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JOURNAL OF THE PROCEEDINGS

OF THE

LINNEAN SOCIETY OF LONDON.

On the Importance of an Examination of the Structure of the Integument of Crustacea in the determination of doubtful Species.—Application to the genus *Galathea*, with the Description of a New Species of that Genus. By SPENCE BATE, Esq., F.L.S.

[Read January 21, 1858.]

OF the various genera of Decapod Crustacea none are more interesting, or more difficult of description, than those which constitute the family Galatheadæ.

The interest attaching to these forms arises from the intermediate position which they occupy in the natural arrangement of the class, their structure placing them between the Macrura and Brachyura; in accordance with which we find that, whilst Professor M.-Edwards classes them among the Macrura, Professor Bell, in his work on the British Crustacea, places them (more correctly, as we think) in the intermediate group of Anomura.

This opinion is fully borne out both in the development of the animals and in their structure in the adult state.

The early form of the larva bears, anteriorly, a resemblance to the Brachyural type, whilst the caudal appendages assimilate to those of the Macrura. The same conditions obtain in the young of Anomura. At the time of birth, the larva, like that of the Brachyura, has only the two gnathopoda developed, whilst the

termination of the tail is like that of a fish, as in the *Macrura*. In the adult, the internal antennæ possess short flagella and complementary appendages, such as exist in the order *Brachyura*, whilst the external antennæ have the long and slender flagella proper to the *Macrura*. The *scale*, however, commonly appended to the external antennæ in the latter order is wanting, a circumstance which exhibits a relation to the *Brachyura*.

An examination of the legs shows that the coxæ are fused with the thorax, as in the *Brachyura*, and not articulated with it as in the *Macrura*, whilst, on the other hand, the posterior division and caudal termination approach the *Macrural* type more nearly than that of the *Brachyura*, the animal thus assuming a character intermediate between the two orders.

But in the description of the several species of the genus *Galathea*, a peculiar difficulty appears to arise, originating in the affinity which they bear to each other. So close, in fact, is the approximation, that the descriptions of the best writers will scarcely avail for the distinction of the individual species without the assistance of figures. This arises from the fact that the general characters, upon which the descriptions are based, vary, in this genus, only in their comparative degrees of development.

In the three species recognized in Professor Bell's work on the British Crustacea, it will be found that each species retains the same characters in greater or less degree.

Galathea strigosa is peculiar for the spinous character of the carapace and cheliform legs. Every spine, however, is repeated in both the other species, only less developed. We find the rostrum furnished with four lateral teeth on each side, a character which also exists in each of the other species; and although close observation may detect a slightly different arrangement in the relative position of these teeth, the differences are not of sufficient importance to enable a naturalist thence to derive a specific distinction, unless the peculiarity is seconded by some more unqualified character less liable to be affected by any peculiarity of condition.

In order to arrive at more certain results in the identification of species, we think that the microscopic examination of the surface of the integument will be found peculiarly useful.

This mode of examination of species may also be applied to a considerable extent throughout the Crustacea generally with great advantage; and if found valuable in recent, there can be no doubt that it will prove of far greater importance in extinct forms, where

parts on which the identification of species usually rests are lost, and fragments only of the animal obtainable.

It should be borne in mind that, as the structure in question undergoes modifications more or less considerable in different parts of the animal, it will always be advisable to compare the corresponding parts with each other.

Applying this test to the known species of *Galathea*, we perceive that the structure of the integument upon the arms, independent of the marginal spines, exhibits a squamiform appearance, but that the scales, which characterize the structure, possess features peculiar to each species.

In *Galathea strigosa* the scales are convex, distant from each other, smooth at the edge, and fringed with long hairs. In *G. squamifera* they are convex, closely placed, scalloped at the edge, and without hairs. In *G. nexa* the scales are obsolete, tufts of hair representing the supposed edges. In *G. depressa*, n. sp., the scales are broad, less convex than in *G. strigosa* and *G. squamifera*, smooth, closely set, and fringed with short hairs. In *G. Andrewsii* they are small, distant, very convex, tipped with red, and slightly furnished with hair.

As another instance of the practical application of the microscopical examination of the surface, I would refer to two species of Amphipoda, classed by Leach under the name of *Gammarus Locusta*, from his inability to assign them any separate specific characters. In the structure of their integuments, however, these two forms will be found to exhibit widely different microscopical appearances.

Again, there exists in the same group three or four species, the description of any one of which would apply to either of the others; and it is probable they would never have been ranked as separate species had not their habitats been geographically distant. Thus *Gammarus Olivii*, M.-Ed., *G. affinis*, M.-E., *G. Kröyii*, Rathke, and *G. gracilis*, R., can only be specifically determined by a microscopic examination of the integument.

The same may be said of other Amphipoda, such as *Urothoe inostratus*, Dana, from South America, which so nearly resembles in form the *U. elegans* of the British shores.

GALATHEA DISPERSA, mihi.

G. rostro brevi, dentibus 4 utrinque ornato, 2 anterioribus minoribus; pedibus anterioribus elongatis, sparse spinosis; chelarum digitis parallelis.

Galathea with short rostrum, armed on each side with 4 teeth, the two posterior being less important than the two anterior. The fingers of the chelæ impinge through their whole length; outer margin of the hand furnished with 3 or 4 small spines.

Hab. Trawling-ground, Plymouth, common; Moray Frith, Scotland.

This species unites *G. Andrewsii* with *G. nexa*, and, I think, has often been mistaken for the young of the latter; but *G. nexa*, so far as my experience goes, is a species peculiar to the north of England, whereas *G. dispersa*, I anticipate, will be found to be the most universally dispersed, in deep water, of any of the species known. It can always be detected from *G. nexa* by the form of the hand and the manner in which the fingers impinge: in *G. nexa* the hand is broad towards the extremity, and the fingers meet only at the apex; in *G. dispersa* the hand gradually narrows to the apex, and the fingers meet each other through their whole length, the inner margin of the finger being finely serrated, the thumb not.

It also may be distinguished from *G. Andrewsii* by the breadth of the hands, which are narrow and round in *G. Andrewsii*, and moderately broad and flat in *G. dispersa*.

By an examination of the texture of the integument under a magnifying power of low degree, the surface of *G. dispersa* will be seen distinctly to differ from that of any of the others; it is covered with flat scales, fringed with short cilia. The length of the animal, including the arms, is about $2\frac{1}{4}$ inches.

Catalogue of Hymenopterous Insects collected at Celebes by Mr. A. R. WALLACE. By FREDERICK SMITH, Esq., Assistant in the Zoological Department, British Museum. Communicated by W. W. SAUNDERS, Esq., F.R.S., F.L.S.

[Read April 15th, 1858.]

THIS collection of the Hymenoptera of Celebes is specially interesting, as adding greatly to our knowledge of the geographical range of many well-known species, while the additions made to the Fossorial group contain many of great beauty and rarity. A new species belonging to the tribe of Solitary Wasps, *Odynerus clavicornis*, is perhaps the most interesting insect in the collection; this Wasp has clavate antennæ, the flagellum being broadly dilated towards the apex, convex above and concave beneath. I am not acquainted with any other insect belonging to the Vespidioid group which exhibits such an anomaly.

Fam. ANDRENIDÆ, *Leach.*Gen. SPHECODES, *Latr.*

1. SPHECODES INSULARIS. *S. niger*, abdominis segmentis primo secundo et tertio (basi) rubris; alis hyalinis.

Male. Length $3\frac{1}{2}$ lines. Head and thorax black, closely and strongly punctured; the face below the antennæ with silvery-white pubescence; the joints of the flagellum submoniliform; the mandibles ferruginous. Thorax: the tegulæ pale rufo-testaceous, wings hyaline, the nervures ferruginous; the metathorax coarsely rugose; the articulations of the legs and the tarsi ferruginous. Abdomen: the first, second, and base of the third segments red, the apical ones black, very finely and closely punctured, with the apical margins of the segments smooth and shining; a black spot in the middle of the basal segment.

Hab. Celebes.

Gen. NOMIA, *Latr.*

1. NOMIA PUNCTATA. *N. nigra nitida punctata*, alis nigro-fuscis.

Male. Length $4\frac{1}{2}$ lines. Shining black: head and thorax coarsely punctured, the metathorax ruggedly sculptured, truncate at the apex, the truncation and sides smooth with a few fine punctures; the abdomen closely and rather finely punctured, the apical margins of the segments smooth and shining. The tips of the mandibles, the tarsi and apex of the abdomen rufo-testaceous, the wings fuscous.

Hab. Celebes.

2. NOMIA FLAVIPES. *N. nigra pedibus flavis*, abdomine cinereo fasciato, alis hyalinis.

Female. Length $3\frac{1}{4}$ lines. Black; the face and cheeks densely clothed with short cinereous pubescence, the vertex thinly so; the margins of the prothorax, mesothorax and scutellum with a line of pale ochraceous pubescence, the disk of the thorax thinly covered with short pubescence of the same colour, the emargination of the metathorax as well as its sides with longer pubescence of the same colour; the base of the abdomen and basal margin of the second and following segments covered with short cinereous pubescence. The flagellum beneath fulvous; the mandibles ferruginous. The legs reddish-yellow, with the coxæ and base of the femora black; the wings hyaline; the tegulæ yellow, the nervures pale testaceous.

Hab. Celebes.

3. NOMIA FORMOSA. *N. capite thoraceque nigris*; abdomine chalybeo; marginibus apicalibus segmentorum cæruleo fasciatis.

Female. Length $5\frac{1}{2}$ lines. Head and thorax black and very closely punctured; the face covered with griseous pubescence; the clypeus with a central longitudinal carina. Thorax: the apical margin of the prothorax, the margins of the scutellum, and the sides of the meta-

thorax covered with a dense short ochraceous pubescence; the disk of the thorax thinly sprinkled with short black hairs; the posterior tibiæ obscurely ferruginous; the tarsi ferruginous; the legs covered with bright golden-yellow pubescence; wings subhyaline, the nervures ferruginous; the tegulæ yellow with a fuscous stain in the middle. Abdomen obscurely chalybeous, closely punctured, the two basal segments strongly so; the apical margins of the segments with smooth shining narrow blue fasciæ.

Male. Closely resembling the female, but with the legs black; the posterior femora incrassate, the tibiæ narrow at their base and broadly dilated at their apex, which, as well as the calcaria, are pale testaceous. This species closely resembles a species from North China, *N. chalybeata*, Westw. MS., from which it is readily distinguished by the form of the fourth ventral segment, which is notched in the middle, rounded, and then emarginate with the lateral angles rounded; in the species from China the margin is arched, and fringed with fulvous pubescence.

4. *NOMIA HALIOTOIDES.* *N. nigra*, pube cinerea tecta, abdominis segmentis intermediis pube alba fasciatis.

Female. Length $4\frac{1}{2}$ lines. Black; head and thorax opaque, and thinly clothed with cinereous pubescence, that on the disk of the thorax and margin of the scutellum slightly ochraceous. The flagellum fulvous beneath, the mandibles ferruginous at their apex; the tarsi ferruginous, wings hyaline, nervures fuscous, stigma testaceous. Abdomen shining, delicately punctured; the basal margins of the second, third, and fourth segments with a band of cinereous pubescence, attenuated in the middle.

Hab. Celebes.

Fam. DASYGASTRÆ.

1. *MEGACHILE INCISA.* *M. nigra*, rude et dense punctata, facie fulvo pubescente; alis fuscis, segmentis abdominis marginibus multo depressis.

Male. Length $5\frac{1}{2}$ lines. Black; closely and strongly punctured, the punctures confluent on the abdomen. The face clothed with fulvous pubescence. The tarsi obscurely rufo-piceous, the claws ferruginous; wings dark fuscous, their base hyaline. Abdomen: the apical margins of the segments smooth, impunctate, their basal margins very deeply depressed; a deep fovea at the tip of the apical segment; the head, thorax, and abdomen clothed beneath with short cinereous pubescence.

Hab. Celebes.

2. *MEGACHILE FULVIFRONS.* *M. nigra*, delicatule punctata; facie dense fulvo pubescente; thoracis lateribus abdomineque subtus fulvo pubescentibus; fasciis marginalibus abdominis fulvis.

Female. Length 7 lines. Black; head and thorax closely punctured, the abdomen delicately so and shining; the mandibles stout, with two acute teeth at their apex, shining and covered with oblong punctures; the face, sides of the thorax, and abdomen beneath, densely clothed with fulvous pubescence; the apical margins of the segments of the abdomen above with narrow fasciæ of short fulvous pubescence; the abdomen in certain lights has a metallic tinge.

The *male* is similarly clothed to the female, the margins of the segments are deeply depressed, and that of the apical segment slightly notched in the middle.

Hab. Celebes.

3. *MEGACHILE TERMINALIS.* *M. nigra*, capite thoraceque dense punctatis; abdomine pube nigra vestito; segmentis duobus apicalibus pube alba vestitis; alis fuscis.

Female. Length 9 lines. Black; the face with tufts of black pubescence above the insertion of the antennæ; mandibles very stout, with an acute tooth at their apex, the inner margin subdentate, and covered with fine cinereous pubescence. Thorax with black pubescence at the sides of the metathorax; the wings dark fuscous. Abdomen clothed with black pubescence; the fifth and sixth segments clothed with ochraceous pubescence above, that on the sixth nearly white.

Hab. Celebes.

This species resembles the *M. ornata*; but when viewed beneath, the different colour of the pollen-brush at once separates them.

Gen. CERATINA, *Spin.*

1. *Ceratina viridis*, *Guér. Icon. Reg. Ann.* 444. t. 73. f. 6.

Hab. India (Bengal, N. India), Ceylon, Celebes, China.

2. *Ceratina hieroglyphica*, *Smith, Cat. Hym. Ins.* ii. 226.

Hab. Northern India, Celebes, Philippine Islands, Hong Kong.

Fam. DENUDATÆ.

1. *STELIS ABDOMINALIS.* *S. dense punctata*, capite thoraceque nigris, abdomine ferrugineo; alis nigro-fuscis violaceo iridescentibus.

Male. Length 5 lines. Head and thorax black, abdomen ferruginous; head and thorax strongly punctured, the scutellum very strongly so; the sides of the face and the anterior margin of the face fringed with white pubescence. The posterior margin of the scutellum rounded; wings dark brown with a violet iridescence. Abdomen ferruginous and closely punctured.

Hab. Celebes.

2. *CÆLIOXYIS PULVIFRONS.* *C. nigra*, rude punctata, facie pube fulva vestita; alis fuscis cupreo iridescentibus.

Male. Length 6 lines. Black; the head and thorax with large con-

fluent punctures; the face clothed with fulvous pubescence. Thorax: a stout tooth on each side of the scutellum at its base; wings dark brown with a coppery effulgence, subhyaline at their base; beneath clothed with short cinereous pubescence. Abdomen: elongate, conical; closely punctured, with the apical and basal margins of the segments smooth; the apical segment with a tooth on each side at its base and four at its apex; beneath the margins of the segments fringed with pale pubescence; the apical margin of the fourth segment notched in the middle; the fifth entirely clothed with pale pubescence.

Hab. Celebes.

Fam. SCOPULIPEDES.

Gen. ANTHOPHORA, *Latr.*

1. *Anthophora zonata*, *Linn. Syst. Nat.* i. 955. 19.

Hab. India, Ceylon, Malacca, Sumatra, Borneo, Philippine Islands, Hong Kong, Shanghai, Celebes.

Gen. XYLOCOPA, *Latr.*

1. *Xylocopa fenestrata*, *Fabr. Syst. Piez.* p. 339. 6. ♂.

Hab. India, Celebes.

2. *Xylocopa æstuans*, *Linn. Syst. Nat.* 961. 53.

Hab. India, Java, Singapore, Celebes.

3. *Xylocopa Dejeanii*, *St. Farg. Hym.* ii. 209. 59.

Hab. Java, Borneo, Sumatra, Celebes.

4. *Xylocopa collaris*, *St. Farg. Hym.* ii. 189. 26.

Hab. India, Sumatra, Malacca, Borneo, Celebes.

5. **XYLOCOPA NOBILIS.** *X. nigra*, pube nigra induta; abdominis basi pube flava, apice lateritio.

Female. Length 11 lines. Black; a narrow line of pale fulvous pubescence on the margin of the thorax in front, a patch of the same colour on each side of the metathorax, and the basal segment of the abdomen covered above with similar pubescence; the apical margin of the third and fourth segments, and the fifth and six entirely, covered with bright brick-red pubescence; the wings black, with coppery iridescence.

Hab. Celebes.

Fam. SOCIALES.

1. **APIS ZONATA.** *A. nigra*, thoracis lateribus dense ochraceo pubescentibus; alis fumatis; abdomine nitido, segmentis secundo tertio quartoque basi niveo pubescentibus.

Worker. Length 8-8½ lines. Black; the head and thorax opaque, the abdomen shining; the clypeus smooth and shining, the flagellum rufo-piceous beneath; the anterior margin of the labrum narrowly,

and the apex of the mandibles, ferruginous; the face with a little fine short cinereous pubescence above the insertion of the antennæ; the vertex with long black pubescence; the eyes covered with short black pubescence. Thorax: the sides with ochraceous pubescence; wings smoky, the superior pair darkest at their anterior margin beyond the stigma. Abdomen: a snow-white band at the basal margin of the second, third, and fourth segments, the bands continued beneath, but narrower.

Hab. Celebes, Philippine Islands.

Specimens of this species denuded of their white bands would approach the *A. unicolor* of Latreille; but that insect is described as having the anterior wings black; in the present species both pairs are of the same smoky colour, not approaching black.

Fam. MUTILLIDÆ.

Gen. MUTILLA.

1. *Mutilla sexmaculata*, *Swed. Nov. Act. Holm.* viii. 286. 44. ♀.

Mutilla fuscipennis, *Fabr. Syst. Piez.* 436. 35. ♂.

Hab. India (Punjaub, &c.), China, Java, Celebes.

2. *Mutilla unifasciata*, *Smith, Cat. Hym.* pt. iii. p. 38.

Hab. India, Celebes.

3. *Mutilla rufogastra*, *St. Farg. Hym.* iii. 629. 51. ♂.

Hab. India, Celebes.

4. **MUTILLA VOLATILIS.** *M. nigra*, rude punctata et pubescens; capite abdomineque nitidis, alis fusco-hyalinis.

Male. Length 5-6 lines. Black. Head and thorax very coarsely punctured; head and disk of the thorax punctured; the metathorax opaque, with a central abbreviated channel and covered with large shallow punctures; the eyes notched on their inner margin; wings fuscous and iridescent; the tegulæ smooth and shining. Abdomen shining and rather finely punctured; the basal segment narrow and campanulate; the margins of the segments thickly fringed with silvery-white hair; the cheeks, sides of the thorax, and beneath the legs and abdomen with scattered long silvery-white hairs.

Hab. Celebes.

Fam. SCOLIADÆ, *Leach.*

Gen. SCOLIA, *Fabr.*

1. *Scolia erratica*, *Smith, Cat. Hym. Ins.* pt. iii. p. 88. 10.

Scolia verticalis, *Burm. Abh. Nat.-Ges. Halle*, i. 37. 61.

Hab. India, Sumatra, Celebes.

2. *Scolia aurentula*, *Smith, Cat. Hym. Ins.* pt. iii. p. 102. 80. (nec *Fabr.*).

Hab. Philippine Islands, Celebes.

3. *Scolia fimbriata*, *Burm. Abh. Nat.-Ges. Halle*, i. p. 32. 24.

Hab. Java, Celebes.

4. *Scolia dimidiata*, *Guér. Voy. Coq. Zool.* ii. pt. 2. p. 248.

Hab. Senegal, Celebes.

5. **SCOLIA TERMINATA.** *S. nigra*, clypeo mandibulisque flavis, thorace flavo variegato, alis hyalinis, abdomine flavo quinque-fasciato; apicisque marginibus flavis.

Male. Length 5 lines. Black; the clypeus, labrum, and mandibles yellow; the former with a triangular black spot in the middle; the latter ferruginous at their apex. The posterior margin of the prothorax, the tegulae, a transverse curved line on the scutellum, and a spot on the postscutellum yellow; the anterior and intermediate tarsi, tibiae, and knees, and the posterior tibiae outside, yellow; a black line on the intermediate tibiae beneath, and the apical joints of the tarsi fuscous; wings hyaline, the nervures ferruginous. Abdomen brightly prismatic; the margins of all the segments with a narrow yellow fascia, those on the second and third segments terminating at the sides in a large rounded macula; the fascia very narrow or obliterated on the sixth segment; the fasciae on the second and third segments continued beneath.

Hab. Celebes.

6. **SCOLIA AGILIS.** *S. nigra*, mandibulis clypeoque flavis, alis fulvo-hyalinis, abdomine prismatico flavo quadrefasciato.

Male. Length 8 lines. Black and punctured, with thin long griseous pubescence; the vertex, disk of the thorax, and the abdomen shining; the mandibles and clypeus yellow, the latter with a black bell-shaped spot in the middle; wings fulvo-hyaline, the nervures ferruginous; the tibiae with a yellow line outside. Abdomen beautifully prismatic; the first and three following segments with a yellow fascia on their apical margins, the second and two following much attenuated in the middle, or the fourth interrupted.

Hab. Celebes.

7. **SCOLIA FULVIPENNIS.** *S. nigra*, antennis capiteque supra basin antennarum rubris, alis fulvo-hyalinis.

Male. Length 7 lines. Black; the antennae and the head above their insertion ferruginous, the scape black, the head coarsely punctured. Thorax: coarsely punctured; the mesothorax with an abbreviated deeply impressed line in the middle of its anterior margin; wings fulvo-hyaline, the nervures ferruginous; the apex of the wings slightly fuscous, the anterior pair with two submarginal cells and one recurrent nervure. Abdomen: shining, punctured, and prismatic.

Hab. Celebes.

8. **SCOLIA ALECTO.** *S. nigra*, capite supra basin antennarum rubro; alis nigris violaceo micantibus.

Female. Length 14 lines. Black and shining; head red above the insertion of the antennæ, very smooth and glossy, with a few punctures at the sides of and in front of the ocelli; antennæ black; the mandibles with a fringe of ferruginous hairs on their inferior margin. Thorax: smooth on the disk, which has a few scattered punctures at the sides; the scutellum punctured and shining; the thorax in front and the metathorax with black pubescence, the latter widely emarginate at the verge of the truncation, the lateral angles produced; wings black with a bright violet iridescence. Abdomen punctured, with the middle of the second, third, and fourth segments smooth and shining in the middle; the first segment with a smooth shining carina at its base slightly produced forwards, the abdomen with a slight metallic lustre. The wings with one marginal and three submarginal cells, and one recurrent nerve.

Male. Smaller than the female, and differs in having the clypeus red and the red colour running down behind the eyes, the antennæ longer, and the abdomen with a bright metallic iridescence.

Hab. Celebes.

9. *SCOLIA MINUTA.* *S. nigra*, abdomine iridescente, segmentorum marginibus apicalibus flavo fasciatis, alis subhyalinis iridescentibus.

Male. Length 4 lines. Head and thorax black and shining, with scattered pale pubescence; the mandibles and clypeus yellow, the latter with an anchor-shaped black spot. Thorax: the posterior margin of the prothorax and the anterior and intermediate tibiæ and tarsi yellow; a minute yellow spot on the postscutellum yellow; the wings subhyaline, the nervures fusco-ferruginous. Abdomen: the apical margins of the segments with a narrow yellow border, the second and third uniting with a lateral spot; the sixth segment immaculate; the apex pale testaceous.

Hab. Celebes.

Fam. POMPILIDÆ, *Leach.*

1. *Pompilus analis*, *Fabr. Syst. Piez.* p. 209. 42.

Hab. India, Java, Ceylon, Celebes.

2. *POMPILUS SALTITANS.* *P. niger*, pedibus subferrugineis, prothoracis margine postica flava; alis flavo-hyalinis, apice fuscis, abdomine pilis cinereis fasciato.

Female. Length 6 lines. Black and thinly covered with ashy pile. The scape, labrum, mandibles and palpi ferruginous; the clypeus widely emarginate anteriorly. The posterior margin of the prothorax angular and with a yellow border; the scutellum prominent, covered on each side with a dense silvery-white pile, the postscutellum with two spots of the same; the wings flavo-hyaline, their apex with a broad dark-fuscous border, the nervures ferruginous, the tegulæ yellow; the posterior wings palest; legs pale ferruginous, the coxæ black with

their tips pale; the apical joints of the tarsi blackish, the spines of the legs black. Abdomen: the first, second, and third segments with a fascia of silvery-white pile at their basal margins; the apex of the abdomen ferruginous.

Hab. Celebes.

3. **POMPILUS CONTORTUS.** *P. niger*, cinereo-pilosus, prothorace flavo postice marginato; alis subhyalinis, marginibus apicalibus fuscis, pedibus subferrugineis.

Female. Length $5\frac{1}{2}$ lines. Black; the head, thorax, and four basal segments of the abdomen covered with ashy pile; the first and second segments with their apical margins naked. The scape yellow in front; the flagellum beneath, the labrum, mandibles and palpi ferruginous; the joints of the antennæ arcuate, particularly the apical ones; the apex of each joint is oblique, giving the antennæ a twisted appearance. Thorax: the posterior margin of the prothorax angular and with a broad yellow border; the scutellum compressed and prominent; wings subhyaline with a broad fuscous border at their apex, the tegulæ yellow; legs pale ferruginous, with their coxæ and trochanters black; the apical joints of the tarsi fuscous. Abdomen with a yellow macula at the tip.

Hab. Celebes.

4. **POMPILUS PILIFRONS.** *P. niger*, facie argenteis pilis dense tecta; thorace abdomineque flavo maculatis, alis subhyalinis, apice fuscis.

Female. Length $4\frac{1}{2}$ lines. Black; the face densely covered with silvery-white pile; a narrow line at the inner orbits of the eyes, the palpi and mandibles yellow; the latter ferruginous at their apex. The posterior margin of the prothorax rounded and yellow; a minute yellow spot on the mesothorax touching the scutellum, the thorax and abdomen covered with a changeable silky pile; the wings subhyaline, their nervures fuscous, a broad dark fuscous border at the apex of the superior pair. A transverse spot on each side of the basal margin of the second and third segments, and an emarginate fascia on that of the fifth, yellow.

5. **POMPILUS DECEPTOR.** *P. rufescenti-flavus*; vertice nigro, alis anticis apice fuscis.

Male. Length 6 lines. Pale reddish-yellow; the antennæ slightly dusky above; a black transverse stripe on the vertex between the eyes, and another issuing from it in the middle and passing beyond the ocelli. Thorax: a black stripe on each side of the mesothorax over the tegulæ; the wings subhyaline, the nervures ferruginous, the superior pair fuscous at their apex. Abdomen immaculate.

Subgenus PRIOCNEMIS.

1. **PRIOCNEMIS RUFIFRONS.** *P. niger*; facie, antennis, tibiis tarsisque

ferrugineis, alis fulvo-hyalinis; abdominis segmento apicali flavo unimaculato.

Female. Length $9\frac{1}{2}$ lines. Black; the face above the clypeus, as high as the anterior ocellus, reddish-yellow; the extreme edge of the clypeus, the labrum and base of the mandibles ferruginous; the antennæ reddish-yellow. Thorax: fulvo-hyaline, with a dark fuscous border at the apex; the knees, tibiæ and tarsi reddish-yellow; the two latter spinose. Abdomen: gradually tapering to an acute point at the apex, the sixth segment with an elongate red spot.

Hab. Celebes.

Subgenus AGENIA.

1. *Agenia blanda*, Guér. *Voy. Coq. Zool.* ii. pt. 2. p. 260.

2. *AGENIA BIMACULATA.* *A. nigra*, cinereo-pilosa, clypeo plagis duabus flavis; antennarum articulis apicalibus, tibiis tarsisque anticis et intermediis femoribusque posticis ferrugineis; alis subhyalinis, nervuris nigris.

Female. Length 7 lines. Black, and covered with ashy pile; a large macula on each side of the clypeus, the mandibles and palpi yellow; the base and apex of the mandibles rufo-piceous; the flagellum pale ferruginous, more or less fuscous above towards the base. Thorax: the posterior margin of the prothorax arched; the anterior and intermediate tibiæ and tarsi and the femora at their apex beneath, also the posterior femora, pale ferruginous; the wings subhyaline, the nervures dark fuscous. Abdomen: the apical margins of the segments obscurely and narrowly rufo-piceous, the apex ferruginous.

Hab. Celebes.

Gen. MACROMERIS, St. Farg.

1. *Macromeris splendida*, St. Farg. *Hym.* iii. 463. 1. ♂.

Hab. India, China, Malacca, Borneo, Java, Celebes.

Gen. MYGNIMIA, Smith.

1. *Mygnimia iridipennis*, Smith, *Journ. Proc. Linn. Soc.* ii. p. 98.

Hab. Celebes, Borneo.

This insect, a female, is 5 lines larger than *M. iridipennis*; but I can point out no other distinction beyond a slight difference in the colour of the wings: the specimen from Borneo has a metallic bluish-green iridescence, the Celebes insect has a violet iridescence; notwithstanding which I am inclined to regard them as one species.

2. *MYGNIMIA FUMIPENNIS.* *M. aurantiaco-rubra*, alis obscure fuscis.

Female. Length 9 lines. Orange-red; the anterior margin of the clypeus entire; the labrum produced, its anterior margin widely emarginate; eyes large, black and ovate. Thorax: the posterior margin

of the prothorax rounded; the mesothorax with a longitudinal fuscous stripe on each side, widest anteriorly; the metathorax truncate; above, transversely striate; the tibiæ and tarsi spinose; wings dark fuscous, with a pale semitransparent macula at the base of the second discoidal cell and a dark fuscous macula beyond; the insect entirely covered with a fine orange-red downy pile.

Hab. Celebes.

Fam. SPHEGIDÆ.

1. *SPHEX PRÆDATOR*. *S. niger, rude punctatus, facie pube fulva vestita; alis fuscis cupreo iridescentibus.*

Male. Length $10\frac{1}{2}$ lines. Black; the head and thorax opaque. Abdomen shining blue-black. The face with silvery pile on each side of the clypeus, and sprinkled with erect black hairs. Thorax: the posterior margin of the prothorax with a line of silvery pubescence; the metathorax with a short light-brown pubescence at the apex, and thinly clothed with black hairs; wings dark brown, with a brilliant violet iridescence. Abdomen blue-black, smooth and shining.

Hab. Celebes.

2. *AMMOPHILA INSOLATA*. *A. nigra, scapo mandibulis, pedibus, abdominisque segmentis primo et secundo ferrugineis; alis subhyalinis.*

Female. Length $8\frac{1}{2}$ lines. Black; the scape, the base of the flagellum beneath, the anterior margin of the clypeus and the mandibles ferruginous; the latter black at their apex. Thorax: the prothorax smooth and shining; the meso- and metathorax above transversely striated, the scutellum longitudinally so; the legs ferruginous, with their coxæ black; a spot of silvery-white pubescence on each side of the metathorax at its base, and two at its apex close to the insertion of the petiole; the wings fulvo-hyaline with the nervures ferruginous. Abdomen: the petiole and the following segment red, the base of the third also slightly red; the three apical segments obscurely blue, with a thin glittering pile.

The *male* differs in having the legs black, their articulations only being ferruginous; the head entirely black with the face densely covered with silvery-white pile. The thorax is sculptured as in the other sex; the petiole more elongate and slender, the basal joint black, the second and the first segment ferruginous beneath; the rest of the abdomen blue.

Hab. Celebes.

Gen. PELOPÆUS, Latr.

1. *Pelopæus Madraspatanus*, *Fabr. Syst. Piez.* p. 203. 3.

Hab. Malabar, Madras, Nepal, Bengal, Celebes.

2. *Pelopæus Bengalensis*, *Dahlb. Syst. Nat.* i. 941. 2.

Hab. India, Philippine Islands, China, Isle of France, Celebes.

3. *PELOPÆUS INTRUDENS*. *P. niger*; clypeo bidentato, tibiis anticis et intermediis, femorumque apice, femoribusque posticis basi, trochanteribus, tibiaram dimidio basali, petioloque rufescenti-flavis; alis fulvo-hyalinis.

Female. Length 11 lines. Black; the face with silvery pubescence; the clypeus with two large blunt teeth at its apex, formed by a deep notch in its anterior margin; the scape reddish-yellow in front. The meso- and metathorax transversely striated; the wings fulvo-hyaline, the nervures ferruginous; the anterior and intermediate tibiæ and the femora at their apex, the posterior femora at their base, the trochanters, the tibiæ with their basal half and the middle of the basal joint of the posterior tarsi, reddish-yellow; the petiole of the abdomen of a paler yellow; the abdomen smooth and shining. The male only differs in being rather smaller.

Hab. Celebes.

Mr. Wallace says of this species, "A common house-wasp in Macassar; builds mud cells on rafters."

Note.—In describing the species of this genus collected by Mr. Wallace at Borneo, I incorrectly gave that locality for *P. javanus*. The insect mistaken for that species may be shortly characterized as *P. benignus*, length 12 lines. Opaque-black, with the petiole shining; the metathorax transversely striated; the wings pale fulvo-hyaline, the nervures ferruginous; the scape in front, the anterior and intermediate tibiæ, the apex of the femora, and the basal joint of the tarsi reddish-yellow; the posterior legs, with the trochanters and basal half of the femora, yellow.

4. *PELOPÆUS FLAVO-FASCIATUS*. *P. niger*; capite thoraceque flavo variegato; pedibus abdominisque basi ferrugineis; alis hyalinis, apice fuscis, abdominisque segmento tertio fascia lata flava ornato.

Female. Length 9 lines. Black; the clypeus yellow; the mandibles and scape ferruginous, the former black at their base, the latter yellow in front; the sides of the face with a bright golden pile. Thorax: the posterior margin of the prothorax, the tegulæ, scutellum, and a quadrate spot on each side of the metathorax at its base yellow; the legs ferruginous, with the coxæ, trochanters, and claw-joint of the tarsi black; wings fulvo-hyaline, the nervures ferruginous, a fuscous spot at the apex of the anterior pair; the meso- and metathorax transversely striated, the latter with a yellow spot at the insertion of the petiole. Abdomen: the petiole slightly curved upwards, the first segment ferruginous; a broad yellow fascia at the apex of the third segment, the apex of the fourth with a narrow obscure fascia; the abdomen covered with a fine silky pile.

Hab. Celebes.

Fam. BEMBICIDÆ, *Westw.*

1. *Bembex trepanda*, *Dahlb. Hym. Europ. i. p. 181.*

Hab. India, Celebes.

Fam. LARRIDÆ.

Genus LARRA, *Fabr.*

1. *Larra prismatica*, *Smith, Journ. Proc. Linn. Soc.* ii. p. 103.
Hab. Malacca, Celebes.

Genus LARRADA, *Smith.*

1. *Larrada aurulenta*, *Smith, Cat. Hym. Ins.* pt. iv. 276. 6.
Sphex aurulenta, *Fabr. Mant.* i. 274. 10.
Hab. India, Java, Sumatra, Celebes, Philippine Islands, China, Cape of Good Hope, Gambia.

2. *Larrada exilipes*, *Smith, Cat. Hym. Ins.* pt. iv. p. 278.

3. LARRADA ÆDILIS. *L. nigra*; facie argenteo-pilosa, alis subhyalinis, articulis apicalibus tarsorum rufo-testaceis, abdomine lævi et nitido.

Female. Length $5\frac{1}{2}$ lines. Black; head and thorax subopaque, the abdomen shining; the face densely covered with silvery pile, the cheeks, sides of the thorax and abdomen thinly so; the tips of the mandibles and apical joints of the tarsi ferruginous, the latter obscurely so. The metathorax transversely and rather finely rugose, the truncation more strongly striated; the scutellum shining; the wings subhyaline, the nervures ferruginous; the tibiæ with scattered spines, the tarsi spinose.

4. LARRADA AURIFRONS. *L. nigra*; facie mesothoracis metathoracisque lateribus aurato pubescentibus, abdominis marginibus segmentorum trium basalium argentato piloso fasciatis; alis fuscis.

Male. Length 8 lines. Black; the face and outer orbits of the eyes clothed with golden pile; the lateral margins of the mesothorax and the metathorax thinly clothed with golden pile; wings dark fuscous with a violet iridescence; the three basal segments of the abdomen with fasciæ of silvery pile.

Hab. Celebes.

5. LARRADA PERSONATA. *L. capite thoraceque nigris*, abdomine ferrugineo.

Female. Length $8\frac{1}{2}$ lines. Head, thorax, and legs black; the two former closely punctured and thinly covered with short cinereous pubescence; the metathorax with the punctures running into transverse striæ in the middle; the sides of the thorax and the legs with a fine silky silvery-white pile; the tibiæ and tarsi strongly spinose; wings fusco-hyaline; abdomen entirely red, smooth and shining.

The *male* is smaller, and has the four apical segments of the abdomen black, the face, cheeks, and apical margins of the segments of the abdomen with silvery pile.

Hab. Celebes.

This is probably merely a variety of *L. simillima*, wanting the black apex to the abdomen; it very much resembles the *L. anathema* of Europe.

6. LARRADA RUFIPES. *L. nigra*, mandibulis pedibusque rufis; alis hyalinis, venis pallide testaceis; abdomine sericeo-piloso.

Female. Length 7 lines. Black; the head smooth and shining; the clypeus, the cheeks, and face anteriorly, covered with silvery pile; the scape in front, the mandibles, and palpi ferruginous. Thorax: the sides and beneath with a thin silvery-white pile; the legs ferruginous with the coxæ black, the posterior pair red beneath; the thorax closely punctured, the metathorax transversely striated; wings fulvo-hyaline, the nervures pale-testaceous. Abdomen shining, very closely and delicately punctured; thinly covered with a fine white silky pile, which is very bright on the margins of the segments, which are slightly rufo-piceous.

The *male* closely resembles the female, and is similarly sculptured and coloured.

Hab. Celebes.

7. LARRADA FESTINANS. *L. nigra*; facie abdominisque marginibus segmentorum argentato-pilosis.

Female. Length 3 lines. Black; the face and cheeks thinly covered with silvery pile. Thorax: the disk very closely punctured, the metathorax rugose; the sides and the legs with a fine glittering sericeous pile, the wings subhyaline, their apical margins fuscous, the nervures fuscous. Abdomen smooth and shining, covered with a thin silky pile, the apical margins with bright silvery fasciæ, only observable in certain lights.

The *male* closely resembles the female, but has the face more silvery.

Hab. Celebes.

Genus MORPHOTA, *Smith*.

1. MORPHOTA FORMOSA. *M. capite thoraceque nigris; abdomine rufo, apice nigro, pilis argentatis ornato.*

Female. Length 5 lines. Black, with the two basal segments of the abdomen red; covered with a brilliant changeable silvery pile, most dense on the face, cheeks, sides of the metathorax, and on the apical margins of the abdominal segments. The mandibles ferruginous, with their apex piceous. The vertex smooth, and having *three distinct ocelli*; the head more produced behind the eyes than in *Larrada*. Thorax: the prothorax subtuberculate at the sides; wings subhyaline and iridescent, the nervures fuscous, the tegulæ pale testaceous behind. The apical margin of the first segment of the abdomen rufo-fuscous.

Hab. Celebes.

The insects belonging to the genus *Morphota* differ from those of *Larrada* in having three distinct ocelli, the vertex without any depres-

sions, and the head much less compressed than in *Larrada*; the recurrent nervures are received nearer to the base and apex of the second submarginal cell; the species have, in fact, a distinct habit, and do not assimilate with the species of *Larrada*.

Genus TACHYTES, *Panz.*

1. TACHYTES MOROSUS. *T. niger*, scutello abdomineque nitidis, facie argenteo-pilosa; marginibus lateralibus abdominis segmentorum argentatis.

Female. Length $4\frac{1}{2}$ lines. Black; the face covered with silvery pile; the thorax finely and very closely punctured; the metathorax opaque and finely rugose, thinly covered with cinereous pubescence; the anterior tarsi ciliated on the exterior, and the intermediate and posterior tibiæ with a few dispersed spines; wings fusco-hyaline and iridescent, the nervures fusco-ferruginous, the costal nervure black. Abdomen smooth and shining; the apical margins of the intermediate segments slightly depressed, with the sides sericeous.

Fam. CRABRONIDÆ.

Genus OXYBELUS, *Latr.*

1. *Oxybelus agilis*, *Smith, Cat. Hym. Ins. pt. iv. 387. 25.*

Hab. India, Celebes.

Genus CRABRO, *Latr.*

1. CRABRO (RHOPALUM) AGILIS. *C. obsкуро-nigra*, clypeo argentato, capite, thorace abdomineque flavo variis.

Female. Length 4 lines. Black, opaque; head larger than the thorax, quadrate; the ocelli in a curve on the vertex; the clypeus and lower portion of the cheeks with silvery pile; the scape, two basal joints of the flagellum, the palpi, and the mandibles, yellow; the latter rufo-piceous at their apex. The margin of the prothorax, the tubercles, the scutellum, the tibiæ and tarsi, the anterior femora and the intermediate pair at their apex yellow; the anterior femora black above; the wings subhyaline and iridescent, the nervures testaceous. Abdomen: with an elongate clavate petiole; the first segment with an oblique yellow macula on each side, the third with a large lateral macula at its base, and the following segments entirely yellow.

Hab. Celebes.

This species closely resembles the *C. Westermanni* of Dahlbome, from the Cape of Good Hope.

Genus CERCERIS, *Latr.*

1. *Cerceris instabilis*, *Smith, Cat. Hym. Ins. pt. iv. 452. 74.*

Hab. India, China, Celebes.

2. *Cerceris unifasciata*, *Smith, Cat. Hym. Ins.* pt. iv. 456. 84.

Hab. North China, Celebes.

3. *Cerceris fuliginosa*, *Smith, Cat. Hym. Ins.* pt. iv. 454. 79.

Hab. Celebes.

4. *CERCERIS VARIPES*. *C. nigra*, facie flavo varia; alis fuscis basi hyalinis; pedibus variegatis; abdomine flavo maculato.

Male. Length 6 lines. Black; a line down the inner orbits of the eyes, continued along the lower margins of the face, and uniting with the clypeus, which as well as a line above it between the antennæ are yellow; a spot on the scape in front, and the mandibles, yellow; the latter rufo-piceous at their apex. Thorax: a spot on each side of the prothorax, a minute one on the tegulæ; the postscutellum, the intermediate and posterior coxæ and trochanters, the anterior tibiæ behind, the femora beneath, and the intermediate and posterior tibiæ yellow; the femora reddish above and at their articulations; the posterior femora and tibiæ black, with the tarsi rufo-testaceous; the anterior wings and the apex of the posterior pair brown, the base of the anterior pair hyaline. Abdomen: the second and three following segments with a short yellow stripe on each side.

Hab. Celebes.

Tribe VESPIDÆ.

Fam. EUMENIDÆ, *Westw.*

Genus ZETHUS, *Fabr.*

1. *Zethus cyanopterus*, *Sauss. Mon. Guêpes Sol.* i. 23. 2.

Genus MONTEZUMIA, *Sauss.*

1. *Montezumia Indica*, *Sauss. Mon. Guêpes Sol.* i. *supp.* 167. 59. t. 9. f. 4.

Hab. India, Celebes.

Genus RHYNCHIUM, *Spin.*

1. *Rhynchium hæmorrhoidale*, *Sauss. Mon. Guêpes Sol.* i. 109. 12.

Vespa hæmorrhoidalis, *Fabr. Syst. Piez.* p. 259. 28.

Hab. India, Java, Cape of Good Hope, Celebes.

2. *Rhynchium argentatum*, *Sauss. Mon. Guêpes Sol.* i. 115. 22.

Vespa argentata, *Fabr. Syst. Piez.* p. 260. 39.

Hab. India, Celebes.

3. *Rhynchium atrum*, *Sauss. Mon. Guêpes Sol.* i. 109. 11.

Hab. India, Celebes.

4. *Rhynchium parentissimum*, *Sauss. Mon. Guêpes Sol.* p. 111. 14.—

Var. R. hæmorrhoidale?

Hab. India, Java, Celebes.

GENUS EUMENES.

1. *Eumenes circinalis*, *Fabr. Syst. Piez.* p. 286. 4.

Hab. India, Sumatra, Celebes.

2. *Eumenes fulvipennis*, *Smith, Cat. Hym. Ins.* pt. v. 24. 26.

Hab. Celebes.

3. **EUMENES VINDEX.** *E. niger*, flavo variegatus, alis subhyalinis iridescentibus.

Male. Length 6 lines. Black; strongly punctured and shining; a minute spot behind the eyes, another in their emargination, the clypeus, with two minute spots above it, a spot at the base of the mandibles, and the scape in front yellow. Thorax: a subinterrupted line on its anterior margin, the tubercles, a spot on the tegulæ behind, and the legs yellow; the coxæ, femora at their base, and the posterior tibiæ outside dusky; wings light brown and iridescent, the anterior margin of the superior pair darkest. Abdomen delicately punctured; the apical margin of the first segment with a narrow yellow border slightly interrupted on each side; the apical segments with a thin cinereous pile.

Hab. Celebes.

4. **EUMENES ARCHITECTUS.** *E. niger*, clypeo, prothoracis margine postscutello abdominisque segmenti primi margine flavis.

Female. Length 6 lines. Black and closely punctured; a line behind the eyes near their vertex, a spot between the antennæ and the clypeus, yellow; the latter black at the apex, which is notched; the labrum and mandibles reddish-yellow, the latter black at their base. Thorax: the anterior margin yellow; the tubercles, tegulæ, postscutellum, an interrupted line on each side of the metathorax, the tibiæ, farsi, and femora at their apex, yellow; the coxæ spotted with yellow and the posterior tibiæ dusky; the wings fusco-hyaline; a black line across the tegulæ. Abdomen: an ovate spot on each side of the petiole, its apical margin, a transverse ovate spot on each side of the first segment, and its posterior margin yellow; the following segments covered with a grey silky pile.

Male. Differs from the female in having the clypeus entirely yellow, the metathorax and abdomen entirely black; only the apical margin of the petiole is yellow, it is also longer.

Hab. Celebes.

5. **EUMENES FLORALIS.** *E. niger*; clypeo flavo; thorace pedibusque ferrugineo-flavo variegatis.

Male. Length $6\frac{1}{2}$ lines. Black; strongly punctured and shining; the clypeus and a spot above yellow; a narrow abbreviated line behind the eyes, a minute spot in their emargination, and the tips of the mandibles orange-red; the flagellum fulvous beneath. Thorax: the anterior and posterior margin of the prothorax, the tubercles, and a

spot on the tegulæ behind, a line on the postscutellum and the legs, orange-red, the coxæ black, and the tarsi dusky; the wings slightly brownish with a violet iridescence. Abdomen immaculate, with a minute spot on the posterior border of the petiole; the third and following segments with a fine cinereous pile.

Hab. Celebes.

Genus ODYNERUS, Latr.

1. *Odynerus ovalis*, Sauss. *Mon. Guêpes Sol.* 215. 122. t. 19. f. 4.

Hab. India, China, Celebes.

2. ODYNERUS (ANCISTROCERUS) CLAVICORNIS. *O. niger, flavo varius*; capite thoraceque fortiter, abdomine delicatule punctatis, antennis clavatis.

Male. Length $4\frac{1}{2}$ lines. Black; head and thorax strongly punctured and shining; a spot on the mandibles, the labrum, the clypeus, a spot above, the scape in front, a line in the emargination of the eyes and a spot behind them, yellow; the flagellum broadly clavate, the joints transverse, the apex of the club and the terminal hook reddish-yellow, the thickened part of the club concave beneath, the hook bent into the cavity. Thorax: two spots on the anterior margin, a spot on the tegulæ in front, and the legs, reddish-yellow, the coxæ dusky; the metathorax coarsely rugose and deeply concave-truncate. Abdomen: the first segment with a transverse carina at its base, in front of which is an irregularly cut deep transverse channel forming a second carina in front of the groove; the segments finely punctured, the first and second segments with a yellow posterior border, the fourth and following segments rufo-piceous.

Hab. Celebes.

3. ODYNERUS (LEIONOTUS) INSULARIS. *O. niger, flavo et aurantio variegatus*; abdominis basi ferruginea.

Male. Length 6 lines. Black; the head and thorax strongly punctured; the mandibles, clypeus, a line above extending to the anterior ocellus, the emargination of the eyes, a spot at their vertex and a line at their outer orbits, yellow; the antennæ reddish-yellow, with the scape pale yellow in front and a narrow fuscous line above; the yellow marking more or less stained orange. Thorax: the prothorax orange, its anterior border, the tubercles, tegulæ, two spots on the scutellum and postscutellum, the lateral margins of the metathorax and the legs, yellow, the latter with reddish stains; wings subhyaline, the superior pair with a fuscous cloud at their apex. The base of the abdomen and a large macula on each side of the second segment ferruginous; the apical margin of the segments with a yellow border, the first and second with a minute notch in the middle; the first and second segments entirely ferruginous beneath.

4. *ODYNERUS FULVIPENNIS*. *O. niger*, flavo varius, pedibus ferrugineis, alis fulvo-hyalinis.

Male. Black; head and thorax closely and strongly punctured; the clypeus and two spots above, a line along the lower margin of the sinus of the eyes, a narrow line behind them, the scape in front, and the mandibles yellow; the tips of the latter rufo-piceous; the antennæ and legs ferruginous; an interrupted yellow line on the anterior margin of the thorax; the wings fulvo-hyaline; the veins which enclose the marginal and second and third submarginal cells fuscous, the rest pale testaceous; a fuscous cloud in the marginal cell. Abdomen: the apical margin of the second segment with a yellow fascia, the following segments with red fasciæ.

Hab. Celebes.

Genus ICARIA, Sauss.

1. *Icaria ferruginea*, Sauss. *Mon. Guêpes Soc.* p. 37. 15.

Hab. India, Celebes.

2. *ICARIA PILOSA*. *I. nigra*, rude punctata et densissime pubescens, clypeo flavo, thorace, pedibus abdomineque ferrugineo variegatis; alis subhyalinis, anticis apice fusco maculatis.

Male. Length $7\frac{1}{2}$ lines. Black; closely and strongly punctured; the clypeus, a line on the mandibles, and the scape in front, yellow; tips of the mandibles, the scape above, and the base of the flagellum ferruginous. Thorax: the prothorax, scutellum and postscutellum, ferruginous; the tegulæ and legs pale ferruginous, the coxæ black; wings fusco-hyaline, with a dark cloud in the marginal cell extending to the apex of the wing; a fainter cloud traverses the margin of the wing to its base. Abdomen: the first, second and third segments with a reddish-yellow fascia, that on the second segment continued beneath; a longitudinal broad stripe of the same colour on each side of the second segment; its apical margin serrated.

Hab. Celebes.

Genus POLISTES, Latr.

1. *Polistes sagittarius*, Sauss. *Mon. Guêpes Soc.* p. 56. 12.

Various specimens from Greece and Celebes have the thorax more or less ferruginous.

Hab. India, Celebes, China, Greece.

2. *Polistes Picteti*, Sauss. *Mon. Guêpes Soc.* 69. 28. t. 6. f. 8.

Hab. Ceram, Australia, Celebes.

3. *Polistes fastidiosus*, Sauss. *Mon. Guêpes Soc.* p. 60. 18.

Hab. Africa (Gambia), Celebes.

4. *Polistes stigma*, Fabr. *Syst. Piez.* p. 261. 41.

Hab. India, Ceram, Celebes.

5. *Polistes Philippinensis*, Sauss. *Mon. Guêpes Soc.* 58. 14 (var.).

Hab. Philippine Islands.

Genus *VESPA*, *Linn.*

1. *Vespa affinis*, *Fabr. Syst. Piez.* p. 254. 6 (var. *V. cincta*?).

Hab. India, China, Singapore, Celebes.

2. *VESPA FERVIDA*. *V. nigra*, delicatule punctata; clypei margine antica, macula pone oculos, margineque postica segmenti primi abdominis flavis; alis fulvo-hyalinis.

Female. Length 13 lines. Black; closely and finely punctured; the clypeus convex and strongly punctured, emarginate anteriorly, the emargination with a yellow border; the eyes extending to the base of the mandibles, which have three stout teeth at their apex and a narrow yellow line at their inner margin. Thorax: the postscutellum yellow, and a minute yellow spot on the outer margin of the tegulæ; the wings rufo-hyaline, darkest along the anterior margin of the superior pair; the nervures ferruginous, gradually becoming darker at the base of the wings, the costal nervure black.

Worker. Length 9 lines. Very closely resembles the female, but in addition to the yellow markings of that sex has the anterior margin of the clypeus yellow, a narrow transverse line between the antennæ, another along the lower margin of the notch of the eyes, an abbreviated stripe behind them at the base of the mandibles, a spot beneath the postscutellum and a narrow yellow line along the posterior margin of the basal segment of the abdomen.

Hab. Celebes.

Fam. TENTHREDINIDÆ.

Genus *TENTHREDO*, *Linn.*

1. *TENTHREDO* (*ALLANTUS*) *PURPURATA*. *T. capite thoraceque cæruleo-viridibus*, abdomine purpureo, alis fuscis iridescentibus.

Size, length 4 lines. Head and thorax blue-green, abdomen purple; wings dark fuscous with a violet iridescence; an oblique white line on each side beneath the scutellum; legs and antennæ black.

Hab. Celebes.

Fam. ICHNEUMONIDÆ.

Genus *MEGISCHUS*, *Brullé.*

1. *Megischus indicus*, *Westw. Trans. Ent. Soc.* new ser. i. 1851.

Hab. Philippine Islands, Celebes.

Genus *MESOSTENUS*, *Brullé.*

1. *MESOSTENUS ALBO-SPINOSUS*. *M. niger*, albo varius, abdominis segmentis albo marginatis, metathorace spinis duabus albis armato.

Female. Length 5½ lines. Black; a half-circular spot on the clypeus, a heart-shaped one above it, a spot at the base of the mandibles, the orbits of the eyes, interrupted at their vertex, yellowish white, the palpi of the same colour, and a broad incomplete annulus on the

antennæ beyond their middle. Thorax: the mesothorax with two deeply impressed oblique lines inclined inwards and terminating at an ovate spot in the middle of the disk, the scutellum and an oblique line on each side a little before it, a horseshoe-shaped spot in the middle of the metathorax, and a little below it on each side a conical tooth, yellowish white; four spots beneath the wings, one on each side of the metathorax, and the coxæ beneath, white; the legs ferruginous, with the intermediate pair dusky behind, the posterior pair entirely so, the femora being black; the wings hyaline, nervures fuscous. Abdomen: punctured and with a white fascia on the margins of the three basal segments; the two apical segments with very narrow fasciæ.

Hab. Celebes.

This species is closely allied to the *M. literatus* of Brullé; but it differs too much, I think, to be identical with it.

2. *PIMPLA TRIMACULATA*. *P. flava*, oculis, macula circa ocellos, vittulis tribus mesothoracis setisque caudalibus nigris.

Female. Length 6 lines. Yellow; the antennæ fuscous above, also a fuscous cloud at the apex of the anterior wings, the wings hyaline with the nervures black; a spot on the scape within, and three longitudinal stripes on the mesothorax, black; the latter slightly punctured anteriorly; the metathorax smooth and shining, with three oblique carinæ on each side, and a small subovate enclosed space in the middle of the disk. Abdomen punctured, all the segments margined at their apex, and each with a deeply impressed line at their extreme lateral margins; the sixth segment with two minute black spots at its basal margin, the two apical segments smooth and shining; the ovipositor black.

Hab. Celebes.

This species is closely allied to the *P. trilineata* of Brullé.

Fam. BRACONIDÆ.

1. *BRACON INSINUATOR*. *B. capite, thorace pedibusque ferrugineis; antennis, tibiis tarsisque posticis et abdomine nigris; alis nigro-fuscis, macula hyalina sub stigmatate.*

Female. Length $7\frac{1}{2}$ lines. Head and thorax smooth, shining, and ferruginous, the legs ferruginous, with the posterior tibiæ and tarsi black; the antennæ black, with the scape and following joint ferruginous; wings dark brown, with their extreme base pale testaceous; a hyaline stripe runs from the stigma across the first submarginal cell and passes a little below it. Abdomen black, smooth, and shining, with the lateral margins of the basal segment pale yellow-testaceous; this segment has on each side a longitudinal carina, and between them is a highly polished bell-shaped form; the second segment with deep oblique depressions at the sides, and deeply

longitudinally rugose-striate, leaving the apical margin smooth and shining; the second segment is similarly sculptured, and the third has a transverse groove at its base.

Hab. Celebes.

2. *BRACON INTRUDENS.* *B. rufescenti-flavus*, antennis setisque caudalibus nigris; alis nigro-fuscis, basi fasciaque angusta transversa flavis.

Female. Length 9 lines. Pale reddish-yellow; the eyes, flagellum, and ovipositor black; the scape and the following segment yellow; the head and thorax smooth and shining, both pubescent at the sides and beneath, the legs covered with a similar pale pubescence; the face with an upright horn between the antennæ, and a raised flattened plate in front of it. Abdomen: the basal segment with the lateral margins raised, and having on each side an elongate broad depression extending its entire length; the three following with an oblique depression on each side at the base of the segment; the third, fourth, and fifth segments distinctly margined at their apex; the ovipositor the length of the insect.

Hab. Celebes.

Genus AGATHIS, Latr.

1. *AGATHIS SCULPTURALIS.* *A. nigra*, prothorace, pedibus anticis mediisque ferrugineis; abdomine lævigato nitido.

Male. Length $5\frac{1}{2}$ lines. Black; the mouth, prothorax, anterior and intermediate legs, ferruginous; the face with two teeth or horns between or a little before the insertion of the antennæ, and another at the side of each, close to their insertion. Thorax: the mesothorax with two deeply impressed lines in front, running inwards, and uniting about the middle, and with two or three deep transverse channels before their junction; the lateral margins of the mesothorax deeply impressed; the metathorax ruggedly sculptured; the posterior coxæ and femora closely punctured; wings black with a hyaline spot in the first submarginal cell. Abdomen very smooth and shining, with a deeply impressed line on each side of the basal segment.

Hab. Celebes.

2. *AGATHIS MODESTA.* *A. rufescenti-flava*; antennis, vertice, tibiis posticis apice, tarsisque nigris; alis fusco maculatis.

Female. Length 4 lines. Reddish-yellow: the antennæ and vertex, black. The mesothorax with two deeply impressed longitudinal oblique lines, and two parallel ones between them; the metathorax reticulated; wings hyaline, with a dark fuscous stain crossing the anterior pair at the base of the first submarginal cell, these hyaline to the middle of the stigma, beyond which they are fuscous; a subhyaline spot at the apex of the marginal cell, and another beneath it at the inferior margin of the wing; the posterior tarsi dusky, and the tips of the tibiæ black.

Hab. Celebes.

3. *AGATHIS NITIDA*. *A. nigra, nitida*; facie, pectore, pedibus anticis et intermediis, plaga infra alas, scutelloque pallide ferrugineis.

Length 4 lines. Black and shining; the face, mandibles, head beneath, legs, pectus, sides of the thorax beneath the wings, the scutellum and the basal half of the abdomen beneath, pale ferruginous; the mesothorax with two longitudinal oblique lines on the disk, which have two parallel ones between them; the metathorax coarsely rugose; the wings dark brown, with the base of the stigma pale, and a hyaline spot beneath it. Abdomen very smooth and shining, with the apical margins of the segments narrowly rufo-piceous; the posterior legs incrassate and dark rufo-piceous.

Fam. CHRYSIDIDÆ.

Genus HEDYCHRUM, *Latr.*

1. *HEDYCHRUM FLAMMULATUM*. *H. viridi-purpureo lavatum*; capite thoraceque fortiter, abdomine delicatule, punctatis; alis fuscis basi hyalinis.

Length 3 lines. Bright green; the vertex, two oblique stripes on the prothorax, meeting in the centre of its anterior margin, a broad longitudinal stripe on the disk of the mesothorax, and the sides of the scutellum and postscutellum deep purple. Abdomen: the middle of the basal segment, the second and third segments at their base, broadly purple; the apical margin of the third tinged with purple; wings subfuscous, with their base hyaline. The head and thorax coarsely and closely punctured, the abdomen finely so; the tarsi with the claws unidentate.

Hab. Celebes.

Genus CHRYSIS, *Linn.*

1. *CHRYSIS PURPUREA*. *C. læte purpurea, capite, thorace abdominisque basi rugosis punctatis, segmentis abdominis secundo et tertio delicatule punctatis, apice quadridentato.*

Length 3 lines. Bright purple; the head, thorax, and base of the abdomen strongly and coarsely punctured, the rest of the abdomen finely punctured; the disk of the thorax and apical margins of the segments of the abdomen reflecting bright tints of green; the wings subhyaline, the nervures dark fuscous; the apical margin of the third segment of the abdomen with four teeth, the two central ones approximating, separated by a deep notch, the lateral teeth more distant, separated from the others by a wide emargination.

Hab. Celebes.

2. *CHRYSIS INSULARIS*. *C. nigro-purpurea, violaceo et viridi lavata; capite, thorace abdominisque basi rude punctatis.*

Length 5 lines. Dark purple, with violet and green reflections; the face, legs, and thorax beneath, green; wings slightly fuscous, and

iridescent; the head and thorax closely and coarsely punctured; the base of the abdomen roughly punctured, the two following segments much more finely so; the apical segment armed with six teeth, the outer ones subacute.

Hab. Celebes.

3. *CHRYSIS SUMPTUOSA*. *C. fortiter punctata*, metallico-viridis auro lavata; thoracis disco, abdominis segmentis secundo et tertio basi purpureis; segmento apicali margine integro.

Length $3\frac{1}{2}$ lines. Golden-green; the thorax at the sides and posteriorly with bright coppery effulgence; an oblong purple spot on the disk of the thorax; the metathorax and its lateral teeth vivid green, the vertex and prothorax splashed with gold. Abdomen: the basal segment bright green, with a bright coppery or golden effulgence at the sides; the second segment purple at the base, coppery at the apex, and with a suffusion of green between these tints; the third segment is similarly coloured, with the apical margin entire; the insect closely and strongly punctured throughout.

Hab. Celebes.

Description of a new Genus of Crustacea, of the Family Pinnotheridæ; in which the fifth pair of legs are reduced to an almost imperceptible rudiment. By THOMAS BELL, Esq., Pres. L. S.

[Read June 3rd, 1858.]

Fam. PINNOTHERIDÆ, *Edwards*.

Genus AMORPHOPUS, *Bell*.

CHAR. GEN.:—Corpus subcylindricum. Testa semicircularis, margine posteriore recto.—*Antennæ externæ minimæ*, articulo basali orbitam subtus partim claudente.—*Antennularum fossulæ transversæ*, continuæ, et ab orbitis haud separatæ.—*Pedipalpi externi* articulo quarto ovato, palpo tri-articulato, ad angulum antico-interiorem articuli quarti inserto.—*Oris apertura* antice arcuata.—*Orbitæ* apertæ, margine inferiore carente, superiore integro.—*Oculi* transversim positi.—*Pedes antici* robusti, inæquales; *pedum paria secundum, tertium et quartum* longa, subcompressa; *par quintum* exiguum, simplicissimum, rudimentarium, in incisura articuli basalis paria quarti insertum.—*Abdomen* MARIS segmentis tertio cum quarto, et quinto cum sexto coalitis; FEMINÆ ?

Sp. unica. *Amorphopus cylindræus*, mihi.

Description.—The body is nearly cylindrical, somewhat depressed, the carapace very much curved from the point to the back, quite

straight from side to side; the anterior and lateral margins forming nearly a semicircle, the posterior margin straight; the orbits are deeply cut in the anterior margin of the carapace, looking upwards; the inferior margin wanting; the oral aperture much arched anteriorly; the external footjaws with the third articulation somewhat rhomboid, the fourth irregularly oval, and the palpi three-jointed, inserted at its anterior and inner angle. Epistome extremely small, transversely linear; the external antennæ placed directly beneath the orbits, the basal joints partly filling them beneath. The antennules folded transversely in large open fossæ, which are scarcely at all separated from each other, and are open to the orbits, the eyes lying transversely; the peduncles short and thick; the sternum is semicircular, the segments separated by very deep grooves; the abdomen very long and narrow, the first and second joint transversely linear, the third and fourth united and forming a triangle truncated anteriorly at the articulation of the portion formed by the fifth and sixth joints united, and which with the seventh form a very narrow and linear piece extending forwards to the posterior margin of the oral aperture; the first pair of legs robust, unequal (the right being the larger in the only specimen at present observed); the hand in each as broad as it is long; that of the smaller conspicuously tuberculated, that of the larger much less so; the former with the fingers nearly meeting throughout their length, those of the latter only at the tips; the second, third, and fourth pairs of legs are long, somewhat compressed, the third joint tuberculated on the under side, the third pair the longest; the fifth pair is reduced to a mere rudiment, in the form of a minute tubercle inserted in a little notch at the base of the first joint of the fourth pair, and scarcely discernible by the naked eye.

Observations.—The relation of this genus to the Pinnotheridæ is tolerably obvious, in the smallness of the antennæ, the direction and arrangement of the eyes, and particularly in the form of the oral aperture, and of the external footjaws. I shall not, however, enter upon the consideration of these relations, as I am about shortly to offer to the Society a review and monograph of the whole of this family. The most remarkable peculiarity in the genus is the apparent absence of the fifth pair of legs, which can only be discovered to exist at all by examination with the help of a lens. In this respect I doubt not that the Fabrician genus *Hexapus*, adopted and figured by De Haan, will be found to agree with it, although it is very remarkable that the anomalous condi-

tion of this part never excited any particular attention on the part of either of these distinguished naturalists ; and De Haan describes Fabricius's species, *Hexapus serpes*, as if there were nothing especial or abnormal in a Decapod having only six pairs of legs besides the claws. Mr. White made a similar mistake on one occasion, when he described an anomourous genus allied to *Lithodes*, in which the fifth pair of legs were not visible ; but when, at my suggestion, a more careful examination was made, they were found, as was anticipated, in a rudimentary form, concealed under the edge of the carapace. I believe that I can discover even in De Haan's figure something like a little tubercle at the base of the fourth leg, which is probably the rudimentary representative of the fifth.

Death of the Common Hive Bee, supposed to be occasioned by a parasitic Fungus. By the Rev. HENRY HIGGINS. Communicated by the President.

[Read June 3rd, 1858.]

ON the 18th of March last, Timpron Martin, Esq., of Liverpool, communicated to me some circumstances respecting the death of a hive of bees in his possession, which induced me to request from him a full statement of particulars. Mr. Martin gave me the following account :—

“ In October last I had three hives of bees which I received into my house. Each doorway was closed, and the hive placed upon a piece of calico ; the corners were brought over the top, leaving a loop by which the hive was suspended from the ceiling. The hives were taken down about the 14th of March ; two were healthy, but all the bees in the third were dead. There was a gallon of bees. The two hives containing live bees were much smaller ; but in each of them were dead ones. Under whatever circumstances you preserve bees through the winter, dead ones are found at the bottom, in the spring. The room, an attic, was dry ; and I had preserved the same hives in the same way during the winter of 1856. In what I may call the dead hive there was abundance of honey when it was opened ; and it is clear that its inmates did not die for want. It is not a frequent occurrence for bees so to die ; but I have known another instance. In that case the hive was left out in the ordinary way, and possibly cold was the cause of death. I think it probable that my bees died about a month before the 14th of

March, merely from the circumstance that some one remarked about that time that there was no noise in the hive. They might have died earlier; but there were certainly live bees in the hive in January. I understand there was an appearance of mould on some of the combs. There was ample ventilation, I think; indeed, as the bees were suspended, they had more air than through the summer when placed on a stand."

When the occurrence was first made known to me, I suggested that the bees might probably have died from the growth of a fungus, and requested some of the dead bees might be sent for examination. They were transmitted to me in a very dry state; and a careful inspection with a lens afforded no indications of vegetable growth. I then broke up a specimen, and examined the portions under a compound microscope, using a Nachet No. 4. The head and thorax were clean; but on a portion of the sternum were innumerable very minute, linear, slightly curved bodies, showing the well-known oscillatory or swarming motion. Notwithstanding the agreement of these minute bodies with the characters of the genus of *Bacterium* of the Vibrionia, I regarded them as spermatia, having frequently seen others undistinguishable from them under circumstances inconsistent with the presence of *Confervæ*, as in the interior of the immature peridia and sporangia of Fungals.

In the specimen first examined there were no other indications of the growth of any parasite; but from the interior of the abdomen of a second bee I obtained an abundance of well-defined globular bodies resembling the spores of a fungus, varying in size from $\cdot 00016$ to $\cdot 00012$ in. Three out of four specimens subsequently examined contained similar spores within the abdomen. No traces of a mycelium were visible; the plants had come to maturity, fruited, and withered away, leaving only the spores.

The chief question then remaining to be solved was as to the time when the spores were developed; whether before or after the death of the bees. In order, if possible, to determine this, I placed four of the dead bees in circumstances favourable for the germination of the spores, and in about ten days I submitted them again to examination. They were covered with mould, consisting chiefly of a species of *Mucor*, and one also of *Botrytis* or *Botryosporium*. These fungi were clearly extraneous, covering indifferently all parts of the insects, and spreading on the wood on which they were lying. On the abdomen of all the specimens, and on the clypeus of one of them, grew a fungus wholly unlike the sur-

rounding mould. It was white and very short, and apparently consisted entirely of spores arranged in a moniliform manner, like the fertile filaments of a stemless *Penicillium*. These spores resembled those found in the abdomen of the Bees, and proceeded I think, from them. The filaments were most numerous at the junction of the segments. The spores did not resemble the globules in *Sporendonema muscæ* of the English Flora, neither were they apparently enclosed.

The Rev. M. J. Berkeley, to whom I sent some of the bees, procured, by scraping the interior of the abdomen with a lancet, very minute, curved linear bodies from $\frac{1}{80000}$ to $\frac{1}{100000}$ in. long, which he compares to Vibrios. He also found mixed with them globular bodies, but no visible stratum of mould.

From the peculiar position of the supposed spores within the abdomen of the bees, and from the subsequent growth of a fungus unlike any of our common forms of Mucedines, I think it probable that the death of the bees was occasioned by the presence of a parasitic fungus.

Notice of the occurrence of recent Worm Tracks in the Upper Part of the London Clay Formation near Highgate. By JOHN W. WETHERELL. Communicated by JAMES YATES, Esq., M.A., F.L.S.

[Read June 3rd, 1858.]

THE London clay is very tenacious, and near the surface is generally of a brown colour, probably owing to the decomposition of the iron pyrites which it contains. It abounds in selenite or sulphate of lime, and in nodules which often contain organic remains. Fossil wood with *Teredo antenautæ* is also met with, and pyritous casts of univalve and bivalve shells. Lower down the stratum becomes more compact and is of a bluish or blackish colour, and its fossil contents are in a fine state of preservation. During the last summer, while examining the London Clay in the vicinity of Highgate in search of fossils, my attention was directed to certain appearances in it which I could not account for. This led to a further examination, when I found they were produced by the borings of *Lumbrici* or earth-worms. These appearances consisted of long tubes passing nearly perpendicularly through the clay and terminating in receptacles or *nidi*, each tube leading to a separate receptacle. As these receptacles

occurred in large numbers, I had an opportunity of examining a great many of them with various results. In one instance, I found a dead worm coiled up; in another, a portion of a worm protruding into the lower part of the tube. Again, *nidi* were found partially filled with only the casts of worms, whilst others contained more or less of a species of *Conferva*; and, lastly, I obtained some with the cavities partially or wholly filled up. The receptacles varied in shape, from a sphere to an oval, and were extremely thin and fragile. They also varied in size from a pea to a nut. Externally they presented an appearance so singularly contorted, that I could not help considering they were moulded from the casts of worms. They did not appear to have any attachment to the surrounding clay, except at the point of junction with the tube; and the clay beneath them presented no unusual appearance.

Internally they generally exhibited impressions of the worm; but occasionally I detected some of the round and contorted appearances which I have mentioned as being so conspicuous on the outside. I cannot speak with precision as to the length of the tubes, as the clay when examined had been broken up into large rough masses in digging for the foundations of houses. The largest noticed was about three inches long, and the general width one-eighth of an inch. They often run parallel to each other, but at unequal distances. I now have to notice what I consider a remarkable circumstance, namely, that all the tubes contained a solid cylinder of clay, and in every instance where the worms occurred under the circumstances above recorded, they were found to be dead. Researches of this kind are calculated to throw a light on some of those singular phenomena which geologists occasionally meet with in the older rocks.

[*Mem.*—Several specimens of clay, containing the worm-tubes as above described, were exhibited to the meeting.]

Natural History—Extracts from the Journal of Captain Denham, H.M. Surveying Vessel 'Herald,' 1857. Communicated by Captain WASHINGTON, through the Secretary.

[Read June 3rd, 1858.]

WE found upon the larger islands the small species of the Kangaroo, bearing the native name Wallaby (*Halmaturus Billar-*

dierii), which, when mixed with other meats, affords a fine-flavoured soup.

On the islets are flocks of the Cape Banca goose, which Mr. Smith informed me were only to be found in these straits in the vicinity of Flinders Island, from Cape Banca to Cape Frankland (west about), and that they are readily domesticated, and hatch from three to seven eggs, and afford an acceptable dish. I obtained a live specimen, which Dr. Rayner of this ship describes thus:—“*Cereopsis Novæ Hollandiæ*. Body about the size of a common goose; bill short, vaulted, obtuse, two-thirds of which is covered by an expanded cere of a pale greenish-yellow colour, the tip of the bill being black, arcuated, and truncated. Nostrils large, round, open, and situated in the middle of the bill. Wings ample, third quill longest. Legs long, light dull-red, and naked to a little above the knee. Feet black, webbed, the membrane being deeply notched, great toe articulated to the metatarsus. Plumage slate-grey, with black spots upon the wings and back. Wing-feathers dusky black, and edged at the tip with pale grey. Irides light hazel.”

We likewise obtained specimens of the following wildfowl:—

AVES.

A BRONZE-WING PIGEON,	<i>Phaps elegans</i> .
QUAIL,	<i>Corturnix pectoralis</i> (<i>Gould</i>).
OYSTER-CATCHER,	<i>Hæmatopus fuliginosus</i> .
RING PLOVER,	<i>Hiaticula bicincta</i> .
WILD DUCK,	<i>Anas punctata</i> (<i>Cuvier</i>).
GREAT GULL,	<i>Larus pacificus</i> .
LESSER GULL,	<i>Xema Jamesonii</i> .
MUTTON BIRD,	<i>Puffinus brevicaudus</i> (<i>Brandt</i>).
SOUTHERN GANNET,	<i>Sulu australis</i> (<i>Gould</i>).
SMALL PENGUIN,	<i>Spheniscus minor</i> (<i>Temminck</i>).

The Mutton Bird we observed streaming from island to island; and I learnt from Mr. Benvenuto Smith the following particulars of its habits from his own observations.

The male birds come in from sea in the month of September, and prepare the burrows for the reception of the hens. The hen bird does not make her appearance till about the 25th November, when she lays and sits at once.

The Mutton Bird lays but one egg; they are employed rearing the young bird until the month of May, at which time the old birds leave the young ones to shift for themselves; the young birds remain in the burrows till they are starved down, and then

set off to sea, and are not seen again amongst the islands till September. The cock and hen sit alternately night and day; and all the labour of providing for the young is equally shared.

There are at this date about ninety people living on the small islands in "Franklin Inlet" who make a livelihood by gathering the oil, feathers, and eggs of the Mutton Bird.

Upwards of 2000 gallons of the oil are extracted from the birds annually; and although 300,000 birds are known to be destroyed each year, they appear undiminished in numbers. The oil burns well, and is of a bright-red colour.

I was presented by Mr. Smith with two Paper Nautilus shells (*Argonauta tuberculosa*) found on the shore of Flinders Island this season, a circumstance which he has remarked occurs but every seventh year, when many hundreds are thrown up: the shells are rarely obtained perfect, as they are extremely fragile, and the sea fowl pick the fish out of them.

Our Botanic Collector, Mr. Milne, ascertained, from what he obtained himself and from what we could contribute from our individual visits to the islets, the existence of plants, which he believes to be indigenous, belonging to the following families and genera, viz.

Amentaceæ.	Umbelliferæ.
Asteraceæ.	Graminaceæ.
Rosaceæ.	Junceæ.
Geraniaceæ.	Solanum.
Euphorbiaceæ.	Geranium.
Myrtaceæ.	

Testing the chances of fish refreshment at this anchorage, we found little encouragement for hook and line; but the two favouring opportunities which the weather allowed for hawling the seine produced as tabulated on opposite page.

We found the Reef Islands in this sound so abundant in rabbits since Captain Stokes's forethought had set some loose upon them, that, in two visits of four hours with but four guns, 100 brace were brought on board.

I took care to follow my esteemed brother officers' example and the system of introducing such productions, and obtained a dozen couple alive for letting loose in Shark Bay.

[A coloured drawing of *Cereopsis Novæ Hollandiæ* accompanied Captain Denham's observations.]

Locality.	How many hauls and phase of O.	Trawl-scine, or hook and line.		Natural History Names.	Common Names.	No. of sorts.	Pounds weight.
		Depth of water.	Nature of bottom.				
West side	6 hauls	with scine.	with scine.	Mugil	Mullet	23	28
Flinders Isl. ...	...	$\frac{1}{2}$	...	Hemiramphus	Gar-fish.....	10	5
Settlement ...	O	1 fathom	Sand	Platycephalus	Flat-head, small	3	1
Bay	14 days	on	and	Rais	Sting Ray	2	29
H.W.F. & C.) X. 30.	...	a flat	weed	Iulis	Small fish of the Basse family...	Several	...
Range 10 ft. ...	L.W.	...	...	Labrax	Basse	1	1
East side of	7 hauls	with scine (mar.)	...	Myliobatis	Ray	11	375
Hummock ...	D	...	...	Mugil	Mullet	20	30
Island centre...	26 days	1 to 3 fms.	Sandy beach	Platycephalus	Flat-head	3	2
				Siphycarus.....	Barracouta	1	1
				Scomberesox	Saury	27	17
Bay	at $\frac{3}{4}$ flood	...	...	Sepioteuthis	Cuttle-fish.....	Several	...
					Total .....	...	489

On some points in the Anatomy of *Nautilus pompilius*. By T. H. HUXLEY, F.R.S., Professor of Natural History, Government School of Mines.

[Read June 3rd, 1858.]

SOME time ago my friend Dr. Sinclair, of New Zealand, had the kindness to offer me two specimens of the Pearly Nautilus which had been brought to him from New Caledonia, preserved in Goadby's solution. I gladly accepted the present, and looked forward to the dissection of the rare animal with no little pleasure; but on proceeding to examine one of the specimens, I found its anatomical value greatly diminished by the manner in which a deposit from the solution had glued together some of the internal viscera. Other parts of the Nautilus, however, were in a very good state of preservation; and I have noted down such novel and interesting peculiarities as they presented, in the hope that an account of them will be acceptable to the Linnean Society.

Of the six apertures which, besides the genital and anal outlets, open into the branchial cavity of *Nautilus pompilius*, one on each side lies immediately above and in front of that fold of the inner wall of the mantle which forms the lower root of the smaller and inner gill, and encloses the branchial vein of that gill. The aperture is elongated and narrow, with rather prominent lips. It measures about $\frac{1}{8}$ th of an inch.

The other two apertures are larger, and lie at a distance of $\frac{7}{16}$ ths of an inch below and behind the other. They are in close juxtaposition, being separated only by a thin triangular fold of membrane, which constitutes the inner lip of the one and the outer lip of the other.

The inner aperture is the larger, measuring $\frac{3}{16}$ ths of an inch in long diameter, and having the form of a triangle with its base directed posteriorly. The outer aperture is not more than $\frac{1}{8}$ th of an inch long. The two apertures lie just above the edge of the fold of membrane which runs from the inner root of the larger or outer branchia, across the branchial cavity and beneath the rectum, to the other side.

These apertures lead into five sacs, which collectively constitute what has been described as the pericardium. The sacs into which the superior apertures open, by a short wide canal with folded walls, are situated on each side of and above the rectum. Their inner boundaries are separated by a space of not less than $\frac{5}{8}$ ths of an

inch in width, in which lie the vena cava and the oviduct. Each cavity has a rounded circumference, and a transverse diameter of about half an inch. In a direction at right angles to this diameter the dimensions vary with its state of distension; but a quarter of an inch would be a fair average.

The anterior or outer wall of the cavity is formed by the mantle; the posterior, inner, or visceral wall by a delicate membrane. The former separates it from the branchial cavity; the latter from the fifth sac, to be described by-and-by. I could find no natural aperture in the thin inner wall, so that I conceive no communication can take place between either of these sacs and the fifth sac.

Two irregular, flattened, brownish, soft plates depend from the posterior wall of the sac into its cavity; their attached edges are fixed along a line which is directed from behind obliquely forwards and upwards.

The outer and smaller of the inferior apertures on each side leads into a sac of similar dimensions and constitution to the preceding, but having a less rounded outline in consequence of its being flattened in one direction against its fellow of the opposite side, from which it is separated only by a delicate membranous wall, whilst on another side it is applied against the inferior wall of the superior sac, and is in like manner separated from it only by a thin and membranous partition.

Like the upper sacs, each of these has two dark-brown, lamellar, glandular masses depending from its membranous visceral wall.

A delicate, but broad, triangular membranous process, about $\frac{1}{4}$ th of an inch long, hangs down freely from the visceral wall of the cavity just behind the opening of the short canal which connects the sac with its aperture.

The third and largest aperture on each side opens directly into a very large fifth cavity, whose boundary is formed anteriorly by the visceral walls of the sacs already described, and behind this by the mantle itself as far as the horny band which marks and connects the insertion of the shell-muscles.

In fact this cavity may be said to be co-extensive with the attached part of the mantle,—the viscera, enclosed within their delicate “peritoneal” membranous coat, projecting into and nearly filling it, but nevertheless leaving a clear space between themselves and the delicate posterior wall of the mantle.

A layer of the “peritoneal” membrane extends from the posterior edge of the muscular expansion which lies between the shell-muscles and from the upper wall of the dilatation of the vena cava,

and passes upwards and backwards like a diaphragm to the under surfaces of the gizzard and liver. It is traversed by the aorta, to whose coats it closely adheres.

Along a line nearly corresponding with the horny band which proceeds from the insertions of the shell-muscles and encircles the mantle below, the pallial wall is produced inwards and forwards into a membranous fold or ligament, which I will call the pallio-visceral ligament; and this pallio-visceral ligament becoming attached to various viscera, divides the great fifth chamber into an anterior inferior, and a posterior superior portion, which communicate freely with one another.

Commencing with its extreme right-hand end, the ligament is inserted into the line of reflection of the mantle, and then into the wall of the oviduct, which becomes enclosed as it were within the ligament. The latter then ends in a free edge on the inner side of the oviduct, and is continued along it until it reaches the inferior surface of the apex of the ovary, into which it is inserted.

The free edge is arcuated; and the rectum passes over it, but is in no way connected with it.

Here, therefore, is one great passage of communication between the anterior and posterior divisions of the fifth chamber.

On the left side, this aperture is limited by the heart, whose posterior edge is, on the left side, connected by means of a ligamentous band with the surface of the apex of the ovary; but on the right, for the greater part of its extent, receives a process of the pallio-visceral ligament. Between the ovario-cardiac ligament and this process lies the small oval aperture already described by Professor Owen, which gives passage to the siphonal artery. It constitutes the middle aperture of communication between the two divisions of the fifth chamber.

The left-hand end of the ligament is inserted into the upper wall of the dilated end of the vena cava; but between this point and the heart it has a free arcuated edge, as on the right side.

Thus there are in reality three apertures of communication between the two divisions of the fifth chamber, the middle, by far the smallest, being alone hitherto known.

A delicate membranous band passes from the whole length of the middle line of the rectum to the heart and to the ovary.

The singular "pyriform appendage" of the heart lies in the left process of the ligament, its anterior edge nearly following the arcuated contour of that process.

The siphuncular process of the mantle was broken in my speci-

men; but its aperture appeared to communicate quite freely with the posterior division of the fifth chamber.

Four sets of brownish, glandular-looking bodies depend into the anterior division of the fifth chamber, from parts of the delicate septa dividing this from the four small sacs, corresponding with the insertions of the glandular bodies above described.

In fact, on distending the vena cava with air, it is found that the four branchial arteries traverse these septa, and that the appendages in question are diverticula of their walls. Consequently the anterior wall of each branchial vein is produced into two glandular appendages, which hang into one of the four smaller sacs, while the posterior wall is produced into a single mass of appendages, which hangs into the anterior division of the fifth chamber.

Although, as I believe, the five chambers do not communicate directly, all the appendages must nevertheless be equally bathed with sea-water, which enters by the apertures of the chambers.

An impacted yellowish-white concretory matter filled the anterior chamber; and a small quantity of it lay as a fine powder at the bottom of the posterior one. In the latter, however, its presence might, by possibility, have been accidental. My colleague, Dr. Percy, who kindly undertook to examine this substance, informs me that he has been unable to detect uric acid in it. The follicular appendages of the branchial arteries present remarkable differences in their external appearance. The eight which hang into the four anterior chambers are similar, slightly festooned, but otherwise simple lamellæ; while the four which depend into the posterior chambers are produced into a number of papillary processes. This external difference is obvious enough: whether it be accompanied by a corresponding discrepancy in minute structure I am unable to say; for I have not as yet been able to arrive at any satisfactory results from the microscopic examination of the altered tissues, and, as will be seen below, the only observer who has had the opportunity of examining the Nautilus in the fresh state has not noted any difference of structure in the two sets of follicles.

One is naturally led to seek among other mollusks for a structure analogous to the vast posterior aquiferous chamber of the Nautilus; and it appears to me that something quite similar is offered by the *Ascidioidea* and the *Brachiopoda*. In both cases, the viscera, inclosed within a delicate tissue, project into a large cavity communicating freely with the exterior by the cloacal aper-

ture in the one case, and by the funnel-shaped channels which have been miscalled "hearts" in the other.

The rudimentary renal organs of the Ascidian are developed in the walls of the cavity in question; and an aquiferous chamber of smaller dimensions has the same relation to the kidney in Lamellibranchiata—in Gasteropoda, Heteropoda, Pteropoda, and dibranchiate Cephalopoda. But although such is likely enough to be the case, we do not know at present that the aquiferous chambers in any of the last named mollusks attain an extension similar to that which obtains in *Nautilus*.

On comparing the observations detailed above with the statements of previous writers, I find that, in his well-known "Memoir on the Pearly *Nautilus*" (1832), Professor Owen describes "on each side, at the roots of the branchiæ," "a small mamillary eminence with a transverse slit which conducts from the branchial cavity into the pericardium. There is, moreover, a foramen at the lower part of the cavity (*o*, pl. 5) permitting the escape of a small vessel; and by the side of this vessel a free passage is continued between the gizzard and ovary into the membranous tube or siphon that traverses the divisions of the shell, thus establishing a communication between the interior of that tube and the exterior of the animal."

The foramen here described is easily seen; but, as I have stated, there are other modes of communication between the so-called pericardium and the cavity with which the siphuncle communicates, of a far more extensive nature.

With respect to the pericardium itself, Professor Owen states, "The peritoneum, after lining the cavity which contains the crop and liver, and enveloping those viscera, forms two distinct pouches at the bottom of the pallial sac, in one of which, the left, is contained the gizzard, and in the other the ovary; anterior to these, and on the ventral aspect of the liver, is another distinct cavity, of a square shape, which contains the heart and principal vessels, with the glandular appendages connected therewith." This is what the author terms the pericardium.

As Van der Hoeven has pointed out, however, the gizzard lies to the right and the ovary to the left. Moreover, the gizzard is superior to the ovary, so as only to overlap it a little above; and I can find no evidence of the existence of such distinct pouches as those described.

Professor Owen states that the branchiæ "arise by a common peduncle from the inner surface of the mantle." My own obser-

vations, however, and Van der Hoeven's figures, of both male and female, lead me to believe that the peduncles of the branchiæ are perfectly distinct from one another.

The follicles of the branchial arteries are thus described in the "Memoir on the Pearly Nautilus:"—"They are short and pyriform and closely set together. To each of the branchial arteries are appended three clusters of these glands, of which one is larger than the united volume of both the others; and the larger cluster is situated on one side of the vessel and the two smaller on the opposite side. Each of these clusters is contained in a membranous receptacle proper to itself, partitioned off, as it were, from the pericardium, but communicating with it. . . . The two canals which form the communication between the pericardium and the branchial cavity commence at the receptacle of the lesser cluster attached to the superior branchial arteries, and terminate at the papillæ before mentioned, which are situated at the roots of the branchiæ. The pericardium and these receptacles of the glands, when first laid open, were found filled with a coagulated substance so closely compacted as to require a careful removal, bit by bit, before the contained follicles and vessels could be brought into view."

Like Valenciennes and Van der Hoeven, I have been unable to find any communication between the four sacs in which the small double clusters of follicles are contained, and the "pericardium;" and I hold it to be certain that the other four sets of follicles are not contained in sacs at all, but lie free in the "pericardium" or posterior chamber.

No notice is here taken of the widely different characters of the anterior and posterior follicles; and the figure gives both a similar structure.

Valenciennes ("Nouvelles Recherches sur le Nautilé Flambé," 'Archives du Muséum,' ii., 1841) pointed out the existence of three pairs of apertures opening into the branchial sac, besides the genital and anal openings; and he affirms that they open into as many closed sacs, which communicate neither with one another nor with the cavity that contains the heart. M. Valenciennes indicates the difference in the structure of the anterior and posterior venous appendages. He seems to me to have seen something of the part which I have described as the pallio-visceral ligament; but I cannot clearly comprehend either his figure or his description.

Van der Hoeven, in his 'Contributions to the Knowledge of the Animal of *Nautilus pompilius*,' 1850, confirmed the statement

of Valenciennes with regard to the existence of three pairs of apertures; but he showed, in opposition to him, that one of these pairs of apertures communicated with the pericardium. The sacs into which the other two pairs open are, according to this anatomist, blind. In the aperture of the anterior blind sac he found a concretionary matter which he supposed to contain uric acid, but chemical analysis did not confirm the supposition. Van der Hoeven refers to some observations by Vrolik; but as these are in Dutch, and have not, so far as I can find, been translated into either French, German, or English, I know not what they may contain.

In his more recent essay, translated in 'Wiegmann's Archiv' for 1857, under the title of "Beitrag zur Anatomie von *Nautilus pompilius*," Van der Hoeven states that he has again found hard concretions in the chamber enclosing the appendage of the anterior branchial artery, and that these on chemical analysis yielded phosphate of lime and traces of fat and albumen, but no uric acid.

Mr. Macdonald, in a valuable paper on the anatomy of *Nautilus umbilicatus*, published in the Philosophical Transactions for 1855, thus describes the follicular appendages of the branchial arteries:—

"These follicles are subcylindrical in form, somewhat dilated at the free extremity, to which is appended a folded and funnel-shaped process of membrane, which expands rather suddenly, presenting a jagged and irregular border. They open by a smooth and oval or slit-like, orifice into the afferent pulmonary vessels, on each of which, as Professor Owen has observed, they are disposed in three clusters. The outer membrane is smooth and glassy, homogeneous in structure and sprinkled over with minute rounded and transparent bodies, probably the nuclei of cells. Beneath this layer, flat bundles of fibres, apparently muscular, are traceable here and there, principally disposed in a longitudinal direction, and sometimes branched. The lining membrane consists of a loose epithelial pavement in many respects similar to that of the uriniferous tubules of the higher animals, the cells containing, besides the nuclei, numerous minute oil-globules, or a substance much resembling concrete fatty matter. This membrane is thrown up into an infinite number of papillæ and corrugations, so as to augment the extent of surface considerably. The papillæ are more numerous at the inner part or towards the attached end; and a circlet of longitudinally disposed folds radiate from the bottom of the follicles, in which a number of small pits or fenestrations are sometimes visible. The sides of these folds are wrinkled

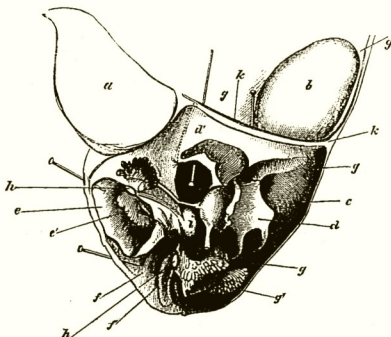
transversely so as to present a median zigzag elevation. The funnel-shaped membranous process above noticed is continuous with the lining membrane, consisting of an extension of the same epithelial pavement; but the cells are somewhat larger and more regular in form. The cavity of each follicle, therefore, communicates with the exterior through the centre of this process; and the aperture is thus guarded by a kind of circular valve, permitting the escape of secreted matter, but effectually preventing the entrance of fluid from without."

In his fig. 9, pl. xv., Mr. Macdonald depicts certain "crystalline bodies often occurring within the follicles."

From what Mr. Macdonald states, one would be led to conclude that all the follicles have the same structure; but I suspect this to be an oversight.

In the second edition of Professor Owen's Lectures on the Invertebrata (1855), I find no mention of Valenciennes' discovery

Nautilus pompilius. Fig. 1.



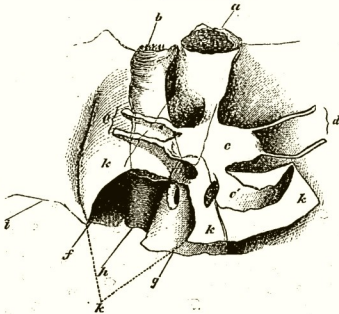
Viewed from the left side and a little behind.

Two of the anterior chambers, and the fifth or posterior chamber, laid open. Natural size.

- a.* Shell muscle. *b.* Ovary. *c.* Intestine. *d.* Heart; *d'.* its pyriform appendage. *e.* Superior anterior chamber; *e'.* its follicles. *f.* Inferior anterior chamber; *f'.* its follicles. *g.* Posterior chamber; *g'.* Follicles. *h.* Cut ends of branchial arteries. *i.* Termination of vena cava. *k.* Pallio-visceral ligament.

of the additional four apertures; but the author states that "on each side, at the roots of the anterior branchiæ, there is a small mamillary eminence with a transverse slit, which conducts from the branchial cavity to one of the compartments of the pericardium containing two clusters of venous glands. There are also two similar, but smaller, slits, contiguous to one another, near the root of the posterior branchia on each side, which lead to and may admit sea-water into the compartments containing the posterior cluster of the venous follicles." In this work the ovary is not only described, but *figured*, on the right side of the gizzard. The figure, however, rightly places the greater part of the ovary below that organ.

Nautilus pompilius. Fig. 2.



Natural Size.

The pallio-visceral ligament seen from below: torn on the right side to show the rectum and oviduct; cut through on the left side along the dotted line close to *d'* in the preceding figure.

a. Anus. *b.* Oviducal aperture. *c.* Heart. *d.* Left branchial veins. *e.* Right branchial veins. *f.* Oviduct cut through. *g.* Ovary. *h.* Rectum. *i.* Mantle. *k k k.* Pallio-visceral ligament; *k'* its torn portion. The oval "aperture for the siphonal artery" is seen to the left of *c'*, and the right-hand style in *Fig. 1* passes through it.

On the Tendency of Species to form Varieties; and on the Perpetuation of Varieties and Species by Natural Means of Selection. By CHARLES DARWIN, Esq., F.R.S., F.L.S., & F.G.S., and ALFRED WALLACE, Esq. Communicated by Sir CHARLES LYELL, F.R.S., F.L.S., and J. D. HOOKER, Esq., M.D., V.P.R.S., F.L.S., &c.

[Read July 1st, 1858.]

London, June 30th, 1858.

MY DEAR SIR,—The accompanying papers, which we have the honour of communicating to the Linnean Society, and which all relate to the same subject, viz. the Laws which affect the Production of Varieties, Races, and Species, contain the results of the investigations of two indefatigable naturalists, Mr. Charles Darwin and Mr. Alfred Wallace.

These gentlemen having, independently and unknown to one another, conceived the same very ingenious theory to account for the appearance and perpetuation of varieties and of specific forms on our planet, may both fairly claim the merit of being original thinkers in this important line of inquiry; but neither of them having published his views, though Mr. Darwin has for many years past been repeatedly urged by us to do so, and both authors having now unreservedly placed their papers in our hands, we think it would best promote the interests of science that a selection from them should be laid before the Linnean Society.

Taken in the order of their dates, they consist of:—

1. Extracts from a MS. work on Species*, by Mr. Darwin, which was sketched in 1839, and copied in 1844, when the copy was read by Dr. Hooker, and its contents afterwards communicated to Sir Charles Lyell. The first Part is devoted to "The Variation of Organic Beings under Domestication and in their Natural State;" and the second chapter of that Part, from which we propose to read to the Society the extracts referred to, is headed, "On the Variation of Organic Beings in a state of Nature; on the Natural Means of Selection; on the Comparison of Domestic Races and true Species."

2. An abstract of a private letter addressed to Professor Asa Gray, of Boston, U.S., in October 1857, by Mr. Darwin, in which

* This MS. work was never intended for publication, and therefore was not written with care.—C. D. 1858.

~~19th Nov~~

~~Thanking you very much for the~~
having made an ~~in correct statement~~ ; and all the
entirely pleasant to be fully understood.

he repeats his views, and which shows that these remained unaltered from 1839 to 1857.

3. An Essay by Mr. Wallace, entitled "On the Tendency of Varieties to depart indefinitely from the Original Type." This was written at Ternate in February 1858, for the perusal of his friend and correspondent Mr. Darwin, and sent to him with the expressed wish that it should be forwarded to Sir Charles Lyell, if Mr. Darwin thought it sufficiently novel and interesting. So highly did Mr. Darwin appreciate the value of the views therein set forth, that he proposed, in a letter to Sir Charles Lyell, to obtain Mr. Wallace's consent to allow the Essay to be published as soon as possible. Of this step we highly approved, provided Mr. Darwin did not withhold from the public, as he was strongly inclined to do (in favour of Mr. Wallace), the memoir which he had himself written on the same subject, and which, as before stated, one of us had perused in 1844, and the contents of which we had both of us been privy to for many years. On representing this to Mr. Darwin, he gave us permission to make what use we thought proper of his memoir, &c.; and in adopting our present course, of presenting it to the Linnean Society, we have explained to him that we are not solely considering the relative claims to priority of himself and his friend, but the interests of science generally; for we feel it to be desirable that views founded on a wide deduction from facts, and matured by years of reflection, should constitute at once a goal from which others may start, and that, while the scientific world is waiting for the appearance of Mr. Darwin's complete work, some of the leading results of his labours, as well as those of his able correspondent, should together be laid before the public.

We have the honour to be yours very obediently,

CHARLES LYELL.

JOS. D. HOOKER.

J. J. Bennett, Esq.,

Secretary of the Linnean Society.

- I. *Extract from an unpublished Work on Species, by C. DARWIN, Esq., consisting of a portion of a Chapter entitled, "On the Variation of Organic Beings in a state of Nature; on the Natural Means of Selection; on the Comparison of Domestic Races and true Species."*

De Candolle, in an eloquent passage, has declared that all nature is at war, one organism with another, or with external nature.

Seeing the contented face of nature, this may at first well be doubted; but reflection will inevitably prove it to be true. The war, however, is not constant, but recurrent in a slight degree at short periods, and more severely at occasional more distant periods; and hence its effects are easily overlooked. It is the doctrine of Malthus applied in most cases with tenfold force. As in every climate there are seasons, for each of its inhabitants, of greater and less abundance, so all annually breed; and the moral restraint which in some small degree checks the increase of mankind is entirely lost. Even slow-breeding mankind has doubled in twenty-five years; and if he could increase his food with greater ease, he would double in less time. But for animals without artificial means, the amount of food for each species must, *on an average*, be constant, whereas the increase of all organisms tends to be geometrical, and in a vast majority of cases at an enormous ratio. Suppose in a certain spot there are eight pairs of birds, and that *only* four pairs of them annually (including double hatches) rear only four young, and that these go on rearing their young at the same rate, then at the end of seven years (a short life, excluding violent deaths, for any bird) there will be 2048 birds, instead of the original sixteen. As this increase is quite impossible, we must conclude either that birds do not rear nearly half their young, or that the average life of a bird is, from accident, not nearly seven years. Both checks probably concur. The same kind of calculation applied to all plants and animals affords results more or less striking, but in very few instances more striking than in man.

Many practical illustrations of this rapid tendency to increase are on record, among which, during peculiar seasons, are the extraordinary numbers of certain animals; for instance, during the years 1826 to 1828, in La Plata, when from drought some millions of cattle perished, the whole country actually *swarmed* with mice. Now I think it cannot be doubted that during the breeding-season all the mice (with the exception of a few males or females in excess) ordinarily pair, and therefore that this astounding increase during three years must be attributed to a greater number than usual surviving the first year, and then breeding, and so on till the third year, when their numbers were brought down to their usual limits on the return of wet weather. Where man has introduced plants and animals into a new and favourable country, there are many accounts in how surprisingly few years the whole country has become stocked with them. This increase would

necessarily stop as soon as the country was fully stocked; and yet we have every reason to believe, from what is known of wild animals, that *all* would pair in the spring. In the majority of cases it is most difficult to imagine where the checks fall—though generally, no doubt, on the seeds, eggs, and young; but when we remember how impossible, even in mankind (so much better known than any other animal), it is to infer from repeated casual observations what the average duration of life is, or to discover the different percentage of deaths to births in different countries, we ought to feel no surprise at our being unable to discover where the check falls in any animal or plant. It should always be remembered, that in most cases the checks are recurrent yearly in a small, regular degree, and in an extreme degree during unusually cold, hot, dry, or wet years, according to the constitution of the being in question. Lighten any check in the least degree, and the geometrical powers of increase in every organism will almost instantly increase the average number of the favoured species. Nature may be compared to a surface on which rest ten thousand sharp wedges touching each other and driven inwards by incessant blows. Fully to realize these views much reflection is requisite. Malthus on man should be studied; and all such cases as those of the mice in La Plata, of the cattle and horses when first turned out in South America, of the birds by our calculation, &c., should be well considered. Reflect on the enormous multiplying power *inherent and annually in action* in all animals; reflect on the countless seeds scattered by a hundred ingenious contrivances, year after year, over the whole face of the land; and yet we have every reason to suppose that the average percentage of each of the inhabitants of a country usually remains constant. Finally, let it be borne in mind that this average number of individuals (the external conditions remaining the same) in each country is kept up by recurrent struggles against other species or against external nature (as on the borders of the Arctic regions, where the cold checks life), and that ordinarily each individual of every species holds its place, either by its own struggle and capacity of acquiring nourishment in some period of its life, from the egg upwards; or by the struggle of its parents (in short-lived organisms, when the main check occurs at longer intervals) with other individuals of the *same* or *different* species.

But let the external conditions of a country alter. If in a small degree, the relative proportions of the inhabitants will in most cases simply be slightly changed; but let the number of

inhabitants be small, as on an island, and free access to it from other countries be circumscribed, and let the change of conditions continue progressing (forming new stations), in such a case the original inhabitants must cease to be as perfectly adapted to the changed conditions as they were originally. It has been shown in a former part of this work, that such changes of external conditions would, from their acting on the reproductive system, probably cause the organization of those beings which were most affected to become, as under domestication, plastic. Now, can it be doubted, from the struggle each individual has to obtain subsistence, that any minute variation in structure, habits, or instincts, adapting that individual better to the new conditions, would tell upon its vigour and health? In the struggle it would have a better *chance* of surviving; and those of its offspring which inherited the variation, be it ever so slight, would also have a better *chance*. Yearly more are bred than can survive; the smallest grain in the balance, in the long run, must tell on which death shall fall, and which shall survive. Let this work of selection on the one hand, and death on the other, go on for a thousand generations, who will pretend to affirm that it would produce no effect, when we remember what, in a few years, Bakewell effected in cattle, and Western in sheep, by this identical principle of selection?

To give an imaginary example from changes in progress on an island:—let the organization of a canine animal which preyed chiefly on rabbits, but sometimes on hares, become slightly plastic; let these same changes cause the number of rabbits very slowly to decrease, and the number of hares to increase; the effect of this would be that the fox or dog would be driven to try to catch more hares: his organization, however, being slightly plastic, those individuals with the lightest forms, longest limbs, and best eyesight, let the difference be ever so small, would be slightly favoured, and would tend to live longer, and to survive during that time of the year when food was scarcest; they would also rear more young, which would tend to inherit these slight peculiarities. The less fleet ones would be rigidly destroyed. I can see no more reason to doubt that these causes in a thousand generations would produce a marked effect, and adapt the form of the fox or dog to the catching of hares instead of rabbits, than that greyhounds can be improved by selection and careful breeding. So would it be with plants under similar circumstances. If the number of individuals of a species with plumed seeds could be increased by greater powers of dissemination within its own area

(that is, if the check to increase fell chiefly on the seeds), those seeds which were provided with ever so little more down, would in the long run be most disseminated; hence a greater number of seeds thus formed would germinate, and would tend to produce plants inheriting the slightly better-adapted down*.

Besides this natural means of selection, by which those individuals are preserved, whether in their egg, or larval, or mature state, which are best adapted to the place they fill in nature, there is a second agency at work in most unisexual animals, tending to produce the same effect, namely, the struggle of the males for the females. These struggles are generally decided by the law of battle, but in the case of birds, apparently, by the charms of their song, by their beauty or their power of courtship, as in the dancing rock-thrush of Guiana. The most vigorous and healthy males, implying perfect adaptation, must generally gain the victory in their contests. This kind of selection, however, is less rigorous than the other; it does not require the death of the less successful, but gives to them fewer descendants. The struggle falls, moreover, at a time of year when food is generally abundant, and perhaps the effect chiefly produced would be the modification of the secondary sexual characters, which are not related to the power of obtaining food, or to defence from enemies, but to fighting with or rivalling other males. The result of this struggle amongst the males may be compared in some respects to that produced by those agriculturists who pay less attention to the careful selection of all their young animals, and more to the occasional use of a choice mate.

II. *Abstract of a Letter from C. DARWIN, Esq., to Prof. ASA GRAY, Boston, U.S., dated Down, September 5th, 1857.*

1. It is wonderful what the principle of selection by man, that is the picking out of individuals with any desired quality, and breeding from them, and again picking out, can do. Even breeders have been astounded at their own results. They can act on differences inappreciable to an uneducated eye. Selection has been *methodically* followed in *Europe* for only the last half century; but it was occasionally, and even in some degree methodically, followed in the most ancient times. There must have been also a kind of unconscious selection from a remote period, namely in

* I can see no more difficulty in this, than in the planter improving his varieties of the cotton plant.—C. D. 1858.

the preservation of the individual animals (without any thought of their offspring) most useful to each race of man in his particular circumstances. The "roguing," as nurserymen call the destroying of varieties which depart from their type, is a kind of selection. I am convinced that intentional and occasional selection has been the main agent in the production of our domestic races; but however this may be, its great power of modification has been indisputably shown in later times. Selection acts only by the accumulation of slight or greater variations, caused by external conditions, or by the mere fact that in generation the child is not absolutely similar to its parent. Man, by this power of accumulating variations, adapts living beings to his wants—may be said to make the wool of one sheep good for carpets, of another for cloth, &c.

2. Now suppose there were a being who did not judge by mere external appearances, but who could study the whole internal organization, who was never capricious, and should go on selecting for one object during millions of generations; who will say what he might not effect? In nature we have some *slight* variation occasionally in all parts; and I think it can be shown that changed conditions of existence is the main cause of the child not exactly resembling its parents; and in nature geology shows us what changes have taken place, and are taking place. We have almost unlimited time; no one but a practical geologist can fully appreciate this. Think of the Glacial period, during the whole of which the same species at least of shells have existed; there must have been during this period millions on millions of generations.

3. I think it can be shown that there is such an unerring power at work in *Natural Selection* (the title of my book), which selects exclusively for the good of each organic being. The elder De Candolle, W. Herbert, and Lyell have written excellently on the struggle for life; but even they have not written strongly enough. Reflect that every being (even the elephant) breeds at such a rate, that in a few years, or at most a few centuries, the surface of the earth would not hold the progeny of one pair. I have found it hard constantly to bear in mind that the increase of every single species is checked during some part of its life, or during some shortly recurrent generation. Only a few of those annually born can live to propagate their kind. What a trifling difference must often determine which shall survive, and which perish!

4. Now take the case of a country undergoing some change. This will tend to cause some of its inhabitants to vary slightly—

not but that I believe most beings vary at all times enough for selection to act on them. Some of its inhabitants will be exterminated; and the remainder will be exposed to the mutual action of a different set of inhabitants, which I believe to be far more important to the life of each being than mere climate. Considering the infinitely various methods which living beings follow to obtain food by struggling with other organisms, to escape danger at various times of life, to have their eggs or seeds disseminated, &c. &c., I cannot doubt that during millions of generations individuals of a species will be occasionally born with some slight variation, profitable to some part of their economy. Such individuals will have a better chance of surviving, and of propagating their new and slightly different structure; and the modification may be slowly increased by the accumulative action of natural selection to any profitable extent. The variety thus formed will either coexist with, or, more commonly, will exterminate its parent form. An organic being, like the woodpecker or misseltoe, may thus come to be adapted to a score of contingences—natural selection accumulating those slight variations in all parts of its structure, which are in any way useful to it during any part of its life.

5. Multiform difficulties will occur to every one, with respect to this theory. Many can, I think, be satisfactorily answered. *Natura non facit saltum* answers some of the most obvious. The slowness of the change, and only a very few individuals undergoing change at any one time, answers others. The extreme imperfection of our geological records answers others.

6. Another principle, which may be called the principle of divergence, plays, I believe, an important part in the origin of species. The same spot will support more life if occupied by very diverse forms. We see this in the many generic forms in a square yard of turf, and in the plants or insects on any little uniform islet, belonging almost invariably to as many genera and families as species. We can understand the meaning of this fact amongst the higher animals, whose habits we understand. We know that it has been experimentally shown that a plot of land will yield a greater weight if sown with several species and genera of grasses, than if sown with only two or three species. Now, every organic being, by propagating so rapidly, may be said to be striving its utmost to increase in numbers. So it will be with the offspring of any species after it has become diversified into varieties, or subspecies, or true species. And it follows, I think, from the foregoing facts, that the varying offspring of each species will try

(only few will succeed) to seize on as many and as diverse places in the economy of nature as possible. Each new variety or species, when formed, will generally take the place of, and thus exterminate its less well-fitted parent. This I believe to be the origin of the classification and affinities of organic beings at all times; for organic beings always *seem* to branch and sub-branch like the limbs of a tree from a common trunk, the flourishing and diverging twigs destroying the less vigorous—the dead and lost branches rudely representing extinct genera and families.

This sketch is *most* imperfect; but in so short a space I cannot make it better. Your imagination must fill up very wide blanks.

C. DARWIN.

III. *On the Tendency of Varieties to depart indefinitely from the Original Type.* By ALFRED RUSSEL WALLACE.

One of the strongest arguments which have been adduced to prove the original and permanent distinctness of species is, that *varieties* produced in a state of domesticity are more or less unstable, and often have a tendency, if left to themselves, to return to the normal form of the parent species; and this instability is considered to be a distinctive peculiarity of all varieties, even of those occurring among wild animals in a state of nature, and to constitute a provision for preserving unchanged the originally created distinct species.

In the absence or scarcity of facts and observations as to *varieties* occurring among wild animals, this argument has had great weight with naturalists, and has led to a very general and somewhat prejudiced belief in the stability of species. Equally general, however, is the belief in what are called “permanent or true varieties,”—races of animals which continually propagate their like, but which differ so slightly (although constantly) from some other race, that the one is considered to be a *variety* of the other. Which is the *variety* and which the original *species*, there is generally no means of determining, except in those rare cases in which the one race has been known to produce an offspring unlike itself and resembling the other. This, however, would seem quite incompatible with the “permanent invariability of species,” but the difficulty is overcome by assuming that such varieties have strict limits, and can never again vary further from the original type, although they may return to it, which, from the

analogy of the domesticated animals, is considered to be highly probable, if not certainly proved.

It will be observed that this argument rests entirely on the assumption, that *varieties* occurring in a state of nature are in all respects analogous to or even identical with those of domestic animals, and are governed by the same laws as regards their permanence or further variation. But it is the object of the present paper to show that this assumption is altogether false, that there is a general principle in nature which will cause many *varieties* to survive the parent species, and to give rise to successive variations departing further and further from the original type, and which also produces, in domesticated animals, the tendency of varieties to return to the parent form.

The life of wild animals is a struggle for existence. The full exertion of all their faculties and all their energies is required to preserve their own existence and provide for that of their infant offspring. The possibility of procuring food during the least favourable seasons, and of escaping the attacks of their most dangerous enemies, are the primary conditions which determine the existence both of individuals and of entire species. These conditions will also determine the population of a species; and by a careful consideration of all the circumstances we may be enabled to comprehend, and in some degree to explain, what at first sight appears so inexplicable—the excessive abundance of some species, while others closely allied to them are very rare.

The general proportion that must obtain between certain groups of animals is readily seen. Large animals cannot be so abundant as small ones; the carnivora must be less numerous than the herbivora; eagles and lions can never be so plentiful as pigeons and antelopes; the wild asses of the Tartarian deserts cannot equal in numbers the horses of the more luxuriant prairies and pampas of America. The greater or less fecundity of an animal is often considered to be one of the chief causes of its abundance or scarcity; but a consideration of the facts will show us that it really has little or nothing to do with the matter. Even the least prolific of animals would increase rapidly if unchecked, whereas it is evident that the animal population of the globe must be stationary, or perhaps, through the influence of man, decreasing. Fluctuations there may be; but permanent increase, except in restricted localities, is almost impossible. For example, our own observation must convince us that birds do not go on increasing every year in a geometrical ratio, as they would do, were there not

some powerful check to their natural increase. Very few birds produce less than two young ones each year, while many have six, eight, or ten; four will certainly be below the average; and if we suppose that each pair produce young only four times in their life, that will also be below the average, supposing them not to die either by violence or want of food. Yet at this rate how tremendous would be the increase in a few years from a single pair! A simple calculation will show that in fifteen years each pair of birds would have increased to nearly ten millions! whereas we have no reason to believe that the number of the birds of any country increases at all in fifteen or in one hundred and fifty years. With such powers of increase the population must have reached its limits, and have become stationary, in a very few years after the origin of each species. It is evident, therefore, that each year an immense number of birds must perish—as many in fact as are born; and as on the lowest calculation the progeny are each year twice as numerous as their parents, it follows that, whatever be the average number of individuals existing in any given country, *twice that number must perish annually*,—a striking result, but one which seems at least highly probable, and is perhaps under rather than over the truth. It would therefore appear that, as far as the continuance of the species and the keeping up the average number of individuals are concerned, large broods are superfluous. On the average all above *one* become food for hawks and kites, wild cats and weasels, or perish of cold and hunger as winter comes on. This is strikingly proved by the case of particular species; for we find that their abundance in individuals bears no relation whatever to their fertility in producing offspring. Perhaps the most remarkable instance of an immense bird population is that of the passenger pigeon of the United States, which lays only one, or at most two eggs, and is said to rear generally but one young one. Why is this bird so extraordinarily abundant, while others producing two or three times as many young are much less plentiful? The explanation is not difficult. The food most congenial to this species, and on which it thrives best, is abundantly distributed over a very extensive region, offering such differences of soil and climate, that in one part or another of the area the supply never fails. The bird is capable of a very rapid and long-continued flight, so that it can pass without fatigue over the whole of the district it inhabits, and as soon as the supply of food begins to fail in one place is able to discover a fresh feeding-ground. This example strikingly shows us that the procuring a constant supply

of wholesome food is almost the sole condition requisite for ensuring the rapid increase of a given species, since neither the limited fecundity, nor the unrestrained attacks of birds of prey and of man are here sufficient to check it. In no other birds are these peculiar circumstances so strikingly combined. Either their food is more liable to failure, or they have not sufficient power of wing to search for it over an extensive area, or during some season of the year it becomes very scarce, and less wholesome substitutes have to be found; and thus, though more fertile in offspring, they can never increase beyond the supply of food in the least favourable seasons. Many birds can only exist by migrating, when their food becomes scarce, to regions possessing a milder, or at least a different climate, though, as these migrating birds are seldom excessively abundant, it is evident that the countries they visit are still deficient in a constant and abundant supply of wholesome food. Those whose organization does not permit them to migrate when their food becomes periodically scarce, can never attain a large population. This is probably the reason why woodpeckers are scarce with us, while in the tropics they are among the most abundant of solitary birds. Thus the house sparrow is more abundant than the redbreast, because its food is more constant and plentiful,—seeds of grasses being preserved during the winter, and our farm-yards and stubble-fields furnishing an almost inexhaustible supply. Why, as a general rule, are aquatic, and especially sea birds, very numerous in individuals? Not because they are more prolific than others, generally the contrary; but because their food never fails, the sea-shores and river-banks daily swarming with a fresh supply of small mollusca and crustacea. Exactly the same laws will apply to mammals. Wild cats are prolific and have few enemies; why then are they never as abundant as rabbits? The only intelligible answer is, that their supply of food is more precarious. It appears evident, therefore, that so long as a country remains physically unchanged, the numbers of its animal population cannot materially increase. If one species does so, some others requiring the same kind of food must diminish in proportion. The numbers that die annually must be immense; and as the individual existence of each animal depends upon itself, those that die must be the weakest—the very young, the aged, and the diseased,—while those that prolong their existence can only be the most perfect in health and vigour—those who are best able to obtain food regularly, and avoid their numerous enemies. It is, as we commenced by remarking, “a struggle for existence,” in

which the weakest and least perfectly organized must always succumb.

Now it is clear that what takes place among the individuals of a species must also occur among the several allied species of a group,—viz. that those which are best adapted to obtain a regular supply of food, and to defend themselves against the attacks of their enemies and the vicissitudes of the seasons, must necessarily obtain and preserve a superiority in population; while those species which from some defect of power or organization are the least capable of counteracting the vicissitudes of food, supply, &c., must diminish in numbers, and, in extreme cases, become altogether extinct. Between these extremes the species will present various degrees of capacity for ensuring the means of preserving life; and it is thus we account for the abundance or rarity of species. Our ignorance will generally prevent us from accurately tracing the effects to their causes; but could we become perfectly acquainted with the organization and habits of the various species of animals, and could we measure the capacity of each for performing the different acts necessary to its safety and existence under all the varying circumstances by which it is surrounded, we might be able even to calculate the proportionate abundance of individuals which is the necessary result.

If now we have succeeded in establishing these two points—1st, *that the animal population of a country is generally stationary, being kept down by a periodical deficiency of food, and other checks*; and, 2nd, *that the comparative abundance or scarcity of the individuals of the several species is entirely due to their organization and resulting habits, which, rendering it more difficult to procure a regular supply of food and to provide for their personal safety in some cases than in others, can only be balanced by a difference in the population which have to exist in a given area*—we shall be in a condition to proceed to the consideration of *varieties*, to which the preceding remarks have a direct and very important application.

Most or perhaps all the variations from the typical form of a species must have some definite effect, however slight, on the habits or capacities of the individuals. Even a change of colour might, by rendering them more or less distinguishable, affect their safety; a greater or less development of hair might modify their habits. More important changes, such as an increase in the power or dimensions of the limbs or any of the external organs, would more or less affect their mode of procuring food or the range of

country which they inhabit. It is also evident that most changes would affect, either favourably or adversely, the powers of prolonging existence. An antelope with shorter or weaker legs must necessarily suffer more from the attacks of the feline carnivora; the passenger pigeon with less powerful wings would sooner or later be affected in its powers of procuring a regular supply of food; and in both cases the result must necessarily be a diminution of the population of the modified species. If, on the other hand, any species should produce a variety having slightly increased powers of preserving existence, that variety must inevitably in time acquire a superiority in numbers. These results must follow as surely as old age, intemperance, or scarcity of food produce an increased mortality. In both cases there may be many individual exceptions; but on the average the rule will invariably be found to hold good. All varieties will therefore fall into two classes—those which under the same conditions would never reach the population of the parent species, and those which would in time obtain and keep a numerical superiority. Now, let some alteration of physical conditions occur in the district—a long period of drought, a destruction of vegetation by locusts, the irruption of some new carnivorous animal seeking “pastures new”—any change in fact tending to render existence more difficult to the species in question, and tasking its utmost powers to avoid complete extermination; it is evident that, of all the individuals composing the species, those forming the least numerous and most feebly organized variety would suffer first, and, were the pressure severe, must soon become extinct. The same causes continuing in action, the parent species would next suffer, would gradually diminish in numbers, and with a recurrence of similar unfavourable conditions might also become extinct. The superior variety would then alone remain, and on a return to favourable circumstances would rapidly increase in numbers and occupy the place of the extinct species and variety.

The *variety* would now have replaced the *species*, of which it would be a more perfectly developed and more highly organized form. It would be in all respects better adapted to secure its safety, and to prolong its individual existence and that of the race. Such a variety *could not* return to the original form; for that form is an inferior one, and could never compete with it for existence. Granted, therefore, a “tendency” to reproduce the original type of the species, still the variety must ever remain preponderant in numbers, and under adverse physical conditions *again alone survive*.

But this new, improved, and populous race might itself, in course of time, give rise to new varieties, exhibiting several diverging modifications of form, any of which, tending to increase the facilities for preserving existence, must, by the same general law, in their turn become predominant. Here, then, we have *progression and continued divergence* deduced from the general laws which regulate the existence of animals in a state of nature, and from the undisputed fact that varieties do frequently occur. It is not, however, contended that this result would be invariable; a change of physical conditions in the district might at times materially modify it, rendering the race which had been the most capable of supporting existence under the former conditions now the least so, and even causing the extinction of the newer and, for a time, superior race, while the old or parent species and its first inferior varieties continued to flourish. Variations in unimportant parts might also occur, having no perceptible effect on the life-preserving powers; and the varieties so furnished might run a course parallel with the parent species, either giving rise to further variations or returning to the former type. All we argue for is, that certain varieties have a tendency to maintain their existence longer than the original species, and this tendency must make itself felt; for though the doctrine of chances or averages can never be trusted to on a limited scale, yet, if applied to high numbers, the results come nearer to what theory demands, and, as we approach to an infinity of examples, become strictly accurate. Now the scale on which nature works is so vast—the numbers of individuals and periods of time with which she deals approach so near to infinity, that any cause, however slight, and however liable to be veiled and counteracted by accidental circumstances, must in the end produce its full legitimate results.

Let us now turn to domesticated animals, and inquire how varieties produced among them are affected by the principles here enunciated. The essential difference in the condition of wild and domestic animals is this,—that among the former, their well-being and very existence depend upon the full exercise and healthy condition of all their senses and physical powers, whereas, among the latter, these are only partially exercised, and in some cases are absolutely unused. A wild animal has to search, and often to labour, for every mouthful of food—to exercise sight, hearing, and smell in seeking it, and in avoiding dangers, in procuring shelter from the inclemency of the seasons, and in providing for the subsistence and safety of its offspring. There is no muscle of

its body that is not called into daily and hourly activity ; there is no sense or faculty that is not strengthened by continual exercise. The domestic animal, on the other hand, has food provided for it, is sheltered, and often confined, to guard it against the vicissitudes of the seasons, is carefully secured from the attacks of its natural enemies, and seldom even rears its young without human assistance. Half of its senses and faculties are quite useless ; and the other half are but occasionally called into feeble exercise, while even its muscular system is only irregularly called into action.

Now when a variety of such an animal occurs, having increased power or capacity in any organ or sense, such increase is totally useless, is never called into action, and may even exist without the animal ever becoming aware of it. In the wild animal, on the contrary, all its faculties and powers being brought into full action for the necessities of existence, any increase becomes immediately available, is strengthened by exercise, and must even slightly modify the food, the habits, and the whole economy of the race. It creates as it were a new animal, one of superior powers, and which will necessarily increase in numbers and outlive those inferior to it.

Again, in the domesticated animal all variations have an equal chance of continuance ; and those which would decidedly render a wild animal unable to compete with its fellows and continue its existence are no disadvantage whatever in a state of domesticity. Our quickly fattening pigs, short-legged sheep, pouter pigeons, and poodle dogs could never have come into existence in a state of nature, because the very first step towards such inferior forms would have led to the rapid extinction of the race ; still less could they now exist in competition with their wild allies. The great speed but slight endurance of the race horse, the unwieldy strength of the ploughman's team, would both be useless in a state of nature. If turned wild on the pampas, such animals would probably soon become extinct, or under favourable circumstances might each lose those extreme qualities which would never be called into action, and in a few generations would revert to a common type, which must be that in which the various powers and faculties are so proportioned to each other as to be best adapted to procure food and secure safety,—that in which by the full exercise of every part of his organization the animal can alone continue to live. Domestic varieties, when turned wild, *must* return to something near the type of the original wild stock, *or become altogether extinct.*

We see, then, that no inferences as to varieties in a state of nature can be deduced from the observation of those occurring among domestic animals. The two are so much opposed to each other in every circumstance of their existence, that what applies to the one is almost sure not to apply to the other. Domestic animals are abnormal, irregular, artificial; they are subject to varieties which never occur and never can occur in a state of nature: their very existence depends altogether on human care; so far are many of them removed from that just proportion of faculties, that true balance of organization, by means of which alone an animal left to its own resources can preserve its existence and continue its race.

The hypothesis of Lamarck—that progressive changes in species have been produced by the attempts of animals to increase the development of their own organs, and thus modify their structure and habits—has been repeatedly and easily refuted by all writers on the subject of varieties and species, and it seems to have been considered that when this was done the whole question has been finally settled; but the view here developed renders such an hypothesis quite unnecessary, by showing that similar results must be produced by the action of principles constantly at work in nature. The powerful retractile talons of the falcon- and the cat-tribes have not been produced or increased by the volition of those animals; but among the different varieties which occurred in the earlier and less highly organized forms of these groups, *those always survived longest which had the greatest facilities for seizing their prey.* Neither did the giraffe acquire its long neck by desiring to reach the foliage of the more lofty shrubs, and constantly stretching its neck for the purpose, but because any varieties which occurred among its antitypes with a longer neck than usual *at once secured a fresh range of pasture over the same ground as their shorter-necked companions, and on the first scarcity of food were thereby enabled to outlive them.* Even the peculiar colours of many animals, especially insects, so closely resembling the soil or the leaves or the trunks on which they habitually reside, are explained on the same principle; for though in the course of ages varieties of many tints may have occurred, *yet those races having colours best adapted to concealment from their enemies would inevitably survive the longest.* We have also here an acting cause to account for that balance so often observed in nature,—a deficiency in one set of organs always being compensated by an increased development of some others—powerful wings accompanying weak

feet, or great velocity making up for the absence of defensive weapons; for it has been shown that all varieties in which an unbalanced deficiency occurred could not long continue their existence. The action of this principle is exactly like that of the centrifugal governor of the steam engine, which checks and corrects any irregularities almost before they become evident; and in like manner no unbalanced deficiency in the animal kingdom can ever reach any conspicuous magnitude, because it would make itself felt at the very first step, by rendering existence difficult and extinction almost sure soon to follow. An origin such as is here advocated will also agree with the peculiar character of the modifications of form and structure which obtain in organized beings—the many lines of divergence from a central type, the increasing efficiency and power of a particular organ through a succession of allied species, and the remarkable persistence of unimportant parts such as colour, texture of plumage and hair, form of horns or crests, through a series of species differing considerably in more essential characters. It also furnishes us with a reason for that “more specialized structure” which Professor Owen states to be a characteristic of recent compared with extinct forms, and which would evidently be the result of the progressive modification of any organ applied to a special purpose in the animal economy.

We believe we have now shown that there is a tendency in nature to the continued progression of certain classes of *varieties* further and further from the original type—a progression to which there appears no reason to assign any definite limits—and that the same principle which produces this result in a state of nature will also explain why domestic varieties have a tendency to revert to the original type. This progression, by minute steps, in various directions, but always checked and balanced by the necessary conditions, subject to which alone existence can be preserved, may, it is believed, be followed out so as to agree with all the phenomena presented by organized beings, their extinction and succession in past ages, and all the extraordinary modifications of form, instinct, and habits which they exhibit.

Ternate, February, 1858.

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By Professor LINDLEY, F.R.S., F.L.S., &c.

(Continued from vol. i. p. 190.)

[Read March 4th, 1858.]

DENDROBIUM, Swartz.

THIS great Indian genus varies extremely in the habit of its numerous species,—some being little larger than the mosses among which they grow, while others are surpassed in stature by few of the Order. Like the *Oncidia* of the New World, there are some species of which the foliage is ancipitous, others having it terete, while in the majority it is in the usual flat condition. A few have no other stem than a wiry creeping rhizome; others have small conical pseudo-bulbs; many form clavate horny stems, leafy only at the summit; but the greater part produce long leafy branches. In the majority the colour of the flowers is some shade of purple; a few are destitute of all colour except green; and a rather considerable group is especially distinguishable by the rich yellow tint of their blossoms. Of such distinctions advantage has been taken in the following sketch of the entire genus, now consisting of more than 200 species, of which I have examined the larger part. In this all the species agree, that there are only four pollen-masses, nearly equal in size, and of uniform breadth at either end. On the contrary, the *Erias*, which in some cases have been mistaken for *Dendrobium*, have the pollen-masses pyriform, so that when, in the

herbarium, a specimen has lost a part of its pollen-masses, as is frequently the case with *E. muscicola*, *Dalzellii*, &c., its true genus may still be determined. It is mainly because *Sarcostoma* has the pyriform pollen-masses of an *Eria*, although their number is that of *Dendrobium*, that I now hesitate to reduce it to the latter genus.

In forming the sections now proposed, it will be seen that a regular sequence of the most nearly allied forms is not wholly obtained. However desirable, indeed, such an arrangement may be in theory, it is certainly unattainable in practice in cases where great numbers of species are brought together; for the points of resemblance and difference are so various and complicated, that, like countries in a geographical map when placed in a continuous series, some must of necessity be dissevered from those to which they are conterminous in nature. Thus the *Bolbodia*, forming a natural group among each other, run into *Stachyobium* as much as into *Eudendrobium*, next which the section is placed; and such species as *D. Dalhousieanum* are much allied to the *Holochrysalis*. It would, moreover, be desirable to collect into one subdivision such species as *D. excisum*, *metachilinum*, *Tmesipteris*, *lycopodioides*, &c., now forming a part of *Eudendrobium*; but I do not at present see what combining characters are available for the purpose.

The following Table brings into one view the distinctions of the groups under which the annexed memoranda are collected:—

Folia verticalia (<i>scalpellifolia</i>)	1. APORUM.
— teretia	2. STRONGYLE.
— horizontalia.	
Caulis nullus, rhizoma tantum	3. RHIZOBIUM.
— apicè tantum 1-3-phyllus. Folia coriacea...	4. DENDROCORYNE.
<i>a.</i> labello continuo.	
<i>b.</i> labello in crinibus soluto (<i>Desmotrichum</i>).	
Caulis undique foliatus :	
Flores omnino aurei	5. HOLOCHRYSA.
— rosei aut candidi, labello tantum quandoque luteo.	
Mento nullo.....	6. ACLINIA.
— producto :	
Flores fasciculati aut solitarii :	
<i>a.</i> Caule brevissimo, conico (<i>Bolbodium</i>).	
<i>b.</i> Caule elongato	7. EUDENDROBIUM.
Flores dense racemosi, mento elongato	8. PEDILONUM.
Flores laxè racemosi, mento brevi :	
petalis conformibus	9. STACHYOBIUM.
petalis elongatis spathulatis	10. CERATOBIMUM.

§ I. APORUM, *Blume*.

The ancipitous leaves clearly distinguish this group from all other *Dendrobia*. The genus *Oxystophyllum* differs in nothing except having only two globose pollen-masses instead of four. *D. (Aporum) sinuatum* of the 'Bot. Register, 1841, Misc. No. 3,' which has quite the habit of *Ox. carnosum*, seems to connect the two genera; for although it has four pollen-masses, two are much smaller than the others, as if rudimentary*.

* *Flores terminales et laterales. Caules apice sæpe aphylli.*

72. *D. (A.) micranthum (W. Griffith, in Calcutta Journal of Natural History, iv. 376; Ib. v. 369).*

Java, *T. Lobb*.

His erroneous description of the lip of this plant was corrected by Griffith in a later paper: the specimen in my herbarium which I refer to here differs in the lip being too broad to be called "linear-oblong"; but I have seen nothing else to which Griffith's description will apply.

73. *D. (A.) Serra, Lindl. Gen. & Sp. Orch. No. 5.*

Java, *T. Lobb*. in hb. Hooker.

A flower in the Hookerian Herbarium shows this to be the *Macrostomium aloifolium*, Blume, which is confirmed by one of Kuhl and Hasselt's unpublished drawings. It is, however, not the *Herba supplex quinta* of Rumphius, as I formerly suspected, the figure of that plant certainly representing *D. (A.) subteres*. According to Griffith this is also the *Dend. acinaciforme*, Roxb.

74. *D. (A.) LOBBII: caulibus apice aphyllis, foliis scalpelliformibus duplo longioribus quam latis; floribus minutissimis terminalibus; sepalis recurvis; labello erecto carnosio trilobo; lobis lateralibus brevioribus unguiculato.*

Borneo, forests of Labuan, *T. Lobb*.

This looks like a very small state of *D. Serra*; but the leaves are

* Prof. H. G. Reichenbach reduces *Oxystophyllum* to *Dendrobium*. Neither the materials with which he has favoured me nor those in my own herbarium enable me to form a decided opinion on the subject. In fact that whole genus, if it be one, is in inextricable confusion. A fragment of Blume's *Sarcostoma*, and a drawing of the details of its structure, for which I am also indebted to my learned friend, seem to show that that genus should be preserved. The pollen-masses are represented as having long tails, and have no resemblance to Blume's figure.

more distant and rather narrower, the sepals are recurved, and the lip quite different in form. The flowers are not larger than those of the smallest *Oberonia*. The whole plant forms a tuft little more than 2 inches high.

75. *D. (A.) anceps*, *Wallich, Catalogue*, No. 2020.

My flowers of this are unexamined. It cannot be the *D. anceps* of Roxburgh, which has lateral flowers only.

76. *D. (A.) LUNATUM*: foliis scalpelliformibus densis obtusiusculis, labello lunato ante unguem canaliculatum crista transversa instructo. Philippines, *Cuming*.

Flowers scarcely larger than in *D. (A.) Lobbia*. The lip is quite unlike that of any other of the section.

76b. *D. parviflorum*, *Rehb. f. MSS.* (*D. Jenkinsi*, *W. Griffith, in Calc. Journ. N. H.* v. 367. t. 25); an Assam plant with large white terminal flowers, I have not seen.

77. *D. (A.) subteres*, *Griffith in Calc. Journ. N. H.* v. 370. (Herba supplex quinta species, *Rumph. Amb.* vi. t. 51. f. 2?) Malacca, *Griffith*.

This is a very distinct plant, with the long slender leafless terminations of its shoots yellow, polished, and remarkably flexuose.

78. *D. (A.) Roxburghii*, *Griffith, l. c.* (Dend. Calceolum, *Roxb. Flor. Ind.* iii. 370. Herba supplex femina, *Rumph. Amb.* vi. t. 51. f. 1.) New Guinea, *Hindes*; Amboyna, *Roxburgh*.

Judging from the account of this plant given by Griffith, it must be a very distinct plant, with "large dull-orange flowers slightly veined with dull red." The lip, he adds, is represented as almost 4-lobed, or 3-lobed with the central lobe emarginate. In my specimen, without flowers, the long leafless branches are straight, not flexuose, and the distant leaves when full-grown are thin, $1\frac{3}{4}$ inch long by $\frac{2}{10}$ of an inch wide. The figure in Rumphius makes them broader.

** *Flores laterales tantum.*

79. *D. (A.) anceps*, *Roxb. Flor. Ind.* 487; *Griffith in Calc. Journ. N. H.* v. 369; *Bot. Mag.* t. 3608; *Bot. Reg.* t. 1239; *Bot. Cab.* t. 1895, not of Wallich's Catalogue.

Sikkim, hot valleys, *J. D. H.* (14).

80. *D. (A.) cuspidatum*, *Wallich in Bot. Reg.* 1841, *Misc.* 7.

Khasija, at 2000 feet, *J. D. H. & T. T.* (14 in part); Moulmein, *T. Lobb*.

Perhaps this is not distinct from *D. anceps*, with which it is mixed in the Khasija specimens; but its long naked terminal shoots, narrower leaves, much smaller flowers, and almost flabeliform lip, seem to be sufficiently different.

81. *D. (A.) EULOPHOTUM*: foliis crassis scalpelliformibus obtusiusculis approximatis; labello rotundato crista maxima transversa utrinque acuta.

Mergui, *Griffith*; Java, *T. Lobb* in hb. Hooker.

Of this I have a carefully prepared drawing by Griffith. Its great transverse crest on the lip resembles nothing except what is found in *D. indivisum* of Blume; but that plant, the *Schismoceras distichum* of Presl, has terminal capitate flowers. The Java plant is rather different, the apex of the lip being deeply and widely retuse, while Griffith's plant is, according to his drawing, regularly rounded; but I see no other difference.

§ II. STRONGYLE, *Lindl. in Paxt. Fl. Gard.* i. sub t. 27.

Under this are included all the species with terete leaves. Some occur among the collections from continental India. I have one or two to add to those already on record.

82. *D. UNCATUM*: foliis rigidis triquetris brevibus distichis retrorsum uncatis acutis; labello obovato bilobo intra sinum obsolete tristiche papilloso.

Java, *T. Lobb* (156).

This differs from *D. subulatum* in its strongly hooked leaves, broader, more emarginate lip, and larger flowers. Nevertheless Prof. Reichenbach, who saw both in my herbarium, does not distinguish it. (See *Bonplandia*, March 1, 1857.) It is not unlike a small form of *D. subteres*.

§ III. RHIZOBIUM, *Lindl., l. c.*

Of this there is no Indian species.

§ IV. DENDROCORYNE, *Lindl. in Bot. Reg.* 1844, t. 53; 1847, t. 36. *Paxton, l. c.*

This section must be confined to the species with stems or pseudo-bulbs bearing leaves at the apex only, and always of a thick leathery structure. What I have formerly called *Desmotrichum*, only in part the same as Blume's genus of that name, have for their character the same vegetation, with a lip whose middle lobe is broken up into long threads.

* *Flores terminales. Labellum margine continuum.*

83. *D. Macraei*, Lindl. *Gen. & Sp. Orch.* No. 3. (?*D. nodosum*, Dalzell in Hook. *Journ.* iv. 292.)

Ceylon, *Macrae*; Nilgherries, Madras Herbarium, *J. D. H.* (27)?; Khasia, at the height of 4000 feet, *J. D. H.* (26)?

The flowers of *D. Macraei* were described as having an entire lip, upon the faith of a Cingalese native drawing. It is, however, very doubtful whether such is their structure, and I can hardly doubt that Dalzell's *D. nodosum*, of which I have examined perfect flowers out of the herbarium of my late lamented friend Dr. Stocks (No. 30), is the same plant. Its leaves, indeed, are narrower, and its pseudo-bulbs less unequal-sided, in the specimens before me. Of Dr. Hooker's No. 26, from Khasia, the flowers are unknown, but are said to be solitary and white; the leaves are not half the width of *D. Macraei*, and the pseudo-bulbs are so slender as to be scarcely distinguishable from the main stem. All are nearly allied to *D. flabellum* of Reichenbach.

84. *D. PUMILUM* (*Griff. Notul.* iii. p. 315); pseudobulbis clavatis tetragonis nitidis diphyllis, foliis brevibus ovato-oblongis obtusis, floribus inter squamas sessilibus, sepalis petalisque acuminatis, mento attenuato incurvo ovario subæquali semifisso, labello unguiculato oblongo nudo dimidia superiore acuminata crispa.

Mergui, on trees, *Griffith* (24 and 1175).

Flowers small, white, sweet-scented, according to Griffith, whose description is, however, not quite exact. In habit it resembles *D. tetragonum*.

85. *D. LABUANUM*; pseudobulbis parvis diphyllis secus caulem arcte adpressis, foliis obtusis anguste ovalibus obtusiusculis, floribus solitariis, labello trilobo intra apicem papilloso axi elevata carnosâ abrupta.

Borneo, *T. Lobb*.

This is related to *D. cymbidioides* and its allies, but the flowers are much smaller.

86. *D. BRACHYPETALUM*; pseudobulbis parvis monophyllis secus caulem arcte adpressis, foliis obtusis, floribus geminis sessilibus, sepalis acuminatis, petalis acutissimis duplo brevioribus, mento brevi, labello brevi oblongo acuto bicarinato.

Java, *T. Lobb* in hb. Hooker.

A small species with flowers not larger than in an *Oberonia*. The short acute petals and lip are unusual.

87. *D. RABANI*; pseudobulbis subcylindræis monophyllis secus caulem imbricatis, folio oblongo obtuso, floribus parvis sessilibus terminalibus, sepalis petalisque acutis æqualibus, mento brevi, columna bicamerata, labello basi excavato lævi lamina intus villosa medio tuberculata. Khasia, in Mr. Raban's garden, at 4000 feet, *J. D. H.* (25).

"Flowers small, white, sweet-scented." I have been unable to ascertain the form of the lip; but the other characters are amply sufficient to distinguish this.

** *Flores laterales. Labellum margine continuum.*

Some of the supposed species of this section are probably founded on insufficient grounds. *D. Farmeri* (Bot. Mag. t. 4659), for instance, is scarcely distinct from *D. chrysotoxum* (Bot. Reg. 1847, t. 36), although its flowers are tinged with pink, and its lip less abundantly fringed. In like manner my *D. palpebræ* (Journ. Hort. Soc. v. 33) may be a white-flowered variety of *D. Griffithianum* (Bot. Reg. xxi. 1756). The only species among the collections of Hooker and Thomson is—

88. *D. densiflorum*, Wallich, *Plant. As. rar.* t. 40; *Bot. Mag.* t. 3418. Sikkim, at 1000–5000 feet of elevation, *J. D. H.* (7 and 150); Khasia at 2000–4000 feet, *J. D. H. & T. T.* (7).

89. *D. EUPHLEBIUM* (*H. G. Rchb. MSS.*); caule angulato clavato basi angustato, foliis geminis membranaceis ovali-lanceolatis, flore solitario laterali, labello oblongo unguiculato concavo emarginato cordato, venis ab axi carnosio rectangulis divergentibus. Java, *T. Lobb.*

A very distinct plant, remarkable for its clavate angular stem tapering to the base, and solitary lateral flower.

*** *Labelli lobus medius stuposus* (Desmotrichum).

The species hitherto known are wholly insular.

§ V. HOLOCHRYSA.

- * *Fasciculata*; floribus solitariis, fasciculatis aut breviter racemosis.

In proposing now, for the first time, to collect into one group all the distichous-leaved yellow species, I have no character to rest upon except the uniformly yellow colour of all parts of the flower, a colour disappearing somewhat in *D. aureum*, whose yellow almost fades into white in the variety called *D. rhombeum*, just as that of *D. Griffithianum* disappears in its variety *Palpebræ*.

* *Flores fasciculati, aut geminati, aut in racemulis 3-4-floris.*

90. *D. HOOKERIANUM*; foliis ovatis acuminatis, pedunculis 3-4-floris, bracteis minutis, sepalis petalisque subæqualibus integris, labello ovato fimbriis crenatis cincto laminæ ipsæ æqualibus, ungue convuluto basi retrorsum bidentato.

Sikkim, at 1000-5000 feet, *J. D. H.* (8).

A very striking species, with flowers as large as *Dalhousieanum*, with very long shaggy fringes surrounding the labellum, which has two blood-red spots on each side above the unguis itself, furnished at the base with a double reversed tooth. There is a figure among Mr. Cathcart's drawings.

91. *D. chrysanthum*, *Wallich, Cat. No. 2012; Bot. Reg. 1299.*

Darjeeling, *Griffith*; Khasija, *Griffith*; at 3000-5000 feet, *J. D. H. & T. T.* (13); Churra, *J. D. H.*; Sikkim, in hot valleys, at 2000-5000 feet, *J. D. H.* (13).

There is scarcely any variation among the numerous specimens before us. All have the broad rounded sepals and strictly fascioled flowers so characteristic of this beautiful species. *Dendrobium Paxtoni* (*Bot. Reg. 1839, Misc. 56*), of which I have seen no wild specimen, differs in its longer and less rounded petals, which are slightly serrated.

92. *D. ochreatum*, *Lindl. in Wall. Cat. no. 7410. (D. Cambridgeanum, Paxton, Mag. Bot. vi. 265; Bot. Mag. t. 4450.)*

Khasija, *Griffith*.

Prof. H. G. Reichenbach informs me that the odd stigma is at the base of the fovea stigmatica, and not at the apex beneath the rostellum as usual,—a circumstance I have not had an opportunity of observing.

Other species of this section are *aureum*, Lindl., or *heterocarpon*, Wallich, of which *D. rhombeum*, Lindl. is a white variety; *villosulum*, Wall., or *Jerdonianum*, Wight; *Ruckeri*, Lindl.; *sanguinolentum*, Id.; *rugosum* and *salaccense*, Blume; and I suppose *intermedium* and *ochroleucum*, Tijsmann.

** *Racemosa*; racemis multifloris.

93. *D. moschatum*, *Wall. Pl. As. ii. p. 83.; B. M. t. 3837.*

Khasija, at 4000 feet, *J. D. H. & T. T.* (16).

94. *D. FUSCATUM*; foliis oblongo-lanceolatis acutissimis, racemis filiformibus flexuosis, bracteis linearibus herbaceis, petalis sepalisque subæqualibus oblongis rotundatis, labello oblato cucullato retuso denticulato ciliato.

Sikkim, *Cathcart*, in hot valleys, *J. D. H.* (12); Khasija, at 2000-4000 feet, *J. D. H. & T. T.* (12).

This remarkable plant has orange-brown sepals, and in the shape of its parts is like *D. chrysanthum*, but with ten or twelve flowers in a slender raceme. The petals are orange-yellow, as also is the lip, which has two crimson spots on each side. The flowers of the Khasija specimens are smaller than in those from Sikkim.

§ VI. ACLINIA, *Griffith, Not.* iii. 320.

In retaining this supposed genus as a section of *Dendrobium*, I must at the same time observe that the species are probably Pelorias of others, although, with perhaps one exception, their parentage cannot be traced. They are all characterized by a perfect, or nearly perfect, regularity in the inner as well as outer series of floral envelopes, one result of which is the loss of the mentum, which belongs to all the other plants collected under the genus. In the case of *D. normale*, the column seems to be always triandrous; and in *D. Pseudaclinia*, there is sometimes an apparent attempt to gain that structure. It is, however, for Indian botanists to investigate this curious subject, and trace the monsters, if monsters they are, to their origin. Prof. H. G. Reichenbach has discovered that Endlicher's genus THELYCHITON, founded on a terrestrial Norfolk Island plant, is one of these Aclinias. Judging from a tracing from Ferdinand Bauer's drawing in the Vienna Museum, it seems possible, perhaps probable, that this plant (*Dendrobium macropus*, H. G. Rehb.) is a Peloria of *D. elongatum*, A. Cunn. (*D. brisbanense*, H. G. Rehb.). I also much suspect my genus *Paxtonia* to be nothing more than a Peloria of *Spathoglottis spicata*.

95. *D. Aclinia*. (*Aclinia, Griff. Not.* iii. 320. t. 351 A. fig. 21.)
Mergui, *Griffith* (809).

I can have no doubt that this is a Peloria of *D. incurvum* (*infra*, No. 133), which seems to have been gathered by Griffith in the same place on the same day. The flowers are in pedunculate divaricating secund racemes, and appear to have been white, as Griffith describes them.

96. *D. Pseudaclinia*. (*Dend. Aclinia, Rehb. f. in Bonpl. Oct.* 15, 1856.)
Bootan, *Hort. Kew*.

This has flowered with Consul Schiller at Hamburg as well as at Kew; and Prof. Rehb. informs me that it has also been received by the same great cultivator from Manilla. It is a slender erect plant with yellow flowers, springing in pairs or singly from the sides of the stem. I have before me a sketch by Rehb. made at

Hamburg, and another of my own dated Sept. 1854, in both which the stigmatic hollow is concealed by a tooth-like elevation of its lower edge, a structure also occurring in *Thelychiton* and *D. normale*; in the Kew plant there was, moreover, a bristle on one side of this front tooth, and external to it; but Prof. Reichenbach did not find it in many fresh flowers examined by himself, nor does either the bristle or the front tooth occur in the original *Aclinia*. The meaning of these malformations opens a curious field of inquiry, to which I hope to address myself on a future occasion.

97. *D. LAWANUM*; caule juniore carnosio ascendente foliis membranaceis lanceolatis acutis, florido aphylo vaginis laxis membranaceis fere abdito, sepalis petalisque ovatis obtusiusculis, labello paulo majore conformi concavo. (*Dendrochilum roseum*, *Dalzell in Hooker's Journal*, iv. 291.)

On trees on the Syhadree range of mountains, *Dalzell in hb. Stocks* (31); Concan, *Law in hb. Hooker* (2).

Mr. Dalzell states that in this plant, "across the front of the column and below the orifice of the stigmatic cavity, there is a small crest terminated on each side by a deeply-coloured horn, two- or three-toothed at the apex." This seems as if we had here also some monstrous structure; but I am unable to refer the plant to any of the *Eudendrobia*, unless indeed *D. transparens* should claim it; and I must add, that there was nothing unusual in the column of the only flower I have had an opportunity of dissecting.

98. *D. TETRODON* (*H. G. Rehb. in litt.*); caulibus floridis tenuibus pendulis aphyllis junioribus foliis anguste lanceolatis membranaceis subobliquis, floribus geminatis, sepalis petalisque lineari-lanceolatis acutissimis, mento obsoleto, labello conformi paulo majore et obtusiore, clinandrio quadridentato.

Java, on trees at the foot of M. Salak, *Zollinger* (11).

Of this I have a good specimen from Prof. Reichenbach. It has the habit of such a plant as *D. transparens*; and there is a slight tendency to the extension of the lateral sepals at the base. Can it be a *Peloria* of *D. macrostachyum*? I find nothing monstrous in the column.

99. *D. normale*, *Falconer in Ann. Nat. Hist.* iii. 196; *Griffith, Not.* iii. 255. t. 284.

Western Himalayas; Mussooree and Landour, *Col. Vicary*; pass near Paoree in Gurwhal, at 4000-6000 feet, *T. Thomson* (17); Saharanpur, *Falconer*.

My examination of this singular plant agrees with Dr. Falconer's description. Although a monster, I am unable to indicate the species to which it may possibly belong. Suspicion points to *D. fimbriatum*; but that species seems to be quite an eastern plant, while *D. normale* has hitherto been seen only in the Western Himalayas. The late Col. Vicary informed me that the specimens which he first found, and from which Dr. Falconer's description was taken, were gathered in 1832, in the vicinity of Mussooree and Landour.

§ VII. EUDENDROBIUM, *Lindley, in Paxton's Fl. Gard.* i. sub t. 27.

I have no other change to make in the limits of this large section than the exclusion of all the species with great yellow flowers, which now stand in the first section of *Holochrysa*.

A. *Caule 0, v. brevissimo carnosio* (Bolbodium, *Lindl. l. c.*).

No species are among the Hookerian collections. The following are new.

100. *D. SUBACAULE*, *Reinwardt, MSS.*; folio parvo oblongo pedicellis geminatis brevior, sepalis petalisque acuminatis, labello nudo latiori subconformi, mento gracili recto petalis duplo longiore, ovario triptero. Java, on the top of Mount Tidore, *Reinwardt*.

Whole plant, the vermilion flowers included, is little more than an inch high. This is the smallest of the genus.

101. *D. PRASINUM*; folio ovali obtuso, floribus solitariis, sepalis lanceolatis petalisque ovatis acutissimis, mento brevi obtuso, labello unguiculato auriculato rhombeo acuminato concavo nudo bilineato. Feejee islands, 2000 feet above the sea, *Asa Gray*.

A very distinct plant, of which I only know a drawing by Agati, in the possession of my learned friend Prof. Asa Gray. The flowers are sea-green, nearly two inches in diameter. The sepals about $\frac{2}{3}$ of an inch wide.

102. *D. extinctorium*, *Lindl. in Bot. Reg.* sub t. 1756.

Moulmein, *Griffith*, on *Careya arborea*, in damp places.

A true *Dendrobium*, as is shown by its pollen-masses. Pseudobulbs depressed. Peduncles filiform, erect, 2 to 3 inches long, one-flowered, with a minute bract about an inch off the ovary.

B. *Caule elongato*.

* *Labello integro*.

This group consists of numerous species so nearly related to

each other that it is scarcely possible to find good distinctions for them. Even when seen alive in their natural state, the uncertainty is the same. "All the species," says Griffith, "with cochleate labella are nearly akin; they run into each other so much, that distinguishing marks are very difficult." (Itinerary Notes, p. 185, speaking of a form of *Dendrobium nobile* found at Panukka in Bootan.)

103. *D. pulchellum*, *Lindl. Gen. & Sp. No.* 35; *Bot. Cab.* t. 1935. (*D. brevifolium*, *Hort. D. Devonianum*, *Paxton, B.M.* t. 4429. *D. pictum*, *Griffith.*)

Khasija, *J. D. H.* (15); Bootan, *Griffith.*

I have this from Bootan from Griffith, under the name of *D. pictum*, but have failed to discover any trace of it in his Itinerary Notes.

104. *D. Pierardi*, *Roxb. Fl. Ind.* 3. 482.

Valleys of Sikkim, *Cathcart*; *J. D. H.* (5).

105. *D. primulinum*, *Lindl. in Gard. Chron.* 1858, no. 223. (*D. nobile pallidiflorum*, *Bot. Mag.* t. 5003.)

Hot valleys of Sikkim, *J. D. H.* (154).

Possibly this is not distinct from *D. cucullatum*, as is suggested in the work above referred to.

106. *D. transparens*, *Wallich, Cat.* No. 2008. (*D. Henshalli*, *Rchb. f.*; *Bot. Mag.* t. 4663.)

Sikkim, at 2000 feet, *J. D. H.* (153); on rocks towards Chuka, in Bootan, and near Murichom, at 3500 to 4000 feet, *Griffith.*

I am unable to distinguish the Sikkim specimens from this plant, although they are somewhat larger than such as have appeared in our gardens; there can be no doubt that it is the No. 1135 of 'Griffith's Itin. Notes,' p. 198, and Prof. Rchb. has himself pointed out the identity of his *D. Henshalli*.

107. *D. amœnum*, *Wallich, in Lindl. Gen. & Sp. Orch.* p. 78. Sikkim, *Cathcart (Ic.)*.

This is readily known by its narrow, blunt, nearly equal sepals and petals, each with a purple stain at the point.

108. *D. nobile*, *Lindl. Gen. & Sp. Orch.* 24. (*D. cœrulescens*, *Lindl. Sert. Orch.* t. 17.)

Khasija, *Griffith, J. D. H.*; Darjeeling, *Griffith*; Assam, *Id.*

Evidently variable in the size, and probably in the colours, of the flowers. It is the No. 940 of Griffith's Itin. Notes, p. 184.

109. *D. Lindleyanum*, *Griffith, Not.* iii. 309.

Hot valleys in Sikkim, at 1000-5000 feet of elevation, *J. D. H.* (6).

This, notwithstanding the size of the flowers, which are twice as large as in *D. nobile*, is probably a mere variety of that species.

110. *D. FURCATUM* (*Reinwardt*); caule gracillimo, foliis linearibus apicem versus angustatis obtusis, sepalis ovatis obtusis, petalis unguiculatis cuneatis retusis latioribus, labello lanceolato acuto nudo intra mentum rectum sepalis longiorem clausum fere abdito.

Celebes, *Reinwardt*.

A remarkable plant, which, because of the sepals almost completely united into a long chin, might be perhaps better referred to *Pedilonum*. I have only seen fragments of a stem and leaves, and a perfect flower. The broad cuneate petals are very characteristic.

111. *D. DISTACHYON*; foliis distichis linearibus oblique bidentatis basi latioribus, floribus solitariis, axillaribus subsessilibus, sepalis petalisque angustioribus acutis, labelli ungue lineari-elongato lamina oblata nuda.

Borneo, *Thomas Lobb*.

This and the two following resemble *D. excisum*, *revolutum*, and *metachilinum* in habit.

112. *D. LYCOPODIODES*; foliis distichis densis linearibus apice obliquis apiculatis, floribus solitariis, bracteis lineari-lanceolatis carinatis pungentibus, sepalis acutissimis lateralibus latis triangularibus, petalis angustioribus minus acutis mento subrotundo, labello sessili obovato concavo apiculato lamellis 2 maximis carnis.

Borneo; forests of Sarawak, *T. Lobb*.

Very like one of the larger *Lycopodia*. Flowers scarcely more than 2 lines long. Both this and the following are distinguished by two fleshy parallel plates almost as broad as the lip itself on which they lie.

113. *D. TMESIPTERIS*; foliis distichis distantibus linearibus apice obliquis, floribus solitariis, bracteis lineari-lanceolatis carinatis pungentibus, sepalis acutissimis dorsali apice recurvo lateralibus antice arcuatis, petalis angustioribus acutissimis subfalcatis, mento oblongo prominente, labello sessili obovato concavo mucronato margine apicis membranaceo crispulo lamellis 2 maximis carnis.

Borneo; forests of Sarawak, *T. Lobb*.

Very like a *Tmesipteris*. Differs from the last in the flowers being even smaller, as well as in the points above described.

114. *D. SPINESCENS*; caulibus erectis, foliis distantibus oblongo-lanceolatis, pedunculis oppositifoliis squamosis demum spinescentibus, sepalis labelloque oblongis obtusis, petalis conformibus triplo minoribus. (*Cymbidium spinescens*, Ic. Reinwardt.)

Java? Reinwardt.

Very different, in its flowers having the sepals spreading and $\frac{3}{4}$ of an inch long, from any of the allied species. According to Reinwardt's drawing, the fruit is nearly cylindrical, angular, and surmounted by the sepals, petals, lip, and column, much enlarged and become quite green. There is no specimen in the herbarium of Reinwardt.

** Labello trilobo; calvæ.

115. *D. BREVIFLORUM*; fasciculo florum sessili subgloboso, sepalis petalisque duplo brevioribus carnosissimis, labello oblato nudo lobis lateralibus falcatis auriformibus intermedio truncato plica utrinque sub sinibus.

Singapore? Herb. Loddiges.

I know nothing like this, which flowered in 1844, in the nursery of Messrs. Loddiges. The flowers are white, fleshy, with stripes of crimson spots.

116. *D. stuposum*, Lindl. in Bot. Reg. 1838, misc. 94.

Khasija mountains, at 2000–4000 feet of elevation, J. D. H. & T. T. (11).

The lip is 3-lobed, not entire as is stated in the original definition taken from an imperfect garden specimen, which led Prof. Reichenbach to suppose that his *D. sphenoglossum* was different, —a mistake the blame for which is mine.

117. *D. Blumei*, Lindl. Gen. & Sp. Orch. No. 65. (*Onychium fimbriatum*, Blume, Bijdr. p. 325. Dend. planibulbe, Lindl. in Bot. Reg. 1843, misc. 70.)

Java, Zollinger; Manilla, Loddiges.

An authentic fragment from Prof. Reichenbach shows that the Manilla plant is identical with that from Java.

118. *D. aqueum*, Lindl. in Bot. Reg. 1843, misc. 6. t. 54; Bot. Mag. t. 4640. (*D. album*, Wight, Ic. t. 1645.)

Khasija hills, T. Lobb.

This is not to be found in the collections of Hooker and Thomson; nor have I seen any wild specimens, except a few flowers sent home by Mr. Thomas Lobb to Messrs. Veitch. These want the long hairs represented by Dr. Wight's artist, but agree perfectly with the figure in the Botanical Magazine. *D. ramosum*, an obscure plant with a slender pendulous branched stem and lan-

ceolate acuminate leaves, is apparently near this; but the fragments of flowers before me afford little information except that the lip is broad with fine hairs on the inside near the edge.

119. *D. SPATHACEUM*; caulibus gracilibus erectis, foliis anguste oblongis apice oblique obtusis, bracteis linearibus membranaceis basi coloratis, sepalis petalisque æqualibus acutis mento brevi rotundato, labelli angusti lanceolati laciniis lateralibus rotundatis medio tuberculatis ad sinus plicatis intermedia duplo longiore acuta.

Sikkim, at the height of 6000 feet, *J. D. H.* (143).

A solitary specimen of this exists in Hooker's herbarium; the stems are about 6 inches long, and the flowers (apparently solitary) the size of those of *D. macrostachyum*.

120. *D. SCABRILINGUE*; foliis oblongis apice obtusis valde obliquis, floribus geminatis, sepalis petalisque ovalibus æqualibus, mento conico, labelli 3-lobi medio pluries canaliculati lobis lateralibus semi-ovatis obtusis intermedio carnosio oblongo scabro multo brevioribus.

Borneo, *T. Lobb*.

A pair of flowers and a single leaf, communicated by Messrs. Veitch, are the materials on which this very distinct species is established. Its structure is, however, so peculiar, that no doubt can exist of its perfect distinctness from any other yet known. The flowers appear to be white. The lateral sepals from the point of the mentum to their own apex are about an inch long.

121. *D. TRUNCATUM*; caulibus gracilibus ramosis basi ramulorum subrotundis incrassatis, foliis linearibus oblique emarginatis, floribus solitariis, sepalis petalisque ovatis acutissimis æqualibus, mento ascendente valde obtuso ovario duplo longiore, labelli laciniis lateralibus semicuneatis intermedia lineari basi unidentata.

Java, *Reinwardt, Lobb*.

I find this among Reinwardt's plants under the name of *Ophrys pubescens* of Blume; probably owing to some error in labelling, for there is no such name known to me, nor has this any structure that can be called pubescent. It is a very small-flowered slender species, closely allied to *D. tetraedre*, from which it differs in the labellum, and in the thickened bases of the branches being round or roundish oblong, not at all angular.

122. *D. INVOLUTUM*; caulibus teretibus, foliis ovato-lanceolatis oblique obtusis, gemmis oppositifoliis conicis, sepalis petalisque lineari-lanceolatis æqualibus acuminatis apice incurvis, mento brevi acuto, labelli laciniis lateralibus acutis falcatis intermedia revoluta crispa acuminata brevioribus.

Society Islands, pendulous from the branches of trees, *Mathews*.

Flowers a quarter of an inch long, with the points of all the divisions hooked or rolled downwards.

*** *Labello trilobo; nigro-hirsutæ.*

These species are all distinguished by the presence of short black hairs on the young stems, a peculiarity which separates them from everything except *D. furcatum*.

123. *D. formosum*, *Roxb. Flor. Ind.* iii.; *Wallich, Pl. As.* t. 39; *Bot. Reg.* 1839, t. 64.

Khasija, *J. D. H. & T. T.* (1007); *T. Lobb* (373). Moulmein, *Griffith* (350).

124. *D. INFUNDIBULUM*; foliis lanceolatis angustis acutis, sepalis lineari-oblongis, petalis oblongis obtusis triplo latioribus, mento infundibulari pedicello æquali, labelli lobis lateralibus rotundatis integris intermedio subrotundo plano serrulato emarginato.

Moulmein, at 5000 feet on Thoung-gyun, *T. Lobb, in hb. Hooker.*

A very striking plant, intermediate between *D. formosum* and *longicornu*, having the large flowers of the former and the slender habit and narrow leaves of the latter. The lip with large round lateral lobes also distinguishes it from the former, and the large petals with a circular middle lobe to the lip and short funnel-shaped mentum from the latter.

125. *D. longicornu*, *Lindl. in Wall. Cat.* 1997; *Bot. Reg.* t. 1315. (*D. flexuosum*, *Griffith, Notul.* iii. 317. *D. hirsutum*, *Id.* iii. 318. t. 305.)

Khasija, *T. Lobb, Griffith*; at 4000–6000 feet, *J. D. H. & T. T.* (10); Sikkim, inner valleys at 5000 feet. *J. D. H.* (10); Assam, *Griffith*.

A variable plant as to the form of the middle lobe of the lip, which is broken up into fringes in very unequal degrees, and as to the size of the flowers, which however appear to have always a membranous lip, with strong orange-coloured veins on the lateral lobes.

126. *D. XANTHOPHLEBIUM* (*Lindl. in Gard. Chron.* 1856, no. 196); caule foliisque *D. longicornu*; sepalis petalisque linearibus acutis, mento brevi, labelli carnosii lobis lateralibus triangulis obtusis intermedio ovato dilatato apiculato crispo scabro: axi elevata carnosia.

Moulmein, *T. Lobb* (176, 177).

Flowers much smaller than in the last, with quite a different, fleshy not membranous, lip. Flowers white. Lip yellow with orange-coloured veins and disk. It is cultivated by Messrs. Veitch.

127. *D. ATTENUATUM*; foliis linearibus graminibus patentissimis, floribus solitariis squamulis minutis obtusis, sepalis petalisque obtusiusculis, mento lineari obtuso, labelli elongati spathulati lobis lateralibus dentiformibus intermedio subrotundo margine carnoso medio subaspero tuberculis geminis linearibus.

Borneo, *T. Lobb*.

Flowers small, apparently white. Leaves long, narrow, and grassy. Stems slender, ascending, from 6 to 8 inches high.

*** The only other species of this section are *D. calcaratum* (Bot. Reg. 1840, misc. 218) and *D. nutans* (Gen. & Sp. Orch. No. 73), whose lip is not undivided as it was supposed to be, but lanceolate with short entire lateral lobes and a crisp, almost linear, middle part, as I learn from specimens communicated by my learned correspondent Mr. Thwaites (156).

§ VIII. PEDILONUM, *Blume*.

No continental species of this section have been observed, nor have I found among the collections examined by me anything like Roxburgh's *D. purpureum*, a Molucca plant. The following are new insular species.

128. *D. AUROROSEUM* (*Rehb. f. in litt.*); foliis angustis ovato-lanceolatis acutis, sepalis petalisque æquilongis acutis, mento elongato obtusissimo, labello nudo oblongo apice dilatato retuso utrinque reflexo ungue unituberculato.

Java, *T. Lobb*; *Zollinger* (231).

The oval lip, suddenly expanded into a broad apex reflexed on each side, and the extremely broad mentum, are like nothing elsewhere in this section. The flowers are the size of *D. Pierardi*.

129. *D. BURSIGERUM*; foliis oblongis acutis, spicis cylindræcis densifloris, sepalis petalisque acutis, mento arcuato infra apicem ventricosum, labello spathulato acuto cucullato.

Philippines, *Cuming*.

Like *D. secundum*, but flowers are not half the size, and in longer, slenderer, not secund spikes. Lip apparently white with an orange-yellow tip.

130. *D. REINWARDTI*; foliis anguste oblongis obtusis apiculatis, spicis densissimis brevibus, bracteis setaceis divaricatis, sepalis acutis, petalis obtusiusculis, mento duplo longiore apiculato, labello nudo angusto spathulato obtusiusculo.

Banda, *Reinwardt*.

Near *D. viridiroseum* of *Rehb. f.*, from which it differs in its

longer apiculate mentum, and in the blunt lip not at all contracted in the middle.

§ IX. STACHYOBIMUM, *Lindl. in Paxton, Fl. Gard. i. sub t. 27.*

* *Labello integerrimo.*

131. *D. Dalhousieanum*, *Paxton, Mag. Bot. xi. t. 145; Bot. Reg. 184, t. 10.*

Mergui, Griffith (Dendr. No. 7, Notul. iii. 313).

An authentic specimen from Griffith shows that this fine species was described by him in the place above quoted; and thus its native country is now ascertained.

132. *D. ramosissimum*, *R. Wight, Ic. 1648.*

S. Concan, Dalzell in hb. Hooker. (Stocks, 52).

This is very near my *D. herbaceum* (*Bot. Reg. 1840, misc. 153*); but the flowers are white with a yellow lip, not white tinged with green; the lip itself is longer and more fleshy, and the flowers are considerably smaller. I have examined fresh specimens out of Mr. Bellenden Ker's garden from Dharwar.

133. *D. INCURVUM*; foliis angustis membranaceis oblique obtusis apiculatis, racemis oppositifoliis rectiusculis brevioribus, bracteis membranaceis uninerviis pedicellis æqualibus, sepalis angustis acutissimis antice cum mento semiaperto acuto arcuatis, petalis angustioribus, labello oblongo venoso antice serrato circa discum 2-denticulato.

Mergui, Griffith (808).

This is the *Dendrobium* No. 9 of Griffith's *Notul. iii. 314*, forming the number succeeding to that of his *Aclinia*, and apparently gathered in the same place. It has so entirely the appearance of that plant, that, as has been already observed, it is difficult to doubt that it is not the customary state of the species, notwithstanding the very different structure of the flower.

134. *D. PORPHYROCHILUM*; caulibus brevibus cæspitosis tetraphyllis, foliis angustis membranaceis racemis terminalibus multifloris sæpius æqualibus, bracteis setaceis ovario subæqualibus persistentibus, sepalis lineari-lanceolatis acuminatis, petalis paulo brevioribus, labello brevioribus, ovato acuto concavo lineis 3 elevatis, mento brevissimo rotundato.

Assam, Griffith; Khasija hills, T. Lobb; at 4000-6000 feet, J. D. H. & T. T. (28).

"Sepals dirty pale yellow. Petals the same, with small red streaks at the base. Lip purple with a yellow margin."—*J. D. H.* The whole plant seems thin and membranous, and varies in height from 2 to 5 inches. It approaches the *Bolbodia*.

** *Labello trilobo.*

135. *D. PANDURATUM*; subacaule, foliis membranaceis acutissimis racemis filiformibus erectis brevioribus, bracteis minutis squamiformibus, sepalis petalisque linearibus acuminatis, mento recto conico semiaperto, labello æquilongi pandurato (trilobo lobis lateralibus rotundatis intermedio duplo majore crenulato apiculato).

Ceylon, *hb. Hooker.* (147); *Thwaites* (2353).

A small species almost referable to *Bolbodium*.

136. *D. eriæflorum*, *Griffith, Not.* iii. 316. t. 307.

Khasija, in Myrung Wood, on dry ridges, *Griffith* (1020), on rocks and dry trunks of trees at 2000-5000 feet, *J. D. H. & T. T.* (18).

This forms tufts from 4 to 9 inches high. The stems are covered with great loose sheaths of fallen leaves. The flowers are in dense nodding racemes; according to Cathcart's drawing, greenish yellow with purple mentum. The lip is strongly veined and edged with purple; its side lobes regularly and sharply serrated, its middle lobe small, oblate, apiculate, and entire. It would be a beautiful species in a garden.

137. *D. PYNOSTACHYUM*; caulibus laxe membranaceo-vaginatibus erectis carnosius, foliis, racemis densis cylindraceis, bracteis setaceis rectangularibus persistentibus ovario æqualibus, sepalis linearibus acuminatis, petalis minoribus, mento brevi obtuso incurvo, labelli lobis lateralibus acutis integerrimis intermedio triangulari recurvo crispo parum latioribus axi juxta sinus abrupto elevato.

Moulmein, *T. Lobb.*

Like *D. eriæflorum*, but with smaller and denser flowers and a totally different lip.

138. *D. microbolbon*, *Ach. Richard, Ann. Sc. n. s. xv. t. 8.* (*D. humile*, *R. Wight, Ic.* 1643. *D. crispum*, *Dalzell, in Hooker's Journal*, iv. p. 111.)

Trees in Western India, *Dalzell (Hb. Stocks. 34).*

There is no doubt that all three of the above plants are the same. A. Richard's figure is very formal and uncharacteristic.

139. *D. denudans*, *Don, Prodr.* 34.

Sikkim, in the drier valleys, at 5000 feet, *J. D. H.* (20); E. Nepal, at 4000 feet, *Id.*

This varies in height from 4 to 15 inches. In the Sikkim plant the colours are bright red on a pale yellow ground, according to a drawing by Dr. Hooker; in gardens they are much greener.

140. *D. PEGUANUM*; caulibus ovatis cæspitosis, foliis (linearibus?), racemis erectis densis multifloris, bracteis membranaceis acutissimis

ovario longioribus, petalis linearibus falcatis sepalis multo longioribus, mento elongato, labello longe unguiculato subrotundo cochleato axi abrupta obtusa, lobis lateralibus semicircularibus intermedio parvo triangulari crispo.

Pegu, *M'Lelland in hb. Hooker.*; Borneo, *T. Lobb.*

A very small species with short erect dense racemes. The long falcate petals are very remarkable.

141. *D. SARCANTHUM*; caulibus cæspitosis 3-4-phyllis, foliis angustis racemo paucifloro longioribus, bracteis (testaceis) ovario longioribus, floribus valde carnosius mento horizontali obtuso, labelli 3-partiti sagittati axi elevata truncata lobis subæqualibus lateralibus oblongis intermedio ovato.

Java, *T. Lobb, 406, in hb. Hooker.*

It is not certain where this curious little species was found. The whole plant is only 2 inches high with slender 3- or 4-leaved stems. The rachis is very zigzag, the flowers apparently pale yellow. I have only examined a bud, the extreme softness of which rendered it difficult to dissect.

142. *D. chlorops*, *Lindl. in Bot. Reg. 1844, Misc. 54.* (*D. barbatulum*, *Wight, Ic. iii. 909.*)

Concan, *Law in hb. Hooker (21)*; common on trees in both Concan, in the cold season, *Stocks, in hb. Hooker.*

Flowers small, yellow tinged with green.

143. *D. barbatulum*, *Lindl. Gen. & Sp. Orch. No. 44; Paxton's Fl. Gard. 502. Ic. Xyl.*

Concan, *Law, in hb. Hooker. (3)*; trees in the S. Concan, *Dalzell, in herb. Stocks. (32).*

The woodcut in Paxton's Flower Garden shows how different this species is from the last.

§ X. CERATOBIMUM.

No species of this fine division has been yet seen in continental India. Of one I have a leaf 18 inches long by 14 broad, found in Borneo by Lobb, the flowers of which are unknown; and the following undescribed species occurs among Reinwardt's drawings.

144. *D. BICAUDATUM* (*Reinwdt. MSS.*); foliis oblongis acutis racemis horizontalibus 4-5-floris subæqualibus, petalis linearibus spathulatis erectis sepalis multo longioribus, labelli trilobi lobis lateralibus incurvis intermedio subrotundo minoribus.

Java, *Reinwardt.*

Flowers yellowish striped with green. Lip delicately marked

with red transverse veins. Apparently the axis is fleshy, elevated, and extended as far as the point of the lip.

Obs.—*Dendr. pumilum*, Roxb. Fl. Ind. 479, is not the plant so called by Griffith, if the statement in the former work can be trusted; but the specific character and description are so much at variance, that some error of the Indian transcriber is to be suspected.

D. crepidatum, Griff. Notul. iii. p. 319, is quite different from the species so named by me. But the printed description is so confused and self-contradictory, that I have not been able to identify the species.

Prof. Reichenbach reduces the genera CADETIA, LATOURIA, and DICHOPUS to the present genus. I have examined no specimens of them.

CRYPTOCHILUS, Wallich.

145. *C. SANGUINEA* (*Id.*); calyce oblongo bis longiore quam lato laciniis acuminatis, petalis labelloque obovatis acutis, polliniis viridibus. Khasija, Churra Punjee, Griffith, at an elevation of 4000–5000 feet, *J. D. H. & T. T.* (200); Sikkim, *J. D. H.*, Cathcart.

Flowers crimson. Capsule pyriform, strongly and equally six-ribbed.

146. *C. LUTEA*; calyce ovato longitudine et latitudine æqualibus laciniis triangularibus, petalis labelloque lanceolatis, polliniis luteis.

Mishmee, Griffith; Darjeeling, *Id.*; Sikkim, Cathcart.

This very distinct species occurs only among my specimens from Griffith and in Cathcart's drawings, according to which the flowers are of one uniform clear-yellow colour. Calyx much contracted at the mouth, and not at all longer than broad; petals linear-lanceolate; lip lanceolate. Pollen-masses yellow, not green as in the last. Capsule obscurely six-ribbed. I can find no trace of this remarkable plant among Griffith's descriptions or notes.

ACANTHOPHIPPIUM, Blume.

147. *A. sylhetense*, Lindl. Gen. & Sp. Orch. 177. (*A. ringiflorum*, Griffith, Notul. iii. 347. Ic. 325.)

Sikkim, Cathcart; Khasija, at the elevation of 2000–3000 feet, *J. D. H. & T. T.* (198).

Flowers straw-colour, freckled with red inside.

ANTHOgonium, Wallich.

148. *A. gracile*, *Wall. Cat.* 7398; *Rehb. fl. in Allg. Gartenzeit*, July 1856; *Bonplandia*, Oct. 15, 1856; *Griffith, Notul.* iii. 383, *lc.* 345. (*A. Griffithi*, *Rehb. f. in Bonplandia*.)
 Khasija, grassy places, 4000-6000 feet, *J. D. H. & T. T.* (199), *Lobb*; Assam, *Griffith*.

This plant varies in the breadth of the leaves, which are sometimes 9 lines and sometimes only 2 lines wide. I can find no ground for the separation of *A. Griffithi*, whose original specimens are before me.

SPATHOGLOTTIS, Blume.

149. *S. ixioides*, *Lindl. Gen. & Sp. Orch.* p. 120.
 Sikkim, at an elevation of 8000-10,000 feet, *J. D. H.* (146).

"Flowers yellow." *J. D. H.*

150. *S. pubescens*, *Lindl.* l. c.
 Khasija, *Lobb*; grassy hills at 5000-6000 feet, *J. D. H.* (145).

"Flowers yellow," *J. D. H.* I fear my Chinese *Sp. Fortuni* (*Bot. Reg.* 1845, t. 19) is not distinct from this, which varies greatly in the breadth of its leaves and the form of the petals.

151. *S. parvifolia*, *Lindl. in Bot. Reg.* 1845, sub t. 19. (*S. Khasijana*, *Griff. Not.* p. 323, *lc.* t. 311. 1.)
 Khasija, on dry rocks near Churru, also in Assam, *Griffith*.

N. B. *Spathoglottis? trivalvis* of Wallich's *Cat.*, No. 3742, the fruit of which alone is known, Prof. Reichenbach, jun. refers, and probably with justice, to *Acriopsis*. Griffith's *Sp. lilacina*, *Not.* p. 325, *lc.* t. 311. 3, is *Sp. plicata*; the same author's *Sp. plicata* is *Sp. aurea*.

ARUNDINA, Blume.

152. *A. bambusifolia*, *Lindl. Gen. & Sp. Orch.* 125.
 Khasija, 2000-3000 feet, *J. D. H.* (149); hot valleys, Sikkim, *Id.*

153. *A. affinis*, *Griffith, Notul.* iii. 330.
 Khasija, at an elevation of 3000 feet, in shady wet places, on rocks near streams, *J. D. H.* (151); Churra Punjee, *Griffith*.

"Labellum yellow inside." Very like *A. chinensis*, from which it seems to differ in having only two ragged lamellæ on the lip instead of five, the lateral and middle of which are shortest. My specimens are from Griffith himself.

154. *A. speciosa*, Blume. (*Cymbidium speciosum*, Hb. Reinwardt.)
Java, Lobb (217); Goorgong, Assam, Griffith; common in rocky places
in wet situations on Mt. Ophir, at the height of 2500 feet, where it is
called Paddam Bhattoo, Id.

This is principally distinguished from *A. bambusifolia* by the
terminal lobes of its lip being parallel and overlapping each other,
while in *A. bambusifolia* they divaricate. *A. affinis* has smaller
flowers and narrower petals. *A. densa* is much more distinct, its
flowers being closely arranged, and the middle lobe of the lip
almost obsolete.

NEPHELAPHYLLUM, Blume.

155. *N. cordifolium*. (*Cytheris cordifolia*, Lindl. Gen. & Sp. p. 128.)
Khasija, at 4000 feet, J. D. H. (147).

"Flowers pale green, striped with pale purple; lip pale purple."
J. D. H. These specimens are much larger than Wallich's from
Silhet. The plant appears to spread and creep among moss, through
which the leaves and flowering stem arise. In *N. tenuiflorum*, Bl.,
which resembles this, the flowers are much smaller as well as more
numerous, and the leaves are frequently almost truncate at the base.
N. pulchrum, Bl., which is the *Limodorum maculatum* of Reinwardt's
unpublished drawings, is much dwarfer, the scape not being longer
than the leaves, which are purple beneath, clouded with varying
tints of green on the upper side, and in form oval-acuminate; the
flowers are straw-coloured with a purple spur and a yellow crest
in the middle of an undivided lip. The genus certainly belongs
to *Epidendrea*, in the neighbourhood of *Bletia*.

EULOPHIA, R. Br.

156. *E. bracteosa*, Lindl. in Wall. Cat. No. 7366. (*E. grandiflora*, Id.
Gen. & Sp. p. 181.)

Khasija, at 2000 feet, J. D. H. & T. T. (222).

Further examination has satisfied me that there is no difference
between the above two supposed species. I even doubt whether
there has not been some error in making *E. grandiflora* a native
of Ceylon.

157. *E. graminea*, Lindl. l. c. No. 13.

Malacca, Cuming; Burma, at Amherst, in woods near the sea, Griffith;
plains of Behar, J. D. H. & T. T. (221).

This must no longer be regarded as a Malay plant, the spec-
imens from Behar differing in nothing except the flowers being
rather smaller, with the lip less deeply 3-lobed.

158. *E. inconspicua*, *Griffith*, *Not.* iii. 349. t. 326.

This Malacca plant I have not seen. It seems to differ from the last in little beyond the processes on the labellum.

159. *E. BRACHYPETALA*; foliis oblongo-lanceolatis, scapi vaginis 2 longis membranaceis, racemo raro secundo, sepalis erectis linearilanceolatis, petalis conformibus multo brevioribus, labelli trilobi venis crispulis lobis lateralibus acutis intermedio multo longiore oblongo obtuso, calcare subgloboso.

N. W. Himalaya, Gurwhal at 2000-3000 feet, *T. T.* (216).

I have not seen the pollen-masses of this plant, which might be mistaken for *Ania angustifolia*. It must be re-examined with better materials than I possess. Much like *E. Promensis*, but the lip is different.

160. *E. virens*, *R. Brown*.

Courtallum, *J. D. H.* (221).

161. *E. herbacea*, *Lindl.* l. c. (*E. albiflora*, *Edgeworth*, MSS.)

Himalayas, *Edgeworth*, in *hb. Benth.*; Concan, *Law*, in *hb. Hooker.* (220).

The long green narrow sepals, the much broader and shorter petals, and the fringed veins of the lip are peculiar.

162. *E. OCHREATA*; foliis oblongis acutis, scapo laxo trivaginato, bracteis linearibus acuminatis ovarii longioribus, racemo cylindraceo, sepalis ovalibus acutis concavis, petalis planis latioribus, labello oblongo serrato venis omnibus fimbriatis, calcare parvo hemisphærico.

Concan, *Law*, in *hb. Hooker.*; Canara, *Stocks* (71).

A small-flowered species with a rather dense cylindrical raceme 4 or 5 inches long. All the parts of the flower membranous.

163. *E. bicolor*, *Dalzell*, in *Hooker's Journ.* iii. 43.

Western Ghauts, *Dalzell*, in *hb. Stocks.* (23); Concan, *Law*, in *hb. Hooker.*

Much like *E. herbacea*; but the spike is longer and more slender, and the flowers are not half the size. Moreover the spur is longer, and the middle lobe of the lip obovate with long fringes on the veins.

164. *E. campestris*, *Lindl.* l. c. (*E. ramentacea*, *Wight*, *Ic.* 666.)

Western India, *Jacquemont* (653 in *Herb. Mus. Par.*); plains of Rohilcund, *T. T.* (218).

Both these, especially *Jacquemont's* plant, are taller and more slender than *Wallich's* Oude specimens, but do not appear to differ otherwise.

165. *E. HEMILEUCA*; aphylla, vaginis 4 apice herbaceis, racemis longis laxis subsecundis, sepalis lineari-lanceolatis herbaceis, petalis latioribus planis, labelli trilobi laciniis lateralibus apice rectangulis acutis intermedia concava crispa, ramentis venarum paucis sparsis, calcare brevi conico.

Plains of Rohilcund, *T. T.* (219).

Sepals green, petals white. The lip is very membranous, with a very few scattered ramenta on the veins of the middle lobe. Next *E. campestris*.

166. *E. PRATENSIS*; aphylla, vaginis caulis 5 acutissimis, racemo laxo multifloro, sepalis petalisque brevioribus oblongis acutis, labello oblato 3-lobo laciniis lateralibus ovatis obtusis intermediae ovatae obtusae subaequalibus venis tribus cristatis, calcare brevi conico obtuso.

Pasture lands in the Deccan, in the cold season, *Stocks* (22 bis. *E. virens*, in *herb. Hooker.*).

Quite a different plant from *E. virens*, to which *Stocks* referred it, known at sight by its short oblong sepals, still shorter petals, and obtuse 3-lobed 3-crested lip.

167. *E. DENSIFLORA*; aphylla, vaginis pluribus obtusis, racemo denso, bracteis inferioribus herbaceis ovario longioribus, sepalis petalisque lineari-lanceolatis his brevioribus, labelli trilobi calcare conico lobis lateralibus rotundatis intermedio ovato crispo, venis tribus fimbriatis, ovario calcaris longitudine.

Bootan, *Griffith*.

I have this by favour of the East India Company, through the good offices of Dr. Royle. It is much larger in all its parts than any other of the aphyllous section. The ovary is not at all longer than the spur.

168. *E. ramentacea*, *Lindl.* l. c. (not *Wight*).

Bootan, *Griffith*.

169. *E. rupestris*, *Lindl.* l. c.

N. W. Himalayas, *Royle, Jacquemont, Herb. Mus. Par.* (53, 47).

170. *E. HASTATA*; aphylla, racemis gracilibus densis multifloris, bracteis setaceis ovario brevioribus, sepalis petalisque linearibus distantibus acuminatis, labello unguiculato hastato trilobo acuminato lamellis 2 altis integris supra unguem ortis ad sinus evanescentibus, calcare brevi oblongo.

Assam, *Griffith*.

The flowers are smaller than in any other of the aphyllous species. The nearly hastate lip, the side lobes curving forwards, and the two deep lamellæ beginning above the unguis and vanishing into mere lines opposite the re-entering angles, are unlike anything else in the genus.

171. *E. STENOPETALA*; aphylla, scapo gracili 3-4-vaginato, racemo brevi, bracteis ovatis acuminatis incurvis ovario longioribus, sepalis secundis petalisque porrectis linearibus æqualibus, labello infundibulari: limbi trilobi lobis lateralibus rectangularibus intermedio subtrotundo crispo ramentis 3 parvis fissis sinubus oppositis, calcare elongato apice inflato, foliis hysteranthiis gramineis.

Bootan; Panukka on dry hills, *Griffith* (847, *Itinerary Notes*, p. 164).

Authentic specimens, sent me by Griffith himself, show this to be a slender plant, with a graceful scape 18 inches high, terminated by from 5 to 8 flowers, with large herbaceous bracts ending in fine points. According to Griffith's *Itinerary*, the flowers are purplish with darker veins; at least such seems to have been written by that lamented botanist, as far as can be judged from the wretched state of the printed text.

CORALLORHIZA, *Haller*.

172. *C. INDICA*: floribus subglobosis, sepalis petalisque oblongis æqualibus secundis obtusis, labello unguiculato concavo reflexo lamina subtrotundo-quadrata utrinque medio unidentata intus nuda.

N. W. Himalaya; upper part of Hattee? *T. T.* (no number).

A solitary specimen, found by Dr. Thomson, is before me. It has no root, a stout scape a foot high with two distant close-pressed sheaths, a loose spike of 7 flowers, with linear acuminate spreading bracts, the lower of which are empty. The flowers are about $\frac{3}{4}$ inch in diameter. The only flower I have been able to dissect had lost anther and pollen-masses; but I think the plant must belong to the present genus.

The leafy *Corallorhizas* formerly published by me I have now had better means of examining. *C. foliosa* I have redissected; and a second species, from Dr. Thomson, has proved to be in a good examinable state. In both, the pollen-masses are globular, not at all compressed, and in the latter I have found them attached to a true caudicle with its gland. It is therefore clear that they must be separated from *Corallorhiza* and placed near *Eulophia*, from which their pollen-masses distinguish them. A third species is the Siberian *Corallorhiza patens*. The alpine habits of all lead me to propose the name of *Oreorchis* for this small group.

OREORCHIS, gen. nov.

Tuberosa. *Folia* angusta radicalia plicata. *Scapi* simplices distantes vaginati, apice dense racemosi. *Sepala et petala* subæqualia secunda, lateralia basi obliqua. *Labellum* unguiculatum

cum columna continuum tripartitum membranaceum intus bicarinatum. *Columna* elongata marginata, stigmatē excavato. *Pollinia* 4, globosa, disjuncta, caudicula lineari, glandula carnosa.

173. *O. FOLIOSA*; sepalis petalisque oblongo-linearibus, labelli lobis lateralibus ovatis obtusis medianis, carinulis parallelis membranaceis. —Corallorhiza with leaves, *Lindl. in Royle's Botany of the Himalayas*, p. 362.

Mussooree, *Royle*; Lachen in Sikkim, at 11,000–12,000 feet, *J. D. H.* (213), rare.

Sepals red; labellum white dabbled with red. Tuber roundish, the size of sparrow's egg. Leaves from 5 to 15 inches long. Flowers small, somewhat secund. In my sketch of Dr. Royle's plant the lip has two distinct parallel carinulæ terminating opposite the re-entering angles of the lip: in the only imperfect flower from Sikkim which it has been possible to dissect, the carinulæ are short, broad, and acute; yet the plants are indubitably the same.

174. *O. MICRANTHA*; tubere foliis scapoque præcedentis, labelli lobis lateralibus filiformibus basilaribus intermedio apice lunato crispo basi appendice cochleari carnosa instructo.

N. W. Himalayas, 8000–10,000 feet; Yakul Mountain, Kumaon, *T. T.* (214).

Habit exactly that of the last. Flowers not a quarter the size; petals broader than the sepals. Pollen-masses 4, globular, perfectly distinct, on the end of a spatulate caudicle, connected with an oblong fleshy gland. Capsules pendulous, oval, mucronate, not dehiscent in the plant before me.

175. *O. PATENS*; tuberibus ovatis monophyllis in rhizoma approximatis, folio (latiore), scapi vagina in medio lineari herbacea patente, labelli lobis lateralibus linearibus supra basin enatis carinulis 2 clavatis distantibus.—Corallorhiza patens, *Lindl. Gen. & Sp.* 535.

Siberia, *Prescott*.

Flowers intermediate in size between the two preceding; lateral lobes of the lip springing neither from the base nor above the middle, but below the middle.

CYMBIDIUM, *Swz.*

176. *C. aloifolium*, *Swartz*; *Wight, Ic.* 1687??

Nilgherries, *J. D. H.* (234); Sikkim, 1000–3000 feet, *J. D. H.* (228).

The racemes in the Sikkim plant are short, the flowers are rather more fleshy, and the lip shorter than in the southern form. There is however a drawing in Cathcart's collection representing

a plant with leaves 2 feet long, $1\frac{3}{4}$ broad, and a raceme almost as dense as in *C. elegans*. Wight's figure resembles *C. pendulum*; but that does not seem to be a continental species. *C. erectum* (Wight, Ic. 1753) is very near this; I have not seen it.

177. *C. cyperifolium*, *Wallich, Cat. No. 7353.* (*Cymbidium viridiflorum*, *Griff. Itin. Notes*, p. 126, No. 454.)

Khasija, *J. D. H. & T. T.* (267); Bootan, *Griffith.*

The long leaves of this resemble those of some *Carex*; its long linear-lanceolate bracts far overtopping the flowers; and the linear distant straight lamellæ are quite peculiar.

178. *C. COCHLEARE*; foliis longissimis angustissimis caricinis, racemo debili multifloro, bracteis obsoletis, sepalis petalisque linearibus acuminatis, labello angusto versus apicem dilatato trilobo lamellis in cochlear semiliberum apice confluentibus.

Sikkim, in hot valleys, *J. D. H.* (235).

The habit is that of *C. cyperifolium*; but the bracts are almost obsolete, the very narrow sepals, petals, lip, and column are full 2 inches long, and the lamellæ of the perfectly bald lip are united into a spoon-shaped process attached by its middle. The form of the end of the lip is unknown to me.

179. *C. eburneum*, *Lindl. in Bot. Reg.* 1847, t. 67. (*C. syringodorum*, *Griff. Not.* iii. 338.)

Khasija mountains, Myrung, *Griffith.*

180. *C. affine*, *Griffith, Not.* iii. 336, t. 291.

Khasija hills, Sururem, *Griffith.*

It is impossible to reconcile the statements made for Griffith by his editor, without assuming that some confusion of papers has taken place. This plant, which I have from himself with his own name, is evidently that to which the second description of his *C. densiflorum* applies, and has nothing to do with the first description, which applies either to a variety of *C. elegans*, or to something very near it. The hairy middle lobe of the lip assists in distinguishing this from *C. elegans*, to which it approaches.

181. *C. elegans*, *Lindl. Gen. & Sp. Orch.* 163, No. 9, *Sertum Orchidaceum*, t. 14. (*Cyperorchis elegans*, *Blume, Mus. Lugd. Bot.* i. 48. *C. densiflorum*, *Griffith, Not.* iii. 337, so far as the first description goes.)

Khasija hills, 5000-6000 feet, *J. D. H. & T. T.* (231); Myrung, *Griffith*; Darjeeling, *Id.*; Sikkim, *Cathcart*, 5000-8000 feet, *J. D. H.* (232).

This species varies greatly in the number of orange-yellow flowers

collected in its great oblong nodding racemes. In all states it is to be known by the connivent sepals and petals, and probably also by the presence of a pair of teeth near the base of the two contiguous parallel lamellæ. I must however observe, that I cannot find the latter in my specimens of *C. densiflorum*, from Griffith, although he describes them as being present.

182. *C. longifolium*, *D. Don* ; *Lindl.*, l. c.

Sikkim, *Cathcart* ; Khasija, *J. D. H. & T. T.* (230).

Flowers appear, from *Cathcart's* figure, to be olive-brown, with a white lip spotted with crimson. The lip is covered with down in the inside, and the appearance of the species is that of a small *C. giganteum*.

183. *C. giganteum*, *Wall. Cat. No. 7355* ; *Bot. Mag.* 4844.

Khasija, Nunklow on trees, *Griffith* ; *Darjeeling, Id.* ; Sikkim, 5000-7000 feet, *J. D. H.* (227, 233).

Varies much in the size and colour of the flowers and the breadth of the leaves. Among *Cathcart's* drawings, one represents them as dull red on a greenish ground, with the inside of the lip streaked with red, the whole flower being about 3 inches in diameter ; another, on the contrary, represents them as nearly 5 inches in diameter, with deep bright-green whole-coloured sepals and petals, and a yellowish lip, the inside of which is profusely dotted with crimson.

184. *C. MICROMESON* ; foliis linearibus loratis basi canaliculatis rigidis racemo erecto paucifloro longioribus, perianthio membranaceo patente, labello cuneato glaberrimo basi conspicue saccato laciniis lateralibus rotundatis intermedia unguiculata oblata biloba apiculata multo minore lamellas 2 filiformes crenulatas emittente versus medium labellum evanescentes.

Khasija, *Griffith*.

For this curious species I am indebted to the East India Company, by whom it was communicated with many other of *Griffith's* plants, through my friend *Dr. Royle*. The great bag formed between the bases of the column, lip, and lateral sepals, the long lip smooth, wedge-shaped, with a very small double purple middle lobe, from which run down two smooth crenated lamellæ, disappearing before they reach the middle of the lip, are like nothing else in this genus.

185. *C. chloranthum*, *Lindl. in Bot. Reg.* 1843, *Misc.* 102. (*C. variferum*, *Rchb. f. in Bonplandia*, Oct. 15, 1856.)

This is not among the collections before me. I learn from *Prof. Reichenbach* himself that his name has to be cancelled.

186. *C. sinense*, Willd.

Khasija, at 1500 feet, *J. D. H. & T. T.* (226).

This does not seem to differ from the Chinese plant.

187. *C. ERYTHRÆUM*; foliis angustis acutis racemis multifloris brevioribus, bracteis minutis, sepalis lanceolatis, petalis angustioribus patentissimis falcatis, labello convoluto intus tomentoso apice æqualiter trilobo laciniis rotundatis recurvis lateralibus planis intermedia crispa lamellis contiguis rectilineis pilosis apice confluentibus.

Sikkim, in hot valleys, *J. D. H.* (229).

“Panicule varies in length and density, flowers in size and colour. Upper and back part of column grows over stigma, and whole column very much incrassated.” *J. D. H.*—From the sketches of Dr. Hooker I learn that the sepals of this fine species are spreading, oblong-lanceolate, green with dull-red broken streaks; the petals somewhat narrower, rose-coloured, and curved backwards; the lip yellow, with numerous red streaks on the outside and inside. In the dried flowers the sepals are two inches long.

188. *C. lancifolium*, *Hooker, Exot. Fl.* t. 51. (*C. Gibsoni*, *Paxton, Fl. Garden*, No. 618, *lc. Xyl.* 301?—*C. javanicum*, *Blume, Bijdr.* 380.)

Khasija, at 4000–5000 feet, *J. D. H. & T. T.* (139); Mishmee hills, lower ranges, *Griffith*; Sikkim, *Catcart*; Java, *T. Lobb* (187), *Reinwardt* (“*C. vaginatum*”).

This plant has not appeared among the Hindostan collections, but it seems to be common in the North-eastern Provinces, its track then bending downwards into the Indian Archipelago. That it exists in Java is shown by the specimens above-mentioned from *T. Lobb* and *Reinwardt*. Of the only other two Javanese Cymbids that I have seen, one is a grassy-leaved plant allied to *C. ensifolium*, the other is possibly Prof. Blume's *C. cuspidatum*; but nothing certain can be said without examining authentic specimens. *C. Gibsoni* is only a half-monstrous state of this.

CREMASTRA, *Lindl. Gen. & Sp.* p. 172.

189. *C. Wallichiana*, *Id.* l. c.

Sikkim, at 7000 feet, *J. D. H.* (242).

Blume's figure of the Japanese *Hyacinthorchis variabilis* (*Mus. Lugd. Bot.* i. t. 16) differs in no respect whatever from the Indian plant, except in having a short shrivelled appendage of the lip instead of a long cucullate one. If this is really so, the species would seem to be distinct; if not, not.

CYRTOPERA, *Lindl.*

190. *C. bicarinata*, *Lindl. Gen. & Sp. Orch.* 189.

Griffith's *Cymbidium*, Not. iii. 343, No. 9, is certainly this, and it is to that description, not to No. 8, that his figure 319 belongs. The description of No. 8 has nothing to do with any species of *Cymbidium*, *Eulophia*, or *Cyrtopera*.

191. *C. CANDIDA*; foliis oblongis acutis petiolo æqualibus, bracteis subulatis ovario æqualibus, sepalis lineari-lanceolatis, petalis oblongis apiculatis brevioribus duplo latioribus, labelli trilobi lobis lateralibus ovatis obtusis intermedio subrotundo crispo apiculato recurvo multo brevioribus tuberculis 2 rotundis versus basin venisque 3 majoribus carnosius elevatis.

Sikkim, *Cathcart, J. D. H.* (241).

Corm orbicular, covered with coarse shreds. Flowers rather before the leaves, greenish white, except the sepals, which are herbaceous. The base of the column is saccate, but the lip is merely concave. Anther fleshy, triangular, stained with crimson. In a dried state it is much like *C. tricarinata*.

192. *C. fusca*, *Wight, Ic.* t. 1690.

Nilgherries, *J. D. H.* (215).

Wight's figure is a good one, except that the lower half of the veins on the lip is represented as scabrous, like the upper half, while in reality it is perfectly smooth.

193. *C. flava*, *Lindl. l. c.* = *C. Cullenii*, *Wight, Ic.* 1754, no doubt.

194. *C. ensiformis*. (*Eulophia exaltata*, *Rehb. f. in Bonplandia*, Feb. 15, 1857.)

Philippines, *Cuming*.

An authentic specimen, though but a single flower, from Prof. Reichenbach, enables me to identify his *E. exaltata*, which is certainly a genuine *Cyrtopera*. I am unable to find on the lip the elevated keels which my learned friend describes. What I find is a somewhat fleshy middle lobe, hollowed out like a spoon, and compressed between the lateral lobes. This being smaller than some other *Cyrtoperas*, I am obliged to change the specific name: that of *ensiformis* indicates one main feature of the species whose leaves are as long, straight, and narrow as any *Iris* or *Gladiolus*.

195. *C. squalida*, *Rehb. in Bonpl. Feb. 15, 1857.* (*Eulophia squalida*, *Lindl. in Bot. Reg.* 1841, *Misc.* 164.)

Philippines, *Cuming*; Borneo, *T. Lobb*.

I assent to the removal of this from *Eulophia*, although the

short spur may almost as well be referred to the labellum as to the column.

196. *C. MYSORENSIS*; foliis oblongis petiolo longioribus, bracteis subulatis ovario æqualibus, sepalis lineari-lanceolatis carinatis apiculatis, petalis planis minoribus? labello oblongo indiviso crispo apiculato intus nudo.

Mysore, *Law in hb. Stocks.* (56).

A plant with the habit of *C. fusca*, but widely different in the structure of the lip. Owing to the bad state of my specimen, I am uncertain whether the petals are really much shorter than the sepals, or not.

197. *C. SANGUINEA*; aphylla, discolor, tubere crasso oblongo articulo, scapo trivaginato, bracteis lineari-lanceolatis ovario longioribus, sepalis oblongo-lanceolatis, petalis ovatis brevioribus, labello obsolete trilobo apice rotundato recurvo, anthera mucronata.

Sikkim, *Cathcart*; at 4000-5000 feet, *J. D. H.* (223 & 361).

Plant from 1 foot to more than 2 feet high, of one uniform dull-greenish crimson tint, except the lip, which is rose-colour. The petals are not much more than $\frac{1}{3}$ rds the length of the very acute sepals, which are rather more than 1 inch long. The inside of the lip is free from lamellæ or other processes, but is obscurely papillose on all the veins.

There is a *Cyrtopera* from Sumatra with dense pyramidal racemes of dull-purple flowers among Professor De Vriese's drawings, where it is called *Cymbidium geophilum*; but I have seen no specimen. It seems to be different from this.

SACCOLABIUM, *Blume.*

198. *S. guttatum*, *Lindl. Gen. & Sp. Orch.* 220.

Chittagong, *Col. Fielding*; Kamaon, in the Simai valley, *J. D. H.* (185); Sikkim, in hot valleys, *Id.* (184).

It may be doubted whether either *Saccolabium Blumei* (which is *S. Rheedii* of Wight's Ic.), or *S. macrostachyum* (Sertum, Orch. t. 47), are distinct from this common species, notwithstanding the difference in the form of the middle lobe of their lip and some other circumstances. At least I have from Java a plant gathered by Mr. T. Lobb, which combines the præmorse leaves of *S. guttatum* with the short spike and retuse lip of *S. Blumei*.

199. *S. GURWALICUM*; subacaule, radicibus maximis compressis, foliis canaliculatis distichis truncatis spicis simplicibus longioribus, sepalis petalisque obtusis, labelli calcare late conico rotundato compresso

intus hirto lamina carnosu concava unguiculata subtriloba, fructu ovali brevi trialato ligneo.

Gurwhal, N.W. Himalaya, at 3000 feet of elevation, *T. Thomson* (181); Gunai valley, Kamaon, *Id.* (185).

A very distinct plant, nearly allied to *S. guttatum*. The raceme in my specimen is not more than 3 inches long, and very dense; the lateral sepals are considerably larger than the petals and dorsal sepal. The ripe fruit is not above a quarter the size of that of *S. guttatum*, almost exactly oval, and much harder.

200. *S. calceolare*, *Lindl.* l. c.; *Griff. Notul.* iii. 356. t. 334. (*Vanda pulchella*, *Wight*, *Id.* t. 1671.)

Base of Khasija, *J. D. H. & T. T.* (187); Sikkim, in hot valleys, *Id.* (187), *Cathcart*; Java, *T. Lobb.* (339.)

A most variable plant, constant in little except the extremely acuminate unequal-sided points of the leaves. The middle lobe of the lip is sometimes a mere ciliated rim, sometimes a deep triangular fringed plate, and occasionally quite entire. The leaves vary in breadth from $\frac{1}{3}$ th of an inch, as in Griffith's figure, to $\frac{2}{3}$ ths, as in Hooker's Khasija specimens. The Java plant has the leaves less unequal at the end, and acuminate, and appears to be smaller than the Indian forms, one of my specimens not being more than $\frac{1}{4}$ inch high. In all cases the flowers would seem to be spotted, with the sepals and petals fleshy and oblong.

201. *S. obliquum*, *Lindl.* l. c.

Khasija, *J. D. H. & T. T.* (189).

A careful examination of flowers in spirits does not enable me to point out any important distinction between this and *S. calceolare*; so that the broad leaves with very blunt ends afford the only available specific character. Dr. Hooker writes on his label, "flowers exactly as in 188 (*S. calceolare*), but larger and whiter." The sepals and petals appear to be also narrower.

202. *S. intermedium*, *Griff.* MSS. (Sacc. no. 4, *Griff. Not.* iii. 357).

Khasija hills: Moosmai, Oct. 1835, *Griffith*.

I have this from the author. It is much like *S. calceolare*, but is more caulescent and more fleshy, with scarcely any appearance of a second lobe on the thin extremely acuminate end. The flowers are not half the size, with much narrower sepals and petals. The lip is, moreover, almost exactly hemispherical. It seems distinct.

203. *S. acutifolium*, *Lindl.* l. c. (*S. denticulatum*, *Paxton, Mag. Bot.* vii. 145; *Bot. Mag.* t. 4772.—*Saccolabium*, *Griff. Itin. Not.* p. 46, no. 713; *Notul.* iii. t. 333.)

Sikkim, *Cathcart*; at 5000 feet, *J. D. H.* (367); Khasija, *Griffith*.

This has numerous flowers on long stalks at the end of a stout peduncle; and the very fleshy leaves are convex and acute. It is also quite different from *S. calceolare* in its decidedly caulescent habit. The flowers are whole-coloured, yellowish-brown, unspotted, with the lamina of the lip broad, triangular, and marked with a circular collection of crimson spots in the very disk. Griffith's plant is a narrow-leaved small state, as compared with the Sikkim form, which has twenty flowers at the end of a stout peduncle $2\frac{1}{2}$ inches long. I have seen no specimen; and the Indian drawing, after which the definition in the Gen. & Sp. was prepared, seems to have been misunderstood.

No Indian collection yet examined by me has contained a plant that answers to the account of *S. dasypogon*.

204. *S. micranthum*, *Lindl.* l. c.

Bootan, *Griffith*; *Mergui*, *Id.*

205. *S. niveum*, *Lindl.* l. c.

Ceylon, *Thwaites*, in the Hewahette district.

206. *S. gemmatum*, *Lindl.* in *Bot. Reg.* 1838, misc. 88; *Rchb. fl.* in *Bonplandia*, Oct. 15, 1856.

Sikkim, at 4000-6000 feet, *J. D. H.* (209); Ceylon, *Gardner*, in *hb. Hooker.* (872).

This has much the appearance of the last; but the petals are short and obtuse, the leaves much broader, the racemes longer, and the flowers blood-red, except the lamina of the lip, which is white, with the two lateral short lobes greenish, succulent, and resembling oblong glands. The flowers are scentless (*J. D. H.*). I have it from Griffith without locality.

207. *S. PACHYGLOSSUM*; foliis semiteretibus spicis paniculatis subæqualibus, sepalis carinatis oblongo-linearibus apice secundis, petalis linearibus, labelli calcare oblongo leviter arcuato limbo carnosio unguiculato apice dilatato plano-subrotundo dorso convexo.

Borneo, *T. Lobb*.

Flowers not half as large as in the two last, which it much resembles. Sepals remarkably fleshy, narrow, with their points recurved, while from between the laterals projects the lamina of the labellum in the form of a minute spoon.

208. *S. RAMULOSUM*; caulescens ramosum, foliis semiteretibus angustissimis recurvis, floribus (minutis) paniculatis clausis carnosis, sepalis oblongis carinatis, petalis brevioribus retusis, labello apice plano-convexo calcare oblongo.—*Schænorchis paniculata*, *Blume*, *Bijdr.* 362.

Java, *De Vriese*.

This wants the peculiar column of *Schœnorchis*, and is in no respect distinguishable from *Saccolabium*. The leaves seem to vary much in size.

209. *S. CHIONANTHUM*; foliis teretibus recurvis spicis simplicibus æqualibus, floribus (minutis) carnosis, sepalis obtuse carinatis petalisque minoribus apiculatis, labello apice appendice plano-convexa triangulari instructo calcare horizontali oblongo, anthera apice lineari elongata erecta.—*Schœnorchis micrantha*, Blume, *l. c.*

Java, *Reinwardt*.

Like the last, this is quite without the essential character of *Schœnorchis*. The whole plant is only 4 or 5 inches long, with minute snow-white flowers.

210. *S. ampullaceum*, *Lindl. in Sert. Orch. t. 17.* (*S. rubrum*, *Id. Gen. & Sp. no. 11.*—*Aerides ampullaceum*, *Roxb. Fl. Ind. iii. 476.*)

Sikkim, in hot valleys, *J. D. H.* (196).

The flowers are rather larger than in Wallich's specimens. *S. miniatum* (*Bot. Reg. 1848, t. 58*) differs in little except colour, varying greatly in the size of its flowers.

211. *S. brevifolium*, *Lindl. l. c. no. 27.*

Ceylon, *Thwaites* (488.—*S. virescens*, *Gardner MSS.*), *Gardner* (871).

The form sent from Ceylon by Thwaites appears to be identical with the original plant, except in having the flowers green instead of red.

212. *S. gracile*, *Lindl. l. c.*

Ceylon, *Gardner* (869); Hautane, *Champion*.

213. *S. PALLENS* (*Cathcart, MSS.*); caulibus longis pendulis ramosis radicanibus, foliis carnosis loratis oblique obtusis, racemis axillaribus laxis flexuosis foliis brevioribus, sepalis petalisque oblongis æqualibus, calcare cornuto duplo longiore, limbi 3-lobi laciniis parvis subæqualibus lateralibus rotundatis intermedia acuta.

Sikkim, *Cathcart*.

I have seen no specimen of what seems a very distinct and handsome species; the above description is taken from a figure of Mr. Cathcart. The plant is represented as having branches 9 inches long, protruding strong free flexible roots as long or longer than themselves, leaves 8 inches, and loose zigzag racemes 4-5 inches. The flowers are whitish, with a pink line in the middle of each sepal and petal, and on the outside of the long curved spur. It is very near the next species; but the flowers are much larger, and the middle lobe of the lip, instead of being as long as the spur, is merely a triangular point.

214. *S. Wightianum*, *Lindl. l. c.*; *Wight, Ic. t. 917.* (*Aerides radiocosum*, *A. Rich. in Ann. Sc. 2 ser. xv. p. 65, t. 1. fig. C.*
Courtallum, Wight (907); Nilgherries, *Perrottet (75 Herb. Mus. Par.)*;
 Khasija, *T. Lobb.*

Like the last, except in the circumstances already mentioned. In my specimen the lip has sharp lateral triangular lobes, and a middle one acute, rather fleshy towards the base, but thin and slightly crenulate above the middle. A. Richard's plant, which came from the neighbourhood of Ootacamund, is certainly to be referred here.

215. *S. DISTICHUM*; caulibus elongatis filiformibus, foliis lanceolatis setaceo-acuminatis distichis, pedunculis paucifloris terminalibus et axillaribus, sepalis petalisque oblongis carnosissimis, labello calceolari lobo medio semicirculari membranaceo acuto disco didymo carnosio.
 Sikkim, 6000–8000 feet, *J. D. H. (206)*; Khasija, 5000–6000 feet, *Id. (83).*

A very peculiar species, probably most nearly allied to *S. acutifolium*, and remarkable for its long weak stems and fleshy distichous leaves about an inch long. The middle lobe of the lip is not exterior to the two others, and it has a remarkable glandular convex double disk.

216. *S. ringens*, *Lindl. l. c.*, is *S. rubrum*, *Wight, Ic. t. 1673*, a good figure, but not the plant of the Genera and Species Orch.

217. *S. VIRIDIFLORUM*; acaule, foliis (2) oblongis planis obtusis emarginatis, pedunculo laterali bivaginato paucifloro foliis multo brevioribus, sepalis petalisque unguiculatis obtusis, labello ovali nudo calcare infundibulari incurvo æquali. *Micropera viridiflora, Dalzell, in Hooker's Journal, iii. 282.*

Western India, *Dalzell, in hb. Hooker.*

Very near *Æceoclades pusilla*, but with much shorter spikes, and fleshy, not membranous, flowers. This *Æ. pusilla*, with *flexuosa, paniculata (Sacc. parvulum, m.)*, and perhaps *tenera*, are *Saccolabia*, while others are certainly *Angræca*; and it is probable that *Æ. maculata* is the only plant to which the generic name will attach.

Note.—The *Sarcanthus roseus*, *Wight, Ic. 1685*, and *filiformis, Ic. 1684*, are certainly species of this genus, and perhaps not distinct from each other. I have seen no specimens.

Saccolabium papillosum of the same author, *Ic. 1672*, is not *Acampe papillosa*, nor do I recognize it.

PODOCHILUS, *Blume.*

218. *P. densiflorus, Bl. Rumphia, iv. p. 43.*
 Borneo, *T. Lobb.*

219. *P. lucescens*, *Blume, Bijdr.* 295, t. 12.

Borneo, in Sarawak, *T. Lobb*.

The unguiculate labellum, with a pair of appendages at its base, and the absence of all cohesion between the labellum and lateral sepals, are characters at variance with the usual structure of this genus; and yet it is the original typical species.

220. *P. cultratus*, *Lindl. Gen. & Sp.* p. 234.

Sikkim, in hot valleys, *J. D. H.* (1); Assam, *Griffith, Masters*.

It is remarkable that all the specimens examined by me continue to be without flowers.

221. *P. microphyllus*, *Lindl. l. c.*

Khasija, at 3000 feet, *J. D. H.* (84); Penang, *Gaudichaud*.

Blume's *P. scalpellifolius*, which I have not seen, if accurately dissected by his artist, differs in the lip being linear, not broad at the base, and cordate; and in the sepals being almost wholly united, like some species of *Tæniophyllum*. In general appearance it is undistinguishable from this.

Note.—Blume's *Cryptoglottis serpyllifolia*, which I have from *T. Lobb*, gathered in Borneo, is only a *Podochilus* with an excessive development of the lateral sepals into a long spur: the basal processes of the lip are analogous to those of *Podochilus lucescens*.

CAMAROTIS, *Lindl. Gen. & Sp.* p. 219.

222. *C. purpurea*, *Lindl. l. c.* Sertum Orch. t. 19.

E. Bengal, Chittagong, and base of Khasija, *J. D. H. & T. T.* (186).

223. *C. pallida*. (*Micropera pallida*, *Lindl. l. c.*)

This is not among the collections recently placed in my hands. It is undoubtedly nothing more than a *Camarotis*.

224. *C. PHILIPPINENSIS*; folio oblongo oblique obtuso, racemis arcuatis multifloris, sepalis lateralibus liberis labello suppositis, labello subtriangulari saccato-cucullato apice carnosio tridentato incurvo.

Philippines, *Cuming*.

Flowers larger than in either of the former, somewhat triangular in the bud, apparently fleshy. There is no adhesion between the sepals and labellum, as in *C. purpurea* and *pallida*, on which account the generic character requires to be modified; and the same is the case in my *Saccolabium fasciculatum*, as Prof. Reichenbach has suggested, if indeed the leaves and loose flowers of that species really belong to the same plant.

MICROPERA, *Dalzell*.

225. *M. maculata*, *Dalzell*, in *Hooker's Journal*, iii. 282.

On trees near Tulkut, in the Western Ghauts, in lat. 16° N., *Dalzell*, in *hb. Stocks*. (25).

I have already stated that my genus *Micropera* must be reduced to *Camarotis*. The present plant, which seems not to be referable to any known genus, may as well, however, retain the name. Mr. *Dalzell*'s account of it is good as far as it goes, describing correctly the very curious lip, which looks like a side saddle with two horns instead of one,—the pouch, into which there is an opening only between the horns, being almost concealed by the lamina, which hangs down in the manner of saddle-flaps. The column, which Mr. *Dalzell* does not mention, falls back, is small, short, semiterete, with a vertical rostellum pointing downwards, and dividing into a pair of broad scissor-like blades. Upon this lies a great oblong gland, to which is attached an obovate channeled membranous caudicula.

N.B. *Micropera viridiflora*, *Dalzell*, is *Saccolabium viridiflorum*, No. 217.

STEREOCHILUS, n. gen.

Acaulis. *Folia* lorata, apice obliqua. *Racemi* laterales, laxi, flexuosi, pauciflori (hirti). *Sepala et petala* subæqualia patentissima, lateralibus labello leviter adnatis. *Labellum* solidum, carnosum, sacciforme, facie superiore concava basi bicorni. *Columna* recta, teres, basi haud producta, rostello horizontali subulato. *Pollinia* 4, oblonga, omnino distincta, caudicula setacea, glandula minutissima.

This genus is near *Camarotis*, from which it differs in its solid bag-shaped lip with a pair of horns at the base, in its setaceous caudicula, and in the 4 oblong pollen-masses being perfectly distinct from each other.

226. *S. hirtus*.

Khasija, at 5000 feet, *J. D. H. & T. T.* (177).

Leaves narrow, rather more than 4 inches long by $\frac{3}{8}$ ths wide. Racemes 7-8-flowered. Flowers less than $\frac{1}{2}$ an inch in diameter, free from the coarse short hairs that clothe the ovary and pedicels.

SCHENORCHIS, *Blume*.

227. *S. juncifolia*, *Blume*,

Seems to be the only species, if the genus is characterized by the two long erect filiform processes of the column. Otherwise there is nothing sufficient to distinguish the genus from *Sacco-*

labium, to which *Schænorchis paniculata* and *S. micrantha* certainly belong.

SARCANTHUS, *Lindley*.

228. *S. peninsularis*, *Dalzell*, in *Hook. Journ.* iii. 343. (*S. pauciflorus*, *Wight, Ic.* 1747).

Western India, *Dalzell*; Malabar, on trees, *Jerdon (Wight)*.

Specimens of this from *Dalzell* occur in *Stocks's* Herbarium now at *Kew*; and I also have it in a very young state from *Dr. Wight*, whose figure is by no means so good as usual. (*Wight's* three other *Sarcanti* belong to *Saccolabium*.) *Griffith's Sarcanthus secundus*, *Not.* iii. 363, t. 336, from *Suddyah* in the *Mishmee hills*, seems to be this, which, if so, will no longer be merely a western plant.

229. *S. pallidus*, *Lindl. Bot. Reg.* 1840, misc. 185. (*S. tricolor*, *Rehb. f. in Bonplandia*.—*Saccolabium racemiferum*, *Lindl. Gen. & Sp. Orch.* 224, no. 24.)

Khasija, at 4000 feet, *J. D. H. & T. T.* (178), also found in *Mr. Raban's* garden, *E. Nepal*, *J. D. H. (id.)*.

This differs in no respect whatever from the garden plant. *Prof. Reichenbach's* synonym is derived from a communication from that learned *Orchidologist*.

COTTONIA, *R. Wight, Ic.* no. 1755.

230. *C. macrostachya*, *Wight, l. c.* (*Vanda peduncularis*, *Lindl. Gen. & Sp.* p. 216.)

S. Concan, *Dalzell*, in *hb. Stocks.* (4).

231. *C. Championi*, *Lindl. in Hook. Journal*, vii. p. 35.

Khasija, at 3000–4000 feet, *J. D. H. & T. T.* (190).

This seems to be in no respect different from the plant found by *Champion* on *Victoria Peak* in *Hong Kong*, and thus affords another remarkable instance of epiphytal *Orchids* occurring in stations widely remote, without, as far as we at present know, any intervening locality.

UNCIFERA, gen. nov.

Caulescens. Folia disticha, subcarnosa. *Racemi* densi, oppositifolii. *Sepala* libera, erecta, obtuse carinata, æqualia. *Petala* paulo minora, retusa. *Labellum* infundibulare, in calcar retrorsum uncatum vacuum productum, membranaceum leviter trilobum, apice carnosum. *Columna* teres, decurva, apice dilatata, biauris, area stigmatica horizontali prona. *Anthera* apice membranacea, elongata, bidentata. *Caudicula* maxima, cartilaginea deorsum canaliculata supra medium dilatata, apice in falcem obtusam contracta cujus acies labellum respicit. *Pol-*

linia 4, arctissime geminata, æqualia, aciei falcis per ligulas 2 elasticas adnata. *Glandula* longissima, cartilaginea, sagittata.

232. *U. OBTUSIFOLIA*; foliis latis loratis obtusis oblique bilobis, petalis 3-venis, labelli margine utrinque 1-dentato apice retrorsum bidentato, calcare apice inflato.

Base of Khasija, *J. D. H. & T. T.* (194).

Flowers twice as large as in the following.

233. *U. ACUMINATA*; foliis lanceolatis oblique acuminatis obtusis petalorum venis 3 cis apicem evanescentibus, labelli 3-lobi lobis lateralibus rotundatis intermedio brevi tereti carnosio obtuso, calcare acuminato.

Assam and Khasija, *Griffith*; base of Khasija, *J. D. H. & T. T.* (193).

Flowers much smaller than in the last. Spur of lip tapering to the point. Petals 3-veined, as in *U. obtusifolia*; but the veins stop short of the blunt end, instead of running out.

Of this very curious genus the two species exactly agree in their column and its parts, although so different in the details of the petals and lip. I know of no parallel to the terete column, bent down till the stigma is brought into a horizontal position, looking down as it were into the spur; or to the singular caudicle, which after expanding laterally from its narrow point, and bending down its sides so as to form an arch over the anther-bed, which is here the apparent back of the column, suddenly contracts into a process like a billhook, the edge of which faces the front and bears the pollen-masses. The abruptly hooked lip, which has suggested the name, is itself unlike anything among Indian Orchids.

ANGRÆCUM, *Thouars.*

The only Indian species that I have seen of this African genus is the following:—

234. *A. ZEYLANICUM*; subacaule, foliis lanceolato-loratis lobo altero apicis elongato subfalcato, racemis filiformibus paucifloris duplo longioribus, sepalis petalisque acuminatis æqualibus, labello cochleato acuminato calcare horizontali clavato.

Ceylon, at Narawelle, *Champion.*

Very like *A. caulescens*; but the leaves are broad, 10 inches long, with one of the terminal lobes much longer than the other, and the spur not inflated at the point. I have not seen the column in an examinable state.

AERIDES, *Loureiro.*

235. *A. Wightianum*, *Lindl. Gen. & Sp.* p. 238. (*A. testaceum*, *Id.*

—*Vanda parviflora*, *Lindl. in Bot. Reg.* 1844, *misc.* 57.)

Ceylon, Tangalle, *Champion*; Concan, *Law*, in *hb. Hooker.* (183).

236. *A. cylindricum*, *Lindl. l. c.*; *Wight, Ic. 1744*; *Bot. Mag. 4982*.
Nilgherries, *J. D. H.* (210); Sikkim, at 5000 feet, *Id.* (210).

237. *A. tæniale*, *Lindl. l. c.* (*Aerides carnosum*, *Griff. Not. t. 338 A.*)
Bootan, *Griffith*; Khasija mountains, up to 3000 feet, *J. D. H. & T. T.*
(191).

"Flowers pale lilac," *J. D. H.* In the Khasija specimens the leaves are from 4 to 5 inches long, and 1 to 1½ inch broad.

238. *A. affine*, *Wallich, Cat. no. 7316*; *Sertum Orch. t. 15*; *Bot. Mag. t. 4049*, bad. (*A. roseum*, *Loddiges*; *Paxton, Fl. Gard. t. 60*.—*A. trigonum*, *Klotzsch, fide Rchb. f.*)

Plains of E. Bengal and Assam, *J. D. H. & T. T.* (185); Assam and Bootan, *Griffith*.

Among the many specimens I have seen, flowers have occurred in drooping and upright racemes, deep crimson and pale rose, with the lip and other parts acute or obtuse, all which are therefore marks of one and the same variable species.

239. *A. odoratum*, *Loureiro*.

Base of Khasija, up to 2000 feet, *J. D. H. & T. T.* (182); Garden of Saharunpore, *Id.*; Sikkim, in low valleys, *J. D. H.*

240. *A. crispum*, *Lindl. Gen. & Sp. Orch. p. 239*; *Bot. Reg. 1842, t. 55*; *Bot. Mag. t. 4427*. (*A. Brookei*, *Bateman, in B. R. 1841, misc. 116*.—*Saccolabium speciosum*, *Wight, Ic. t. 1674*.)

Concan, *Law, in hb. Hooker.* (268); *Dalzell, in hb. Stocks.* (75).

Several varieties of this beautiful plant are in our gardens. The flowers in *A. Brookei* are rather smaller than usual.

241. *A. Lindleyanum*, *Wight, Ic. t. 1677*.

"On clefts of rocks bordering the Kartairy falls below Kaitie; also on rocky clefts on a high hill over Coonoor, flowering nearly the whole year," *R. Wight*; Nilgherries, *T. T.* (208).

One of the finest of its order, the flowers being larger than in either *A. crispum* or *falcatum*, and in larger more branching panicles. For this reason the localities given by Wight are stated exactly, in the hope that some collector may send it home. In front of the opening into the spur stands a pair of large curved tubercles, which have not been observed in *A. crispum*.

242. *A. difforme*, *Wallich, in Lindl. Gen. & Sp. 242*.

Khasija, at 3000–4000 feet, *J. D. H. & T. T.* (204), *Griffith*.

This, which is the plant that Wallich had before him, seems to differ from the following in having smaller flowers, with the middle lobe of the lip only 2-lobed, the basal ones longer and a little undulated, and the leaves more tapering to the base. This I learn in part from careful dissection, and in part from one of

Dr. Hooker's admirable sketches. The Sikkim plant may therefore be defined thus :—

243. *A. HYSTRIX*; foliis oblongis, petalis linearibus, labelli lobis lateralibus planis intermedio trilobo fimbriato apice recurvo brevioribus. Sikkim, at 4000–5000 feet elevation, *J. D. H.* (204).

The flowers are yellow with crimson streaks along the sepals and petals; the middle lobe of the lip, which is deeply fringed and crimson, consists of two lateral lobes diverging at the base, and converging upwards over a circular recurved middle lobe.

244. *A. decumbens*, *Griff. Not.* iii. t. 320, a Burmese plant, seems to be a true *Aerides*; but I have seen no specimen.

VANDA, *R. Brown.*

To the species described in '*Folia orchidacea*,' the following fine addition to the section *FIELDIA* has to be added :—

245. *V. UNDULATA*; foliis distichis obtusis bilobis pedunculo apice paucifloro triplo brevioribus, sepalis petalisque recurvis membranaceis lineari-lanceolatis undulatis, labello brevioris carnosio cochleato in laminam linearem acutam sub apice tuberculatam producto.

Sikkim, *Cathcart, Ic.*

The whole habit is that of *V. spathulata* and *cærulescens*. The flowers are fully two inches in diameter, with thin white sepals and petals tinged with pink, and a yellow fleshy lip fasciated internally with red lines. I have only seen a drawing prepared by Mr. Cathcart's artists.

TÆNIOPHYLLUM, *Blume.*

246. *T. ALWISII*; minutissimum, spica pauciflora erecta, bracteis carinatis triangulis, perianthii laciniis omnibus connatis acutis conformibus, calcare hemisphærico, polliniis pyriformibus in glandulam sessilibus.

On the branch of a *Symplocos*, Ceylon, *De Alwiz.*

The smallest Orchid I know, the flat roots not being more than $1\frac{1}{2}$ inch long, and the stem, including flowers, $\frac{1}{4}$ inch. The whole plant is pale green, even the flowers having no other colour. Mr. Thwaites, who sent me a drawing of it (and I have seen nothing more), proposed to call it *Alwisia minuta*, after his excellent native draughtsman, who was the first to discover it; and if the figures in Blume and the *Xenia* represent the invariable characters of *Tæniophyllum*, this and *Dendrobium algosum* of Reinwardt's MSS. ought to be distinguished; but Prof. Reichenbach, jun., who has had the opportunity of examining *Tæniophylla*, assures me that this is one, and I possess no materials on which to form an opinion for myself.

CHILOSCHISTA, *Lindl. Gen. & Sp.* p. 219.

247. *C. usneoides*, *Id.*; *Wight, Ic.* 1741.

Sikkim, at 4000 feet, *J. D. H.* (192).

According to Cathcart's drawings, the caudicula is short and broad, with a large semicircular gland, not subulate with a minute gland, as represented by both Wallich's and Wight's artists. The plant seems to be constantly leafless.

ACERAS, *R. Br.*

248. *A. angustifolia*, *Lindl. Gen. & Sp. Orch.* p. 282.

Khasija, 5000-6000 feet, *J. D. H. & T. T.* (280); N.W. Himalaya, 5000-8000 feet, *T. T.*; Sikkim, in hot valleys, *J. D. H.*

Flowers green, in a very long slender spike.

HERMINIUM, *R. Br.*

249. *H. monorchis*, *Id.*

N.W. Himalaya, 8000-12,000 feet, *T. T.* (263); Nutra, W. Thibet, 11,000 feet, *Id.*

250. *H. congestum*, *Lindl. Gen. & Sp. Orch.* p. 305. (*H. unalaschense*, *Rchb. f. Orch. Fl. Germ.* p. 107, t. 65, excluding the syn. of *Platanthera Schischmareffiana.*)

Sikkim, 11,000-12,000 feet, *J. D. H.* (265).

Differs from *H. monorchis* in its erect blunt obovate-lanceolate leaves and entire lip.

SATYRIUM, *Swartz.*

The first knowledge we had of the existence in India of this African genus was derived from the collections of Buchanan Hamilton, from which, in the year 1824, David Don published his *Satyrium nepalense*. In 1838 I became aware of the existence of two others, and described them under the names of *S. Wightianum* and *ciliatum*. Three years later Achille Richard described three others from the Nilgherry collections of Perrottet,—*Perrottetianum*, *albiflorum*, and *pallidum*. Authentic specimens of all these are before me, together with a considerable number from various parts of India, among which is a fine series from Drs. Hooker and Thomson. These materials show, not only that the genus *Satyrium* abounds in individuals, but that it is subject to very great differences of stature, foliage, and inflorescence. I think, however, the three species admitted in 1838 are to be distinctly recognized; but the Nilgherry plants of Achille Richard are not distinguishable from *S. nepalense*, not even his *S. pallidum*, said to have yellow flowers, which is probably a mistake.

The original *S. nepalense* is distinctly known by its somewhat lax inflorescence, large coloured bracts, and spurs as long as the ovary, or longer. The two others have very short spurs. Of these, *S. ciliatum* has a thin inflorescence like that of *S. nepalense* itself; *S. Wightianum* has a very dense inflorescence; both are much dwarfer than *S. nepalense*. The specimens under my examination may be arranged thus:—

251. *S. Nepalense*. *D. Don, Prodr. Fl. Nep.* 26; *Wight, Ic.* 929. (*S. Perrottetianum*, *Ach. Rich. Ann. Sc. ser. 2. xv.* 76; *Wight, Ic.* 1716. —*S. albiflorum*, *A. Rich. l. c.*; *Wight, Ic.* 1717. *S. pallidum*, *A. Rich. l. c.*).

Sikkim, 7000–12,000 feet, stout, like *Gymnadenia*, *J. D. H.* (259); Ceylon, *Macrae* (9); Nilgherries, *Wight, Perrottet* (193, *hb. Mus. Par.*); Mysore, *Stocks* (53); Khasija, *Griffith, Lobb*, 4000–6000 feet, *J. D. H. & T. T.* (259); N. W. Himalayas, *T. T.*

S. Perrottetianum is merely a gigantic state of the species, while *S. pallidum* is its starved form; not, however, the most so, for the old specimens sent from Nepal by Wallich among his earliest collections are still more attenuated.

252. *S. Wightianum*, *Lindl. Gen. & Sp. Orch.* p. 340; *Wight, Ic.* 1718. Nilgherries, *Perrottet* (191 & 850 in *hb. Mus. Par.*), *Wight*; Khasija, *Lobb*.

A much dwarfer plant than the preceding, with two broad radical leaves suddenly changing to about two great inflated herbaceous sheaths, and an extremely dense blunt spike. Flowers “*rubri aut coccinei*” according to *Perrottet*, pink according to *Wight*, and smaller than in *S. nepalense*.

253. *S. ciliatum*, *Lindl. l. c.*

Sikkim, 7000–12,000 feet, *J. D. H.* (259); Bootan, grassy sward above Tongsa, 10,000 feet, *Griffith*.

The very short spurs of this are so different from the long attenuated ones of *S. nepalense*, that I think it must be distinct. Moreover it is a smaller plant with 2–3 spreading herbaceous distant sheaths, but little inflated. In the original specimen the bracts are large and herbaceous, in those from Bootan much smaller and deflexed, the plant varying like *S. nepalense* in that respect.

DIPLOMERIS, *D. Don.*

254. *D. pulchella*, *Id.*

Khasija, *Griffith*, 2000–4000 feet, *J. D. H. & T. T.* (256).

Flowers pale straw-colour or nearly white, variable in size. Spur green.

POGONIA, *Jussieu*.

255. *P. flabelliformis*, *Lindl. Gen. & Sp. Orch.* 415.

Concan, *Law, in hb. Hooker.* (350); near Dharwar, *Stocks, in hb. Hooker.* (68); Mysore, *Id.* (54).

It is probable that Blume's *Rophostemon concolor* should be referred to this species.

256. *P. carinata*, *Lindl. l. c.*; *Wight, Ic. t. 1720.* (*Pogonia 2, Griffith, Notul. iii. 377, Ic. 345.*)

I have never seen this plant, which appears to be perfectly distinguished by its stout habit, very large tubers, and lip acute and shaggy within, instead of being nearly naked and rounded at the point. Griffith's *Pogonia No. 2* is evidently the same; of his *Pogonia No. 1*, which seems to be near *P. Juliana*, but distinct, I have seen no specimen.

ERIA, *Lindley, in Bot. Reg.* 904.

This genus, like *Dendrobium*, consists of species extremely dissimilar in habit, and must now receive several supposed genera, created by different authors before the limits could be definitely settled. These are *Conchidium* and *Xiphosium* of Griffith, *Tylostylis*, *Mycaranthes*, *Cylindrolobus*, and *Trichotosia* of Blume, and my own *Bryobium* and *Trichosma*. But although no longer admissible as genera, the species collected under these names are for the most part convenient sections.

The careful study of a very large quantity of materials leads me to propose the following classification. In the first place, the species of Griffith's CONCHIDIUM, analogous to the small *Stachyobia* in *Dendrobium*, are readily known by their thin leaves, almost stemless habit, and smooth flowers; such stem as they form is merely a depressed pseudobulb covered by the bases of the leaves. Then follow the species with true fleshy pseudobulbs and nothing more, separable into large-flowered woolly species (DENDROLIBIUM), large-flowered naked species (XIPHOSIUM), large-flowered woolly species with an unguiculate flat roundish lip (TYLOSTYLIS), and small-flowered woolly species (MYCARANTHES), in which the fleshy pseudobulb is sometimes exchanged for a slender cylindrical stem like that of *Trichosma*. Next to these stands TRICHOSMA itself, with its long slender 2-leaved stems, large smooth flowers, and fleshy anther. Another group, HYMENERIA, includes the species with thin sepals and petals, which are usually naked, and short fleshy stems having a few leaves towards the top. The remainder are truly caulescent; among these, four well-marked

subdivisions may be formed: viz. *ERIURA*, remarkable for a tuft or two of wool on the axis of the lip, *TRICHOTOSIA* with coarse shaggy racemes, *CYLINDROLOBUS*, with 1- or 2-flowered peduncles clothed with smooth coloured membranous bracts below the flowers, and finally *UROSTACHYA*, which includes the species that will go into none of the preceding sections.

§ I. CONCHIDIUM, *Griffith.*

This group bears the closest analogy to the second section of *Stachyobium* among *Dendrobia*, like it, consisting of small stemless species, with round or depressed pseudo-bulbs, membranous leaves, and flowers solitary or in few-flowered racemes, for the most part very minute. To this last, however, *E. braccata* and *Lichenora* are exceptions. In *E. pusilla*, *microchilos*, and others, four of the pollen-masses are rudimentary and easily overlooked: in *musciola* and *microchilos*, indeed, I have only succeeded in finding four; but their form, tapering downwards into a point, seems to be a safe mark to separate them from the minute *Dendrobia*.

257. *E. braccata*. (*Dendrobium braccatum*, *L. O.* p. 75.—*Eria reticosa*, *Wight, Ic.* 1637.—*Eria uniflora*, *Dalzell in Hooker's Journal*, iv. 111.) Ceylon, *Macrae, Gardner* (859), *Thwaites* (2356); Horton plains, *Champion* (*Eria velifera*, *R. W.*); Nilgherries, *Wight*; common on trees in the Western Ghauts, in the rainy season, *Stocks* (24).

When this was first published I had been unable to examine the pollen-masses. It varies in the size of the flowers; those from the Western Ghauts, preserved among *Stocks's* plants, are four times as large as the Cingalese, with much more acuminate sepals and petals.

258. *E. Lichenora*. (*Lichenora Jerdoniana*, *Wight, Ic.* 1738.) Malabar mountains, *Wight*.

This remarkable plant is certainly not different from *Eria*.

259. *E. nana*, *Ach. Rich. in Ann. Sc. Nat.* ser. ii. xv. 19. Nilgherries, *A. Richard, Wight* (171, 172).

My authentic specimens from *A. Richard* are identical with *Wight's* 171. His 172 is somewhat different, with flowers as large as those in *Richard's* very bad figure of his *Dendrobium microbolbon*, which looks as if it had been made up from the leaves and flowers of *E. nana*, while the dissections belonged to another plant. The thin broad obovate leaves of this have, however, no resemblance to *Richard's* figure.

260. *E. MUSCICOLA*; foliis binis lanceolatis basi angustatis scapo apice bifloro æqualibus, bracteis cucullatis membranaceis cuspidate herbaceo flore brevior, sepalis petalisque lineari-lanceolatis æqualibus ascendentibus, labello lanceolato canaliculato dorso pubescente.

Dendrobium muscicola, *Lindl. Gen. & Sp.* 75.

Ceylon, *Champion, Gardner* (853).

I can only find 4 pyriform pollen-masses in the single flower at my disposal. The whole plant not more than 2 inches high. Flowers resemble those of *Eria nana* on a very small scale. Since it has never been found among collections from the N. of India, it is probable that the old locality "Nepal," was erroneous.

261. *E. microchilos*. (*Dendrobium microchilos*, *Dalzell*, in *Hooker's Journ.* iii. 345.)

On Mango trees in Western Bengal, *Dalzell, Stocks* (28).

I have this as *D. fimbriatum* of *Dalzell*, out of *Stocks's* herbarium; it is certainly distinct from that plant, although very much like it. The flowers are smaller, more fleshy; and the lip is slightly unguiculate, then irregularly widened and thick-edged, after which it contracts into a thin-edged acute apex. Only two pairs of pollen-masses could be found in the flowers I dissected. The tubercles at the base of the lip, spoken of by Mr. *Dalzell*, I have not succeeded in finding.

262. *E. Dalzelli*. (*Dendrobium Dalzelli*, *Hooker, Journ. Bot.* iv. 292.

Dendr. fimbriatum, *Dalzell*, l. c.—*Dendr. filiforme*, *Wight, Ic.* 1642.)

Western Ghauts, on trees, *Dalzell*; hollow trees in the ruins, *Stocks* (27); Concan, *Law (hb. Hooker.* 166, 91); Bombay Presidency, *Dalzell (hb. Hooker.* 167).

I am not surprised at Mr. *Dalzell's* having taken this for *E. microchilos*, as he tells us was the case; for the two are exceedingly similar, as is indeed shown by so accurate an observer as *Stocks* having given the name of *microchilos* to specimens now before me. The flowers are, however, rather larger and less fleshy; the lip is membranous, ovate-lanceolate, and distinctly serrulate towards the point. As to the marginal glands of the sepals, which gave rise to the name *fimbriatum*, they are very evanescent, and I suspect sometimes altogether absent. They are hardly discoverable in Mr. *Law's* Concan specimens. Imperfect specimens from Ceylon (2353 Hb. *Hooker.*) probably belong here. Of the eight pollen-masses, four are quite rudimentary.

263. *E. ARTICULATA*; pseudobulbis oblongis in catenæ speciem articulatis, foliis, scapo setaceo flexuoso 5-7-floro, bracteis ovatis cucullatis, petalis acutis multo brevioribus.

Ceylon, *Mrs. General Walker (hb. Hooker.)*; *Gardner*.

Of this singular plant I have a fragment from Gardner, and several are preserved in the Hookerian herbarium, but all without leaves. The pseudobulbs are oblong shrivelled bodies, jointed into a sort of chain or necklace. The flowers are very small and with no elongation of the sepals. Neither lip nor pollen-masses are known to me.

264. *E. pusilla*. (*Conchidium pusillum*, *Griffith*, *Not.* 321. t. cccx.—*Phreatia uniflora*, *Wight*, *Ic.* t. 1734.).

Khasija, *Griffith*; Churra Punjee, *Id.* (666).

This, the original *Conchidium*, has not eight equal pollen-masses, as is represented in the figure of Wight's artist, but they are even more unequal in size than is shown in Griffith's plate. It is not in the Khasija collections formed by Hooker and Thomson.

265. *E. sinica*. (*Conchidium sinicum*, *Lindl.* in *Hooker's Journ.*)

Hong Kong, *Champion* (278).

Differs from the last in the sepals and petals not being acuminate, in the lip being serrated; the scape is both 1-flowered and 2-flowered. I fear, not distinct from the Khasija species.

§ II. DENDROLIRIUM, *Blume*.

If we collect into one group all the large-flowered woolly species with pseudobulbs only, an assemblage will be formed both natural and obvious, to which Blume's happy name of *Dendrolirium* may be applied. Some terete-leaved plants can hardly indeed be said to form pseudobulbs; but their leaves fall eventually from the summit of very short stems altogether analogous to pseudobulbs, although unlike in form. Two divisions are effected by taking into account the form of the leaves.

A. *Leaves flat and broad.*

266. *E. ornata*, *Lindl. Gen. & Sp.* p. 66. (*E. armeniaca*, *Id. Bot. Reg.* 1841, t. 42.)

Moulmein, *Griffith*; Khasija, at 2000 feet, *J. D. H.* (66); Java, *T. Lobb* (219); Philippines, *Cuming*.

267. *E. AERIDOSTACHYA* (*Rchb. f. in litt.*); folio lanceolato-oblongo coriaceo, racemo cylindraco multifloro ferruginco-tomentoso, bracteis minutis, mento elongato obtuso rectiusculo, labello lanceolato acuto nudo medio involuto basi concavo.

Batavia, *Loddiges*, in hort.

I learn from Prof. Reichenbach that this is among Zollinger's unpublished Java plants. It resembles what I suppose to be the *Dendrolirium sulcatum* of Blume, but is very much more densely tomentose.

268. *E. flava*, *Lindl. in Wall. Cat.* 1973.

Sikkim, hot valleys, 1000-2000 feet, *J. D. H.* (63).

β. RUBIDA; floribus minoribus, petalis virescentibus, labelli lobis lateralibus rotundatis.

Sikkim, *Cathcart*.

The type of this plant is the *Dendrobium pubescens* of Sir W. Hooker, well figured and described in the 'Exotic Flora,' t. 124. It is important to observe this, if we are to determine to which of the other nearly-allied woolly species the name belongs. In that plant the lip has scarcely any hairs on the inner surface, and the lateral lobes are extremely short, which is the case with the plants above quoted. The variety *β* is only known from a native figure; and the account given of it must be judged of accordingly. It looks different, especially as the pollen-masses seem to be long and tapering, not roundish, and plano-convex.

269. *E. ELONGATA*; pseudobulbis ovalibus, foliis lato-lanceolatis coriaceis acuminatis basi angustatis, racemo niveo lanato elongato distantifloro, bracteis ovatis acutis lævibus dorso lanatis, petalis ovalibus subtrinerviis, labelli lobis lateralibus scabro-tomentosis intermedio subcuneato multo brevioribus rotundatis, clinandrio alte marginato.—(*E. flava*, *Griffith, Not.* iii. 301.)

Burma; Moulmein, on trees in damp woods, *Griffith* (346); in woods at Zimjaik, *Id.* (347); Moulmein, *T. Lobb*.

As in *E. flava*, the clinandrium is surrounded by a membrane, which in this species is remarkably deep; the lip has rounded lobes, clothed inside with coarse, scattered felt, and the middle lobe has two obscure raised lines as well as a distinct middle line. That it is perfectly distinct from the last is certain; but it varies in the form of its lip, the 346 of Griffith having the lateral lobes rather acute and falcate instead of rounded, and the middle lobe larger, with a more distinct superficial lamella in the middle.

270. *E. lanata*, *Griffith, Not.* iii. 301.

Mergui, *Griffith* (810).

So much is this in habit like the Sikkim *Eria flava*, that it may be easily mistaken for it; but its petals are linear lanceolate-acuminate, and the long narrow lip has a quadrate cuspidate middle lobe, a long isthmus, and a narrowly wedge-shaped hypochilium with small rounded lobes and three distinct elevated distant ribs. The pseudobulbs are ovate, not oval.

B. *Leaves terete or very narrow.*

271. *E. pannea*, *Lindl. Bot. Reg.* 1842, misc. 79. (*E. teretifolia*, *Griff. Not.* iii. 298, t. 300. fig. 2; *Itinerary*, 202, no. 1185.)

Bootan, at 3600 feet, on *Gordonia*, *Griffith*; Khasija, at 2000 feet, and Sikkim, on rocks in hot valleys, *J. D. H.* (62); *T. Lobb*.

A long creeping slender rhizome bears, at intervals of 2 to 4 inches, very short woolly stems, each furnished with from one to four terete fleshy leaves, varying in length from 1 to 6 inches and more, the longest belonging to the Khasija plant. *Griffith's* figure is thus far bad, that I do not find in his own specimens the lip anything like so wavy as he represents it. I have a very similar plant collected in Borneo? by *T. Lobb*, with very short one-leaved pseudobulbs that touch each other, and leaves more linear; but my solitary flower does not bear examination.

272. *E. SICARIA*; pseudobulbis oblongis 1-2-phyllis, foliis linearibus carnosius acutissimis semiteretibus, racemis lanatis lateralibus multifloris folio multo brevioribus, bracteis ovatis patentibus intus glabris, floribus albo lanatis, labello apice convexo apiculato.

Mergui; Tharapown, in woods, *Griffith*.

"*Folia* carnosa, linearia. *Sepala* extus albovelutina, intus cum petalis viridescencia, lateralia maxima purpureo lineata et notata. *Labellum* albobuscum, intus brunneum disco calloso." *Griffith, MSS.*

Very like a narrow-leaved *Eria flava*. Leaves about 6 inches long, resembling slender stilettos, but tapering at the base into a furrowed petiole. My flowers give no more information.

§ III. XIPHOSEUM, *Griff.*

Although this supposed genus is undoubtedly an *Eria*, it may form a section sufficiently distinguished by its large smooth flowers and distinctly-formed pseudo-bulbs. It only differs from *Dendroliria* in the flowers not being woolly.

273. *E. rosea*, *Lindl. in Bot. Reg.* t. 978.

Hong Kong, *Champion* (275).

This certainly differs from the next, with which I formerly confounded it, in its broad blunt lip with the lower half much wider than the upper.

274. *E. carinata*, *Gibson, in Calc. Journ. Nat. Hist.* v. 365. (*Xiphosium acuminatum*, *Griffith*, l. c. c. ic.; *Itin. Not.* 78, no. 1153; *Notul.* iii. 332, t. 316.—*E. rosea*, *Wall. Cat.* 7409.)

Khasija, *Griffith*; Sylhet, *Wallich*.

Differs from the last in having the sepals, petals, and lip acuminate, the middle lobe of the latter being as wide as the hypochil,

which has two continuous, not interrupted, rugose elevated lines. Not among the collections of Hooker and Thomson.

275. *E. SCABRILINGUIS*; pseudobulbis ovatis sulcatis, foliis binis oblongo-lanceolatis trinerviis, racemo oblongo erecto densifloro, labelli trilobi aspero-cristati lobis lateralibus brevibus acutis intermedio rotundato.

Sikkim, *ic. Cathcart.*

Flowers pale green. Lip deep violet. I have seen no specimen of either this or the next.

276. *E. VITTATA*; pseudobulbis oblongis, foliis binis oblongo-lanceolatis 5-nerviis, racemo oblongo elongato pendulo densifloro, labello oblongo costis 3 elevatis marginibusque crispis.

Sikkim, *ic. Cathcart.*

Flowers larger than in the last, pale green with crimson stripes; lip the same colour, but paler.

§ IV. *TYLOSTYLIS*, *Blume, Fl. Jav. p. vi.* (*Callostylis, Id. Bijdr. 340.*)

The long slender curved column and unguiculate roundish undivided lip of these plants make it convenient to place them in a section by themselves, especially considering their peculiar inflorescence, consisting of flat round woolly horizontal bracts.

277. *E. pulchella*, *Lindl. in Wall. Cat. no. 7407; Bot. Reg. 1841. misc. 106.*

Malacca, *Cuming.*

This is possibly the *Callostylis rigida* of Blume's Tabellen, 74; but if so, the figure is a bad one.

278. *E. DISCOLOR*; pseudobulbo in caulem subarticulatum extenso, labello oblongo subcordato acuto glabro concolore.

Sikkim; Glen Cathcart, 3000-4000 feet, *J. D. H.* (168).

I have seen no flower of this, and therefore trust to one of Mr. Cathcart's drawings, and a solitary specimen of the stem and leaves. It is much like the last; but the lip appears to be longer than broad, as well as whole-coloured and smooth, while in *E. pulchella* it is broader than long, yellow with a small purple disk, and conspicuously tomentose.

§ V. *MYCARANTHES*, *Blume.*

The only species figured by Blume, *M. latifolia*, is an *Eriura*. Whether his *M. obliterated* and *lobata* belong to the same section is uncertain, nothing being known about them. With me, the

species are only the following, easily known by their dense spikes of small woolly flowers, the lateral sepals of which have scarcely any obliquity.

279. *E. stricta*, *Lindl. Coll. Bot.* t. 41 B. (*E. secundiflora*, *W. Griff. Not.* iii. 302. t. 301.—*Mycaranthes stricta*, *Lo.* 63; *Wight, Ic.* 1733.)

On the Naga hills, on a species of *Gordonia* at the elevation of 3500 feet, *W. Griffith*; *Darjeeling, Id.*; Malacca, *Id.* fide cl. *Wight*; Sikkim, at 3000 feet, and Khasija, at 4000 feet, *J. D. H.* (59).

280. *E. retusa*, *Rchb. f. in Bonplandia*, March 1, 1857. (*Phreatia retusa*, *Lindl. Orch.* p. 64.—*Dendrolirium retusum*, *Blume, Bijdr.* 351.—*Bryobium pubescens*, *Lindl. in Bot. Reg.* 1838, misc. no. 145.)

Java, *Zollinger*.

The extrication of this synonymy is due to Prof. *Rchb. fil.*

281. *E. MERGUENSIS*; caulibus cæspitosis carnosis clavatis, foliis papyraceis oblongis basi angustatis apice obliquis uncinulatis, spicis lateralibus elongatis griseo-tomentosis pedunculo evaginulato, floribus (minimis) pilosis, labello trilobo infra isthmum transverse lamellato.

Mergui, *Griffith* (1034); Moulmein, *Lobb*.

Something like a small specimen of *E. stricta*; but the stems are fleshy and clavate, the flowers much smaller and not secund, and the lip quite different.

§ VI. TRICHOSMA, *Lindl. in Bot. Reg.* 1842, t. 21.

Now that the limits of the genus *Eria* begin to be understood, I must admit that Prof. Reichenbach is right in reducing to its ranks my genus *Trichosma*, notwithstanding its very peculiar habit. It will now, therefore, stand as a section, distinguished by its great fleshy anther and long slender 2-leaved stems, resembling those of a gigantic *Pleurothallis*.

282. *E. suavis*. (*Trichosma suavis*, *Lindl. l. c.*—*Eria cylindripoda*, *Griff. Notul.* iii. 299.)

Khasija, *Griffith* (1013, 1258); *J. D. H. & T. T.* (144); Sikkim at 5000–6000 feet, *J. D. H.* (144).

§ VII. HYMENERIA.

This name is proposed for all those species which, to a fleshy somewhat shapeless stem with a few thin leaves, add a many-flowered inflorescence that is smooth or nearly so. Possibly it might be subdivided into those with a dense inflorescence like *E. convallarioides* and *pumila*, and such as have the thin racemes of *E. bractescens*.

283. *E. convallarioides*, *Lindl. Gen. & Sp. Orch.* p. 70; *Bot. Reg.* 1841. t. 62, 1847, t. 63.

Khasija, *Griffith*; at 4000-6000 feet, *J. D. H.* (60); Sikkim, at 5000 feet, *Id.*, valleys 3000-4000 feet, *Id.*

Varies in the colour of the flowers, and in their size.

284. *E. excavata*, *Lindl. Gen. & Sp.* p. 67.

This differs from *E. alba* chiefly in having the middle lobe of the lip cordate, acute, ribbed, and much smaller than the middle lobes which are broad, falcate, and acute.

285. *E. alba*, *Lindl. l. c.* p. 67.

a. Lip white.

Sikkim; Darjeeling, in valleys at 3000-4000 feet, *J. D. H.* (142).

β. Lip yellow.

Sikkim, 4000-5000 feet, *J. D. H.* (68); Mussooree, *Edgeworth*.

In *β* the lateral lobes of the lip are shorter and blunter than in *α*, and the leaves are thinner and more acuminate.

286. *E. LINEATA*; foliis oblongis subcoriaceis acutis, racemis multifloris, bracteis ovalibus membranaceis reflexis, ovario tomentoso, sepalis ovatis subsecundis, labelli lobo medio subrotundo retuso plano lateralibus obtusis minoribus, axi lineis 3 crassis elevatis ad isthmum evanescentibus.

Java, *hort.* (*Veitch*); Continent of India, *hort.*

This is very like *E. alba α*, and may be a variety; but the flowers are dirty yellow with distinct purple stripes, not white, and are much smaller, the leaves are twice as broad and more coriaceous, and the dull purple blunt lateral lobes of the lip are not wider than the yellow almost 3-toothed middle lobe. It is a garden plant of doubtful origin.

287. *E. obesa*, *Lindl. Gen. & Sp.* p. 68. (*Eria Lindleyana*, *Griff. Not.* iii. 300.)

Moulmein and Mergui, *Griffith*.

I have no doubt about the correctness of this identification, notwithstanding that in Griffith's *Notulæ* it is said to be 554 of his Mergui herbarium, for I have from himself a drawing, made in Moulmein in February 1834, and a specimen from Mergui numbered 374, which agree with his description. Neither Wallich's bad old specimens, nor that from Griffith, have any leaves. He states them to be "lanceolata v. ovato-lanceolata integerrima glabra venosa apice recta v. torta." By a typographical error in the *Botanical Register*, the stems are said to be 27 instead of 2½ inches long. There is a variety with larger flowers and the lower half of the lip very gradually passing into the upper, formerly

named by me *E. trilophota*, which has been found in Moulmein by Lobb as well as by Griffith (no. 370), and is now in cultivation as a Java and even Borneo species, but probably without foundation. The flowers are pure white with a lemon-coloured lip, marked by three longitudinal purple elevated lines.

288. *E. affinis*, *Griff. Not.* iii. 297.

Burma, *Griffith* (1074).

This is remarkable for a very long narrow cuneate lip, with two small acute teeth (or lobes) at the base of a roundish ovate acute terminal lobe; it has also two converging principal veins slightly raised above the surface into a thin narrow edge, interrupted in the middle. The mentum is long, narrow, and obscurely 2-lobed.

289. *E. pulchella*, *Griff. Not.* iii. 297.

Mergui (1055), and on trees in Moulmein (345), *Griffith*.

Resembles *E. bractescens*; but the stems are 3 or 4 inches long and cylindrical, the flowers are yellow, and the lip has three continuous elevated lines, of which the two lateral are shorter and clavate.

290. *E. pubescens*, *Wight. Ic.* t. 1634.

Khasija, *Lobb*.

The lateral veins of the lip rise into short vertical plates near both the points and the base.

291. *E. MYSORENSIS*; foliis oblongo-lanceolatis conduplicatis nervosis racemis paulo longioribus, ovario pubescente, bracteis ovalibus acutis reflexis glabris, sepalis petalisque acuminatis, labello unguiculato subcordato oblongo acuto juxta basin dilatatam pandurato omnino lævi. Mysore, *Law*. (Cœlogyne, *Hb. Stocks.* 70.)

292. *E. GRAMINIFOLIA*; caule elongato vaginis membranaceis laxè vaginato, foliis lineari-lanceolatis gramineis nervosis, racemis tomentosissimis multo brevioribus, bracteis ovatis reflexis glabris, sepalis ovatis acutis mento brevi, petalis linearibus, labello hastato lobis lateralibus truncatis brevioribus intermedio subrotundo acuto, lamellis 2 oblique transversis bidentatis infra isthmum, ungue lato canaliculato.

Darjeeling, *Griffith*.

293. *E. SPHÆROCHILA*; caulibus brevibus imbricatis ovatis, foliis lato-lanceolatis membranaceis undulatis racemis tomentosissimis longioribus, bracteis linearibus acutis erectis, sepalis tomentosissimis ovatis subæqualibus acutis, petalis conformibus, labelli sessilis lobo intermedio subrepando rotundato venis varicosis lateralibus auriculiformibus.

Khasija, 4000-6000 feet, *J. D. H.* (68).

Like *E. alba* in general appearance, but wholly different in the details of its flowers.

There is also, under the number 68 in Hooker and Thomson's Herbarium, a plant from Gurwhal and Khasija, which is quite different from this, and which may be my *E. acervata*, notwithstanding some discrepancies.

294. *E. Dillwynii*, *Bot. Mag.* t. 4163, is certainly *E. bractescens* in a state of great vigour.

295. *E. ringens*, *Rchb. f. in Bonplandia*, is *E. ovata*, *Bot. Reg.* 1844, sub t. 29.

§ VIII. ERIURA.

Under this name may be collected the species having small flowers more or less woolly, very large lateral sepals, and a lip flat at the base, furfuraceous in the axis, with a woolly tubercle at the apex and base, or at least at the apex. *E. javensis*, *abbreviata*, and *Sonkaris*, *Rchb. f.*, together with the following, are all at present known with certainty.

296. *E. paniculata*, *Lindl. in Wall. Pl. as Rar.* i. 32. t. 36.

Sikkim, 10,000 feet, *J. D. H.* (67); rocks near Sarapanee, *Griffith* (1152).

297. *E. obliqua*. (*Mycaranthes obliqua*, *Lindl. in Bot. Reg.* 1840, *misc.* 184.)

Singapore, *Cuming, in hort.*

This differs from *E. bifalcis* in the form of the lip and in the presence of a large tumour at the base of the furfuraceous axis.

298. *E. MONOSTACHYA*; foliis longissimis coriaceis gramineis canaliculatis, racemis longis cylindraceis tomentosis, labelli quadrilobi laciniis triangularibus acutis apicalibus minoribus, lamellis 2 triangularibus aristatis infra isthmum, tuberculis axeos 3 quorum tertium ultra apicem protrusum.

Mount Gembolo, in the east of Java, *Zollinger* (53).

I have this from Prof. *Rchb.* as *Eria paniculata*, from which it differs in its long cylindrical racemes, and the presence of two sharp-pointed triangular plates below the lateral incisions of the lip, as well as in the other characters above described.

299. *E. REINWARDTII*; foliis distichis linearibus rigidis apice obliquis acutis, racemo solitario tenui sessili multifloro, labelli quadrilobi basi et apice tuberculati laciniis lateralibus obtusis planis terminalibus subcrispis minoribus.

Java, *hb. Reinwardt.* (*Cymbidium parvijlorum*).

Leaves 5 or 6 inches long, somewhat distichous. Spike 4 inches long, terminal, sessile, with small reflexed bracts nearly as long as the ovary.

300. *E. BIFALCIS*; foliis linearibus coriaceis obtusis apice valde obliquis, spica araneosa dissitiflora simplici terminali, floribus albo-tomentosis, labello cuneato 3-lobo laciniis lateralibus falcatis intermedia oblata tridentata, tuberculo apicis maximo inflexo baseos obsoleto.

Borneo, *T. Lobb*.

In habit much like *E. Reinwardtii*, but not more than 5 or 6 inches high. Flowers the size of *E. obliqua*.

301. *E. SCLEROPHYLLA*; foliis patentibus duris lanceolatis distichis apice acutissimis obliquis, racemis pluribus elongatis terminalibus albo-tomentosis, labelli cuneati lobis lateralibus acutissimis intermedio a lata basi lineari apice dilatato cuspidato, tuberculo apicis maximo baseos erecto foveato, lamella lineari a quoque isthmo decurrente apice libera.

Java, *Junghuhn* (279).

Much like *E. paniculata*; but the leaves are shorter, broader, and more spreading, and the lip wholly different. No. 300 of *Junghuhn* seems to be the same, but is only in fruit.

Mycaranthes latifolia, *Blume*, may also belong to this section.

§ IX. TRICHOTOSIA, *Blume*.

This supposed genus differs in nothing whatever from *Eria*. It may only stand as a section, with a caulescent habit and flowers covered with coarse ferruginous hairs. The surface and degree of division of the lip offer no available mark of recognition. All the species are conspicuous for the long brown hair that clothes the stem and leaves.

302. *E. biflora*. (*Trichotosia biflora*, *Griffith*, *Not.* iii. 331. t. 315.)

Malacca; on rocks and trees, Goondong Toondook, Mount Ophir, *Griffith*.

Near *E. annulata*, *Bl.*, from which its excessively shaggy lip distinguishes it, as well as the want of the long glabrous recurved bracts of that species.

303. *E. PULVINATA*; villosissima, caulibus brevibus ascendentibus, foliis ovatis, pedunculis unifloris, sepalis hirsutis in cornu obtusum basi productis ovario æquale, petalis linearibus sepalo dorsali æqualibus, labello obovato emarginato intus piloso infra apicem pulvinato.

Mergui, *Griffith*, no. 2, Aug. 17, 1834.

I only know this from a drawing by *Griffith*, who represents it as having whitish solitary flowers, with an obcordate-spathulate lip, hairy and speckled with red inside, and a tuft of longer hairs below the apex. The clinandrium is also shown to be 4-lobed. It is probably the same as one of *T. Lobb*'s plants distributed as coming from Borneo, but I suspect from Moulmein, of which

I have an imperfect specimen. In that plant the petals are acute, spatulate, and bordered with brown near the points, and the leaves are linear lanceolate, and much less hairy.

304. *E. LEIOPHYLLA*; caule ferrugineo tomentoso apice glabro diphylo vaginis 2 membranaceis oppositis in medio, foliis oblongo-lanceolatis glabris, spica brevissima uniflora (?) arcte tomentosa, bracteis truncatis, labello rhombeo carnosio glabro obtuso basi convexo.

Borneo; on trees, Sarawak, at the height of 2700 feet, *T. Lobb*.

My specimen is nearly glabrous except the inflorescence. The stem is terete, 2-leaved, with a long brown sheath at the base, and a pair of smaller opposite membranous ones in the middle. The lip seems to be deep crimson.

305. *E. annulata*, *Bl. Mus. Lugd.* ii. 184.

A unique specimen from Sikkim comes near this species; but the flowers are very old. The leaves are broad and hairy, and filled with large masses of calcareous concretions.

306. *E. ferruginea*, *Lindl. in Bot. Reg.* 1839, t. 35.

E. Bengal; Jyntea mountains, at the height of 4000 feet, *J. D. H.* (65); Khasija, *Griffith*.

307. *E. VULPINA* (*Rchb. f.*); molliter ferrugineo-villosa, foliis oblongo-lanceolatis papyraceis obsolete nervosis, spica multiflora recta lanata, bracteis ovatis recurvis, floribus distantibus mento rotundato, petalis linearibus brevioribus ciliatis, labello carnosio glabro laciniis lateralibus dentiformibus intermedia rotundata.

Philippines, *Cuming*.

This is the plant hastily referred to in the Botanical Register (1845, t. 2) under *E. vestita*; but a more careful examination shows it to be quite distinct in its straight, not flexuose rachis, ovate not acuminate bracts, round, not elongated chin, short ciliated, not long smooth petals, and in the whole superficies of the lip, which appears to want the hairs and lamellæ of *E. vestita*. I have not been able to observe the tubercle seen at the base of the limb by my learned friend *Rchb. f.*; but the lip is so fleshy and compressed when dry, that I may have missed it.

308. *E. CAPITELLATA*; caulibus ad insertionem foliorum juniorum ferrugineo-hirtis, foliis carnosis anguste lanceolatis acuminatis glabrisculis, spicis brevibus densifloris, sepalis lateralibus ovatis, labello concavo carnosio ovato apice decurvo sub lente tomentoso infra apicem convexo.

Java, *T. Lobb* (253).

Until I received a specimen of the real *E. annulata*, I mistook

this for it. There are, however, these differences: the leaves are twice as broad and much less acuminate; the spikes are so dense as to be almost ovate; the lateral sepals are not acuminate; the lip is more rounded at the point and without the raised median line, instead of which there is only a slight convexity above with a corresponding concavity below. The *linea verruculosa*, ascribed by Blume to his *E. annulata*, does not exist in Zollinger's no. 15 of his second collection, which I take for that species; but there is a distinct elevated even midrib, with a slightly raised line on either side.

§ X. CYLINDROLOBUS, *Blume, Fl. Jav. præf.* vi. (Ceratium, *Id. Bijdr.* 341.)

There is nothing in the structure of the plants of this section, as far as I am acquainted with them, that corresponds with the character proposed by Prof. Blume in his *Mus. Lugd. Bat.* ii. 182. Undoubtedly a protuberance at the foot of the column does sometimes occur, but it affords no sectional mark; for if it exists in *E. nutans*, it is not to be found in *E. Khasiana*, which is only distinguishable upon careful examination; and it is a mere rudiment in *E. bicolor*, another very closely allied species. The siliquose fruit is of as little importance. I think, however, that the section may be conveniently adopted for all the caulescent species whose flowers, whether lateral or terminal, are solitary or in pairs, and arise from among empty coloured bracts. Such is the principle upon which the following have been collected.

A. *Flowers terminal.*

309. *E. TRUNCATA*; foliis 3 lanceolatis terminalibus apice subæqualibus, floribus geminis ovario tomentoso, sepalis oblongis obtusis, petalis subæqualibus antrorsum arcuatis, labello carnoso truncato linea media tenui elevata infra apicem triplici.

Moulmein, on Shoung-gyen at the height of 5000 feet, *T. Lobb.*

"Flowers white." The lip has two small ovate lateral lobes; but the middle lobe is obsolete, appearing only in the form of a broad line lying between the side lobes.

310. *E. pauciflora*, *Wight. Ic.* t. 1636.

Khasija hills, *T. Lobb*; Nilgherries, *Wight.*

Wight's figure of this is unusually good. The withered reflexed sheath at the base of the last joint of the stem seems to be characteristic of the species.

311. *E. bicolor.* (*Dendrobium bicolor*, *Lindl. Gen. & Sp.* p. 90.)
Ceylon, *Thwaites* (2761).

I have been favoured by Mr. Thwaites with a sketch of this, showing it to be a true *Eria*. The pollen-masses were previously unknown to me. A re-examination of the old fragments in my herbarium has shown the lip to be much like that of *Eria pauciflora*, as represented in Wight's plate, but with a shorter middle lobe. There is a small orange-coloured process at the base of the column. The surface of the middle lobe of the lip is rather pulverulent.

312. *E. nutans*. *Lindl. Bot. Reg.* 1840, *misc.* 196.

Singapore, *Cuming in hort. Loddiges.*

In this plant there is a large tubercle on the foot of the column, which is very short.

313. *E. KHASIANA*; foliis binis (?) lanceolatis acutis, floribus geminis glabris, sepalis petalisque subæqualibus, labello obovato laciniis lateralibus membranaceis obtusis subfalcatis incurvis intermedia oblata carnosa lamella tomentosa in medio lineisque 2 truncatis secus axin pulverulentum, columnæ pede omnino nudo.

Khasija, *Griffith.*

Much like *E. nutans* and *pauciflora*, but entirely different in the form of the lip.

B. *Flowers lateral.*

314. *E. clavicaulis*, *Lindl. in Bot. Reg.* 1840, *misc.* 219.

Khasija, at 4000-5000 feet, *J. D. H. & T. T.* (9).

The specimens in hb. Hooker. are not in flower, so that some uncertainty attends this species. It approaches the last section in having the leaves at the end only of the stem; and the flowers are almost terminal.

315. *E. mucronata*, *Lindl. in Bot. Reg.* 1842, *misc.* 27.

Philippines, *Cuming.*

Blume's *E. elongata* seems to be near this; but in my plant the little tuft of hairs at the base of the lip cannot be called "tuberculum dilatatum dense glanduloso-fimbriatum." Among De Vriese's Sumatra drawings is a "*Dendrobium macranthum*," with large solitary white flowers, very short lower sepals, and violet spreading bracts, which may be this *Eria elongata*. What appears to be the same plant exists in the Hookerian herbarium, collected in Tobie Island by Barclay.

316. *E. brachystachya*, *Rchb. f. in Bonplandia.*

Philippines, *Cuming.*

In this, which is perhaps a variety of the last, there is a small truncated tubercle on the foot of the column.

317. *E. VALIDA*; foliis oblongo-lanceolatis coriaceis apice valde obliquis obtusis, pedunculis bifloris bracteis ovatis erectis papyraceis cucullatis, floribus glabris, sepalis lateralibus ovatis dorsali petalisque 3-nerviis oblongo-linearibus, labelli lobo intermedio oblongo rotundato margine papilloso lateralibus duplo brevioribus acutis sinibus rotundatis apertis, lineis tribus clavatis apice divergentibus infra isthmum.

Java, *T. Lobb* (205).

A stout erect plant, with a stem half an inch in diameter, and leaves 6 inches long. I can find no tubercle on the foot of the column; nor can I identify it with any of Blume's plants.

318. *E. APOROIDES*; foliis brevibus obtusis acinaciformibus equitantibus, pedunculis unifloris, bracteis linearibus obtusis carnosis, floribus glabris, sepalis petalisque ovatis obtusis, labello acute 3-lobo lobo intermedio majore carnosio.

Philippines, *Cuming*.

This has very much the appearance of the plant figured by Adolphe Brongniart as *Aporum incrassatum* (*Duperrey*, t. 42 B); but the lip is 3-lobed, not entire.

§ XI. UROSTACHYA.

The caulescent species with numerous leaves, and long racemes or panicles of flowers, without the woolly lip-appendages of § ERIBURA, form a natural group which may be conveniently placed apart from others. The flowers, with the exception of *E. bambusifolia*, are very small and densely arranged.

319. *E. floribunda*, *Lindl. in Bot. Reg.* 1844, t. 20.

Java, *hb. Junghuhn* (307); Mergui, *Griffith*.

Of this *E. leucostachya* of the Hort. Soc. Journ. III. xv. and xvi. is, as was then suggested, a mere variety.

320. *E. micrantha*, *Lindl. Gen. and Sp. Orch.* p. 68.

Java, *Lobb* (314).

The *Octomeria racemosa* of Kuhl and Hasselt seems, from a tracing sent me by Prof. Reichenbach, to be this plant, which is very like *E. floribunda*, but with smaller flowers, and with the lip-auricles perfectly lateral and not intralabellar.

321. *E. PACHYSTACHYA*; foliis oblongo-lanceolatis nervosis, spicis densissimis elongatis glabris, bracteis squamiformibus reflexis, floribus (minutis) tomentosis mento elongato incurvo, petalis glabris linearibus obtusis falcatis sepalis brevioribus, labello sessili oblongo acuto lævi.

Java, *Junghuhn* (298).

322. *E. RETROFLEXA*; foliis anguste oblongis spicis tenuibus duplo

longioribus, bracteis oblongis glabris retroflexis, floribus glabris, sepalis petalis labelloque subæqualibus ovatis acutis.

Philippines, *Cuming*.

The lateral sepals are very little oblique, and the lip is scarcely distinguishable except in being more fleshy; it is quite destitute of all superficial processes.

323. *E. BAMBUSIFOLIA*; foliis oblongis acuminatis nervosis paniculis terminalibus laxis tomentosissimis multifloris subæqualibus, sepalis ovatis obtusis tomentosissimis, petalis obovatis acutis, labello ovato plano glabro inappendiculato apice dilatato.

Khasija, *Griffith*; at 2000 feet, *Mr. Simons, in hb. Hooker.* (64).

I have no species very nearly allied to this, whose great leaves resembling a Bamboo, and loose tomentose terminal panicles as much as 10 inches long, are very peculiar.

PHREATIA, *Lindl. Gen. & Sp.* p. 63.

Prof. Reichenbach has detected the identity of *Plexaure*, *Endlicher*, with this well-marked genus. But he has referred it to *Eria*, to which I must withhold assent. The bifid somewhat cartilaginous rostellum, which led *Endlicher* to refer the genus to *Neottia*, appears to afford an absolute mark of distinction, especially when accompanied, as in this case, by a very peculiar and scarcely mistakeable habit. *Blume* refers *Phreatia elegans* to *Thelasis* (*Mus. Lugd. Bat.* ii. p. 187), for reasons which I am unable to appreciate. No two genera can be more wholly distinct. In *Hooker and Thomson's herbarium* one species only occurs; but a few may be added from other sources, in addition to those described by Prof. Reichenbach.

324. *Phreatia elegans*, *Lindl. l. c.* (*Thelasis elegans*, *Blume, Mus. Lugd.* ii. 187.)

Khasija, 4000 feet, *J. D. H. & T. T.* (93).

325. *PH. MYOSURUS*; foliis membranaceis late loratis planis apice obliquis cuspidatis basi equitantibus, spicis elongatis folio multo longioribus, floribus subverticillatis, bracteis fuscis acuminatis floribus longioribus, labello cuneato juxta apicem buplicato quasi trilobo. (*Eria* [*Phreatia*] *myosurus*, *Rchb. f. in Bonplandia*, March 1, 1857.)

Java, *Lobb* (166 in *hb. Hooker.*).

The largest of the genus except *A. Richard's* two "*Oberonias*," *gladiata* and *micrantha*, which Professor Reichenbach has pointed out to be *Phreatias*. *O. micrantha* especially seems very near this; but the bracts are represented as being much shorter than even the pedicels. Flowers very small, hardly longer than the cinnamon-brown bracts, and arranged in a somewhat verticillate

manner. The lip is so dilated and folded near the end as to seem to be 3-lobed.—Possibly A. Brongniart's *Oxyanthera micrantha* may be this; but if so, the inflorescence is taken from another plant, perhaps the *Thelasis*, which furnished his magnified dissections (as Prof. Reichenbach has pointed out to me in conversation). My learned friend's definition of his *Eria myosurus* appears to have been taken from an incomplete specimen, for which reason the above specific character is now proposed.

326. PH. MINUTIFLORA; foliis linearibus coriaceis recurvis equitantibus obtusis spicis tenuibus æqualibus, bracteis triangulo-setaceis, labello obovato concavo.

Borneo, *Lobb.*

Leaves about 2 inches long. Flowers the smallest in the genus, in an erect very slender spike. Bracts brown, setaceous, broad at the base.

327. PH. MICROTIDIS; foliis linearibus coriaceis equitantibus apice acutis recurvis spicis densis angulatis æqualibus, bracteis floribus brevioribus, labello orbiculari concavo basi pandurato.

Java, *Lobb.*

Much like a pigmy *Microtis*, the whole plant not exceeding 2 inches in height. Blume's *Dendrolirium pusillum*, formerly referred by me to *Phreatia* (Gen. & Sp. p. 64), seems to be rather an *Appendicula*, and can have nothing to do with the present species.

328. PH. TAHITENSIS; folio oblongo coriaceo plano oblique bilobo spicæ densæ multifloræ æquali, scapo trivaginato, mento oblongo obtuso, labelli acuti rhombeï longe unguiculati angulis lateralibus runcinatis, bracteis oblongis herbaceis acutis canaliculatis florum longitudine.

Tahiti, *Bidwill.*

Plant between 3 and 4 inches high, of which $1\frac{1}{2}$ inch is occupied by a dense spike whose flowers are the largest in the genus, measuring in their dried state nearly $\frac{1}{3}$ th of an inch in length. The lateral sepals are extended into a long blunt chin, which probably led M. Reichenbach to remark, that "here the genera *Phreatia* and *Eria* run together." But the cartilaginous bifid rostellum of the former genus is perhaps more strongly marked in this than in any other species.

THELASIS, *Blume.*

The extremely short characters assigned by Prof. Blume, both in his 'Bijdragen,' and in his recent 'Museum Lugd. Bat.,' to the species of this curious genus, render all attempts at identifying his plants almost hopeless—especially since, in the latter work,

he has referred to the genus so wholly different a plant as *Phreatia elegans*. The only species known at present on the continent of India itself, furnishes some addition to the perplexity that surrounds the genus.

329. *Th. pygmæa*. (*Euproboscis pygmæa*, Griffith, in *Calcutta Journal of Nat. Hist.* v. 372. t. 26; *Wight. Ic.* t. 1732, not 1733.)

Khasija hills, Griffith, Lobb; at 2000-4000 feet elevation, flowers white, *J. D. H.* & *T. T.* (29).

Griffith's figure of his *Euproboscis pygmæa*, in the *Calcutta Journal*, is sufficient for the identification of this plant, which seems to be common on the Khasija mountains. In that work the name *E. Griffithii*, quoted by Prof. Reichenbach (*Bonplandia*, Feb. 15, 1857), does not occur. Prof. Blume refers it to his *Th. capitata* which differs in having a "spica densa ovoidea deinde cylindrica," and an ovate obtuse lip, a description that in no way applies to this. Dr. Wight's figure is a good one, but from a small specimen whose flowers are in a state of Peloria. The name *pygmæa* is objectionable, for there are specimens before me as much as 8 inches high; it must however stand. A *Thelasis* from Hong Kong, sent by Dr. Hance (287), appears to be either this or *Th. triptera*; but my specimens are not good enough for positive determination.

330. *TH. OCHREATA*; folio coriaceo lorato obtuso canaliculato basi squama maxima laxa truncata stipato, scapo foliis duplo brevior vaginis maximis laxis truncatis baseos binis medii solitaria, spica densissima bracteis reflexis acutis amplexicaulibus duris concavis, ovario obovato, sepalis alte carinatis supremo galeato, labello ovato obtuso.

Borneo; low forests of Sarawak, *T. Lobb*.

I should have thought that this might have been Blume's *Th. capitata*, judging from his latest definition; but Prof. Reichenbach, who has carefully examined that plant, describes the leaves as cuneate and equally 2-lobed, and the sepals entirely without carinæ. The leaves are a foot long when full-grown.

I have two or three more species of the genus, but until some authentic evidence concerning Blume's plants reaches me, I cannot venture to name them.

A Note upon *PSEUDOCENTRUM*, a New Genus of *Orchidaceæ*.

By Prof. LINDLEY, F.R.S.

[Read March 4th, 1858.]

AMONG the numerous collections of Peruvian Orchids which have been communicated to me from time to time by my excellent corre-

spondent Professor Jameson, there is one possessing so very extraordinary a structure that it seems worthy of being brought separately under the notice of the Society, although nothing more is known of it than that it is a terrestrial plant from the valley of Lloa, a couple of spikes of flowers having alone reached me.

These spikes are dense, erect, cylindrical, 10 inches long, and very slightly coated with minute distant hairs. A thin lanceolate three-veined bract supports each flower, reaching beyond the summit of the ovary. The flowers themselves are not unlike, in general appearance, those of a minute *Aconitum lycoctonum*, being furnished with what seems at first sight to be a slender curved galea many times longer than the limb; but upon dissection this galea proves to consist of the two lateral sepals excessively produced at their base and forming a sheath, within which the labellum lies concealed. Thus far there is nothing in the structure to which a parallel may not be found elsewhere, as in *Dendrobium*, *Bifrenaria*, *Compartmentia*, and especially in *Pelexia*, a genus to which the plant before us is nearly allied. But when the labellum is examined, it is found to be extended within the fold of the lateral sepals, not in the form of a spur arising from its base, but in that of a long slender channeled body proceeding from its point, the base of the labellum being acutely hastate. In other words, the labellum is sessile, hastate, 3-lobed, with the middle lobe extremely long, linear, channeled, and directed upwards between the sepals which conceal it. In this manner the appearance of a spur is produced without recourse being had to the arrangement which occurs in every other genus of this large order, hitherto described; for which reason I propose the name *PSEUDOCENTRUM*, to which the following technical character may be added:—

PSEUDOCENTRUM (Genus *Neottiarum* *Pelexiæ* affine). *Herba* terrestris; *Spica* elongata, densa, striata, cylindræa. *Ovarium* rectum. *Sepalum* anticum parvum, lanceolatum, patens; lateralia dorsalia, multo majora, triangularia, basi in canalem longum ascendentem arcuatum obtusum producta. *Petalata* lineari-lanceolata, apice recurva, sepalo antico breviora. *Labellum* membranaceum, sessile, trilobum; lobis lateralibus acutis hastam referentibus, intermedio lineari, canaliculato, intra canalem sepalinum incluso eique æquali. *Columna* nana, semiteres; stigmatate depresso marginato, rostello acuminato. *Anthera* dorsalis apiculata, bilocularis (?); *pollinia* 4, pulveræa, lateralia majora glandula parva oblonga.

Sp. 1. *Pseudocentrum macrostachyum*. Peru, Jameson.

of 3 papers
2 volumes

NOTICE. 1.49 2 4 1895

It is proposed to issue four numbers annually, as nearly as possible at definite intervals, containing Papers on Natural History read before the Society, and not inserted in its "Transactions." The Zoological and Botanical Papers will be separately paged, so that either section may be taken separately.

The "Journal of the Proceedings" for the present year will be sold to the Public at 12s. for the entire Journal, or 8s. for either the Zoological or Botanical section taken separately; the separate numbers being charged 3s. for the whole, or 2s. for either section.

The number and importance of the Botanical Papers read before the Society have induced the Council to determine on the publication of Supplemental Botanical Numbers during the present year. These will be charged separately to the Public, and will commence with an "Enumeration of the Mosses of the East Indies," by WILLIAM MITTEN, Esq., A.L.S.

The "Journal of the Proceedings," together with the "Supplement," are sent free of charge to Fellows of the Society.