; raceme lax, floral bracts deflexed; flowers 13 mm . in diam., glabrous. E. macrostachya Wight l.c. 1722 (not of Lindl.).

Western Tibet 10 to 11,000 feet, T. Thomson; near Naini Tal in Kumaon, Duthie's collector No. 24088.

## 2. Epipactis consimilis Wall. Cat. 7403 (not of Don).

Height of whole plant $3 \cdot 5$ to 6 dm . Stem glabrous, Leaves 1.5 to 2 dm , long, lanceolate, acuminate, the uppermost shorter and much narrower, nerves prominent. Raceme l to 1.5 dm . long, laxly flowered, its rachis tomentose. Flowers 2 to 2.5 cm . across; floral bract ovate or linear-lanceolate, varying in size. Sepals spreading and pubescent outside, unequal, concave; the dorsal one lanceolate, acute; lateral pair much wider. Petals ovate, acute, tomentose outside on the thickened midrib. Lip a little shorter than the sepals; hypochite trough-shaped, bearing granular unequal calli inside, with two larger obtuse semi-transparent nectar-exuding ones near the apex; epichile lanceolate, with erect lobes, the upper surface with a median ridge terminating below the white apex. Column stout, much curved. Stigma large, subrotund, with two glands on the lower margin. Anther tumid. Hook. f. Fl. Br. Ind. vi, 126; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 272, t. 364; Rolfe in Journ. Linn. Soc. xxxvi, 48. E. veratrifolia Boiss. \& Hohen. Diagn., Ser. 1, xiii, 11; Boiss. Fl. Or. v, 87 ; Lindl. in Journ. Linn. Soc. i, 174.

Gilgit district, Winterbottom No. 956; Chitral district, Duthie's collector Nos. 16673, 10674 ; Bashahr, Lace No. 352 ; near Simla, 3,000 feet, Collett; N.-W. India, Royle; Garhwál, Falconer; below Mussoorie, Mackinnon (Duthie's No. 22720); Dehra Dun, Duthie Nos. 10783, 22720, Gamble, Mackinnon; Kunaon 3,000 feet, Strachey \& Winterbottom No. 51. Flowers during February and iMarch. It is found in Nepal and Sikkim at low elevations and occurs also on the Shan Hills in Upper Burma. In the Gangetic Plain it is met with along the banks of the Jumna Canal distributaries near Sabarunpur. It grows also in the Peshawar Valley and in the Kurram Valley, and extends through Afghanistan westwards to Syria, and is also found in China.

The sepals of this plant are clothed with white hairs on a deep lavender: ground; inside they are green, as are both surfaces of the petals, and are marked with broad bands of reddish-brown; the hypochile of the lip is purple, and the epichile is pale brown, the apes being pure white.
3. Epipactis gigantea Dougl. in Hook. Fl. Bor. Amer. ii, 202, t. 202.

Stem 3 to 6 dm ., clothed at the base with broad loose sheaths. Leaves 1 to 1.5 cm . long, ovate-lanceolate to linear-lanceolate, the margins and nerves beneath scabrous. Racemes 1 to 2 dm . long, the rachis pedicels and ovaries puberulous. Flowers drooping, distant, pedicelled, 2.5 cm . in diam.; bracts longer than the flowers, lanceolate, acuminate, the lower ones large and leaf-like. Sepals and petals about 2 cm . long, connivent. Sepals green veined with red; dorsal sepals erect, broadly ovate; the lateral pair ovatelanceolate, subacute. Petals rather shorter, obliquely ovate, obtuse, often veined with red. Lip longer than the sepals; hypochile large, saccate, much broader than the ovate or ovate-lanceolate epichile. Column stout with two bluish lateral horns below the clinandrium. Capsule 2.3 cm . long, obovate-oblong. S. Watson Bot. King's Exped. 341; Bot. Calif. ii, 137 ; Coulter Bot. Rocky Mt. Flora 243 ; Hemsl. Biol. Cent. Amer. Bot. iii, 304 ; Lindl. in Benth. Pl. Hartweg. 53 ; Bot. Mag. Pl. 7690; Rolfe in Journ. Linn. Soc. xxxvi, 49. E. americana Lindl. in Ann. Sc. Nat. iv, 385 ; Gen. and Sp. Orch. 462. E. Royleana Lindl. in Royle Ill. 368; Gen. and Sp. Orch. 461 ; in Journ. Linn. Soc. i, 174 ; Hook. f. Fl. Br. Ind. vi, 126 ; Collett Fl. Siml. 499. Cephalanthera Royleana Regel in Act. Hort. Petrop. vi, 490 ; Boiss. Fl. Or. v, 85.

Kagán Valley in Hazara between 8,000 and 12,000 feet, Duthie's collector ; Baltistan at 8,000 to 9,000 feet, T. Thomson, Duthie No. 12075; plentiful also in Kashmir and eastwards to Kumaon at elevations between 7,000 and 11,000 feet. Flowers during July. It extends eastwards to Nepal and Sikkim, and beyond the N.-W. Frontier it is found in Waziristan, and in the neighbourhood of Gilgit and Samarkand. It occurs also in China and in N. and Cent. America.

## TRIBE V.-GOODYEREA.

Anther posticous, vertical but inverted; pollinia two, or four in two pairs, attached to a single gland either by one or by two caudicles, or without a caudicle; pollen granular or sectile.

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Stigma single, anticous; pollinia 2, or 4 in two pairs
    Spike spirally twisted, lip not saceate, pollinia 4 . . 36. Spiranthes:
    Spike not twisted, lip saccate, pollinia 2 . . . . . 37. Goodyera.
Stigmas 2, distant, lateral pollinin 2, bipartite (4 in
    Anactochilus Roxburghii)
    Lip saccate or cymbiform at the base . . . . . 38. Zeuxine.
    Lip spurred, its apex deeply 2 -lobed . . . . . . 39. Anectochilus.
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## 36. Spiranthes Richard.

Terrestrial herbs with tuberous or fibrous roots. Stem leafy. Leaves (in the Indian, species) linear. Flowers small, secund, in a spiral spike. Sepals subequal, free or sometimes cohering with the petals to form an erect hood, the lateral pair gibbous at the base. Lip erect, entire or 3-lobed, the base concave, but neither saccate nor spurred, the disk bearing lamellæ or calli. Column short, terete. Stigma single, brond, anticous; rostellum erect, obtuse or elongate and bifid. Anther erect, 2 -celled; pollina 4, united in pairs, sessile on a small gland. Species about 80 , in temperate and tropical regions.

> Roots fibrous, leaves lanoeolate, radioal
> and cauline. . . . . . . . . . . . . . 1. S. australis.
> Roots tuberous, leaves ovate all radical . . . . . . . . 2. S. autumnalis.

1. Spirantees australis Lindl. in Bot. Reg. sub. t. 823.

Whole plant 1.5 to 4.5 dm . ligh. Root-fibres thick and fleshy. Stem stout or slender. Leaves alternate, clustered near the base of the stem, 3.5 to 10 cm long, shortly sheathing, linear or oblanceolate, acute or acuminate. Peduncle with a few distant very acuminate bracts. Spike 7.5 to 15 cm . long, rachis glandular-pubescent. Flowers very small, crowded, secund, arranged in a spiral, white or pink; floral bract ovate, longer than the sessile ovary; perianth 3 to 5 mm . loug. Stpals subequal, ovateoblong, with broad bases and acute reflexed tips. Petals smaller than the sepals, linear, obtuse, their apices reflexed. Lip oblong, crisped, its base saccate and biglandular, the apex sub-quadrate, truncate, erose. Column short. Rostellum pointed. Stigma broad Capsule about 12 mm . long, fusiform, ridged, pubescent. Lindl. Gen. and Sp. Orch. 464 ; in Journ. Linn. Soc. i, 178; Dalz. \& Gibs. Bomb. Fl. 270; A. Rich. in Ann. Sc. Nat., Ser. 2, xv, 78; Hook. f. Fl. Br. Ind. vi, 102; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 278 t. 369 ; Collett Fl. Siml. 495 ; Rolfe in Journ. Linn. Soc. xxxvi, 41. S. flexuosa and S. parviflora Lindl. in Bot. Reg. under t. 823. S. amana Bunge Enum. Pl. China 63. S. novo-Zelandice Hook. f. Fl. New Zeal. 243. Neottia austratis R. Br. Prod. 319 ; Don Prod. Fl. Nep. 27. N. crispata Blume Bijdr. 406
N. flexuosa and v. parviflora Smith in Rees' Cyclop. N. sinensis Pers. Syin. ii, 511. N. amana Bieb. F'l. Taur. Cauc. iii, 606. Gyrostachys australis Blume Fl. Jav. 107, tt. 37, 38. Spiranthes Griff. Notul iii, 381; Ic. Pl. As. t. 348.

Throughout the Western Himalaya up to 10,000 feet. It flowers all through the summer. Eastwards, in India, it extends to Nepal, Sikkim and Assam. It is found over the greater portion of Peninsular India, and beyond the N.-W. Frontier it extends through Afghanistan to Europe, N. Asia and China; it occurs also in N. America, Java, Australia and New Zealand.
2. Spiranthes autumnalis Rich. in Mém Mus. Par. iv (1818), 59.

Glandular-pubescent. Root of two fleshy fusiform or subcylindric tubers 1.5 to 3.5 cm . long. Leaves in a tuft at the side of the flowering stem, arranged on a very short lateral stem that flowers in the following year, 2.5 to 3.5 cm . long, ovate, acute, cuneate at the base. Spike stout, twisted, its length with peduncle 1 to $1 \cdot 5 \mathrm{dm}$.; floral bract ovate-lanceolate, acuminate, longer than the ovary. Flowers secund, greenish-white, variable in size, but usually larger than those of $S$. australis. Sepals and petals connivent, hairy outside. Lip oblong-panduriform, glabrous, with two glands at the base, crenulate along the apical wargin. Reichb. Ic. Pl. Germ. xiii, 150, t. 474; Lindl. Gen. and Sp. Orch. 469 ; in Journ. Linn. Soc. i, 277 ; Boiss. Fl. Or. v, 90. Hook. f. Fl. Br. Ind. vi, 103. Ophrys spiralis Linn. Sp. Pl. 945. Neottia spiralis Swartz Act. Holm. 226.

Lohuaghát in Kumaon between 4,000 and 5,000 feet, T. Thomson, flowering in May. This species was collected in Aferganistan by Griffith, and is found in many parts of Europe between the Caucasus and the Atlantic Ocean.

## 37. Goodyera R. Br.

Terrestrial leafy herbs. Stem decumbent below, erect above. Leaves usually rather thick, with wide sheaths and usually petioled. Flowers small, numerous, in terminal and sometimes secund spikes or racemes. Sepals subequal, often pubescent outside; the dorsal concave and, with the petals, forming a hood over the column, the lateral pair free, subconnivent or spreading. Lip attached to the bass of the column, entire, saccate or cymbiform at the base; apical lobe small, usually acute and decurved, the basal sac with setæ calli or ridges inside, rarely smooth. Column short, the rostellum projecting. Anther usually pyriform, with a long erect beak; pollinia usually 2, clavate, sessile on a large or small gland. Stigma undivided, anticous.-Species about 36, in Europe, Asia, N. America, New Caledonia and the Mascerene Islands.

[^4]Lip setose within.
Leaves more or less dietant on the stem, not cordate at
the base.
Stem elongate, floral bracts muoh exceeding the
erect flowers . . . . . . . . . . 4. a. foliosa.
$\begin{aligned} & \text { Stem short, floral bracts shorter than the very } \\ & \text { large secund flowers . . . . . . . . . . . . bifora. } \\ & \text { Leaves subradical, cordate at the base . . . . . . 6. }\end{aligned}$. cordata.

## 1. Goodyera procera Hook. Exot. Flota t. 39.

Stem 2.5 to 7.5 dm ., glabrous, enveloped in the wide lax leaf-sheaths. Leaves many, long-petioled ; petiole 3.5 to 7.5 cm . long, stout and with a broadly sheathing base; blade $7 \cdot 5$ to 15 cm . long, elliptic or ovate-elliptic, tapering at each end, acute or acuminate. Peduncle bearing many lanceolate acuminate bracts, glabrous below, pubescent above, spike 7.5 to 20 cm . long, many and densely flowered, the rachis pubescent. Flowers minute, subglobose, white tinged with green; floral bract ovate-lanceolate, acuminate, pubescent at the edges, equalling the glabrous ovary. Sepals subequal, broadly ovate, obtuse, sub-connivent, glabrous. Petals cuneately obovate, clawed. Lip a little longer than the sepals, with a large saccate base; its apex decurved, triangular, acute, entire; interior of basal sac with two rows of long setæ on the sides and an oblong callus at the apex of each row. Column very short, with a transverse depression below the broad anticous stigme. Anther broadly pyriform, obtuse; pollinia clavate-cylindric, sessile on the small oblong gland. Lindl. Gen. and Sp. Orch. 493 ; in Journ. Linn. Soc. i, 183 ; Royle Ill. 368 ; Don Prod. Fl. Nep. 28 ; Wight Ic. 1729 ; Hook. f. Fl. Br. Ind. vi, 111, King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 282, t. 378; Rolfe in Journ. Linn. Soc. xxxvi, 45. G. carnea A. Rich. in Ann. sc. Nat. ser. 2, xy, 80. Cionisaccus lanceolatus Breda Orch. Kuhl. et Hassk. t. 1. Cordylestylis foliosu Falc. in Hook. Journ. Bot. iv (1842), 75. Neottia procera Ker. in Bot. Reg. t. 639.

Dehra Dun, Muckinnon's collector; in the Sub-Himalayan tract of the Bahraich District in N. Oudh, Duthie's collector No. 23862; Outer bills of Garhwál and Kumaon up to 3,000 feet. Flowers during May. It extends eastwards to Nepal, Sikkim, Blutan, Assam, Sylhet and to the Khasia and Naga Hills; southwards it is found in Central and S. India; it occurs also in China, Honkong and Java.

## 2. Goodyera repens R. Brown in Ait. Hort. Kew, ed. 2, v, 198.

An evergreen stoloniferous herb, 1 to 2 dm . high. Stem glabrous, leafy below and bracteate above. Leaves elliptic or ovate-elliptic, subacute, petioles sheathing in the lower half, blade 1.2 to 2.5 cm . long, green reticulated with white. Bracts of upper part of stem and on the peduncle linear, convolute. Raceme 2.5 to 5 cm . long, subsecund, its rachis and the bracts and ovaries sparsely pubescent or nearly glabrous. Flower's globular, 3.5 mm . across, white flushed with brownish-pink; floral bract linear-lanceolate, longer than the ovary. Sepals subequal, ovate, acute, connivent. Petals about as long as the sepals, obliquely cuneate-oblong, falcately acute at the apex, the edges slightly erose-dentate. Lip about as long as the sepals, saccate at the base, apical lobe short, ovate, subacute, concave, the edges somewhat undulate;
the sac not setose within. Column short, without processes; stigma orbicular, rostellum shield-shaped. Anther obovate, beaked; pollinia clavate, sessile on the large oblongquadrate gland. Lindl. Gen. and Sp. Orch. 492; in Journ. Linn. Soc. i, 183; Reichb. Ic. Pl. Germ. xiii, 15j, t. 482; Ledeb. Fl. Ross. iv, 86; Boiss. Fl. Or. v, 90; Hook. f. Fl. Br. Ind. vi, 111; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 279, t. 370; Collett Fl. Siml. 496; Rolfe in Journ, Linn. Sec. xxxvi, 40. G. marginata Lindl, in Wall. Cat. 7394, Gen. and Sp, Orch. 493, in Journ. Linn. Soc. i, 183. Satyrium repens Linn. Sp. Pl. 1339.

Widely distributed throughout the Western Himalayan area at elevations between 7,000 and 10,000 feet, flowering during July and August. It extends eastwards from Kashmir to Sikkim, E. Tibet and China, and through Afghanistan to Europa and N. Asia, occurring also in N. America.

In $a$. marginata of Lindley the leaves are uniformly green, the raoeme is longer and more compaot and the slenderly acuminate floral bracts are much longer than the flowers. I nm inclined to believe that it will prove to be a distinct speoies. G. repens (proper) enters India from the direction of Europe through Afghanistan to Kashmir, and is found again in Sikkim, whence it extends to China, whereas $G$. marginata occapies the intermediate area of the Himalaya between Simla and Nepal.
3. Goodyera fosca Lindl. in Wall. Cat. 7395.

Whole plant 2.3 to 3 dm . high. Stem glabrous, with the leaves clustered near the base and bearing upwards several oblong acute leaf-like bracts 2 to 2.5 cm . long. Leaves thick, 2.5 to 3.8 cm . long, 5 -nerved, veins anastomosing, edges subrevolute ; petiole broad, widely sheathing at the base. Peduncle longer than the stem, pubescent. Raceme many-flowered, not secund, its rachis and the bracts pubescent. Flowers white tinged with green and yellow, floral bract ovate-oblong, subacute, longer than the pubescent ovary. Sepals connivent, subequal, oblong, subacute. Petals falcately linear-oblong, subacute. Lip as long as the sepals, its subglobose sac exserted beyond the bases of the sepals, smooth within; apical lobe suddenly narrowed into a deflexed linear beak which is strongly ridged within. Cobumn very short; the stigma broad, orbicular, convex. Anther convex, shortly apiculate; pollinia broadly ovoid, caudicle none, gland orbicular. Hook. f. Ie. Pl. 2181, Fl. Br. Ind. vi, 112; King \& Pantling in Ann. R, Bot. Gard. Calc. viii, 280, t. 371. Etheria fusca Lindl. Gen. and Sp. Orch. 491; in Journ. Linn. Soc. i, 184. Cystorchis fusca Benth. in Gen. Pl. iii, 5¿9.

Harung in the Upper Sutlej valley, Munro No. 2117; Kuári Pass in British Garbwál at 13,000 feet, Duthie No. 443\%; N. Kumaon, Duthie's collector No. 24084. Flowers in August and September. It extends eastwards to Nepal and Sikkim.
4. Goodfera follosa Benth. ex Hook. f. FI. Br. Ind. vi, 113.

Stem decumbent at the base, 1.5 to 3 dm . long, leafy upwards. Leaves distant, green, 6.5 to 9 cm . long, ovate-lanceolate, acute, often very oblique, tapering to the slightly expanded sheathing petiole, $3-5$ nerved; margins undulate. Peduncic $2 \cdot 5$ to $\overline{5}$ cm. long, pubescent, bearing many lanceolate acuninate sheathing bracts. Raceme 4 to 7.5 cm . long, the rachis, floral bracts and ovaries glandular-pubescent. Flowers
many, pink or tinged with orange, much shorter than the narrowly lanceolate, acuminate, 3 -nerved floral bracts. Sepals 6 to 10 mm . long, connivent, subequal, ovate-oblong, subacute, connate at the base. Pctals very obliquely rhomboid, acute clawed. Lip as long as the sepals, saccate at the base and taporing into the subacute orange and white apical lobe, sac hispid within. Column and rostellum rather long. Anther crect, oblanceolate; pollinia narrowly clavate, grooved, united below and seasile on a long oblanceolate glaud. Stigma concave. Hook. f. in Ann. Bot. Gard. Calc. $\mathrm{v}, 61$, t. 91. Georchis foliosa Lindl. Gen. and Sp. Orch. 496. Goodyera sp. Griffith. Itin. Notes 36, No. 591. Notul. iii, 396, No. 11 ; Ic. 1ll. As. 346, f. 1.

Near Mussooric, in oak forests on northern slopes, at about 5,500 feet, P. W. Mackinnon; in flower during November. Found also in Sikkim, Assam, on the Naga and Khasia Hills, and in Burma and Perak.
j. Goodyera biflora Hook. f. Ic. Pl. 2188.

Roots thick and cord-like. Stem 5 to 7.5 cm . long, stout, leafy upwards, usually tinged with red, sometimes decumbent and rooting from the nodes. Leaves 2.5 to 5 cm . long, ovate, obtuse or subacute, dark bluish-green on the upper surface finely veined with white, the lower surface paler and with a tinge of red; the petiole 6 to 12 mm . long, dilated. Spike 2 to 8 -flowered, not much longer than the leaves; rachis stout, pubescent; floral bract $2 \cdot 2 \mathrm{~cm}$. long, exceeding the slender pubescent ovary, reddish tipped with green, puberulous above. Flowers large, secund, white tinged with yellow and pink. Sepals narrowly lanceolate, 3-nerved; the dorsal one 2.5 cm . long, recurved at the apex; lateral pair a littlo shorter than the dorsal, nearly straight, connate at the base. Petals linear-lanccolate, falcate, closely applied to the dorsal sepal. Lip white tinged with yellow, shorter than the sepals, saccato at the base and with a long recurved beak twice as long as the sac; margins membranous, undulate; sac setose within. Column concave in front. Rostellar arms and anther very long and slender. Pollinia on long slender conuato caudicles; gland linear, nearly half as long as the combined caudicles. Capsule 25 cm . long. Hook. f. Fl. Br. Ind. vi, 114; Collett Fl. Siml. 496. Georchis biflora Lindl. in Wall. Cat. 7379 ; Gen. and Sp. Orch. 496.

Song in the Upper Sutlej Valley, Brandis; Simla Hills at about 6,000 feet, Brandis, Gamble No. 4649; between Mussoorie and Simla 4,000 to 5,000 feet, Edgeworth; Mussoorie range 0,000 to 7,000 feet, Mackinnon, Duthie Nos. 24164, 25408. Flowers in August. It has been found also in Nepal by Wallich.

Plate 127. Goodyera biflora Hook. f. A plant,-of natural size. Fig. 1, single flower; 2, petals; 3, side view of young flower, with sepals and petals removed; 4, vertical section of lip; 5, apical portion of lip, spread out; 6, ovary and column, showing the anther in situ; 7, rostellum; 8, anther; 9 and 10, pollinia;-all enlarged.
6. Goodyera cordata Benth. ex Hook. f. Fl. Br. Ind. vi, 114.

A rather slender plant, 1 to 3 dm . bigh, sometimes decumbent, quite glabrous except the scape and bracts. Roots thick, cord-like. Leaves four or five, sub-radical, 2.5 to 6.5 cm. long, ovate, cordate, acute, rather fleshy, glaucous-green, paler beneath.
nerves impressed on the upper surface; petiole dilated, the free portion about half the length of the blade. Spike puberulous, 4- to 6 -flowered, the lower portion bearing a pale narrow sheathing cuspidate bract. Flowers suberect, about 2.4 cm . long, green tinged with brownish-yellow or red; flowering bract overtopping the buds, lanceolate, acuminate, edges papillose. Sepals fleshy, boat-shaped, and with cucullate tips; the dorsal one erect, 13 mm . long, lanceolate and gradually tapering to the blunt apex, 3-nerved; the lateral pair deflexed, a little shorter than the dorsal, 3-nerved. Petals thin, equalling and appressed to the dorsal sepal, dimidiate-lanceolate, acute, 3 -nerved. Lip about as long as the dorsal sepal, rhomboid-ovate, many-nerved, setose on the broad sub-saccate base; terminal lobe reflexed, triangular, acute. Column stout, with projecting cheeks. Arms of rostellum and anther long and slender. Pollinia elongate. tapering below into the long slender connate caudicles; gland linear adnate to the caudicles. Hook. Ic. Pl. 2187. Georchis cordata Lindl. Gen. \& Sp. 496 (excl. babitat); Reiclab. f. in Gard. Chron. 1879, ii, 520.

Near Mussoorie on wooded slopes facing the north at about 6,000 feet, Mackin. non's collector No. 25409. Flowers in September. Previously known only from the Khasia and Naga Hills, and in Perak.

Plate 126. Goodyera cordata Benth. A plant,-of natural size. Fig. 1, single flower; 2, ditto, with the sepals and petals removed; 3, lip; 4 column, showing the rostellum and stigma; 5, back view of ditto, showing the anther in situ; 6, pollinia; all enlarged.

## 38. Zeuxine Lindl.

Terrestrial herbs with succulent glabrous stems, decumbent at the base. Flowers small, in racemes or spikes. Sepals subequal, the dorsal one concave and forming a hood with the petals, the lateral pair free. Lip adnate to the base of the column, cymbiform or saccate; apical lobe shortly clawed or sessile, entire 2 -lnbed or with narrow decurved lobules, the sac at the base with calli or laminæ inside. Column very short, anterior surface with lamellar or conical processes. Stigmas 2, lateral, distant, rarely united. Anther membranous, its cells contiguous; pollinia, pyriform, attacked by an oblong gland to the erect rostellum.-Species about 15 , in Tropical Asia and Africa.

Zeuxine sulcata Lindl. Gen. and Sp. Orch. 485.
Whole plant 5 to 25 cm . high. Stem and peduncle glabrous. Leaves 2 to 7 cm. long, linear, acuminate, sessile on the hyaline truncate sheaths, gradually passing into the linear bracts higher up. Raceme 1.5 to 5 cm . long, densely flowered, glabrous; floral bract ovate-lanceolate, acuminate, much longer than the ovary. Flowe's about 1 cm . long, white or pink. Sepals unequal; the dorsal one ovate, concave; the lateral pair obliquely lanceolate, connivent. Petals falcately oblong, obtuse, forming with the dorsal sepal a hood over the colume. Lip yellow, as long as the sepals, cymbiform and saccate at the base, bearing inside the sac two inward-pointing teeth and two narrow lamellæ uniting at the mid rib; terminal lobe short, subquadrate entire or bifid. Column very short, with two wings at its apex covering
the anther. Rostellum with two short stout parallol arms. Anther depressed, very shortly beaked, covered by the wings of the column; pollinia attached within the tip of a linear appendage of the gland. Capsule ellipsoid, about 13 mm. long. Lindl. in Journ. Linn. Soc. i, 186; Griff. Notul. iii, 396 ; Ic. Pl. Ae. t. 349; Blume Fl. Jevar 55; Miquel Fl. Ind. Bat. iii, 723; Hook. f. Fl. Br. Ind. vi, 106; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 286, t. 381 ; 'Tokutaro Ito in Bot. Mag. 'Tokyo xiv, t. 2. Zeuxine bracteata, Z. brevifolia and Z. robusta Wight Ic. 1724 bis, 1725, 1726. Z. membranacea Lindl. Gen. and Sp. Oren. 486; in Journ. Linn. Soc. i, 186; Blume Fl. Javæ 56. Z. Tripleura Lindl. in Journ. Lim. Soc. i, 188. Z. integerrima, Lindl. Gen. and Sp. Orcl. 486; Blume Fl. Javw 55, t. 19 and 23C; Miq. Fl. Ind. Bat. iii, 723. Z. emarginata Lindl. Gen. and Sp. Orcis. 18j. Z. procumbens Blume Fl. Javæ 56, t. 22 , f. 3 and t. 23B. Triplcura pallida Lindl. in Wall. Cat. 7391 ; Geu. and Sp. Orch. 452. Adenostylis emurginata and A. integerrima Blume Bijdr. 414, t. 17. Pterygodium sulcatum, Roxb. Fl. Ind. iii, 452.

Debra Dun in wet ground, Mackinnon (Duthic's No. 22977), Gamble No. 26478. Below Mussoorie at about 5,000 feet, Proudlock. Flowers during February and March. Abundant in grassy places throughout the greater portion of Iodia. It is found also in Afghanistan, Ceylon, China, Japau, Java, and in the Philippines.

## 39. Anœctochilus Blume.

Terrestrial herbs with succulent stems decumbent at the base and with stout hairy roots. Leaves thick, ovate or lanceolate, with peticles sheathed at the base, peduncle and rachis of spike or raceme glandular-pubescent. Sepals free, unequal; the dorsal smaller, ovate, and with the beaked petals forming a hood over the column; lateral pair free or united at the base, upreading, larger than the dorsal. Lip adnate to the end of tae column by a long-toothed or pectinate rarely entire claw, saccate or spurred at the base, the sac produced beyond the bases of the sepals or quite covered by them, its interior with two tooth-like or laminar calli; terminal lobe with two large diverging lobules. Column short, appendaged in front. Anther 2-celled; rostellum twisted; pollinia 2 and bifid, rarely 4, clavate, lamellate, narrowed into pseudo-caudicles, or attached to true caudicles and inserted on a nurrow gland. Stigmas usually two, one on either side of the rostellum, or united into a transverse band on the column beneath it, rarely single and undivided.-Species about 40, natives of India, China and of the Malayan and Pacific Islands.

## Angctoceilus Roxburgeir Lindl. in Wall. Cat. 7387.

Height of plant not exceeding 3 dm . Stcm decumbent at the base. Leaves several, near the base of the stem, 3 to 6.5 cm . long, ovate or ovate-oblong, acute, glabrous, shortly stalked, purplish-red with a velvety lustre, tinged along the centre vith yellow and pink, and veined with yellow. Peduncle glandular-pubescent, bearing three to five short oblong acuminate bracts. Raceme much shorter than the peduncle. Flowers two to five, about 3 cm . long, resupinate; floral bract about half as long as the sessile cylindric ovary, and like the ovary glandular-hairy. Sepals unequal, pale-fink, glandular-hairy, dorsal one broadly orate, acuminate, its apex recurved; the lateral pair oblong,
scute. Petals smaller than the sepals, obliquely oblanceolate, pale pink or white their apices hooked. Lip adnate by its base to the face of the column, and with two calli; claw unequally fimbriate; terminal lobes linear-oblong, blunt, spreading and recuived. Spur conical, as long as the lateral sepals, with two large wart like processes inside. Appendages on the front of the column large, paraliel, extending from the ovate fleshy rostellum to the spur. Stigmas two, small, elliptic. Anther acumidate; pollinia four, clavate, in two pairs, united at their bases and both attached to a lanceolate gland. Lindl. Gen. and Sp. Orch. 499; Royle Ill. 3.8; Blume Flor. Javæ 41, t. 12 B , fig. 2; Hook. f. Fl. Br. Ind, vi, 95 ; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 293, t. 390 ; Collett. Fl. Siml. 494; Rolfe in Journ. Linn. Soc. xxxvi, 42. Chrysobaphus Roxburghii Wall. Tent. Fl. Nep. 37, t. 27.

Below Simla at about 5,000 feet, Madden, Collet:; on the Chur near Simla, Royle; Kedarkanta in Tehi-Garhwál, Royle. Flowers during July and August. It extends eastwards to Nepal, Sikkim, Bhutan, Assam, Sylhet, Manipur and China.

## TRIBE VI.-OPHRFDEE.

Anther-cells sessile on the column, anticous or (in the Indian specios of Satyrium) lateral, free or contiguous, but always datinct, parallel or diverging, often with tube from their bases, each with a staminode on its outer surface; pollinia two, rarely four, usually with caudicles und always with glands; glands naked or enclosed in the same pouch or in two distinct pouches. Stigmas two, distinct or united below the anther-celle; pollen granular or sectile, not waxy.


## 40. Orshis Linn.

Terrestrial erect leafy herbs with oblong or digitately lobed tubers, or with fleshy fibrous roots. Leaves sheathing, not plicate. Flowers medium-sized, usually pink or purple, in spikes or racemes; floral bract small, or lenf-like and exceeding the flower. Sepals subequal, the dorsal one conniving to form a hood with the potals, the lateral pair spreading. Pelals like the sepals or smaller. Lip adnate to the base of the column, spreading or pendulous, entire or 3 -lobed, rarely 4 -or 5 -lobed, always spurred. Columvery short. Anther-crlls two, anticous, parallel, contiguous, without tubes; pollinic usually attached to caudicles; glands two, distinct or united, lying in a common pouch or naked. Staminodes rugulose, attached to the outer surfaces of the anther-cells or to the column by their sides. Stigmas united into a transverse band lying across the column for its whole breadth, or distinct and at the margins of the coiumn (as in O. habenarioidcs).-Species about 80, in Europe, and in the temperate parts of Asia and N. Africa; also in N. America and in the Mascerene Islands.

```
Stem stout, leaves three or more, lip entire or obscurely 3-lobed.
    Flowers large, purple lilac or occasionally white, polliniar glands enclosed
        in a pouch
    1. O. Latifolia.
    Flowers muoh smaller, piok or occasionally white, polliniar glands free
        and exposed
    2. O. habenarioides.
Stem sleader, leaves one to three, lip distinctly 3-lobed . . . . . . . 3. 0. Chuow.
Stem slender, leaf usually solitary and near the bese of the stem.
    Stignas united, lip 3-lobed, spur longer than the ovary . . . . . . 4. O. Stracheyi.
    Stigmas distinct, lip entire, spur shorter than the ovary . . . . . . 5. O. spulhulata.
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1. Orchis latifolia, Linn. Sp. Pl. 941.

Tubers palmate. Stem $3-9 \mathrm{dm}$. high, usually fistular, leafy upwards. Leaves many, erect, up to 12 cm . long, oblong linear-oblong or lanceolate, tip concave. Spike $2 \cdot \bar{j}$ to 1 cm . long, cylindric, dense-flowered. Flowers about 1.8 cm . from the apex of the dorsal sepal to the tip of the lip, purple (occasionally lilac or white); floral bract linear-lanceolate, acuminate, usually much exceeding the flowers. Sepals and petals acute or obtuse; the lateral pair of sepals ovate, reflexed. Lip oblong or rhomboid, entire crenate or very obtusely 3 -lobed, usually spotted with darker purple, sides deflexed; spur stout, equalling or shorter than the ovary, straight or curved. Royle Ill. 367 ; Reicbb. f. Fl. Germ. xiii. t. 50 ; Boiss. Fl. Or. v, 71 ; Hook, f. Fl. Br. Ind. vi, 127 ; Collett Fl. Siml. 499 ; Krnzl. Orch. Gen. and Sp. i, 146. O. latifolia a indica Lindl. Gen. and Sp. Orch. 260. O. Hatagirea Don. Prod. 23; Wall. Cat. 7062.

Abundant throughout the Western Himalaya at elevations between 8,000 and 12,000 feet. Flowers from June to September according to the elevation and aspect. lt extends as far East as Nepal, and westwards from Afghanistan to N. Africa and Europe; also in N. Asia.

According to Lindley, O. Hatagirea represents the Indian form of this variable species. It bas entirely the habit of the European O. latifulia and, like it, produces a smaller-flowered form, which may be compared to $O$. cruenta. Its lip is sometimes rounded and not at all lobed, and sometimes slightly 3 -lobed. It also varies considerably in the shape of the leaves and in the colocr of the flowers. The leaves of the Himalayan form are usually not at all spotted.
2. Orchis habenarioldes, King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 302, t. 401.

Height of plant 3 to $\bar{j}$ dm.; tubcr digitate. Stem clothed at the base with unequal tubular sub-acute sheaths. Leaves four or five, scattered, sessile, 5 to 12.5 cm . long, elliptic-oblong to linear-oblong, sub-acute, slightly narrowed to the rather long sheath. Spike 4 to 12 cm . long, cylindric, densely flowered. Flowers about 7 mm . across, pink or occasionally white; floral bract longer than the curved beaked ovary, herbaceous. Sepals sub-equal, broadly ovate, puberulous, the dorsal forming a hood with the petals; lateral pair spreading and somewhat refexed, acute. Petals shorter than the sepals, rhombic-orbicular, minutely apiculate. Lip adnate to the base of the columu; the apex broad and with a shallow terminal lobe, the upper surface quite smooth; spur as long as the ovary, laterally compressed, curved and slightly clavate, puberulous inside. Column broad. Anther-cells parallel; pollinia obliquely elliptic-obovate; caudicles short, without pouches; glands ligulate, truncate. Staminodes large, suborbicular, rugulose, lying on either side of the caudicles. Stigmas united into a narrow transverse band heneath the opening to the spur. Capsule $1 \mathrm{~cm} . \operatorname{long}$, ovate-oblong. Gymnadenia cylindrostachya Lindl. in Wall. Cat. 7056; Gen. and Sp. Orch. 278; Royle Ill. 367. G. Orchidis and violacca Lindl. Gen. and Sp. Orch. 272. Platanthera Orchidis Lindl. in Wall. Cat. 7039A. Habenaria Orchidis Hook. f. Fl. Br. Ind. vi, 142. Peisrtylus Orchudis Krnzl. Orch. Gen. and Sp. i, 515.

Hazára at 11,800 feet, Duthie's collector No. 20192; Kashmir, Clarke No. 29239; Liddar Valley in Kashmir 10,000 to 12,000 feet, Duthie Nos. 13147, 13185, Duthie's collector No. 21373; Upper Chenab Valley at 10,000 feet, Baden.Powell No. 319 ; Lahul, Hay; Pángi, Stolickza, Duthic's collecitor No. 23341 ; Chansil range in Tebri Garhwál between 12,000 and 13,000 feet, Osmaston (Duthie's No. 24187); Jumna Valley between 8,000 and 9,000 feet, Duthie No. 525 ; Káli Valley in N. Kumaon between 10,000 and 11,000 feet, Duthie No. 6008; Rálam Valley, Duthie's collector No. 24120. Flowers during August. It extends eastwards to Nepal, Sikkim and Bhutan.

## 3. Orciis Chusua Don Prod. Fl. Nep. 23.

Whole plant 1 to 4 dm . high, tuber small, clliptic, entire. Stem with two blunt tubular sheaths at the base, upper portion above the leaves naked. Leaves 3.5 to 7.5 long, linear-oblong or linear-lanceolate, acute or acuminate, not narrowed to the shathing base. Spike $2 \cdot 5$ to 10 cm . long, few- or many-flowered, secund. Flowers purple or white, 10 to 18 mm . across (vertically); floral bract green, lanceolate, acuminate, equalling the fusiform ovary. Sepals oblong, obtuse; dorsal erect; the lateral pair recurved. Petals broadly and obliquely ovoid, their bases truncate. Lip longer than the sepals, deeply 3 -lobed, the lobes equal, oblong, obtuse, the lateral ones diverging; spur stout, cylindric or clavate, as long as the ovary. Column short. Anther-cells parallel; pollinia ovoid-globose, slightly narrowed to the long tapering caudicle; glands small, each lying in a small pouch. Staminodes large, ovate, pointed. Stigmas united into a large concave surface under the anther-cells. Hook. f, Fl. Lr. Ind. vi, 127; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 303, t. 402 ; Krnzl. Orch. Gen. and Sp. i, 153 ; Rolfe in Journ. Linn. Soc. xxxvi (1903), 49. Gymnadenia Chusuc Lindl. in Wall. Cat. 7058; Gen. and Sp. Orch. 280. G. puberula Lindl. in Wall. Cat. 7059.

Punjab Himalaya, Chamba State, at 11,000 feet, Lace No. 1992; near Mussoorie, King; Byans in N. Kumaon between 11,000 and 12,000 feet, Duthie No. 5998(a). Flowers during July and August. It extends eastwards to Nepal, Sikkim, Eastern Tibet and China.

Lace's Chambe speoimens represent a slender form of this variable species. The leaves are solitary and linear-lanceolate, and the flowers are solitary or in pairs. It differs from the type chielly in the shape of the lip, the lobes of which are much broader than usual.
4. Orchis Stracheyi Hook. f. Ic. Pl. 2197B; Fl. Br. Ind. vi, 128.

Height of plant 6 to 12 cm . Rhizome without tubers (as in O. spathulata). Leaf solitary, radical, petioled, elliptic or ohovate. Scape naked, few-flowered. Floral bract large, ovate-oblong, obtuse, longer than the ovary. Sepals and petals spreading. Lip longer the scpals, broadly cuneate, trifid to the middle, the lobes obtuse, spur equalling or longer than the ovary, incurved, obtuse. Krnzl. Orch. Gen. and Sp. i, 154.

Rogile in Garhwál between 9,000 and 10,000 feet, Strachey $\&$ Winterbottom (No. 35 Gymnadenia puberula).

This speoies which appears to be internediate between $O$. spathulata and $O$. Chusua, may possibly, as Sir Joseph Hooker suggesta, be a hybrid, with the solitary leaf of the former and the flowers of the latter.
5. Orchis spathulata Reichb. f. ex Hook. f. Fl. Br. Ind. vi, 127.

Whole plant 5 to 20 cm . high. Stent proceeding from a thin rhizome, with one or two loose blunt tubulur sheaths at the base. Leaf usually solitary and at the base of the stem, with rarely a second one higher up, oval to narrow-elliptic or spathulate, tapering into a long petiole; blade 2.5 to 7.5 cm . long. Scaps rather stout. Spike short, 1.4 flowered. Flowers purple or occasionally white, about 13 mm . in diam.; floral bract longer than the flower, leaf-like, lanceolate, sub-acute. Scpals sub equal; the dorsal ovate, obtuse, conniving with the petals to form a hood ; lateral pair oblong, sub-acute, spreading. Petals shorter than the sepals, falcately elliptic, obtuse. Lip equalling the sepals, broadly elliptic or obovate, entire or obscurely 3 -lobed, tho edges crenulate; upper surface slightly pubescent, with many shallow grooves extending from the base nearly to the apex; spur stout, obtuse, about half as long as the ovary. Poliinia pyriform, a little longer than the rather stout tapering caudicles; glands elliptic enclosed in a pouch formed from the rostellum. Staminodes small, rugulose. Stigmas distinct, ellipic, widened at the lower end and attached to the margins of the column. Hook. f. Ic. Pl. t. 2197A; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 301, t. 400 ; Krnzl. Orch. Gen. and Sp. i, low; Rolfe in Journ. Linn. Soc. xxxvi (1903), 50. Gymnadenia spathulata Lisdl. Gen. ard Sp. 280; Royle Ill. Him. Bot. 367.

Kedarkánta in Garhwál 11,000 to 12,000 fret, Rnyle; Ganges Valley below Gangotri between 12,000 and 13,000 feet, Duthie Nos. 194, 515 ; Káli Valley in N. Kumaon at 1,3,000 feet, Duthic No. 5998. Flowers from June till August. Found also on the Sikkin Himalaya and extending through E. Tibet to China.

## 41. Habenaria Willd.

Terrestrial leafy herbs with undivided or lobed tubers or fleshy root-fibres. Leares not plaited, their bases sheathing. Flowers in racemes or spikes. Sepals subequal, the dorsal often connivent with the petals to form a hood over the column; the lateral pair spreading, reflesed or deflexed, or sometımes erect. Petals smaller or larger than the sepals, entire or 2-cleft. Lip adnate to the base of the column, entite, 3-lobed or 3partite, its base spurred. Anther-cells adnate to the front of the short and usually broad column, discrete, rarely touching, parallel or divergent below, their bases often prolonged into tubes containing the caudicles. Staminodes represented by two granular more or less conspicuous projections on the outer side of each anther-cell, rarely clongate. Pollinias two, clavate or pyriform, usually grooved, sometimes 2-partite; caudicles varying in lengtb, somotimes absent; glands exposed, flat and discoid, or elliptic or globular, or elongate with truncate ends (conjoined and enclosed within processes of the 2-lobed rostellum in H. secundifora). Stigmas two, distant from each other or united to form
a belt across the face of the column.-Species about 400 , cosmopoliten in temperate and trupical regions.

Sect. i. Atb.-Petals bipartite, lip 3-partite.
Spur equalling the ovary, elender, upturned -.. 1. H. atennpetala.
Spur shorter than the ovary, clavate, deflezed ... 2. H. digitata.
Seot. 1i. Platyglossa-Petals entire; lip 3-lobed or 3-partite; side lobes broad, apical lobe narrow.
Side lobes of lip deeply pectinale.
Stigmas not produced; flowers large, white, spur 2\} times longer than ovary
3. H. Susanna.

Stigmas prominent, flowers medium-sizad.
Anther-tubes short, spur about as long as the ovary.

Petais and lip white, spur stout, funnelehaped, its apes clavate and curved outwards ... ... ...
Dorsal sepal and petals greenish-white, lip white; spur slender, olavate, ourved inwards ... ... ...
Anther-tubes long, slender, upright, spur longer than the ovary.

Stigmas linear-lanceolate, spresding, petals gibbous on oater edge at the base 6. H. arietina.

Stigmas long, slender, oylindrioal, ourved upwards and inwards ... ...
Side lobes of lip entire.
Spur twice as long as the ovary ... ... 8. H. longifolia.
Spur equalling the ovary.

$$
\begin{array}{llllll}
\text { Loaves radionl } & \text {... } & \text {... } & \text {... } & \text { 9. } & \text { H. plantaginea. } \\
\text { Scape lesfy upwards } & \text {... } & \text {... } & \text {... } & \text { 10. } & \text { H. triflora. }
\end{array}
$$

Sect. in. Thimeroolossa.-Petals entire; lip 3-partite, the side lobes very narrow and often fliform.

Anther tubes long.
Spur much exceeding the otary ... ... 11. H. commelinifolia.
Spur equalling the ovary ... ... 12. H. pubeacens.
Anther-tubes short.
Leaves 3 or more.
Leaves not margined, flowers green ... 1s. B. furcifera.
Leaves pale-margined, flowers yellow ... 14. H. marginata.
Leaves 2.
Leaves radionl, orbicular, cordate, margined ...
Leaves not radioal, sub-opposite, orbioular, cuspidate, not margined ... ... ...
Sect. iv. Hologlossa.-Petals entire; lip narrow, entire or
15. B. diphylla.
16. H. Aitchisoni.
with minute basnl lobes (tridentate at the apex in $H$. ciridis).

Stigmas coujvined.
Flowers secund, staminodes as long as the anthercells ... ... ... ... 17. H. urceolata.
Flowers not seound, steminodes muoh shorter than the anther-cells
18. $\boldsymbol{H}$. stenantha.

Stigmatio processes distinot,
Spur longer than the ovary, flesuous.
Petals yellow, erect; spur rather stont, usually upturned ... ... ... ... 19. H. Edgevorthit.
Petals green, spreading; spur slender, usually deflexed ... ... ... ...
Spur much shorter than the ovary, olarate ... 21. H. densa. Stigmatio processes none.

Lip linear, spur much longer than the ovary … 22. H. arcunta.
Lip oblong, its apex tridentate; spur muoh shorter than the ovary
23. $H$. viridis.

Sect. v. Peristylus.-Petals entire, lip slightly or not at all longer than the sepals, 3 -lobed; spur very short, often sub-globose.

Flowers green.
Leaf solitary, lip flat ... ... ... 24. H. fallax.
Leaves 2 or 3, lower half of lip trough-shaped ... 25.* H. Elisabetho. Flowers white, leaves clustered above the middle of the stem.
Leaves narrowly lanceolate or elliptic, aoute, tubers glabrous ... ... ...
26. II. Lawii.

Leaves ovate or ovate-elliptic, tubers hairy.
Flowers in a lax subseound spike ... 27. H. goodyeroides.
Flowers in a dense cylindrioal spike ... 28. $\boldsymbol{H}$. constricta.
Seot. vi. Phyllostachya.-Flowers large, in the axils of sheathing leaves, petals entire; lip broad, entire, petaloid, epur conico-infundibular; stigmatic processes none, rostellum obsoure ... ... ... ...
Sect. vii. Dipyla.-Flowers small, seound, lip 3-fid., spur in-
Sect. Vin. Dipyla.-Flowers small, seound, lip 3 -fid., spur in-
flated, pollinia sessile on a single large oboordate gland seated in a sinus of the broad 2 -lobed rostellum, stigmatio process amall
29. H. galeandra.

Seet. vili. Dithrix.-Flowers small, secund, tubular, sepals petals and lip ooherent at the base; lip oblong, 3 -fid, base saccate; staminodes 2, filiform, capitate, inserted on the back of the anther, stigma a transverse cushion, rostellum a transverse plate below the anther ... 31. H. Griffthii.

1. Habenaria stenopetala Lindl. Gen. and Sp. Orch. 324.

Height of whole plant 3 to $10 \cdot 5$ dn.; basal third of stom clothed with tight fitting sheaths. Leaves distributed over the upper two-thirds of the siem, 7.5 to 20 cm. long, oblong-lanceolate to ovate-lanccolate, acute, the edges undulate, amplexicaul or sheathing and usually broad at the base, membranous; the upper ones much smaller and bract-like. Raceme 1 to 2.3 dm ., densely flowered. Flowers 2 to 2.5 cm . across, pale green; floral bract lanceolate, acuminate, about as long as the slender stalked ovary. Sepals subequal, oblong-lanceolate, acuminate, spreading or reflexed. Petals shorter than the sepals, linear, their bases produced downwards below the point of insertion. Lip 3-partite, as long as the petals, brown; segments narrow, fleshy, the central one horizontal; basal pair usually shorter, deflexed; spur slender, as long as the
stalked ovary, compressed, 2-ridged, upturned. Column stout. Anther-cells erect, distant, parallel, narrow, with long tubes; pollinia oblong, with long slender curved caudicles attached to minute glands. Staminodes ovate, rugulose, on the outaide of each anthercell and stigme. Sligmas two, obloug, with slightly divergent blunt apices, placed below the authers and at the margins of the month of the spur. Capsule linesr. oblong. Hook. f. Fl. Br. Ind. vi, 134 ; in Ann. R. Bot. Gard. Calc. v, t. 9.5; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 308, t. 404. Krantzlin in Engl. Bot. Jahrb. xvi, 162 ; Orch. Gen. and Sp. i, 358.
N.W. India, Royle; Mussoorie 5 to 6,000 foet, Duthie, Mackinnon [Duthie's No. 22980(a)]; below Mussoorie 4,000 feet, Gollan; below Naini Tal 3,000 feet, C. W. Hope. Flowers in Scptember. It extends eastwards to Bengal, Sikkim, Assam and the Naga Hills.
2. Habenaria digitata Lindl. Gen. and Sp. Orch. 307.

Height of plant 3 to 5 dm . Stem stout, cylindrical, lower portion clothed with close-fitting abeaths. Leaves 4 to 6 cm . long by 3 to 4 cm . broad, collected chiefly towards the middle of the stem, broadly lanceolate or ovate-lanceolate, acuminate, 3 -nerved, the edges much undulate. Raceme laxly many-flowered, about 1 dm . long, elongating in fruit. Flowers subsecund, about 13 mm . in diam., green; flnal bract narrowly lanceolate, longer thin the slender ovary, pale-margined. Sepals unequal, the dorsul one erect, suborbicular, its apex bluntly acuminate and recurved, minutely pustulate on the back; lateral pair rather longer, deflexed, subfalcate, with slender filiform recurved tips. Petals deeply 2 -partite; segments linear, fleshy, white towards the base and with slender recurved green tips. Lip 3 -partite, the lateral segments a little longer than the petals; midlobe linear, straight, longer than the decurved lateral, ones. Spur shorter than the overy, laterally compressed and clavate towards the aper. Anther-cells distant, divaricate, with prominent incurved tubes. Staminodes globose, tuberculate, bright green, placed outside and at the base of each anther-lobe; pollinia 2, obliquely ovate in outline; caudicles slender, dilated towards their bases and attached to small ovate brownish-yellow glands. Sligmatic processes subcylindrical, blunt, recurved, the entrance to the spur lying between their bases. Dalz. \& Gibs. Bomb. Fl. 267 ; Krantzlin in Engl. Jahrb. xvi, 67; Orch. Gen. and Sp. i, 270 ; Hook. f. Fl. Br. Ind. vi, 134 (excl. H. trinervia Wight). H. Gibsoni Hook. f. Ic. Pl. 2319; Fl. Br. Ind. vi, 135. Bonatea punduana Lindl. in Wall. Cat. 7063, B. benghalensis Griff. in Calc. Journ. Nnt. Hist. iv, 382; B. herbacea Wall. MSS.

Kashmir, Falconcr; Dehra Dun in sâl forests, Mackinnon (Duthie's No. 22728), Kansrao (Dehra Dun), Duthie's collector No. 24177; Mussuorie Hills, Hugel, Duthie, 637 (1877), Mackinnon (Duthie's Nos. 21758, 24178); Bageswar in Kumaon, Duthie's collector No. 24063. Flowers during July. It extends eastwards to Bengal and Assam and southwarde to Bombay and S. India and Tenasserim; also found in N. Australia.
H. trinervia Wight, whioh in the "Flora of British India" has been reduced to this species, alllough cloeely allied, differs euffioiently to justify its separation. The leaves of the former are more scatered and exteud higher up the stem towards the raceme; the lateral sepale are erect and have not the slender almont filiform tips of $\boldsymbol{H}$. digitata; the lobes of the petals are not deourved, and the three lobes of the lip are nearly parallel and about equal in length. The flowere of H. digilata bave a peculiarly pungent odour resembling that of Valuiana $W$ nllichii.

Plate 128. Habeoaria digitata Lindl. A plant,-of natural size. Fig. 1, front view of a flower; 2, back view of ditto; 3, side view of ditto, with the perianth removed; 4, column, showing the anther, the pollen tubes and the staminodes; 5 . pollinia; -all enlarged. In the plate the name Habenaria digitata has been scored out in error.

## 3. Habenaria Susannex R. Brown Prod. 312.

Height of whole plant 5 to 8 dm . Tubers elongate, 6 to 9 cm . long. Stem stout, with many blunt funnel-shaped sheaths on its lower portion. Leaves mostly on the middle portion of the stem, 5 to 15 cm . long and 3 to 6 cm . broad, ovate-oblong, obtuse; the upper ones bract-like, acuminate, imbricate. Raceme 3 to 5flowered, floral bract. longer than the ovary, cucullate, acuminate. Flowers sessile, 7 to 10 cm . in diam., white tinged with greenish-yellow, fragrant. Sepals spreading, very broad; the dorsal one suborbicular, about 4 cm . in length and breadth; lateral pair sub-quadrately oblong, obtuse. Petals linear-falcate, acute, thick. Lip about as long as the sepals, fleshy; side lobes very broad, truncate, deeply pectinate; midiobe linear, spathulate, with recurved edges. Spur very long, more than twice the length of the elongate ovary. Anther very broad and large; cells divergent; tubes long, adnate to the sides of the column; pollinia linear, curved, about as long as their flexuous caudicles; glands ovoid, fleshy, white. Staminodes linear, prominent. Stigmatic processes large, blunt, not projecting; rostellum confluent with the face of the column.

Royle Ill. 367 ; Blume Bijdr. 402; Hook. f. Fl. Br. Ind. vi, 137 ; Collett Fl. Siml. 501. H. gigantea Don Prod. 2t; Bot. Mag. t. 3374; Grah. Cat. Bomb. Pl. 201. Platanthera Susannoe Lindl. Gen. and Sp. Orch. 295; Wight Ic. 920; Dalz. \& Gibs. Bomb. Fl. 269 ; Krnzl. Orch. Gen. and Sp. i, 601 ; Rolfe in Journ. Linn. Soc. xxxvi (1903), 57. P. gigantea Lindl. in Wall. Cat. 7052. P. robusta Lindl. in Wall. Cat. 70:36; Gen. and Sp. Orch. 295. Orchis Susanne Linn. sp. Pl. 939. O. gigantea Smith Exot. Bot. t. 100. O. altissima Herb. Ham.

Simla Hills below 6,000 feet, Lady Dalhousie, Collett; Siwalik ravge, Royle; Mussoorie range below 6,000 feet, Falconer, Mnckinnon, Duthie No. 22981; Garhwál, 3,000 to 5,000 feet, Duthie Nos. 1195, 2066 ; Kumaon 5,000 to 6,000 feet, Strachey $\&$ Winterbottom No. 39; near Naini Tal, Colonel Davidson; Kali Valley in E. Kumaon, Duthie Nos. 3410, 24062. Flowers during September. It occurs in the hilly districts of Bombay and S. India, also on the Naga and Khasia Hills, extending eastwards to Upper Burma and China.

Plate 129. Habenaria Susannæ, R. Br. Upper portion of plant, $\rightarrow$ of natural size; an entire plant,-reduced in size. Fig. 1, side view of flower, with the sepals and lateral lobes of lip removed; 2, front view of column; 3, pollinia;-all enlarged.

## 4. Habenaria pectinata Don Prod. Fl. Nep. 24.

Height of whole plant up to 3 dm. Stem stout, quadrangular, the angles more or less winged. Leaves 6 to 8 cm . long and 1.5 to 2 cm . broad, ovate-lanceolate, s.cutrmine, often recurved at the apex, strongly 3 -nerved. Flowers 2.5 cm . across
arranged in a compact secund raceme; bracts leaflike, longer than the flowers. Sepals green, their margins pale; dorsal erect, broadly lanceolate, obtuse, 3-nerved; the lateral pair narrower, spreading, subfalcate, mucronate on the back below the reflexed tips. Petals forming a hood with the dorsal sepal, falcately oblong, obtuse, white. Lip longer than the lateral sepals, 3 -partite, pure white; midlobe linear, a iittle longer than the deeply poctinate side lobes. Spur longer than the ovary, stout, funnel-shaped at the base, its apex curving outwards. Anther-cells distant; pollinia bipartite, each attached by a short slender caudicle to the flat oval gland, the caudicles supported by vertical flattened hyaline projections of the rostellum. Stigmatic processes 4 mm . long, linear-clavate, atout, tilted upwards, grooved alung thair upper surfaces. Capsule sessile, fusiform. strongly ribbed. Liodl. Gen. and Sp. Orch. 321; Hook. f. Fl. Br. Ind. vi, 137 (in part); Krnzl. in Engl. Jahrb. xvi, 193 (in part); Orch. Gen. and Sp. i, 405 (in part, and excl. var. arictina); King \& Fantling in Ann. R. Bot. Gard. Calc. viii, 310 (in part, and excl. t. 406 ). Collett Fl. Siml. 501. H. Gerardiana Wall. Cat. 7031. Orchis pectinata Smith Exot. Bot. ii, 77, t. 89.

Chamba district of the Punjab Himalaya at about, 4,000 feet, Lace No. 1816 ; Simla Hills, Lady Dalhousie, T. Thomson, Collett, etc.; Mussoorie Hills 5,000 to 7,000 feet, Duthie Nos. 527, 217j3, Mackinnon; Lansdowne in British Garbwál 4,000 to 5,000 feet, Roberts; Kumaon between 5,000 and 7,000 feet, Strachey \& Winterbottom No. 45, Colonel Davidson, Duthie Nos. 340y, 240j6. Flowers during July and August. It extends eastwards to Nepal.

This is rather a rate speoies, as compared with $\boldsymbol{H}$. ensifolia. Both these species turn black when dried, and are then sometimes rather difficult to distinguish, but when fresh they should not be confounded.

Plate 130. Habenaria pectinata Don. Portion of plant,-of natural size. Fig. 1, front view of single flower; 2, side view of ditio, with the sepals and petale removed; 3, front view of column; 4, anther (spread out), showing the stigmatic and rostellar processes; $;$, pollinia;-all enlarged.

## 5. Habenaria ensifolia Lindl. in Wall. Cat. 7030.

Iubers elongate. Stem 6 to 7.5 dm . high, robust, leafy, lower portion bearing several long acute tubular sheaths. Leaves distributed chiefly towards the upper portion of the stem, 7.5 to 15 cm . long, oblong to linear-lanceolate, acuminate, amplexicaul at the base, strongly 3 -nerved, diminishing in size upwards. Raceme 1 to 2 dm. long. Flowers green, 3.1 to 3.8 cm . across; floral bracts leaflike, linear-lanceolate, acuminate, much longer than the rather slender and straight ovaries. Sepals unequal, erect, their tips recurved; dorsal lanceolate; the lateral pair rather wider, subfalcate and acute. Peials forming a hood with the dorsal sepal, narrowly and falcately oblong, obtuse or acute, pale green, ciliolnte on their outer margins. Lip a little longer than the sepals, 3-lobed pale green; margins of side lobes deeply pectinate; midlobe rather shorter. linear; spur laterally compressed, dilated towards the apex, about as long as the ovary, sigmoid or geniculate. Anther-cells divergent, elongate. Pollinia narrowly elliptic, grooved, their caudicles as lung as themselves, slender and curved; glands minute, discoid. Stigmatic processes linear, elongate, divergent. Capsule nearly sessile, fusiform, thickly ribbed. Lindl. Gen. \& Sp. Orch. 321 ; Collett Fl. Siml. 504, fig. 165 ;

Rolfe in Journ. Linn. Soc. xxxvi (1903), 58. Habenaria pectinala Hook. f. Fl. Br. Ind, vi, $1: 37$ (in part and not of Don); Krazl. in Engl. Bot. Jahrb. xvi, 193 (in part); Orch. Gen. and Sp. 405 (in part and excl. var. arieliza); King \& Pantling in Ann. R. Hot. Gard. Calc. viii, 310 (in part), t. 406.

Near Dalhousie, Dr. Clark; Simla Hills from 6,000 to 8,000 feet, Stcliczla, Lady Dalhousie, Gamble, Collett; Bashahr at 7,000 feet, Lace No. 1036; Mussoorie range between 6,000 and 7,000 feet, Machinnon, Duthie Nos. 21764, 22986, 22993, 24167 ; Garhwál between 5,000 and 6,000 feet, Duthie No. 527 ; Lansdowne in Brit. Garhwál, Roberts; Kumaon between 5,000 and 6,000 feet, Strachey of Winterbotiom No. 46, Colonel Davidson, Duthie No. 3409. Flowers during July and August. It is found also in Sikkim, and on the Khasia Hills.

This is taller and altogether a muoh more robust plant than $H$. pectinata, end it is also much moro abuudant.
6. Habenaria arietina Huok. f. Fl. Br. Ind. vi. 138.

Habit and general appearance of $H$. ensifolia, but leaves much broader. Raceme 1-25 to 2 dm . long. Flowers green. Sepals narrowly oblong-elliptic; the lateral pair sub-falcate, with ciliolate margins. Petals erect and adpressed to the dorsal sepal, gibbous at the base externally, bluntly acuminate, puberulous. Lip as in $\boldsymbol{H}$. ensifolia, but the side lobes with fewer teeth; spur laterally compressed, much longer than the ovary. Anther retuse and mucronate at the apex, their tubes long and upright as in $H$. intermedia. Stigmas large, linear-lanceolate, spreading, green, their margins ciliolate. Hook. f. in Ann. R. Bot. Gard. Calc. $v$ 64, t. 97. H. pectinata Lindl. (not of Wallich); Gen. and Sp. Orch. 341; Wall. Cat. 7029B (in part) and C.; H. pectinata var. arietina Krnzl. Orch. Gen. and Sp. i, 405.

Eastern Kumaon, Duthie's collector No. 24055. Flowers during July and August. It extends eastwards to Nepal, Sikkim and the Khasia Hills.

This epeoies has a muoh greater resemblance generally to $H$. ensifolia than it hes to $\boldsymbol{H}$. pectinata; and, as it also turne black when dried, the diffoulty in distinguishing them in that condition is inoreased. The long upright anther-tubes as well as the pollinia and glands are very similar to those of $\boldsymbol{H}$. intermedia, to whioh it is evidently closely allied. The Simla locality given in the Flora of Brit. India for this species refers to the specimens of $H$. ensifolia collected by Lads Dalhousie. H. arietina is therefore not at present known to occur westward of Kumson.

## 7. Habenamia intermedia Don Prod. Fl. Nep. 24.

Stem 2 to 5 dm ., terete; sheaths at the base two or three, upper sub-foliaceous. Leaves scattered, 8 to 18 cm . long and 2 to 6 cm . broad, ovate-oblong, acuminate, rounded or cordate at the base; nerves 5-7, impressed above. strongly prominent beneath. Racemes $z-6$-flowered ; floral bracts leaf-like, broadly lanceolate acuminate, equalling or exceeding the ovary. Flowers about 5 cm . across. Sepals persistent and enlarging after flowering: dorsal 25 cm . long, ovate-lanceolate, acute, recurved at the apex, the inner surface almost white; lateral sepals spreading, falcately lanceolate, acuminate, 5 to 7 -nerved, tups reflezed. Petald pure white, overlapping at their adices, as long as the dorsal sepal and tightly pressed against it, dimidiate-faicate, odrase, margins miuutely ciliulate.

Lip 3-lobed, longer than the sepals, green except the longer white claw, papillose towards the base; side lobes deeply pectinate, midlobo linear, 3 to 5 cm . long. Spur stout, 6.5 cm . long, exceeding the ovary, tapering towards the apex, more or leas curved. Anther-cells with very long erect filiform tubes; pollinin 6 mm . long, elongate, often bipartite, with slender caudicles as long as the pollinia and minute glands at the base. Stiginatic processes 1.5 cm . long, slender, incurved, white, with spreading green tips, minutely papillose. Rostellum adnate to the face of the column between the anther, cells. Capsule pedicelled, 3 to 5 cm . long, fusiform, beaked. Lindl. Gen. and Sp. Orch. 322; Wall. Cat. 7030; Reichb. f. in Gard. Chron. (1879), 136; Hook. f. Fl. Br. Ind. vi, 138; Krnzl. in Eng. Bot. Jahrb., xvi, 161 ; Urch. Gen. and Sp. i, 403; Collett Fl. Siml. 502, fig. 164; Rolfe in Journ. Linn. Soc. xxxvi (1903), 59.

Abundant from Kashmir to Kumaon at elevations between 5,000 and 7,000 feet, flowering in August. It extends eastwards to Nepal and the Khasia Hills, but there is no record of its occurrence in Sikkim.

Plate 131. Habenaria intermedia, Don. A plant,-of natural size. Fig. 1, side view of single flower; 2, one of the petals; 3, side view of column showing the erect filiform anther-tubes and the long incurved stigmatic processes; 4, pollinia;-all anlarged.
8. Habenaria longifolia Ham. in Lindl. Gen. and Sp. Orch. 324.

Stem slender, leafy, $2 \cdot \overline{0}$ to 4.5 dm . long. Leaves 7 to 12 cm. , scattered, erect, linear, acuminate, diminishing in size upwards. Spike 5 to 7 cm ., many-and laxly flowered; floral bract linear, acuminate, longer than the slender beaked ovary. Ovary 1.3 to 2 cm ., curved. Flowers white. Sepals minute, the lateral pair 5 mm . long, oblonganceolate, 3 -nerved, a little larger than the dorsal. Petals gibbously ovate, as long as the dorsal sepal, 3-nerved. Lip flabelliform, 1.3 to 1.5 cm . broad, twice or thrice as long as the lateral sepals; midlobe linear, shorter than the side lobes; side lobes semi-circular, quite entire; spur slender, twice as long as the ovary, green. Anther beaked, cells parallel, tubes incurved. Stigmatic processes short, clavate, incurved towards the mouth of the spur. Rostellum long, erect, subulate. Hook. f. Fl. Br. Ind. vi, 141 ; Krnzl. in Engl. Bot. Jahrb. xvi, 202; Orch. Gen. and Sp. i, 420. Gymnadenia longifolia Lindl. in Wall. Cat. 7060. Habenaria trapezoidea Falc. MSS.

Mohand Pass on the Siwalik range, Royle; near Mussoorie, Falconer. Found also by Buchanan-Hamilton at Nathpur in Nepal. I have sean no living specimens. The flowers are usually larger than those of $H$. plantaginea, but it may be easily distinguished from the latter by its very narrow leaves.

## 9. Habenaria plantaginea Lindl. Gen. and Sp. Orch. 323.

Tubers ellipsoid, about 3 cm . long. Leaves about three or four, radical, horiznntal, $7 \cdot 5$ to 15 cm . long, narrowly oblong, acute or obtuse, membranous. Scape slender, 2 to 4 dm . high, bearing many lanceolate acuminate bracta, the lowest often large and leaflike. Spike 5 to 15 cm . long, lexly flowered. Flowers sub-secund, white; floral bract lanceolate, ncuminate or setaceous, half as long as the curved beaked ovary. Sepals sub-eaual, about 7 mm . long, strongly 3 -nerved, white tinged with grees; dursal
erect, ovate-oblong, the lateral pair falcately oblong, spreading. Petals linear-lanceolate, adpressed to and forming a hood with the dorsal sepal. Lip flabelliform, clawed, twice as long as the lateral sepals, puberulous; side lobes semi-ovate, entire or toothed, often overlapping at their apices; midlobe a little shorter, linear-oblong, deflexed; spur equalling the ovary, slender. Anther broad, cells divergent; tubes short, upcurved; pollinia globose to ellipsoid; caudicles curved, linear-cuneate, glands falcately ovateacuminate, combined when young. Stigmatic processes large, fleshy, oblong; rostellum triangular, broad. Staminodes prominent. Capsule fusiform, curved, its beak short and slender. Wight Ic. 1710; Hook. f. Fl. Br. Ind. vi, 141 ; Krnzl. in Engl. Bot. Jahrb. xvi, 197; Orch. Gen. and Sp. i, 413. Gymnadenia platyphylla Lindl. Wall. Gat. 7053. Orchis platyphyllos Roxb. Fl. Ind. iii, 609. O. tenuis Herb. Rottl.

Dehra Dun, Falconer (Kew Distrib. No. 1032), Duthie Nos. 7654, 24174, Muckinnon's collector (Dutbie's No. 25417); below Mussoorie, Duthio's collector No. 23002; Binsar in Kumaon at 7,500 feet, Strachey \& Winterbottom No. 36; below Naini Tal, Colonel Davidson, C. W. Hope. Flowers during September and October. It extends eastwards to Sikkim and Cbota Nagpur and southwards to Central and S. India and Ceylon.

Plate 132. Habenaria plantaginea-Lindl. A plant, -of natural size. Fig. 1, single flower; 2, ditto, with the sepals removed; 3, column ovary and spur; 4, front view of columa; 5, pollinia; 6, ditto, taken frow a bud and showing the connate glands;-all enlarged.

## 10. Habenaria triflora Dun Prod. Fl. Nep. 25.

Stem 4.5 dm . high, leafy throughout, rather stout, terete, sheaths at the base loose-fitting. Leaves 2.5 to 7.5 cm . long, ovate-lanceolate, acute, the upper narrower and acuminate. Floral bracts leaflike, embracing the ovaries of the large erect flowers, keeled on the back, membranous. Flowers 1 to 3, shortly pedicelled, white. Sepals about 2 cm . long, suberect with recurved apices, strongly veined; dorsal ovate, rounded; lateral pair falcately lanceolate. Petals very sinall, linear-subulate, 1 -nerved. Lip flabelliform, about 3 cm . long. 3 -partite to about the middle, gibbous at the base; side lobes semi-oblong or hatchet-shaped, the margins crenulate; midlobe a little shorter, linear; spur slender, straight, as long as the ovary, flattened near the tip. Anther very broad, quadrate, truncate, cells marginal; tubes short, free; pollinia semi-ovate; caudicles a little longer, curved, dilated above, glands minute. Stamonodes triangular, spreading. Stigmas inconspicuous. Rostellum broad. Hook. f. Fl. Br. Ind. vi, 142. Platanthera candida Lindl. in Wall. Cat. 7035; Gen. and Sp. Orch. 295 ; Krnzl. Orch. Gen. and Sp. i, 610.

Jaunsar, in the Tonse and Mautar Vulleys, 4,000 to 5,000 feet, Osmaston (Duthie's No. 23102); near Tehri in Garhwál, Mackinnon's collector (Duthie's No. 25419); Kumaon near Loha-thal 5,000 feet, Strachey \& Winterbottom No. 44; near Askot in E. Kumaon 4,000 to 5,000 feet, Duthie No. 5995 . Flowers in August. It extends eastwards to Nepal and Lower Bengal.

Plate 133. Habenaria triflora Don• $\Lambda$ plant, -of natural size. Fig. 1, single flower; 2, ditto, with sepals removed; 3 , lip; 4, front view of column, with petals attached; 5, pollisia;-all enlarged.
11. Habenarin commelinifolia Wall. in Lindl. Gen. and Sp. Orch. 325.

Whole plant 6 to 9 dm . high. Tubers ellipsoid or cylindrical. Lower portion of stem bearing a few loose sheaths. Leaves scattered, 8 to 15 cm . long and 2 to 3 cm . in breadth, oblong or oblong-lanceolate, sub-coriaceous, acute and often sub-spinescent at the apex, margins white. Bracts between the leaves and the spike linear-lanceolate, acuminate, ciliolate. Spike 1 to 2 dm . Iong, many- and laxly-flowered; floral bracts erect, nearly equalling in length the long beaked ovary, scaberulous on both surfaces and ciliolate along the edges. Flowers 1.4 to 2 cm . in diam., white, inodorous. Sepals scaberulous; dorsal small, saccate, with a short recurved beak; lateral pair much shorter, hatchet-shaped, beaked, with the veins deeply looped or arched. Petala unequally oblong, smaller than the lateral sepals. Lip divided into three long slender filiform segments, 2.5 cm . from its base to the tip of the mid-segment; lateral segments 3 cm . long, curved downwards; mid-segment channelied, lovger than the lateral pair, spreading, scaberulous; spur 6 to 7 cm . long, alender and curved downwards; its upper portion funnel-shaped and nearly white, the apex clavate and green. Anther-cells elongate, distant, diverging at the base; the tubes long and straight; pollinia small, oval; caudicles very long, dilated upwards, translucent, glands mioute. Staminodes seated on the long urms of the column and curving round in front of the anther-tubes. Stigmatic processes large, clavate, incurved; rostellum triangular. Ovary including the loug slender beak 3 cm . long. Grif. Notul. iii, 372 ; Ic. Pl. As. t. 339 ; Hook. f. Fl. Br. Ind. vi, 143; Krnzl. in Engl. Bot. Jahrb. xvi, 137; Orch. Gen. and Sp. i, 322. Platanthera commelinifulia Lindl. in Wall. Cat. 7037. Orchis commelinfolia Ruxb. Fl. Ind. iii, 451; Grah. Cat. Bomb. Pl. 201. O. stylosanthes Herb. Ham.

Kangre Valley, Edgeworth; near Simla; 6,000 feet, Collett; Siwalik range, Duthie's collector No. 24166; Dehra Dun in open graesy spots, Duthie No. 2067 (1881,) Mackinnon (Duthie's No. 21751); Garhwál 3,000 to 5,000 feet, Faiconer, Duthie No. 521; Kumaon, Wallich, Royle, Strachey \& Winterbottom No. 43; Káli Valley, Duthie's collector No. 24054. Flowers during August and September. It extends eastwards to Parasnath and Upper Burma, and southwards to Central and S. India.

Plate 134. Habenaria commelinifolia Wall. A plant (upper and lower portions),-of natural size. Fig. 1, side view of single flower; 2, ditto with the lateral sepals, the petals and lip removed; 3, front view of column; 4, pollinia; -all enlarged.
12. Habenaria pobegcens Lindl. Gen. and Sp. Orch. 322.

Tubers elongate, stout, often divided, with a few thick and fleshy fibres from their bases. Stem about 4 dm . long, clothed at the base with two or three tight-fittiag sheaths, pubescent. Leaves crowded towards the base of the stem, about 1 dm . long and 4 cm . broad, lanceolate, acumivate, tapering to their bases, 7 to 9 -nerved, nerves not prominent; margins undulate, ciliolate. Racence with a few empty leaf-like bracts at its base, $1 \cdot 3 \mathrm{dm}$. long, many-flowered, lax, pubescent; floral bracts shorter then the longbeaked ovary, ovate, acuminate, ciliolate. Flowers small. Dorsal sepal 3-nerved, erect, broadly ovate, a little shorter than the dimidiate ovate obtuse reflexed lateral ones. Petals narrowly falcate, longer than the dorsal sepal, and forming an arch with it. Lin 3 -partite, longer than the sepals; segments linear, the lateral oues with filiform tips; tha midlobe about as long as the lateral ones, blunt, keeled beneath. Spur about as long as
the ovary, slender, curved. Anther-tubes long, flexuous; pollinia ovate, obliquely attached to the long slender flexuous caudicles; dises small, flat. Staminodes large and prominent. Stigmatic pro;esses globose. Capsule with a long slender beak, curved, ridges thick and prominent. Hook. f. Fl. Br. Ind. vi, 141 ; Krantzlin in Engler's Bot. Jahrb. xvi, 202 ; Orch. Gen. and Sp. i, 421.

Dehra Dun, Mackinnon (Dutbie's No. 21765); Garhwál and Kumaon, up to 5,500 feet, Royle, Falconcr, Duthie, Mackinnon, etc.

Plate 135. Habenaria pubescens Lindl. A plant,-of natural size. Fig. 1, a single flower; 2, back view of ditto; 3, front view of column, showing the base of the lip, the stigmas, the staminodes and the glands of the pollinia; 4, pollinia;-all enlarged.
13. Habenaria furcifera Lindl. Gen. and Sp. Orch. 319.

Whole plant 2.5 to 4.5 dm . high. Stem sheathed at the buse; leafy below the middle, bracteate above. Leaves 6.5 to 11.5 cm . long, elliptic, acute or acuminate, slightly narrowed to the sheathing base. Bracts on the upper portion of the stem lanceolate, acuminate, diminishing in size upwards. Raceme 12.5 to 17.5 cm . long, many- but laxly-flowered. Flowers about 13 mm . across from base to apex, green; foral bract linear-lanceolate, acuminate, about equalling the ovary. Sepals unequal, the dorsal ovate-oblong, obtuse, concave; the lateral pair rather shorter, broadly and falcately lanceolate, acute or acuminate, spreading. Petals as long as the dorsal sepal, and with it forming a hood over the column, oblong, retuse. Lip longer than the sepals, trifurcate to the base; the lateral segments filiform, diverging, curved, longer than the stouter blunt middle one. Spur slender, longer than the ovary, laterally compressed, curved at the apex. Anther-cells contiguous, diverging at their bases, their tubes rather short; pollinia falcately ovoid, their caudicles slender, slightly curved, attached to narrowly oblong glands. Staminodes rather large and broadly oblong. Stigmatic processes short. Capsule fusiform, decurved, shortly beaked and with thick ribs. Hook. f. !l. Br. Ind. vi, 149 ; Krnzl. in Engl. Bot. Jahrb. xvi, 161 ; Orch. Gen, and Sp. i, 356; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 313, t. 410. II. hamigera Grıff. in Calc. Journ. Nat. Hist. iv, 380, t. 20. H. tenuicornis Wall. MSS.

Delıra Dun, Mackinnon, Duthie Nos. 2314, 2323, 21754, Gamble No. 23178, Siwalik range, Duthic's collector No. 24168; Mussoorie hills 4,000 to 6,000 feet, Royle, Edgiwarth, Mackinnon, Duthic Nos. 21754, 22992. Flowers during August. It extends eastwards to Bengal, Sikkim, Bhutan and Upper Burma.

## 14. Habenaria marginata Colebr. in Hook. Fl. Exot. t. 136.

Subscapigerous. Tubers small, narrow, cylindric. Leaves few, subradical, sessile, 2 to 12.5 cm . long, oblong or linear-oblong, obtuse, margins pale yellow. Scape 1 to 15 dm. long; sheaths erect, laucenlate. Spike 5 to 15 cm . long, many-flowered; fural bract nearly equalling the ovaries, with pale ciliolate margins. Flowers 1.5 cm . in diam., freanish-yellow. Dorsal scpal erect, broadly ovate; lateral falcately oblong.lanceolate spreading or deflexed, 3-i-nerved. Petals íalcately oblong, erect, forming a hood with the dorsal sepal, 2-nerved. Lip longer than the sepals, 3-partite; lateral segments narrowed and with filiform poinis, mid-segments shorter and broader, with the marging
reflexed. Spur about as long as the curved ovary, laterally compressed at the apex. Anther-clels distant; tubes funnel-shaper, short, spreading. Pollinia with short geniculate cnudicles, glands rather large, triangular, flattened. Staminodes elongated. Stigmatic processes long, adnate to the base of the column for two-thirds of their length. Capsule $1.4 \mathrm{~cm} .$, fusiform, turgid, curved. Lindl. Gen. and Sp. Orch. 320; Dalz. \& Gibs. Bomb. Fl. 268; Griff. Notul. iii, 371 ; Ic. Pl. As. t. 341 ; Calc. Journ. Nat. Hist. $\mathrm{i}_{\mathbf{v},} 382$; Hook. f. Fl. Br. Ind. vi, 150; Kräntzlin in Engler's Bot. Jehrb. 164 ; Orch. Gen. and Sp. i, 360; Collett Fl. Siml. 504. Platanthera marginata Lindl. in Wall. Cat. 7038. Habenaria promensis Wall. Cat. 7033; Lindl. Gen. and Sp. Orch. 320. Grchis mysorensis and clavata Herb. Heyne.

Simla, 6,000 feet, Collett; Siwalik range and Dehra Dun, Duthie's collector No. 24172; Garhwál and Kumaon up to 11,000 feet, Falconcr, Strachey \& Winterboltom No. 38, Duthie, Mackinnon, etc., flowering in August. It extends westwards to Simla, Chamba and Kashmir, and eastwards to Bengal, and grows as a weed in the Calcutta Botanic Garden; it is also found in Burma and in Western and Southera India.

Plate 136. Habenaria marginata Colebr. A plant,-of natural size. Fig. 1, side view of single flower; 2, front view of ditto with the sepals removed; 3, lip seen from beluw; 4, side view of column with spur and ovary; 5, pollinia;-all enlarged.
15. Habenaria difeylla $\mathrm{D}_{\mathrm{a}}$ lz. in Hook. Journ. Bot. ii (1850), 262.

Tubers small, elongate or globose. Leaves radical, usually two, 2.5 to 5 cm . in diam., orbicular, cordate, margined, rather fleshy. Scape 1 to 2.5 dm., slender, manyflowered, the peduncle with distant sheathing lanceolate acuminate bracts; foral bract, much shorter than the slender curved ovaries. Flowers distant, spreading, white, tinged with green. Sepals subequal; dorsal erect, 5 mm . long, ovate, concave, acute; lateral pair deflexed, obliquely ovate, acuminate, 3 -nerved. Petals linear, white, as long as, and forming a hood with, the dorsal sepal. Lip much longer than the sepals, 3 -partite, segments filiform, the lateral pair spreading and spirally twisted at the tips, mid-segment shorter, deflexed; spur 8 mm . long, shorter than the ovary, inflated towards its acute apex. Anther broad, its cells distant, tubes very short; pollinia dimidiate-ovate, obliquely attached to caudicles, equal to them in length; glands small, subglobose; staminodes large, petaloid, sub-patent, with incurved tips. Stigmatic processes elongate, clavate, adnate to the mouth of the spur. Rostellum obscure. Dalz. \& Gibs. Bomb. Fl. 268; Hook. f. Fl. Br. Ind. vi, 151 ; Krnzl. in Engl. Bot. Jahrb. xvi, 154; Orch. Gen. and Sp. i, 346. H. Jerdoniana, Wight Ic. 1715. H. Sutleri Reichb. f. in Linnæa xxv, 229. Platanthera canarensis Lindl. in Pl. Hohen, exsicc. No, 142. Liparis diphyllos Nimmo in Grah. Cat. Bomb. Pl. 252.

Dehra Dun, Mackinnon (Duthie's No. 25411); Garhwál, Falconer. Flowers during August. It is found also in Eastern Bengal and Chota Nagpur, and from the Konkan to Malabar.

Piate 137. Habenaria diphylla Dalz. A plant,-of natural size. Fig. 1, single flower; 2, ditto, with sepals, petals and portion of lip removed; 3, front view of column;-all enlarged.
16. Habenaria Aitchisoni Reichb. f. in Trans. Linn. Soc. Ser. 2, Bot. iii, 113.

Tubers about 2 cm . long, rather narrow, often divided at the ends. Leaves two, near the base of the tall scape, subopposite, $4-6 \mathrm{~cm}$. long and about as wide, suborbicular, with cordate sheathing bases, cuspidate at the apex, not margined, thick, dark green abovo and with palo-coloured blotches, uniformly paler beveath. Spike 5—8 cm. long ; bracts of peduncle small, lanceolate, acuminate; floral bracts shorter than the ovary, lanceolate, acuminate. Flowers crowded, subsecund, erect, 8 mm . in diam., yellow-ish-green. Sepals and petals about equal in length; dorsal sepal erect, concare, ovate, obtuse, 3-nerved; thẹ lateral ones reflexed, obliquely lanceolate, acute. Petals erect, falcately ovate-lanceolate, l-nerved, auricled at the base in front. Lip a little longer than the sepals, 3-partite above the base; segments filiform, the two lateral ones spreading and recurved, narrower than the deflexed mid-segment. Spur variable in length, but always much shorter than the ovary. Anther broad, cells nearly parallel; tubes very short, incurved. Pollinia obovate, caudicles very short, glands small. Stigmatic processes thick and prominent. Rostellum minute. Ovary fusiform, curved. Hook. f. Fl. Br. Ind. vi, 152; Boiss. Fl. Or. Suppl. 370 ; Kräntzlin in Engler's Bot. Jahrb. xvi, 154 ; Orch. Gen. and Sp. i, 345. H. brachyphylla Aitch. \& Hemsl. in Journ. Linn. Soc. xix, 118 (not of Kräntzlin).

Mussoorie range, between 6,000 and 7,000 feet, Mackinnon [Duthie's Nos. 21752 and 22991 (b)]; Nag Tiba in Garhwál, 9 to 10,000 feet, Duthie's collector No. 22991 (a); Kumaon, 9 to 10,000 feet, Duthic; flowering during July and August. This species extends westwards to Murree, Kashmir, the Kurram Valley, Afghanistan and Waziristan.

Var. Josephi Hook. f. Fl. Br. Ind. vi, 152. Much smaller than 'the type. Leaves 2.5 to 3.5 cm . long, not cuspidate at the apex. Spike few-flowered. Flowers greenish. King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 311, t. 408. H. Josephi, Reichb. f. in Trans. Linn. Soc. lc. 114.

Northern Kumaon in the Kali Valley 9 to 11,000 feet, Duthie Nos. 3419, 6002, flowering during July and August. Found also in W. Nepail in the Nampa Gadh up to 12,000 feet Duthie No. $6002(\alpha)$, extending eastwards to Sikkim up to eievations between 12 and 14,000 feet.

Plate 138. Habenaria Aitchisoni Reichb. f. A plant,-of natural size. Fig. 1, front view of flower; 2, side view of ditto; 3, column, showing the anther, staminodes, rostellum and stigmatic processes; 4, pollinia ;-all enlarged.
17. Habenaria stenantea Hook. f. Fl. Br. Ind. vi, 153.

Height of plant 3 to 6 dm ., with no tuber, the roots thick and fleshy. Stem stout, sheathed at the base. Leaves three or more, 1 to 2.25 dm . long, the lower ones larger, obovate to oblong-lanceolate, acute or subacute; upper part of stem bearing lanceolate acuminate bracts 1 to 2 cm . long. Spike 1.25 to 2.25 dm . long, laxly many-flowered. Flowers 1.6 to 2 cm . across, green; floral bract linearlanceolate, equalling or shorter than the shortly stalked ovary. Sepals unequal, 3 nerved; the dorsal erect, concave, broadly ovate, blunt; lateral pair smaller
reflexed ovate-elliptic. subacute. Petals longer than the dorsal sepal, erect, linear, blunt, 1-nerved. Lip longer than the sepals, lanceolate, blunt, entire, 3-nerved ; spur spreading, slender, cylindric, longer than the slender beakless ovary, dilated towards the apex and slightly curved. Anther-cells diverging at the base, tubes none; pollinia broadly elliptic-clavate, faintly grooved, the caudicles rather short; glands large, elongato, placed on either side of the entrance to the spur and reaching to the stigma. Stigmas conjoined into a small transversely oblong body situated on the upper margin of the entrance to the spur. Capsule 10 to 11 mm . long. King \& Pantling in Ann. R., Bot. Gard. Calc. viii, 314, t. 412.

Sosa forest in E. Kumaon between 9,000 and 10,000 feet, Duthia No. 3405. Flowers during July and August. Found also in Sikkim, and at Clumbi in Tibet.

This species bears a olose general resemblance to $\boldsymbol{H}$. latilabris, but the column is quite different, the stigme being eingle and transverse; the polliniar glands are also very differently shaped.
18. Habenabia urceolata Clarke in Journ. Linu. Soc. xxv. 73, t. 30.

Whole plant 5 to 15 cm . high. Tubers narrow, elongate. Stem slender, curved, with a single sheath at the base. Leaf usually solitary, from below the middle of the stem, 5 to 10 cm . long, narrowly elliptic-oblong, obtuse or subacute, tapering to the long narrow tubular sheath. Peduncle with several distant bracts, the lowermost often leaflike. Racome 1.6 to 5 cm . long, decurved, jather laxly flowered, socund. Fluwers 8 mm . long, longer than the ovaries, narrowly campanulate, white; floral bract longer than the shortly stalked tumid ovary. Sepals erect, nearly equal, dorsal not connivent with the petals, elliptic, blunt, lateral pair oblong, subacute. Petals as long as the sepals, free, falcately oblong, blunt, tapering slightly to the base. Lip about as long as the sepala and petals, decurved beyond the middle, oblong, slightly conceve, tapering and becoming thicker towards the apex, minutely hispid near the base; spur shorter than the sepals, inflated above the constricted neck. Anther-cells elongate, approximate but not touching, parallel; pollinia ellipsoid, composed of large granules; glands about as long as the short caudicles, acute at one end. Staminodes filiform, parallel to the nuther-cells and exceeding them in length, their apices free. Stigmas conjoined, large, occupying the whole of the anterior surface of the column below the glands of the pollinia. Hook. f. Fl. Br. Ind. vi, 165 ; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 316, t. 415. Diphylax urceolata Hook. f. Ic. PI. 1885 ; Krnzl. Orch. Gen. and Sp. i, 599.

Northern Kumaon in the district of Byáns 11,000 to 12,000 feet. Duthie No. 6003. Flowers during August. Found also in Sikkim and on the frontiers of Nepal and Tibet.
19. Habenaria Edgemorthir Hook. f. ex Collett Fl. Siml. 504, fg. 166.

Height of plant 3 to 7.5 dm . Tubers oblong or sub-globose. Stem rather stout, leafy, its base clothed with a fow short lonse sheaths, of which the upper ono is usually sub-foliaceous. Leaves 3.7 to 10 cm . long, the upper ones diminishing in size, ovate or oblong-lanceolate, acute or acuminate, usually rather fleshy, the main nerves prominent beneath. Spike $7 \cdot 5$ to 25 cm . long, many-flowered, rachis stout. Flowcrs rather crowded,

9 to 12.5 mm . across, deflexed in bud; floral bracts lanceolate, acuminate; the lower ones longer and the upper shorter than the curved beaked ovary. Sepals green, pubescent, their edges minutely ciliolate; the dorsal erect, broadly ovate or sub-orbicular, concave; the lateral pair larger, deflexed, obliquely ovate, obtuse. Petals erect, yellow, thick, obliquely triangular from a broad base, their apices curving inwards and forming a hood with the dorsal sepal, turning black when dried. Lip yellow, longer than the lateral sepals; anterior portion thick and strap-shaped, deflexed abruptly from the end of the wider channelled claw; spur much longer than the ovary, curving upwards, yellowishgreen. Anther-cells distant, parallel; pollinia obliquely pyriform, bipartite ; caudicles short, curved, each attached to a small bipartite gland. Staminodes elongate. Stigmutic processes oblong, nearly parallel, situated below the opening to the spur; rostellum triangular. H. latilabris Hook, f. Fl. Br. Ind. vi, $1 j 3$ (in part). Platanthera acuminata Lindl. in Wall. Cat. 7010 ; Gen, and Sp. Orch. 289.

Throughout the Western Himalaya from Hazára to Kumaon at elevations beiween 6,000 and 10,000 feet. It is the most abundant terrestrial orchid on the Simla and Mussoorie ranges, and is very often found in company with Safyrium nepalense on oper hillsides. It commences to flower during July, but always a little later than H. lutilabris.

The upturned position of the spur in $I$. Edgeionthii may be explained by the fast that the flowers, when in bud, are deflezed, and the opurs are then directed upwards. The flowers, as they begin to open, ourve up and become sub-ereot, but by this time the elongated spurs have not suffioient apaoe in the orowded raceme in whioh to alter their position.

Plate 139. Halenaria Edgeworthii Hook. f. A plant, —of natural size. Fig. 1, side view of flower; 2, front view of ditto, with the lateral sepals removed; 3, side view of flower, the sepals and petals removed; 4, pollinia;-all enlarged.
20. Habenaria latilabris Hook. f. Fl. Br. Ind. vi 153 (in part).

Tubers fusiform. Stem 2 to 4.5 dm ., with a few loose sheaths near the base, of which the upper ones are often sub-foliaceous. Leaves scattered, three to five, 5 to 10 cm . long, elliptic-oblong, acute or acuminate, tapering into the broad sheathe; bracts below the raceme about 2.5 cm . long, lanceolate, acuminate. Spike 7.5 to 13 cm., laxly flowered. Flowers 12 to 14 mm . long (from the base to the tip of the dorsal sepal, the sepals dark green and the petals and lip yellowish-green; floral bract lanceolate, acuminate, those of the lower flowers louger than the curved beaked ovary, of the upper flowers shorter. Sepals unequal, their edges ciliolate; dorsal erect, 4 mm . long, broadly ovate or sub-orbicular, concave; the lateral pair reflexed, 5 mm . long, obliquely ovate, obtuse. Petals slightly longer than the lateral sepals, spreading, lanceolate or linesr from a broad triangular base, gibbous on their outer edges near the base. Lip rather longer than the petala, deflexed from the apex of the short broad claw, sub-terete or linear-oblong with reflexed edges, tapering slightly to the apex; spur abnut, 15 mm . long, slender, curved but not upturned as in $B$. Edgeworthii, cylindric or compressed and with the apex often bifid or trifid. Column short. Anther-cells parallel, distant, each with a rounded rugulose staminode on its outer side near the base; tubes short, curved forwards; polliniz obliquely pyriform, almost bipartite, tapering into the short stout caudicles; glands small, elliptic. Stigmas
two, oblong, blunt, separated by the entrance into the spur. Hook. f. in Ann. R. Bot. Gard. Calc. $\nabla$, 66, t. 100 ; King \& Pantling in Ann. R. Bot. Gard. Cal c. viii, 321, t. 423 ; Krnzl. Orch. Gen. and Sp. i, 442. Platanthera latilabris Lindl. Gen and Sp. Orch. 289. P. Orchidis Wall. Cat. 7039B.

Not uncommon on the Western Himalaya from Dalhousie to Kumaon at elevations between 5,000 and 9,000 feet; specimens have, however, been gathered by Mr. C. W. Hope as low down as Dehra Dun. It becomes more abundant eastwards, but in no portion of the area is it as plentiful as $\boldsymbol{H}$. Edgeworthii, which extends as far west as Hazara. H. latilabris is more of a shade-loving plant, and is very often found as an epiphyte on the trunks of trees. Flowers during July and August. It extends eustwarda to Nepal, Sikkim and E. Tibet.

In the living atate this epecies can be easily distinguished from $\boldsymbol{H}$. Edgeworthii by the nearly uniform greenish tint of its flowers, the spreading petals and by the shorter and much more slender spur, which is uevally not curved upwaras.

Plate 140. Habenaria latilabris Hook f. A plant,-of natural size. Fig. 1, side view of single flower; 2, front view of ditio, with the lateral sepals removed; 3, side viow of flower with the sepals and petals removed; 4, pollinia;-all enlarged.
21. Habenaria densa Wall. in Lindl. Gen. and Sp. 326.

Tubers oblong. Stem stuut, 3 to $7 \cdot 5 \mathrm{dm}$., with a few lcose blunt sheaths at its base, Leaves many, scattered, 6 to 10 cm . long, ovate or oblong, acuminate, tapering very little to the long sheath, diminishing in size upwards. Spike 2 to 3.5 dm . long, manyflowered, rachis stout. Flowers crowded, erect, 7 mm . across, green; foral bract longer than the short curved slender-beaked ovary, lanceolate, acuminate, the edges ciliolate. Sepals sub-equal, elliptic-oblong, obtuse, thick, ciliolate, 3-nerved; dorsel erect, conceve; lateral pair narrower, reflexed. Petals nearly as long as the sepals, obliquely ellipticoblong, obtuse, fleshy. Lip egualling the sepals, linear, obtuse, with a transverse callus at its base close to the column; spur half as long as the ovary, clavate, pendulous, compressed laterally. Column short, broad. Anther-cells distant, parallel, without tubes; pollinia broadly elliptic, caudicles short; glands discoid, guarding the entrance to the spur. Staninodes large, each consisting of two united elongate processes, the upper pair rugulose and parallel to the sides of the anther-cells; lower pair smooth, their apices converging inwards below the atigmas and almost meeting over the base of the lip. Stigmas two, small, sub-orbicular, placed between the polliniar glands and the staminodes. Hook. f. FL. Br. Ind. vi, 153 ; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 319. t. 420 ; Krnzl. in Engl. Bot. Jahrb. xvi, 216 ; Orch. Gen. and Sp. i 443 ; Collett Fl. Siml. 504. Platanthera densa Lindl. in Wall. Cat. 7046. P. clavigera Lindl. Gen. and Sp. Orch. 289.

Not uncommon on the Western Himalnya at elevations between 7,000 and 10,000 feet; Dalhousie, Dr. Clark; Simla, Lady Daihousie, Edgeworth, Gamble (No. 1390) etc.; Garlwál, Falconer, Edgeworth, Royle, Nackinnon, Duthie Nos. 525, 24175, 22410, 22988 ; Kumaon at Kalimundi 8,500, Strachey \& Winterbottom; F. Kumaon, Blinkworth, Duthie No. 3411 , Duthic's collector Nos. 24066, 24067, 24070. Flowers during July and August. It extends eastwards to Nepal, Sikkim and Bhutan.
22. Habenaria arcuata Hook. f. Fl. Br. Ind. vi, 155.

Stem very thick, leafy. Leaves 7.5 to 10 cm ., oblong-lauceolate, subacute, with sheathing bases, upper lanceolate, or linear-lanceolate. Spike broad, many-flowered ; floral bracts herbuceous, linear-lanceolate, the lower ones much longer than the slender curved ovaries. Flowers large, white. Sepals 9 mm . long; dorsal cucullate, beaked; lateral pair larger, oblong, obtuse, 3-nerved, deflexed. Petals small, linear, 1-nerved, membranous. Lip twice as long as the sepals, auricled at the base, puberulous, margins reflaxed. Spur 5 to 6.3 cm . long, incurved, acute. Anther large, broad, cells divergent, tubes orect; pollinia with short stout caudicles; glands very large, ovate ; rostellum broad, flat, acute. Platanthcra arcuata Lindl. Gen. and Sp. Orch. 289 ; Krnzl. Orch. Gen. and Sp. i, 633.

Mussoorie, Royle; Naini Tal, Colonel Davidson. The single specimen in the Kew Herbarium representing this species is the Nain Tal one, and this was gathered in the month of June.
23. Habenaria viridis R. Br. in Ait. Hort. Kew. ed. 2, v, 192.

Tubers ovoid, often lobed. Stem 7.5 to 10 cm . high. Leates usually three or four narrowly oblong, acute or obtuse, smaller upwards, many-nerved. Flowers 9 to 13 mm . long. Spike lax; bracts green, exceeding the ovaries, oblong-lanceolate, acuminate. Sepals and petals green striped with dark red. Sepals sub-connivent, ovate-oblong, concave, obtuse and cucullate at their apices. Dorsal 7 -nerved, the lateral pair obliquely ovate. Petals erect, linear-oblong, equalling the dorsal sepal. Lip linear-oblong, pale brown, widening towards the tridentate apex, the central tooth often very small; spur very short, obtuse. Anther with an emarginate apex, the cells diverging; pollinia broadly ellipsoid, composed of large grains; caudicles short, attached to minute glands, each of which is concealed in a pouch formed by the rostellum, as in the genus Orchis. Syme in Engl. Bot. (ed. 3), ix $10 \overline{0}$, t. 1462 ; Hook. f. Student's Fl. Brit. Islands 376. Pcristylus viridis Lindl. Syn. Brit. Fl., ed. 2, 261 ; Gen. and Sp. Orch. 299; Rolfe in Tourn. Linn. Soc. xxxvi (1903), 54. Satyrium viride Linn. Sp. Pl. 944. Orchis viridis Jrantz Stirp. Austr., ed. 2, 491. Gymnadenia viridis A. Rich. in Mém. Mus. Par. iv 57. Platanthera viridis Lindl. Syn. Brit. Fl., ed. i, 261 ; Reichb. Fl. Germ. xiii, 129, t. 434, Himantoglossum viride Reichb. Fl. Germ. Excurs. 120. Cceloglossum viride Hartm. Handb Skand. Fl., ed. 1, 329.

This interesting addition to the flora of British India was discovered in July 1901 at Nai Gund near the Kamri Pass in N. Kashmir, by Inayat Khán, formerly Head Plant collector to the Botanical Department of N. India, No. 25387. It was previously known from Northern Europe (including Britain), Siberia, Dahuria, China and N. America.

Plate 141. Habenaria viridis $R$. Br. A plant, -of natural siee. Fig. I, side view of single flower; 2, dorsal sepal; 3, front view of flower, with the sepals removed; 4, side view of ditto, with sepals and petals removed; 5, pollinia;-all eniargcd.
24. Hatenaria farlax King \& Pantling in Ann. R. Bot. Gard. Calc. viii,, 325, t. 428.

Whole plant 1 to 3 dm . high. Tubers small. Stem with two tublar bulunt sheaths at the base. Leaf solitary, 3.5 to 15 cm . long, narrowly elliptic or lanceolatc, acute or acuminate, tapering slightly to the short sheath. Peduncle long, with a single linear. lanceolate acuminate bract. Spike 3.5 to 10 cm . long, laxly or densely flowered; foral bract equalling or shorter than the slightly decurved ovary. Flowers small, green Sepals about equal, oblong or ovate-lanceolate, the dorsal connivent with the petals to form a lood; lateral pair erect, not connivent. Petals ovate-oblong, obtuse, variable as to size. Lip not much longer than the sepals, flat, rather fleshy, hastately 3-lobed from about the middle; side lobes oblong, obtuse, diverging; apical lobe longer than the side lobes, oblong, obtuse, deflexed; spur saccate, much shorter than the sepals, 2 -ribbed inside. Column rather long. Anther-cells nearly parallel, but diverging at the base, without tubes. Pollinia obovoid or clavate; caudicles short, tapering to the small cordate glands. Staminodes small, globular, attached about half-way up on the outer sides of the anther-cells. Stigmas two, transversely oblong, touching by their ends and forming a band below the anther-cells. Berminium fallax Lindl. in Wall. Cat. 7412; Hook. f. Ic. Pl. 2198; Fl. Br. Ind. vi, 129. Peristylus fallax Lindl. Gen. and Sp. Orcl. 298; Krazl, Orch. Gen. and Sp. i, 512.

Near Mussoorie 6,000 to 7,000 feet, Duthie No. 21770 ; Nág Tiba in Garhwál 8,000 to 9,000 feet, Muckinnon, Duthie Nos. 21769, 22987; Gori Valley in Kumaon, Duthie's collector No. 24058. Flowers during July and August.

## 25. Habenaria Elisabethe, Duthie in Journ. As. Soc. Beng. laxi, part II, 44.

Height of plant 2 to 4.5 dm., glabrous. Tubers ovoid. Leaves 2 or 3, approximate towards the base of the stem, with one or two loose sheaths below, and a few lanceolate and finely acuminate bracts above them, 6 to 12 cm . long and 1 to 2 cm . in breadth, lanceolate, acuminate or the lowest one often obtuse, amplexicaul at the base, midrib prominent beneath. Spike long, slender, many-flowered. Flowers small, sessile, rather crowded, deflexed, green ; floral bract lanceolate. acuminate, about half as long the curved beaked ovary. Scpals and petals erect, connivent; dorsal ovate, concave; the lateral pair obliquely ovate, obtuse. Petala a little longer than the sepals, obliquely ovate, obtuse. Lip longer than the sepals, 3 -lobed to the middle, fleshy, the basal portion trough-shaped; lateral lobes linear, spreading, their margins gibbous at the base; midlobe oblong, obtuse, as long as the lateral pair but broader. Spur one-fifth the length of the ovary, ovate or obovate. Anther-cells parallel; pollinia obovate, curved, attached by a short caudicle to an oval gland. Stigmatic processes clavate. Slaminodes rather large. Cybele Falc. in Lindl. in Veg. Kingd. 193c. C. alpina Falc. MSS.

Simila Hills between 9,000 and 10,000 feet, Edgeworth, Lady E. Babington-Smith; Mussoorie Hills from 6,000 to 9,000 feet, Edgeworth, Mackinnon, Duthie Nos. 21766, 22990; Jumna Valley in Garhwál, Duthie No. 524; Pharkia at 11,000 feet, Edgeworth; Naini Tal at 7,000 feet, Strachey \& Winterbottom No. 32, Colonel Davidson; Rálam Valley at 12,000 feet, $S^{\prime}$ rachey \& Winterbottom (named Herminium fallax). Flowers in August. It has been found also on the Eastern Himalaya at Chumbi, and in E. Tibet.

This species is very similar at first sight to $H$. fallar, with which it has often been confounded. The lenves, however, are never solitary, the flowers are smaller, more crowded and they are deflexed;
the shape of the lip also is very different. I have named this plant after Lady Elisabeth Babington Smith, who kindly sent me speoimens from near Simla in 1898.

Plate 142. Habenaria Elisabethm Duthie. A plant,-of natural size. Fig. 1, side view of single flower; 2, front viow of ditto (spread out), with the sepals removed; 3 , side view of lip and spur; 4, pollinia;-all enlarged.

## 26. Habenaria Lawii Hook. f. Fl. Br. Ind. vi, 162.

Tubers ellipsoid or globose. Stem 1.5 to $2 \cdot 5$ dm., slender, with a few short loose sheaths below the leaves. Leaves 3 to 5 , clustered above the middle of the stem, 7.5 to 10 cm . long, narrowly lanceolate or elliptic, acute, membranous. Spike 5 to 7.5 cm . long, slender, narrow. Flowers very small, spreading, white; floral bract ovate-lanceolate acuminate, longer than the ovary, membranous. Sepals and petals sub-equal, conaivent, obtuse. Dorsal scpal elliptic, the lateral sub-falcately linear-oblong. Petals fleshy. Lip as long as the sepals, broadly and obtusely 3-fid., its claw concave, and with a short ciliate ridge at its base; spur small, globose. Anther-cells parallel, tubes none; pollinia obovate, the caudicles as long as the pollinia and attached to minute globular glands. Staminodes large, petaloid, green tipped with white. Ovary slender, 6 mm . long, curved forward at the apex. Peristylus Lawii Wight Ic. 169jo ; Dalz. \& Gibs. Bomb. Fl. 270; Krnzl. Orch. Geu, and Sp. 510.

Debra-Dun, Mackinnon and Duthie's collectors Nos. 21767, 22727, 23101; below Landour (Herb. Calc.). Flowers during July and August. Found also on Parasnath Hill in Behar at an elevation of 4,200 feet, and in the Cbánda district of the Central Provinces, extending southwards to the Konkan and Mysore.

Plate 143. Habenaria Lawii Hook f. A plant,—of natural sizg. Fig. 1, side view of single flower; 2, ditto with the sepals and petals removed; 3, column, with lip attached; 4, lip, spread out; 5, anther and stamioodes (the latter spread out); 6, pollinia;-all enlarged.

## 27. Habenaria goodyeroides Don. Prod. Fl. Nep. 25.

Height of plant 3 to 6 dm . Tubers ellipsoid or oblong, hairy. Lower portion of stem with many loose blunt sheaths. Leaves clustered above the middle of the stem but not whorled, 5 to 10 cm . long, ovate or ovate-elliptic, acute, slightly narrowed to the shortly sheathed base. Spike 1 to 2 dm., densely flowered, its peduncle bearing a few lanceolate acuminate bracts. Flowers subsecund, 8 mm . in diam. at the mouth, deflexed by reason of the curved apex of the ovary, white, sweetscented; floral bract narrowly lanceolate, acuminate, about as long as the slender ovary. Scpals unequal, tinged with brown, the dorsal broadly ovate-lanceolate, concave, comiving with the petals and forming a hood; lateral pair oblong, involute, apiculate. Petals as long as the sepals, trapeziform, blunt. Lip longer than the petals, broadly triangular in general outline, the sides rounded, 3-lobed for one-third of its length; side lobes linear-oblong, falcate, acute and diverging at the apex, slightly longer than the broad blunt midlobe; upper surface with a small elongate depression at the base and in front of the minute opening into the spur; spur nearly globular, much sherter than the sepals. Column short and broad. Anther-cells parallel but not contiguous, without tubes; pollinia pyriform, caudicles very short, the glands small
and obovoid. Staminodes large, oblong, spreading outwards at right angles to the anther. Stigmas two, large, lying beneath and parallel to the staminodes, spreading. Hook. f. Fl. Br. Ind. vi, 161 (in part); King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 326, t. 430; Collett Fl. Sinl. 505. II. ornithoides Wall. MSS., Peristylua granais Blume Bijdr. 405. ILerminium goodyeroides Lindl. in Wall. Cat. 7066A (in part).

Below Deoban in Jaunsar at 7,600 feet, Osmaston; Dehra Dun, Mackinnon; Mussooric rauge up to 6,000 feet, Mackinnon, Duthie Nob. 2315, 21756; Bok Hill in Garbwál, Duthic's collector No. 24169; near Almora in Kumaon at 4,000 feet, Strachey \& Winterbottom No. 33, Duthic's collector Nos. 24059, 24065. Flowers during July and August. It extends eastwards to Nepal, Parasnath in Bengal, Sikkim, Assam, the Khasia Hills and Manipur.

Var. affinis Lindl. Gen. and Sp. Orch., 300. Much smaller in all its parts than the type; the lip is rather longer, gibbous at the base, and with broader side lobes. King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 327, t. 430 bis. $\boldsymbol{H}$. affinis Don. Prod. 25. H. goodyeroides in Hook. f. Fl. Br. Ind. (in part). II. saccuata Wall. MSS. Peristylus goodyeroides Lindl. Gen. and Sp. Orch. 299; Royle III. Him. Bot. t. 87, fig. 2; Rolfe in Journ. Linn. Soc. xxxvi, 54 (in part).

In the Cbamba State, Punjab Himalaya at 4,000 feet, Lace No. 1814; Mussoorie range common between 6,000 and 7,000 feet, Mackinnon, Duthic Nos. 17826, 21i57, 22729 ; Garhwál, Royle, King; British Garbwál at Lanedowne between 4,000 and 5,000 feet, Roicrts. Flowers during August. It extends eastwards to Nepal, Sikkim, and to the Khasia and Naga. Hills.
28. Habenakia constricta Wall. ex Hook. f. Fl. Br. Ind. vi, 161.

Tubers obloug, Lairy. Stem stout, 5 to 7.5 dm . high, clothed at the base with wide blunt sheaths. Leaves five or six, at the upper portion of the stem, nore or less whorled, 7.5 to 17.5 cm . long, ovate-elliptic, acute or acuminate, much narrowed towards the loug sheaths; bracts on upper part of stem linear-lanceolate, acuminate. Spike broadly cylindric, 2 to 4 dm . long, many- and densely-flowered. Flowers spreading, white, sweet-scented, 1.9 to 2.3 cm . across; floral bract erect, lanceolate, acuminate, about as long as the erect orary. Sepals about equal, oblong, obtuse, ciliolatethe dorsal conduplichte; the lateral pair spreading, their margins involute. Petals larger than the sepals, obliquely ovate-lanceolate, bluntly acuminate, somewhat gibbous on the lower side, spreading upwards in front of the dorsal sepal, but not conniving with it to form a hood. Lip as long as the petals, oblong, 3-lobed to about the middle; lateral lobes linear, acuminate, somewhat diverging at their apices; midlobe shorter, oblong, tapering to a blunt point. Colunn very short and broad. Anther-cells close together but not contiguous, without tubes; pollinia obovoid; the caudicles short, tapering to the oblong-elliptic gland. Staminodes oblong, obtuse. Sligmas two, obovate-oblong, spreading. King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 325, t. 429. Platanthera constricta Lindl. in. Wall, Cat. 7043. Mab. goodseroddes Lindl. in Wall. Cat. 7066B. (not of Don). Herminiun constrictum Lindl. in Bot. Reg. under 1449. Peristylus constrietus Lindl. Gen. and Sp. Orch. 300; Krazl. Orel. Gen. and Sp. I, 508. Orchis leucuntha Herb. Ham.

Delira Duu in sà forest, Mackinnon; Siwalik range, Duthic's collector No. 24176; Sarju Valley in Kumaon, Duthie's collestor No. 24060. Flowers during July and August. Found also in Sikkia, on the Khasia Fills, Assam, Chittigong, and in Upper and Lower Burma.
29. Habenaria galeandra Benth. Fl. Hongk. 363.

Tuluers s:uall, globose or oblong. Stem 1.5 to 3 dm. high, slender, glabrous or puberulous, usually tinged with purple, the lower portion bearing a few loose tubular sheaths. Leaves 3 to 5.5 cm . long, oblong-lanceolate, blunt or sub-acute, narrowed to the base and auplexicaul, dark green above, and usually with a bright purple band down the centre. Spike 1 to 1.5 dm., many-flowered; floral bracts leaflike, nuch longer than the flowers, diminishing upwards. Flowers about 12 mm . in diam., pale purple. Scpals and petals ovate-lanceolate, acuminate. Dorsal sepal erect, the lateral pair spreading, sub-falcate. Petals rather shorter than the sepals, conniving with the dorsal one. Lip brond, cuneiformly obovate or obcordate, often mucronate, shortly clawed, sides erect, upper surface puberulous at the base; spur stout, about half as long as the ovary. Anther-cells approximate; pollinia narrowly obovate, caudicles short, tapering into the elongate flat glands. Staminodes distinct, curving forward and in front of the auther-tubes. Ovary curved, the ribs brownish purple and puberulous. Hook. f. Fl. Br. Ind. $\cdot \mathrm{vi}$, 163; Collett Fl. Siml. 506. Plutanthera obvordata Lindl. in Wall. Cat. 7050; Geu. and Sp. Orch. 290; Rolfe in Journ. Linn. Soc. xxxvi, 56. I. galeandra Reichb. f. in Linnæa xxv, 226. P. Championi Lindl. in Hook. Journ Bot. vii, 38. Gymnadeuiu olvordata and galeandra Reichb. f. Ot. Bot. Hamb. 32, 33. Grchis obcordsta Buclı.-Ham. in Don Prod. 230. O. Susannce, Herb. Heyne.

Simla Hills, Siolüzka, Collett; Mussoorie range between 5,000 and 7,000 feet, Vicary, Muckinnon, Duthie Nos. 2575, 21755. 22732; Garhwál, Falsoner, Royle; British Garhwál near Lansdowne, Roberts; Kumaon 7,000 feet, Strachey \& Winterbottom No. 40; T. Thomson, Colonel Davidson, Duthie's collector No. 21064. Flowers in August. It extends eastwards to Nepal, Khasia and Naga Hills, Upper Burma and China. No record from Sikkim.

Plate 144.-Habenaria galeandra Benth. A plant,—of natural size. Fig. 1, side view of flower; 2, front view of column, with lip attached (the latter spread out); 3, front view of column, further enlarged; 4, pollinia;-all enlarged.
30. Habenaria secundiflora Hook. f. Ic. Pl. 2321.

Plant 1 to 2.5 dm . high; tubers ellipsoid. Stom with a few small sheaths at the base. Leaves two or three, distant 5 to 12.5 cm ., lincar, acuminate, scarcely narrowed to the tubular sheath. Bracts bolow the racemo linear, acuminate. Raceme up to 1 dm. in length. Flowers secund, rather crowded, 9 mm . long, pink; foral bract lanceolate, acuminate, the margins ciliolate, tho lower ones much longer than the curved tumid subsessile ovary. Sepals sub-cqual, lanceolate. Petals linear, sub-acute, falcate, minutely papillose, connivent with the three sepals to form a hood over the column. Lip as long as the sepals, deflesed, widening towards the 3 -lobed apex; lateral lobes triangular, not diverging; midlobe larger, oblong, acute; spur shorter than the ovary, rather
broadly conical from a contracted base, its apex blunt. Column long. Anther cells parallel, contiguous; pollinia oblong-obovoid; caudivles short, stout; glands large, lanceolate, acuminute, united for half their length by their inner edges. Staminodes oblong, rugulose. Infertilc stigma large, erect, 2-loberl, each lobe fulcately oblanceolate and covering the base of the anther. Fertile stigmas united, transversely oblong, forming a horizontal band below the infertile one. Hook f. Fl. Br. Ind, vi, 165 ; King \& Pantling in Ann. R. Bot. Gard. Calc., viii, 330, t. 433. Peristylus secundiforus Krnzl. Orch. Gen. and Sp. i, 518.

In a forest near Sosa in Eastern Kumaon between 8,000 and 10,000 feet, Duthis No. 3421. Flowers in September. It has been collected also in Sikkim, Bhutan and in E. Tibet.

This species bears a striking resemblance to $I$. urceolata; moreover, in both of them, the stigmas are united and the inforesoenoe is seound. In $H$. secundiffora the sepals and petals are oonnivent, and together form a hood over the blunt column; the lip is 3 -lobed, and the polliniar glands are wited. This cohesion of the glands oocure also in $\boldsymbol{H}$. plantaginea; but, as has been pointed out under that species, they ultimately separate.
31. Habenaria Griffithil Hook. f. Fl. Br. Ind. vi, 197; Ic. Pl. 2322.

Tubers small, oblong. Stem 1.5 to 3 dm. high, slender, straight or flexuous, fewleaved. Leavcs 2.5 to 6 cm . long, elliptic or linear-oblong, acute or obtuse, nembranous, the lower subpetioled. Spike sccund, 2.5 to 6 cm long, densely flowered. Flowers very small, white, deflexed; floral bract, ovate-lanceolate, variable in length. Sepals and petals $: 3 \mathrm{~mm}$. long, spreading at their tips. Dorsal sepal ozate-lanceolate, obtuse, the lateral puir obliquely linear-oblong. Pctals linear-lanceolate. Lip 4 mm. long, oblong, 3 -fid. at the apex; side lobes divaricate, obtuse; midlobe longer and broader; spur very short, and slightly curved outwards. Auther broad, rounded or retuse at the aper, cells diverging at the base; pollinia obovate, the caudicles short and very slender; glands minute. S'aminodes two, filiform, usually longer than the anther, attached to the base and buck of each cell. Rostellum forked, its branches diverging beneath the anther-cells. C'apsule 8 mm . long, oval, shortly stalked, the ribs thick. B. decopiens Hook. f. Fl. Br. Lnd. vi, 165 (not of Wight). Diphylax Grifithii Kınzl. Orch. Gen. and Sp. i, 599 . Herminum Griff. Notul. iii, 270 ; Ic. Pl. As. t. 285, fig. 1.

Bundai in the Chitral di.trict at 4,000 feet, Harriss (Duthie's Nos. 1667, 1668) Jhelam Valley in Kushmir between 5,000 and 6,060 feet, Duthie No. 10926; Labul between 4,000 and $\lambda, 000$ feet, 4 . Thomson; below Simla at 3,000 feet, Edgcworth; Tutwa Gádb in Jaunsar between 3,000 and 4,000 feet, Gleadow; Asuo in T. Garhwál, Gamble No. 25490 (under Goodyeru); Mussoorie range 6 to 7,000 feet, King (under Zcuxine), Mackinnon (Duthie's Nos. 22733, 21170). Flowers from Marc' to May.

This remarkable syeoies was found originally by Grifith in Afghanistan (Kew Distrib. No. 5326). It was collected many years afterwards by Dr. Aitchison in the Kurram Vulley (his number 322). The ditifoully in determining its floral structure from herbarium specimens was the cause of this speoies having been reforred at different times to no fewer than eight genera. It tears a strong outward resemblance to Spiranthes, under which genus Griftith's speoimens were provisionally placed. In Gleadow's speoimens, colleoted in Jaunsar, the staminodes are not longer than the anther, and the brat.ches of the rostellum, instead of spreading laterally, are directed forwards; also they are flat with wide bases and incurved at their apioes.

Plate 145. Habenaria Griffithii Hook. f. A plnnt, -of natural sizs. Fig. 1, side view of flower; 2, lip; 3, front view of columu, showing the anther, the two filiform staminotes and the forked rostellum; 4, column, seen from behind; 5 , pollinia; all cnlarged.

## 42. Herminium Linn.

Erect terrestrial tuberous-rooted herbs of small size. Leaves solitary or few, cauline or radical, sheathing at the base. Flowers in spikes, green or green and white. Sepals subequal, free, or the dorsal conniving with the petals to form a hood, the lateral pair spreading, sometimes fleshy, always entire. Lip adnate to the face of the column, as long as or longer than the sepals, often fleshy, broad or narrow, entire or 3- or 5 -fid., the base concave or very shortly saccate, the upper surface sometimes with calli or pits near the base. Column very short; anther-cells adnate to its face, parallel or slightly divergent below; pollinia two, the caudicles usually short or sometimes absent; the glands small and orbicular or elliptic, or large hollow and horn-like. Staminodes two, rugulose, attached outside the anther-cells. Stigmas 2, distant or conjoined. Species about 14, in the temperate and alpine regions of Europe and Asia.

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Lip 3-lobed.
    Petals subconnivent with the dorsal sepal, flowers green.
        Spike short, leaves broadly lanoeolate . . . . . . 1. H. Monorchis.
        Spike long and narrow, leaves linear-lanceolate . . . 2. H. angustifoliun.
    Sepals and petals spreading.
        Petals and lip white, the lip obscurely sacoate . . 3. H. Hackinnoni.
        Flowers altogether green, lip distinctly saccate . . 4. H. congestum.
Lip entire.
    Leaves two or three . . . . . . . . . . . . . . 5. H. Duthiei.
    Leaf solitary.
        Leaf short, oblong-lanceolate, petals green, subrotund 6. H. pugiouforme.
        Leaf linear-lanceolate, petals yellow, linear . . . . . 7. H. gramineum.
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1. Herminium Monorchis, R. Br. in Ait. Hort. Kew. ed. 2, v, 191.

Plant $7 \cdot 5$ to 15 cm . high. Tubers globose or ellipsoid. Stene with one or two sheaths at the base, the upper one often leaflike. Leaves two or three, near the base of the stem, 2.5 to 10 cm . long, oblong-lanceolate, acute, shining. Peduncle bearing one or two lanceolate acuminate bracts. Spike $2 \cdot \bar{j}$ to 5 cm . long, densely flowered, cylindrical or sub-secund. Flowers decurved, 4 mm. in diam., yellowish-green, muskscented; floral bract lanceolate, acuminate, shorter than or equalling the ovary. Sepals 3 mm . long, oblong, obtuse or sub-acute, the lateral pair narrower. Petals connivent with the sepals and a little longer, obliquely oblong-ligulate, tips flesky. Lip as long as the petals, 3 -fid., concave at the base, lobes narrow, obtuse, the middle one the longest. Anther-cells diverging above ; pollinia globcise, caudicles very short and slender, glands concave. Staminodes sub-globose, rugulose. Rostellum prominent at the base of the anther-cells. Capsule 7 mm . long, turgid, twisted, its beak curved downwards. Lindl. Gen. and Sp. Orch. $30 \overline{5}$; Reichb. Fl. Germ. xiii, t. $41 \bar{o}$; Boiss. Fl. Or. v, 82 ; Hook. f.

Fl. Br. Ind. vi, 128 ; Krnzl. Orch. Geu. and Sp. i, 531; Rolfe in Journ. Linn. Soc. xxxvi (1903), 51. Ophrys Monorchi Linn. Sp. Pl. 947.

Throughout the Western Himalaya at elevations between 9,000 and 14,000 feet. Hazara, Duthie's collector Nos. 21316, 23170 ; Baltistan, T. Thomson, Duthie No. 12010 ; Kashmir, C. B. Clarke Nos. 30737, 31509; Lahul, Jaeschke; Pangi, Duthie's collector No. 23391 ; Hattu near Simla, T'. Thomson; Gangotri Valely, Duthie No. 516 ; Kuman Strachey \& Winterbottom No. 34, Duthie Nos. 3415, 6009, Duthic's collector No. 24108 Flowers during July and August. It is found also in Sikkim and in China, and is widely diffused in N. Asie and Europe.

Plate 146. Herminium Monorchis R. Br. A plant, of natural size, Fig. l, side view of flower; 2, ditto, with the sepals removed; 3, column, with lip attached; 4 , pollinia;-all enlarged.
2. Herminidm angustifolium Benth. ex Hook. f. Fl. Br. Ind. vi, 129.

Tubers small, oblong or ellipsoid. Stem tall, 2.5 to $7 \cdot 5 \mathrm{dm}$., clothed at the base with acute tubular sheaths. Leaves usually three, up to 2.5 dm . long, linear, acuminate, with long sheaths. Spike 6 to 25 cm . long, narrow, cylindric, many-flewered. Flower's crowded, very small, green; floral bract linear-lanceolate, acuminate, sborter than or equalling the ovary. Sepals sub-equal, oblong, obtuse, the doreal one connivent with the petals to form a hood; lateral pair spreading. Petals linear, as long as the sepals. Lip much longer than the sepals, deflexed from the base, auricled on ite lower half and with a small concarity at the base, apical portion 3 -id; midlobe much shorter than the slender curved filiform side lobes. Anther-cells parallel, contiguous; pollinia pyriform, with truncate bases, caudicles very short and slender; glands minute, discoid. Staminodes large. Stigmas two, transversely oblong, lying close together below the anthercells. King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 392, t. 434; Collett Fl. Siml. 499, t. 163 ; Krnzl. Orch. Gen. and Sp. i, 533; Rolfe in Journ. Linn. Soc. xxxvi (1903), 50. Accras angustifolia Lindl. in Wall. Cat. 7061 ; Gen. and Sp. Orch. 282 ; Bot. Reg. under t. 1525 ; in Journ. Lion. Soc. iii, 43; Rogle Ill. Bot. Him. t. 87 ; Wight le. 1691. H. longicruris, Wright in Mem. Amer. Acad. Ser. 2, vi, 141. I'hisóe Falc. in Lindl. Veg. Kingd. 183c (name only).

Abundant throughout the Western Himalaya from Kashmir to Kumaon at elevations between 4,000 and 10,000 feet, flowering during July and August. It extends eastwards to Nepal, Sikkim, Bhutan, the Khasia and Naga Hills, also in Tenasserim, China, Japan, Java and Timor.
3. Herninium Mackinnoni Duthie in Journ. As. Soc. Beng. lxxi (1902), part 2, 44.

Whole plant up to 2.5 dm . Tubers narrowly oblong. Lower portion of the stem clothed with a few close-fitting tubular subacute sheaths. Leaves two, 12 to 14 cm . long and 1 to 2 cm . in breadth, oblong or linear-lanceolate, acute or acuminate, with loosely amplexicaul tubular bases, 3-5 veined. Spike cylindric, about 11 cm . long, many-flowered.

Flowers spreading, crowded, about 10 mm . across, floral bract 5 mm . long, broadly lanceolate, acuminate, a little shorter than the ovary. Sepals sub-erect, ovate-oblong, acute, green. Pctals and lip white, slightly tinged with green. Petals as long as the sepals, linear-lanceolate, divergent. Lip longer than the petals, trifid, deflexed from near its base, the margins reflexed; lower portion very thick and with a small concavity at the base; midlobe lanceolate, obtuse, nearly as long as the curved filiform side lobes. Anther-cells parallel, pu,llunia obovate-ellipsoid, caudicles very short glands discoid, reddish-brown, seated on the diverging arms of the branched rostellum. Stuminodes large, spreading. Stigmas 2, lying beneath the rostellua, obovate, obliquely converging downwards and towards the concavity of the lip. Ovary about 6 mm . long ovate-oblong, beaked. H. laxiflorum Lindl. in Herb.

Near Mussoorie at an elevation of about 6,500 feet, found growing on oak trees, but very rare, Mackinnon (Duthie's Nos. 22993, 2j42l). Flowers in August. Discovered previously by Sir Joseph Hooker at Senchal in Sikkim at an elevation of 7,000 feet (No. 279).

A very distinct species, its nearest Indian ally being II. angustifolium, which it rather ciosely resembles when dried; in faot, it was amongst the speoimens of the latter at Kew that a single specimen of Hooker's Senobal plant was detected. In Lindley's Orchid herbarium are two other speoimens from the same gathering. In the Kew collection of drawings there is a coloured one of this Senchal plant reoeived from the Calcutta gardens in 1876. It agrees in all essential partioulars with the plate here given of $\boldsymbol{H}$. Nlackinnoni. It is smaller and altogether a more delioate plant than $\boldsymbol{H}$. angustifulium, with fewer shorter and broader leaves; the flowering apike also is shorter and broader, the petals and lip are white, and the midlobe is much longer. The shape of the ovary is also very different.

Platr 149. Herminium Mackinnoni Dutlie. A plant,-of natural size. Fig. 1, front view of flower, with the sepals removed; 2 , side view of flower; 3 , front view of column, with lower portion of lip attached; 4, ditto, seen more from below; 5, pollinia; -all enlarged.

## 4. Herminium congestum Lindl. in Wall. Cat. No. 7068.

Plant 1 to 2 dm . high. Tuber sul-globose, hairy. Lower portion of stem clothed with one or two short wide sheaths. Lraves two or three, near the base of the stem, 3.7 to 10 cm . long, narrowly oblong-elliptic or oblanceolate, sub-acute or obtuse. Peduncle stout, naked, or with a single linear or leaf-like bract. Spike rather narrow, 5 to 10 cm . long, many- and densely-flowered. Flowers green, minute, decurved; foral bract ovate, acute, much shorter than the beaked ovary. Sepals sub-equal, obtuse, the dorsal broadly ovate; lateral pair narrower, slightly spreading, oblong and acute. Petals a little longer than the sepals, obliquely lanceolate, acute. Lip longer than the sepals, fleshy, triangularly ovate-lanceolate, obtuse; side lcbes very narrow, cronulate, apical lobe entire; upper surface with two small calli at the base: spur aaccate. sub-globose. Anther-cclls diverging towards the base; pollinia sub-globose, caudicles very short, attached obliquely to the horn-like glands. Staminodes elongate, tapering at the ends. Stigmas two, placed behind the caudicles of the pollinia and above the entrance to the spur. Lindl. Gen. and Sp. Orch. 305; in Journ. Linn. Soc. iii, 43 ; Hook. f. Fl. Br. Ind. vi. 130; King \& Pantling in Ann. R. Bot. Gard. Calc.
viii, 335, t. 440; Kruzl. Orch. Gen. and Sp. i, 930. Jl. unalaschcense Reichb. f. Ic. Fl. Germ. xiii, 107, t. 417. II. Schischmareffinna Chamiss. in Linnaca iii, 20. Platanthera Schischmareffiana Lindl. Gen. and Sp. Orch. 286. N'eotia macrophylla Don. l'rod. 27. Spiranthes macrophylla and unalaschcensis Spreng. Syst. iii. 708.

Tishung P'ass in the Astor District of Baltistan, J. E. Winterbotiom No. 742, Rálam Valley in Kumaon between 8,000 and 9,000 feet, Duthic's collector No. 24103. Flowers during July and August. It extends enstwards to Nepal and Sikkim, and is found also in the Aleution Islands.
5. Herminium Duthiei Hook. f. Ic. Pl. 2199A; Fl. Br. Ind. vi, 130.

Whole plant 1 to 2.5 dm . Tubcrs ellipsoid. Lower portion of stem bearing a single very loose sheath. Leaves two or three, from below the middlo of the stem, 5 to 12.5 cm . long, linear or oblanceolate, acumimate. Scape overtopping the Jeaves, rather stont curved, naked. Spike 5 to 10 cm ., sub-secund, many-flowered. Flovcrs deflexed, paie green, 4 mm . in diam.; floral bract much shorter than the curved and beaked ovary Sepals obtuse, dorsal broadly oblong, the lateral pair smaller sub-falcate. Ptals orate to ovate-lanceolate, acute or acuminate, fleshy. Lip as long as the sepals, triangular or orbicular-ovate, entire, obtuse or sub-acute, with a small globose saccate spur at the base. Upper surface with two small elliptic calli near the basc. Anthar oblong, the cells parallel; pollinia sub-globose, caudicles short, slender, inserted within the conical truncate horn-like glands. Staminodes large, spreading. Stizmatic proccsses large, clevate; rostellum erect, subulate. Krnzl. Orcl. Gen, and Sp. i, 535.

Western Himalaya 8,000 to 12,000 feet, T. Thomson; Laka, Edjeworth; Garbwál, King; Badxinath, Herb. Saharanpur; Kuari Pass in British Garlwail 11,000 to 12,000 feet, Duthic No. 44.24 ; Rálam Valley in Kumaon 8,000 to 9,000 feet, Duthie No. 3413 ; Káli Valley above Budhi 10,000 to 11,000 feet, Duthie No. 6001, 24104 ; Gori Valley, Duthie's collector No. 24105. Flowers during August and September.

Plate 147. Herminium Duthiei Hook. f. A plant,-of natural size. Fig. 1, side view of tower; 2, ditto, with the sepals removed; 3, column, with lip attached; 4, flowers, seen from above and with the sepals removed; 5, pollinia;-all enlarged.
6. Herminium pugioniforme Lindl. MSS. ex. Hook. f. Fl. Br. Iod. vi, 130.

Height of whole plant 5 to 17.5 cm . Tuber small, globose. Stem with one or two loose sheaths at the base. Leaf solitary, sub-radical, shorter than the scape, 2 to 6 coc . long, oblong to linear-lanceolate, rounded or sub-acute at the apex. Scape naked, firm and rather stout towards the base. Spike 1 to 5 cm . long, lasly flowered. Flowers minute, fow, sub-erect, green; floral byact sub-orbicular, much shorter than the ovary. Dorsal sepal orbicular, forming with the petals a hood over the column; lateral pair very broad, obtuse. Petals smaller, concare, the edges crenulate. Lip as long as the lateral sepals, fleshy, base dilated and with two deep oval pits, anterior portion dagger-shaped. Anther-colls divergent towards their bases, the tubes spreading, pollinia obliquely elliptic, caudicles obscure, glands elliptic. Staminodes oblong, obtuse. Stigmas united. King \& Pantling in Ann. K. Bot. Gard. Calc. viii, 333, t. 497 ; Krazl. Orch. Gen. and Sp. i, 534.

Above Gulmarg in Kashmir at about 12,000 feet, Aitchison; Garhwal, on the northern slopes of Srikánta in the Bághiráthi Valley at elevations between 14,000 and 15,000 feet, Duthic No. 517. Flowers in August. Found also in Sikkim.

## 7. Herminium gramineom Lindl. in Wall. Cat. 7413.

Height of plant 5 to 20 cm . Tubers unequal, oblong or sub-globose. Stem with a single loose sheath at its base. Leaf sölitary, linear or narrowly oblanceolate, acute, very variable in length, but shorter than the inforescence. Scape naked, slender but firm. Spike 3 to 9 cm . long, laxly many-flowered; the rachis striated and somewhat hispid. Flowci's minute, secund, yellowish-green; floral bract about 5 mm . long, equalling or shorter than the curved beaked ovary, subulate from a broad clasping base, entire or occasionally more or less trifid. Dorsal sepal oblong or broadly ovate; the lateral pair ovate, obtuse, spreading. Petals erect, as long as the sepals, sub-falcately linear, obtuse, thick, yellow. Lip entire, shorter than the petals, ovate-acuminate, slightly saccate at the base; basal portion pale yellow, curved forwards, concave, the margins ciliate; terminal portion bright yellow, tilted upwards and with reflexed edges. Anther-cells parallel; pollimia sub-globose, white tinged with lilac, caudicles very short; glands large, shining, green or tinged with brown. Staminodes large, rugulose. Stigmatic processes short. Rostelium large, recurved, retuse, fleshy. Lindl. Gen. and Sp. Orch. 305; Royle Ill. t. 87, fig. 3; Hook. f. Fl. Br. Ind. vi, 131 ; Krnzl. Orch. Geu. and Sp. i, 535. Neotia monophylla Don. Prod. 27. Spiranthes monophylla Spreng. Syst. Veg. iii, 709.
N. W. India, Roylc; Garhwál, Falconer; Mussoorie range, very common on limestone rocks at elevations between 5,000 and 7,000 feet, Edgevorth, Mackinnon, Duthie Nos. 17828, 21770, 22713; Kumaon at about 8,500 feet, Strachey \& Winterlottom No. 31 ; Sarju and Káli Valleys in Kumaon, Duthie's collector No. 24107. Flowers during July and August. It extends into Nepal.

This species is uot inoluded in Collett's Flora of Simla, where it no doubt occurs. Owing probably to its small size and inconspicuous colouring, it has as yet escaped notice.

Plate 148. Herminium gramineum Lindl. A plant, -of natural slze. Fig. 1, side view of flower; 2, ditto, with the sepals and petals removed; 3, a trifid bract; 4, column showing the anther-cells, staminodes, stigmatic processes and the prominent rostellum; 5, pollinia; -all enlarged.

## 43. Hemipilia Lindl.

Terrestrial 1-leaved tuberous-rooted herbs. Leaf radical, broad. Flowers laxly racemose. Sepals equal in length, lateral spreading. Petals broadly ovate, entire, Lip continuous with the column, broad, obscurely 3-lobed, spreading ; spur trumpetshaped. Column very short ; rostcllum broad, projecting from between the anther cells, complicate; stigmatic processes none; anther-cells diverging, tips produced into grooves of the rostellum; pollinia 2, candicles long ; glands distant, exposed.-Species 6-one Himalayau, one in Burma, and four in China.

Hemipila cobdifolla Lindl. Gen. \& Sp. Orcb. 296.
Plant 1.5 to 2 dm . high, glabrous. Tuber's ovoid or subylobose. Laaf fleshy, amplexicaul; 5 to 10 cm . long, ovate-cordate obtuse or acute, many-nerved. Racenc
lax-flowered, 5 to 6 cm . long; the peduncle bearing one to three lanceolate, acuminate bracts. Flowers about 1.5 cm . in diam., purple; foral bracts lanceolate, acuminate, shorter than the slender curved beaked ovaries. Dorsal sepal erect, 13 mm . long, ovate-lanceolate, with a blunt inflexed lip; lateral pair spreading, equalling the dorsal in length, falcately oblong. Petals a little shorter than the sepals, obliquely ovate, sub-acute, erect and forming a hood with the dorsal sepal. Lip continuous with the columu, 3 -lobed, the lateral lobes rounded and reflexed; mid-lobe broad, subcrenate bluntly acuminate, pubescent; spur trumpet-shaped, deflexed, shorter than the ovary, often lobed at the apex. Anther-cells nearly parallel, distant. Polliniz obliquely clavate; caudicles dilated above, curved; glands minute, discoid, bifid. Capsule 2.5 cm . long. Royle Ill. Hiw. Bot. 367 ; Hook. f. Fl. Br. Ind. vi, 167 ; Krnzl. Orch. Gen, and Sp. i, 650; Collett Fl. Siml. 506, fig. 167. Platanthera cordifolia Lindl. in Wall, Cat. 7049.

Simla at 6,000 feet, Gamble Nus. 4650, 6441; Mussoorie range, Falconer, Edgeworth, Mackinnon, Duthic No. 21768; Kumaon at 7,000 feet, Strachey $\&$ Winterbotton No. 37 ; below Naini Tal 5,000 to 6,000 feet, Colonel Davidson, Duthic No. 4425. Flowers during August and September. It extends eastwards to Nepal.

Plate 150. Hemipilia cordifolia Lindl. A plant, -of nutural size. Fig. 1, side view of flower; 2, front view of ditto, deprived of the sepals and petals and with the lip spread out; 3, front view of column; 4, pollinia;-all enlarged.

## 44. Satyrium Swartz.

Terrestrial erect leafy herbs with undivided oblong tubers. Louves (in the Indian species) large, fleshy, with wide sheaths. Flowers in dense spikes. Sepals and petals subsimilar, free, spreading or reflexed. Lip superior (the ovary not being twisted), adnate to the base of the column, erect, broad, hood-shaped, 2 -spurred or 2 -saccate. Column much arcned, terete. Stigina single, convex or concave, borne on the upper lobe of the column. Anther-cells dorsal or lateral, tumid, sub-parallel, their tubes at a lower level than the stigma, pointing forward; polinia 2, caudicles curved, ending in two large sometimes connate glands.-Species about 100 , mostly in extra-tropical S. Africa.

Satyrium nepalense, Don. Pred. Fl. Nej. 26.
Whole plant 5 to $7 \cdot 5 \mathrm{dm}$. high; tuber oval, producing stolons each with a small tuber at its end. Stom glabrous, bearing several broad imbricating sheaths at the base. Leaves two or three, fleshy, 1 to 2.5 dm . long and 3.5 to 9 cm . broad, narrowly elliptic, subacute, their bases broad and sheathing. Peduncle, clothed with many sub-tuipular lanceolate-oblong. acute or acuminate bracts. Spike 5 to 17 cm . long, densely flowered. Flower's 8 mm . across at the mouth, pink or white, sweet-scented; floral bruct obloug-lanceolate, acuminate, deflexed, much longer than the turgid ovary. Scpals linear-oblong, obtuse, recurved, ciliolate. Petals narrower than the sepals, obtuse, entjre Lin superior, hooded, broadly oblong, keeled on the back; spurs usually twice as long as the ovary. Column curved, expanded at the apex. Stigma projecting formards above the anther, convex, anticous. Anther-cells turgid, distant and subparallel on the sides of the column below the stigma; pollinia 2, pyriform, bipartite; caudicles slender, curved, directed downwards and forwards, each onding in a thick discoid gland. Staminodes regulose, placed above the auther-cells; rostellum broadly and bluntly
triangular. Lindl. Gen. and Sp. Orch. 340 ; in Journ. Linn. Soc. iii, 44; Wight Ic. 829 ; Bot. Mag. 6625 ; Wall. Cat. 7025 ; Hook. f. Fl. Br. Ind. vi, 168 ; King \& Pantling in Ann. R. Bot. Gard. Calo. viii, 338, t. 444 ; Krantzlin Orch. Gen. and Sp. i, 714; Collett Fl. Siml. 507 fig. 168; Rolfe in Journ. Linn. Soc. xxxvi (1903), 63. S. Perrottetianum A. Rich, in Ann. Sc. Nat., Sor. 2, xv, 76, t. 53 ; Wight Ic. 1716. S. albiforum A. Rich. l.c.; Wight Ic. 1717. S. pallidum A. Rich. l.c.

Abundant throughout the Western Himalaya on open billsides at elevations between 4,000 and 10,000 feet. Flowors during September and October. It extends eastwards to Nepal, Sikkin, Bhutan and the Khasia Hills; and is found also in the hilly parts of $S$. India and in Upper Burma to Tibet and China. A form with larger and much thicker leaves and bracts is occasionally met with.

## TRIBE VII.-CYPRIPEDIEA.

Porfect anthers two, one on each side of the conjoined stigmas. Staminode single, large, fleshy; lip large, saccate.

## 45. Cypripedium Linn.

Terrestrial herbs, stemless or with a leafy annual stem. Leaves coriaceous, evergreen, amooth and often coloured ; or membranous, deciduous and plicate. Flowers large, usually solitary (rarely in pairs), borne on a scape or at the apex of a leafy stem. Sepals spreading, valvate or imbricate in aestivation; the dorsal large, erect; the lateral pair smaller, narrower and usually connate under and behind the lip. Petals free, varying in shape, often very long. $L i p$ sessile with small narrow auricle-like, often inflexed side lobes and a large inflated saccate mid-lobe. Column short, terete Anthers 2, subglobose, the cells parallel, contiguous; pollen viscid or glutinons. Stigma forming a convex often ruguluse disk, deflexed and hidden by the large disciform, fleshy staminode. Ovary 1-celled.-Species about 80, in temperate and tropical Asia and America, also in Europe.

$$
\begin{aligned}
& \text { Sepals and petals green or pale yellow, lip white } \\
& \text { Flowers smaller, sepals and petals streaked with red, lip } \\
& \text { purplish }
\end{aligned} .
$$

## 1. Cypripedium cordigerum Don Prod. Fl. Nep. 37.

Stem 2.5 to 6 dm . in height, stout or slender, puberulous. Leaves several, approximate or scattered, 7.5 to 15 cm . long and 5 to 10 cm . wide, from nearly orbicular to lanceolate; acute or acuminate, membranous, plaited. Flowers solitary; bract leaflike, 2.5 to 10 cm . long. Sepals and petals spreading, longer than the lip, green varying to pale yellow or white, Dorsal sepal ovate-acuminate; lateral pair slightly longer, connate, entire or split at the apex. Petals equalling the dorsal sepal in length, narrowly lanceolate, acuminate. Lip oblong, white often with a few purple spots outside and near the base. Column yellow. Staminode 10 mm . long, ovate or oblong-cordate, yellow with reddish-brown blotches near the apex. Ovary fusiform, glandular-pubescent. Capsule erect, clavate, about 3.8 cm . long. Lindl. Gen. and Sp. Orch. 527 ; Dcne in Jacquem. Voy. Bot. 165, t. 166; Fl. Br. Ind. vi, 170; Krazl. Orch. Gen. and Sp. i. 17; Collett Fl. Siml. 508.

Widely distributed throughout the Western Himalaya from Hazara to W. Nepal at elevations between 8,000 and 12,000 feet, usually found in openings or on the outskirts of forests. It flowers during the month of June.

Plate 151. Cypripedium cordigerum Don. Upper portion of plant,一of natural size. Fig. 1, side view of Hower, with the sepals and petals removed; 2 , the connate lateral sepals; 3, staminode; 4, side view of column;-all enlarged.
2. Cypripedium himalaicum Rolfe in Journ. Linn. Soc. xxix (1892), 319.

Height of plant 2 to 4 dm . Stem clothed at the base with three or four loose tubular acute sheaths. Leaves usually three, up to 8.5 cm . long, ovate-elliptic or oblong, acute, slightly narrowed to the sheathing base, puberulous; the lower and upper ones smaller and narrower. Peduncle pubescent, bearing a solitary flower. Flower reddishor purplish-red, 6.2 cm . in vertical diam.; floral bract longer than the flower, narrowly elliptic, acute or acuminate, slightly concave, many-merved. Dorsal sepal broadly ovate, acute, somewhat concave; lateral pair narrower and slightly longer, connate under the lip. Petals spreading, longer than the dorsal sepal, narrowly oblong, subacute. Lip subglobose, many-nerved, pendent, its mouth wide and crenate. Staminode broadly ovate, obtuse, slightly cordate at the base. Franch. in Journ. de Bot. viii (1894), 249 ; Bot. Mag. t. 2938; King \& Pantling in Ann. R. Bot. Gard. Calc. viii, 342, t. 448 ; Rolfe in Journ. Linn. Soc. xxxvi (1903), 65'; C. macranthon Hook. f. Fl. Br. Ind. vi, 170 (in part and not of Swartz). C. macranthos Sw., var. himalaicum Krnzl. Orch. Gen. and Sp. I. 26.

On the Chor mountain near Simla, ? Royle (Herb. Saharanpur). Above Jhála in the Baghirathi Valley between 12,000 and 13,000 feet, Duthie No. 192 ; Byáns district of N. Kumaon in birch forests between 11,000 and 12,000 feet, Duthie No. 5994. Flowers during July and August. Found also in Sikkim and Bhutan and beyond the British frontier in E. Tibet and China.

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## ANNALS

of the

## ROYAL BOTANIC GARDEN, CALCUTTA.

VOL. I.-PART I.-King, George.-The Species of Ficus of the Indo-Malayan and Chinese Countries. Calcutta, 1887.
11 II.-King, George.-The Species of Ficus of the Indo-Malayan and Chinese Countries. Calcutta, 1588.
Parts I and II (xiii, pp. 185 with 225 plates).
APPENDIX-

1. King, George.-Some New Species of Ficus from New Guinea. Calcutta, 1888, (pp. 9 with 7 plates).
2. Cunningham, D [avid] D [ouglas].-On the Phenomena of Fertilization in Ficus Roxburghii, Wall. Calcutta, 1888, (pp. 11-51 with 6 plates).

VOL. II.--King, George.-The Species of Artocarpus indigenous to British India. Calcutta, 1889, (pp. 1-16 with 14 plates). King, George.-The Indo-Malayan Species of Quercus and Castanopsis. Calcutta, 1889,(pp.17-107 with 91 plates).

VOL. III.-Prain, D [avid].-The Species of Pedicularis of the Indian Empire and its Frontiers. Calcutta, 1891, (pp. 196 with 1-37 plates), and Map and Table.
King, George.-The Magnoliaceæ of British Iodia. Calcutta, 1891, (pp. 197-226 with plates 38-74).
Prain, D [avid]. -An Account of the Genus Gomphostemma, Wall. Calcutta, 1891, (pp.227-273 with plates 75-105).
King, George.-The Species of Myristica of British India. Calcutta, 1891, (pp. 274-331 with plates 106-174).

VOL. IV.-King, George.-The Anonaceæ of British India. Calcutta, 1893, (xi, pp. 169 with plates 1-220).

King, George.-A short account of Colonel Kyd, the Founder of the Royal Botanic Garden, Calcutta (pages 1-11 with portrait ).
VOL. V.-PAPT I.-Hooker, Sir Joseph Dalton. - A Century of Indian Orcbids. Calcutta, 1895, (pp. 1-70 with plates 1-101).
King, George.-A Brief Memoir of William Roxburgh, author of the Flora Indica, Calcutta 1895, (pp. 1-9 with portrait).
II.--Brübl, P [aul] Jiohannes] and King, George.-A Century of New and Rare Indian Plants Calcutta, 1896, (pp. 71-170 with plates 102200)











Drawn by H. Hummasji.








$$
4
$$




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Lith: by A. N. Banerjee
30

5


7


6




12



Lith: by K. P. Bass.



Drawn by H. Hormusji





Ann Roy. Bot. Garden, Calcutta, Vol. 9, Plate 118.





Lith: by Chitra Silpi C?




Lith: by A. C. Singba


Lith by A. C. Singha



4


5



Lith: by A.N. Banerjee






Duthie: Orchids of the Western Himalaya
Ann Roy. Bot. Garden, Ca!cutta, Vol. 9, Plate 132.


新



Lith by S. C. Mondul.



1


Lith: by K. P. Dass.
Drerm by H. Hormusji.





Tith: by A. C. Singha.
Drawn by H. Hormusji.


Lith: by Chitra Silpi Ca


Lith by A. C. Sinģha.



Lith: By Chitra Silpi C?


Lith: by Chitra Sipi C?






[^0]:    - I am glad of this opportunity of being able to bring to notice the servicos of one of these men, vis., Inayat Kban, not only because of his remarkablo nptitude as a collector and of his skill in the selection and preservation of herbarium apecimons, but chielly by reason of his genuine enthusiasm in his work, by means of which he has acquired a very extensive and practical koowledge of botany.

[^1]:    * This does not include the narrow sub-montano tract of North Oudh extending eastwards from the district of Kheri.

[^2]:    - Al60 in Siksim.
    + Pubilshed in Jonrn. As. Soc. Beng. lexi (1902), Part i, pp. 37-46.
    $\ddagger$ Published in Journ. Ag. Soc. Beng. Irvi (1897), Part i, 684
    § Not previously published.

[^3]:    * Not previously published.
    $\dagger$ Published in Joun. As. Soc. Beng. Ixsi (1902), Part i, Pp. 37-45.
    $\ddagger$ Microstylis muscifora; Goodyera vepons; Orchis latifolia, O. Chusua, O. spathulata; Rabenaria ditchisoni var. Josephi, H. Elisabethe; Herminium Monorchis, B. Duthiei, $\boldsymbol{H}$. congestum.
    § Goodyera fusca, Habenaria urceolata, Herminium nugioniforme.

[^4]:    Stem tall; up to 7.5 dm . in length, leafy upwards; flowers in dense spikes

    1. G. procera.

    Stem not exceeding 3 dm . in length, flowers in more or less lay racemes.

    Lip not eetose within, leaves basal.
    Sao of lip quite smooth within, not projecting beyond the bases of the sepals
    2. G. repens.

    Sac of lip with 2 ridges inside, projecting beyond the bases of the sepals
    3. G. fusca.

