Fourth Volume of the Calcutta Journal of Natural History.

DEDICATED TO

PROFESSOR VON MARTIUS.

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PREFACE TO THE FOURTH VOLUME.

It is due to the liberal supporters of the *Calcutta Journal of Natural History*, to acknowledge the kind indulgence with which the work has hitherto been received by them; the more so, as the nature of the subjects treated of in its pages too frequently requires a dry technical phraseology, which is never very inviting to the generality of readers. Fortunately, the supporters of this work are many of them distinguished in the pursuits of which it treats, and all of them more or less eminent as enlightened patrons and friends of the improvements of India. Those who take a just view of this important matter, must be well aware, how much it depends upon a knowledge of the productions of the country.

They must be aware, how much the improvement of roads depends upon the nearest sources of stone-quarries, forests of suitable timber trees, the nature of iron ores in various quarters, and the means of making them available.

They must know, how essential a proper knowledge of the plants of a country is to the improvement of particular objects of cultivation.

In fact, there is no great object of internal improvement that can be undertaken, either by public or private enterprize in India, to which a scientific knowledge of the productions of the country is not more or less essential; and many lacs of rupees have been from time to time thrown away in fruitless experiments, which have failed only for want of that description of information, which it is the object of the *Calcutta Journal of Natural History* to elicit. Several instances of this kind have occurred within the last few years, and will continue still to occur until we gradually become better acquainted with the natural products of the country, and the means by which they may be improved. In future, it will be the aim of the Editors to the utmost of their power, to render the work as generally interesting as possible, consistent with its object. It is also their intention to improve the illustrations, so that the nature and peculiarities of every species or at least genus described, may be exhibited by means of drawings.

The present volume will be found to contain a greater number of original drawings than any Journal of the kind in India ever before attempted to furnish. This has been attended with considerable increase of expence, but not more than the liberal support the work has met with seems to justify, and it is hoped, the future year will work still greater improvements, particularly in the style of the lithographs.

Calcutta, January, 1844.

General Index.

Fig. 1. *Melastoma Malabathrica.*

a. The calyx.

b. The flower.

c. The same laid open, to show the stamina.

d. A longitudinal section of the unexpanded flower, showing the manner in which the anthers are lodged in cells between the calyx and ovary.

e. A transverse section of the same, showing the septa by which the calyx is connected with the ovary.

f. The fruit.

g. A transverse section of the same.

All of the natural size.

Fig. 2. *Melastoma exigua.*

a. The calyx.

b. The flower.

c. The same cut open, to show the stamina.

d. Two stamina magnified.

e. The fruit.

f. A transverse section of the same.

Fig. 3. *Melastoma alpestris.*

a. The flower.

b. The same cut open, showing the stamina.

c. The fruit.

d. A transverse section of the same.

All of the natural size.

Fig. 1. *Cyrtandra macrophylla.*

a. The calyx.

b. The flower.

c. The corolla cut open, showing the stamina.

d. A fertile stamen separate.

e. The pistil with its nectarial ring.

f. The fruit.

g. A transverse section of the same.

All these are of the natural size.

Fig. 2. *Didymocarpus crinita.*

a. The calyx.

b. The flower.

c. The corolla cut open, showing the stamina.

d. A fertile stamen.

e. The pistil with its nectarial ring.

f. A transverse section of the capsule.

g. The capsule.

All these are of the natural size.

h. A transverse section of the capsule magnified.

i. One of the dissepiments with its revolute lobes, showing the manner in which the seeds are inserted in their margin, magnified.

Fig. 3. *Æschinanthus volubilis.*

a. The calyx.

b. The flower.

c. The corolla laid open.

d. The pistil.

e. The corolla seen sideways.

f. A transverse section of the capsule.

g. One of the revolute lobes of the septum, showing the seeds attached to its inner surface.

h. A seed, aristate at both ends.

i. The capsule.

Fig. 1. *Lansium domesticum.*

a. The flower.

b. The same in front.

c. The stamineous tube.

d. The same laid open and expanded.

e. The ovary.

f. A section of the same.

g. The fruit.

h. Transverse section of the same.

i. A double seed.

k. The same separated, showing the four cotyledons and two radicles.

Fig. 1. *l.* A single seed.

m. The cotyledons separated.

Fig. 2. *Leuconotis anceps.*

a. The flower.

b. The corolla laid open.

c. The ovary and style.

d. Transverse section of the same.

e. The fruit.

f. Transverse section of a fruit containing three seeds.

g. Ditto containing a single seed.

h. A seed.

i. The cotyledon externally.

k. The same internally with the radicle.

Fig. 3. *Helospora flavescens.*

a. The flower.

b. The corolla laid open.

c. An anther enlarged.

d. The pistil.

e. The fruit; a tran verse section.

f. A seed.

INDEX TO THE REPRINT OF Dr. JACK'S BOTANICAL WRITINGS.

* Attached to the generic name signifies, that it was first pointed out by Mr. Jack

† That it has been superseded by a prior (?) name.

INDEX TO ROXBURGH'S CRYPTOGAMOUS PLANTS.

ERRATA.

The reader is requested to substitute the following explanations of the Plates, for those given in No. 15, pp. 378, 379. The explanation of the Plate of "Didymoplexis," page 383, then omitted, is likewise added.

Agrostophyllum Khasiyanum.

1. Stem of a Plant about the natural size.
2. One of the peduncles bearing two flowers.
3. Flower viewed posticously.
4. Front view of column.
5. Apex of the same, anther-case removed.
6. Lateral view of column, anthers removed.
7. Front view of the same.
8. Long section of the column.

All but fig. 1 more or less magnified.

Appendicula Lewisii.

1. Stem of a plant, natural size.
2. Flower, lateral view.
3. The same, one lateral sepal removed.
4. Back view of column.
5. Lateral view of the same.
6. Anthers underface—pollen masses partly disclosed.
7. Pollen masses and gland.
8. Lateral view of column. Anthers removed. Gland remaining in situ.
9. Back view of column. Anther pollen masses and gland removed.
10. Front view of the same.

Didymoplexis pallens.

1. Plant, natural size.
2. Lateral view of flower.
3. Front ditto.
4. Lateral view of column and labellum.
5. Lateral view of column.
6. Apex of column in front.
7. Anthers under face.

LIST OF PLATES IN THE FOURTH VOLUME.

* Erratum; line 1, page 372, for Plate xiv, read Plate xi.

THE

CALCUTTA JOURNAL

OF

NATURAL HISTORY.

Descriptions of Malayan Plants. By WILLIAM JACK. *Arranged according to their Natural Families from the Malayan Miscellany, etc.*

In this reprint, Botanists are presented with the whole of the Botanical writings of Mr. Wm. Jack, late of the Bengal Medical Service.

A connected reprint of some sort appears necessary from the excellence of the matter, the rarity of the Malayan Miscellanies, in which the greater part appeared, and the very inconvenient subdivision of those parts reprinted by Sir Wm. Hooker, rendering it necessary to purchase the Companion to the Botanical Magazine, the Botanical Miscellany and Journal of Botany, works of no small expense, and otherwise not essential to a private library.

The sources of the reprints are as follows:—

1. Malayan Miscellanies, vols. 1 and 2.
2. Roxburgh's Flora Indica, ed. Carey.
3. Linnean Transactions, vol. 14.
4. Companion to the Botanical Magazine, vol. 1, being the only work in which we have met with the Third Memoir.

We have made no use of the notes of Dr. Wallich, appended to some of the Plants, either in Manuscript in the public copy of the Malayan

Miscellanies, or in the reprints by Sir Wm. Hooker ; being of opinion, that no benefit whatever accrues to science from merely saying this species is distinct from that, without expressing in what the differences consist.

In the Companion to the Botanical Magazine, an account of Mr. Jack's life is to be found, and of the estimation in which he was held by his friends, who obtained leave to erect a monument to his memory in the Botanic Garden of Calcutta ; but which, somehow or other, was never carried into effect.

As it can never be too late to supply an omission of this nature, we would suggest, that the proposal even now be carried into effect, and a small cenotaph, which might be made an appropriate ornament to the Garden, be erected to his memory, as in the case of Dr. Roxburgh.

To the writings of Mr. Jack, a few notes in italics have been added, chiefly with reference to new habitats of some of his Plants, or the "Locus Naturalis" of some of the anomalous genera.

To us Mr. Jack appears to have been a botanist of the highest promise ; his descriptions are autographs of the Plants. Twenty-two years ago, he shewed a great knowledge of the Natural System, then not much in vogue among Englishmen, and great precision in ascertaining what was known, from what was unknown. Had his Manuscripts and Collections not been burnt at sea with the vessel, on which they were embarked under charge of Sir S. Raffles, it is probable that his successors could not have congratulated themselves on the considerable additions of undescribed species, which have since swelled the list of Indian Plants, and which that accident left them in possession of, to the sad disadvantage of the memory of Dr. Jack, whose life fell a sacrifice to his scientific exertions, a short time before the destruction of his collections and manuscripts, from the cause above adverted to. Mr. Jack was a native of Aberdeen, where his father is still the Principal of one of the Colleges of that place. In addition, therefore, to his high botanical genius and industry, he had also the claim of a British subject, (not always in the case of scientific pretensions, a recommendation,) on the patronage of the Government of India; although he never attained a more suitable place than that of Surgeon to Sir S. Raffles.

I. SCITAMINEÆ.

ZINGIBER GRACILE. *(W. J.)*

Monandria Monogynia.

N. O. Scitamineæ.

Foliis glabris, scapis erectis, spicis cylindricis gracilibus coloratis, bracteis ovatis acutis, corollæ labio trilobo, lobo medio bifido.

Native of Pulo Pinang.

Stem erect, somewhat recurved, round and smooth. Leaves alternate, subsessile on their sheaths, broad lanceolate, 6 or 7 inches long, acuminate, very entire, very smooth, shining above. Sheaths smooth, with a long scariose ligula often lacerated on the edge. Scapes erect, a foot high, invested with alternate sheaths. Spikes cylindrical, oblong, imbricated with bright red, ovate, acute bracts shorter than the flowers. An inner bract or involucre surrounds the base of each flower. Calyx shorter by one-half than the corolla, membranaceous, curved, cleft on one side. Corolla yellowish white; exterior limb three parted, longer than the inner one; laciniæ acuminate, the upper one longer and incumbent; interior limb unilabiate, lip three lobed, middle lobe bifid, with reflexed margins. Anther terminating in an incurved horn. Ovarium three-celled, many-seeded. Style filiform, longer than the horn of the anther, embraced at the base by two linear corpuscules.

AMOMUM BIFLORUM. *(W. J.)*

Monandria Monogynia.

N. O. Scitamineæ.

Foliis lato-lanceolatis glaberrimis, caule ancipite, spicis bifloris.

Native of Pulo Pinang.

A slender delicate species: stem erect, somewhat recurved, three feet in height, compressed, double edged. Leaves alternate, bifarious, short petioled upon their sheaths, broad lanceolate, acuminate, narrow at the base, entire, very smooth, the middle nerve somewhat pubescent. Sheaths striated, slightly tomentose, with a short round ciliate ligula. The base of the leaf-bearing stem is swelled into a tuber, which throws out horizontal shoots of some feet in length, of the thickness of a quill, and invested with membranous sheaths. These shoots which run under ground send up from their joints a number of biflorous peduncles or scapes, which are enveloped in bracteal sheaths. Flowers generally two, the one appearing after the other. At the base of each flower is a single lanceolate acute reddish bract; besides this, there is a tubular bract or involucrum surrounding the base of the germen, membranaceous, half as long as the calyx, and deeply cleft on one side. Calyx superior, tubular, 2 or 3 cleft. Corolla white, tubular, upper part of the tube villous within; exterior limb membranaceous, 3 parted, segments nearly equal; interior limb unilabiate, lip broader above, rounded, thickened and yellow in the middle. Filament of the stamen broad, incumbent. Anther short, thick, two-lobed, crowned with an erect three-lobed crest. Style filiform; stigma infundibuliform. Nectaries two, linear, at the base of the style. Ovarium 3-celled, many-seeded.

ALPINIA ELATIOR. *(W. J.)*

N. O. Scitamineæ.

Scapis radicalibus elatis, spicis ovatis, corollae labio integro basi mutico, foliis basi subcordatis glabris.

Bunga Kenchong. *Malay.*

Found on Pulo Nias, also at Ayer Bangy on the west coast of Sumatra. *Cultivated at Malacca.*

The stems are from five to eight feet high, round, somewhat compressed, smooth, striated. *Leaves* alternate, bifarious, petiolate on their sheaths, ovate-oblong, broad, subcordate at the base, acuminate, very smooth on both sides, polished above, straited with fine parallel nerves; from one to two feet long. *Ligula* of the sheaths rounded. *Scapes,* rising at a little distance from the stems, two or three feet high, erect, round, smooth, invested by sheaths which are rounded at their points and mucronate below the apex. *Spikes* short, thick, ovate, compact, densely covered with flowers. The lower bracts are of a fine rosy colour, large and spreading so as to form a kind of involucre to the head; the upper bracts are shorter, imbricated, oblong or tongue-shaped, rosy with white ciliate edges, each supporting a single flower. The involucel or inner bract which embraces the ovary is tubular and irregularly bifid, being cloven more deeply on one side than the other. *Calyx* reddish, deeply cloven on one side, by which the three regular segments become secund. *Corolla,* outer limb three parted, segments nearly equal, erect, the upper one rather the largest; inner limb unilabiate, longer than the outer, lip ascending, involving the anther, deep purplish red with yellow edge, rhomboid-ovate, entire, somewhat crisped at the point, without spurs or sterile filaments at the base. *Stamen* shorter than the lip; anther naked. *Style* as long as the anther. *Stigma* thick, triangular, anteriorly concave. *Ovary* sericeously pilose, three-celled, many-seeded.

Obs.—This is a very remarkable species, easily distinguished from the other Alpiniae with radical inflorescence by the great height of the scapes, and the fine rosy colour of the lower bracts.

ALPINIA CAPITELLATA. *(W. J.)*

Foliis longe petiolatis supra glabris, racemo terminali composito, capitulis florum bracteis involucratis.

In the interior of Bencoolen. *Malacca.*

Stems four or five fiect high. *Leaves* alternate, bifarious, long petioled on their sheaths, broad-lanceolate, fine pointed, entire, parallel veined, smooth above, slightly tomentose beneath. *Sheaths* villous near the top, terminating above the petioles in a long ciliate ligula. *Raceme* terminal, compound, inclining, red. *Flowers* in heads which are embraced by large round bracts. *Calyx* tubular, three-cornered, nearly entire. *Corolla,* outer limb three-parted, the upper segment fornicate; the inner limb unilabiate, of one large colored segment. *Stamen* one; anther two-lobed, naked. *Ovary* tomentose, three-celled. *Style* slender. *Stigma* concave.

Obs.—The peculiar manner in which the involucral bracts embrace the capitulate flowers and subdivisions of the panicle, forms a good distinctive character. The whole inflorescence is stiff and rigid, and wants that copiousness and richness which marks the greater part of this splendid genus.

HEDYCHIUM SUMATRANUM. *(W. J.)*

N. O. Scitamineae.

Spica imbricata nutante, corollae labio bifido, laciniis oblongis divergentibus.

Gandasuli Utan. *Malay.*

From Salumah on the west coast of Sumatra.

Stem erect. *Leaves* alternate, short petioled on their sheaths, lanceolate, very entire, very smooth, parallel veined; above a foot in length. *Sheaths* smooth, prolonged into a very long ligula. *Spike* terminal, nodding, short, dense, strobiliform. *Bracts* lanceolate, as long as the calyx; within this the ovary is embraced by a tubular bract about half the length of the other. *Flowers* numerous. *Calyx* superior, tubular, oblique at the mouth. *Corolla* long, outer limb three parted, with long narrow segments; two segments of the interior limb much shorter and broader; the third segment or lip, which is united to the filament, bifid, the divisions narrow and diverging. *Filament* very long, embracing the style. *Anther* recurved, naked. *Style* length of the stamen. *Stigma* thick. *Ovary* pilose, three-celled, several-seeded. Nectarial bodies oblong.

Obs.—This is a handsome species, and though its flowers are not so large and shewy as those of the H. coronarium, this is in some degree compensated by the greater number which expand at one time. It is the first wild species I have met with in the Eastern islands.

GLOBBA CILIATA. *(W. J.)*

Foliis ovato-lanceolatis nervis supra pilosis, panicula terminali erecta, anthera bicalcarata.

Puar Amas. *Malay.*

Stem slender, erect, from one to two feet high, somewhat compressed, spotted towards the base with purple. *Leaves* alternate, bifarious, subsessile on their sheaths, ovate-lanceolate, rounded at the base, acuminate, entire, the upper surface furnished with erect hairs disposed in lines along the principal nerves, lower surface smooth, dotted under the lens with minute papillæ; about four inches long. *Sheaths* striated, smooth, ciliate, along the margins, extending very little beyond the petioles, and there bifid. *Panicle* terminal, nearly erect, with alternate, divaricate, somewhat rigid branches, on which are disposed alternately several subsessile, yellow flowers. *Bracts* lanceolate. *Calyx* trifid. *Corolla* orange yellow, two bordered, the exterior three parted, of which the upper segment is largest and concave; the inner consisting of two smaller segments alternating with the outer ones: Lip elevated on the lower part of the filament and reflexed, emarginate, with a purple spot in the centre. *Filament* long, tubular. *Anther* with two subulate recurved horns or spurs. *Style* simple. *Nectarial* bodies long and linear. *Ovary* containing several ovula.

Obs.—It is a small delicate species, growing in moist hollows on the sides of the hills and among the forests in most parts of Sumatra. The ciliary lines of hairs on the upper surface of the leaves distinguish it from most of its congeners.

II. HYPOXIDEÆ.

CURCULIGO SUMATRANA. *Roxb.*

Hexandria Monogynia.

Foliis lato-lanceolatis plicatis glabris, spicis densis brevibus, tubo perianthii bacca longiore.

Involucrum. *Rumph. Amb. vi. p.* 114. *t.* 53.

Kalapa puyu. *Malay.*

Sumatra and Pulo Pinang.

Root composed of fibres proceeding from a tuber. Leaves radical, petiolate, ovate-lanceolate, acuminate, attenuated to the base, plicato-nervose, very entire, smooth. Petioles erect, channeled above, keeled beneath, sheathing at the base. Spikes radical from among the sheaths of the petioles, erect, dense, much shorter than the petioles. Flowers erect, sessile, adpressed to the rachis, each furnished with an ovate, acuminate, membranaceous spathe. Calyx none. Corolla yellow, superior, limb spreading six parted, laciniæ lanceolate acute, tube impervious, being a thick solid column on the summit of the germen. Stamina six, erect, opposite to the laciniæ of the corolla. Anthers linear. Style short. Ovarium 3-celled, many-seeded. Capsule baccate, ovate, three-sided, containing from 8 to 10 ovate black seeds which are imbedded in pulp.

I found at Singapore another species agreeing in most respects with this, but having hirsute leaves.

III. MELANTHACEÆ.

VERATRUM? MALAYANUM. *(W. J.)*

Foliis radicalibus lanceolatis, scapis erectis verticillato-paniculatis, baccis trilocularibus.

Native of Pulo Pinang.

An erect herbaceous plant. *Leaves* radical, three or four feet in length, petiolate, lanceolate, acuminate, attenuated into a petiole at the base, very entire, tomentose, striated with parallel nerves which run nearly longitudinally, but diverge from a central one. *Petioles* canaliculate, obtusely carinate, sheathing at the base. *Scape* erect, round, tomentose, verticillately panicled. *Peduncles* alternately semiverticillate, divaricate and spreading. *Flowers* sessile, on hermaphrodite or male plants fascicled, on female solitary. Beneath each semiverticil is a large floral leaf, which is ovate, acute, and contracted at the base into a flat, straight, petiole-like unguis which embraces the stem. *Perianth* six-parted, the three inner laciniæ petaliform, white, spreading. *Stamina* 6; filaments flat, dilated at the base. *Styles* three, short. *Stigmata* three.

In the female the calyx embraces a globular berry, which is three-celled, each cell one-seeded.

Obs.—The true place of this plant is somewhat ambiguous, and I am doubtful whether it can be admitted as a genuine species of Veratrum. It does not however agree exactly with any other genus of the same family; in habit it is somewhat like Alisma.

IV. TACCEÆ.

TACCA CRISTATA. *(W. J.)*

Foliis indivisis lato-lanceolatis, involucro diphyllo, umbella secunda cernua superne intra involucrum foliolis duobus involucro duplo longioribus stipata.

Native of Singapore and Pulo Pinang.

Root thick and tuberous, sending out a number of fibres. *Leaves* nearly two feet long, numerous, radical, erect, petiolate, ovate-lanceolate, acute, entire, smooth. *Petioles* sheathing at the base. *Scape* erect, round, nearly as long as the leaves, striated, smooth. *Flowers* peduncled, all drooping to one side; peduncles subumbellate, arranged transversely in two parallel rows, and uniting into a kind of crest, from which proceed ten long pendulous filaments. *Involucre* two-leaved, leaflets ovate, acute, broad at the base, nervose, purplish, twice as long as the peduncles, the upper one erect, the lower reflexed, and bent down by the drooping flowers. From within the upper leaflet of the involucre spring two erect folioles, which are twice as long as the involucre, obovate, attenuated below into straight, flat, deep purple petiolar ungues, acute at the apex, pale coloured with purplish nerves. *Perianth* superior, of a dark purple colour, campanulate and somewhat ventricose, rather contracted and three-cornered at the mouth where it is also striated, limb six-parted, somewhat reflex, laciniæ hyaline oblong, broad, obtuse, the three interior ones larger. *Corolla* none. *Stamina* six, in the bottom of the perianth and opposite to the laciniæ. *Filaments* broad at the base, arching upwards into a vaulted cucullus within which the anthers are concealed. *Anthers* adnate, two-lobed. *Style* thick, shorter than the stamina, with six prominent angles. *Stigma* flat, umbilicate, orbicular, six-rayed, three-alternate sinuses deeper. *Berry* ovate, six-angled one-celled, seeds numerous, attached to three parietal receptacles.

Obs.—This approaches to T. integrifolia, *Curt. Mag: t.* 1488, but it is a much larger plant, and is abundantly distinguished by the two-leaved involucre, the long erect leaflets within it, and the flowers drooping to one side.

V. AROIDEÆ.

CALLA ANGUSTIFOLIA. (*W. J.*)

Acaulis, foliis lanceolatis utrinque acutis glabris, pedunculis 4—5 ex axillis foliorum petiolis brevioribus.

Pulo Pinang.

A small plant of the same size and nearly related to the succeeding. Leaves radical, petiolate, lanceolate, acute at both ends, entire, smooth. Petioles sheathing at the base. Peduncles 4—5 axillary, one-flowered. Flowers, &c. exactly as in the succeeding.

These two are so closely allied, that it is doubtful whether they might not be considered varieties.

CALLA HUMILIS. (*W. J.*)

Monoecia Monandria.

Acaulis, foliis ellipticis supra glabris, pedunculis 4—5 ex axillis foliorum petiolis brevioribus.

Kladee Ayer. *Malay.*

Pulo Pinang, &c.

A small stemless plant growing under the shade of forests, 5 or 6 inches in height. Root a leaf bearing tuber which sends out numerous long villous fibres. Stem none except the above mentioned tuber, which is every where invested by the sheathes of the petioles. Leaves erect, petiolate, elliptic, ovate, rather obtuse with a subulate acumen, slightly cordate at the base, entire with a pellucid crisped margin, smooth and green above, somewhat hoary beneath with villous papillæ. Petioles shorter than the leaves, channeled above, sheathing, and dilated into a waved margin at the base. The bases of the sheathes are often perforated by the fibres of the root. Peduncles 4—5 axillary, one-flowered, shorter than the petioles, furnished with membranous sheaths at the base. Spathes of an obscure red colour, oblong, convolute-acuminate, as long as the spadix. Spadix cylindrical, entirely covered with florets, male above, and female below for about a quarter of the length. Anthers numerous subrotund, yellow, sessile. Germina ovate. Styles very short. Stigmata obtuse, peltate. A few anthers are intermingled with the pistilla. Capsules membranaceous, globose, somewhat 4-lobed, (two-celled ?) generally 8-seeded. Seeds somewhat kidney-shaped, arranged round the axis.

CALLA NITIDA. *(W. J.)*

Foliis ovato-lanceolatis acuminatis, scapis compressis foliis brevioribus, baccis monospermis.

Found at Pulo Pinang.

This is a large subcaulescent species; the leaves are from a foot to a foot and a half in length, ovate-lanceolate, acuminate, very entire, very smooth, with numerous parallel nerves preceding from a middle rib. Petioles sheathing nearly their whole length. Scapes compressed, smooth, shorter than the leaves. Spadix invested by the spathe, covered with florets, male above, female beneath. Berries oblong large, one-seeded.

VI. PALMÆ.

ARECA TIGILLARIA. *(W. J.)*

Frondibus pinnatis, foliolis acutis, spadicibus ramosis, flora unico femineo inter duos masculos, fructibus globosis.

Nibong. *Malay.*

Abundant in Sumatra and the Malay islands, where it is much used in the construction of houses, &c.

Trunk erect, generally thicker than that of the common Pinang *(Areca Catechu)*, armed, particularly on the lower part with straight slender flattened spines. *Fronds* pinnate, leaflets linear, acuminate, reflexed at the edges so as to make the upper surface convex, smooth, with a few brownish scales on the middle nerve of the younger ones; they diminish in size to the top of the frond, and the last two are partly united at their base. *Stipes* of the frond scaly while young, compressed, grooved above, the sheaths armed like the trunk. *Spadix* within the sheath of the frond, embracing the stem, flattened at the base, much branched; flower bearing branchlets about two feet long, drooping, the lower ones 3—4 together, the uppermost solitary or in pairs. *Spathe* single, completely enclosing the spadix before expansion, compressed, two-edged, deciduous, partial spathes none. *Flowers* sessile, one female between two males; the latter considerably the largest and deciduous. *Male hermaphrodite*, Perianth 6-parted, the outer leaflets small, the inner much longer, and acuminated with fine points. *Stamina* 6; anthers sagittate. *Ovary* small, surmounted by three linear styles. *Female*, Perianth 6-parted; leaflets nearly equal, rounder and shorter than those of the male. *Stamina* none. *Ovary* monosporous. *Styles* none. *Stigmata* three. *Fruit* globose, about the size of a carabine bullet, of a deep purple colour when ripe, with a glaucous tint, containing under a reddish pulp a single smooth globular nut. *Nut* one-seeded, having a thickened whitish scar on the side, and a small areola at the base opposite to the embryo. *Seed* solid; albumen ruminated; embryo basilar, short cylindrical, obtuse.

Obs.—This differs from the common Areca in the disposition of the flowers on the spadices, and in having the nut contained under a pulpy and not a fibrous covering. In *A. Catechu*, the ovary is likewise monosporous.

SAGUS LÆVIS.

Hexandria Monogynia.

Frondibus inermibus pinnatis, spadicibus alterne ramosis, floribus singulæ squamæ binis hermaphroditis, fructibus subglobosis.

Sagus lævis, No. 4. *Rumph. Amb. I. p.* 76.

Rambiya, *Malay.*

This valuable *Tree* rises to the height of about twenty feet, and is generally surrounded by numerous smaller and younger plants which spring up around it after the manner of the Plantain (*Musa sapientum*). The *stem*, which is about as thick as that of the Cocoa-nut tree, is annulated by the vestiges of the fallen leaves, and the upper part is commonly invested with their withered sheaths. The *leaves* resemble those of the Cocoa, but grow more erect, and are much more persistent, so that the foliage has not the same tufted appearance, but has more of the graceful ascending curve of that of the *Saguerus Rumphii:* they are pinnate, unarmed; the leaflets linear, acute, carinate, and smooth. The tree is from fifteen to twenty years in coming to maturity, the fructification then appears, and it soon after decays and dies. The *inflorescence* is terminal; several *spadices* rise from the summit of the stem, inveloped in sheaths at their joints, and alternately branched. It is on these branches that the *flowers* and *fruit* are produced, and they are generally from five to eight inches in length. They are of a brown colour, and closely imbricated with broad scariose scales, within which is a quantity of dense ferruginous wool, in which the minute flowers are imbedded and completely concealed. Each scale supports two *flowers*, which are hermaphrodite, and scarcely larger than a grain of turnip-seed. The *Perianth* is six-leaved, of which three are interior, the leaflets nearly equal. *Stamina* six; *filaments* very short; *anthers* oblong, two-celled. *Ovaria* three, connected together in the middle, each monosporous. *Style* none. *Stigma* small. *Fruit* single, nearly globular, somewhat depressed at the summit, but with a short, acute, mucro or point in the centre; it is covered with scales which are imbricated from the top to the bottom, and are shining, of a greenish straw-colour, of a rhomboidal shape, and with a longitudinal furrow down their middle. Below the scales, the rind is of a spongy consistence, and the fruit contains a single *seed*, of rather an irregular shape, and having the *umbilicus* situated laterally a little above the base of the fruit. The progress of the fruit to maturity is very slow, and is said, according to the best information I can obtain, to occupy about three years from the first appearing of the spadices to the final ripening of the fruit. During the period of inflorescence, the branches of the spadix are brown, and apparently quite bare. Afterwards a number of small green knobs appear above the brown scales, which go on enlarging, till they at length acquire the size of a small apple. But few fruit come to maturity on each branch.

In habit and character this tree recedes considerably from the true *Palmæ*. Its propagation by radical shoots, exactly in the same manner as the common cultivated Plantain, is peculiar, and is not observed in the true Palms. The terminal inflorescence and death of the tree after fructification, is another peculiarity. It is allied to *Calamus* by its retroversely imbricated fruit.

This species of Sago is abundant in many parts of Sumatra and at Malacca, and is employed in the preparation of Sago for food. Considerable quantities are made at the Poggy Islands lying off the west coast of Sumatra, where it in fact forms the principal food of the inhabitants. The Sago of Siak is remarkably fine, and is also, I believe, the produce of this species. At the Moluccas the spinous sort is considered superior to this, but I am doubtful whether it exists in Sumatra. For making the Sago, the tree must be cut before fructification commences, as it then becomes hard and dry. The process of making it has been so often described, that it is needless to repeat it here.

VII. RUBIACEÆ.

HELOSPORA.

H. FLAVESCENS.—*Linn: Trans:* XIV. 127.

Native of Sumatra. *Swampy places in the thickets along the shore of Pulo Bissar, Malacca.*

A small tree. *Leaves* opposite, short-petioled, ovate-lanceolate, acuminate, very smooth, entire, from three to five inches long. *Stipules* interpetiolar, deciduous, acute; a line of ciliary hairs within them. *Peduncles* axillary, solitary, one-flowered, shorter than the leaves. *Bracts* two, small, at the base of the ovary. *Calyx* superior, erect, four-toothed, persistent. *Corolla* yellow, tube much longer than the calyx; mouth naked; limb four-parted, spreading; segments oblong. *Æstivation* valvate. *Stamens* four, within the tube; *filaments* scarce any; *anthers* linear, obtuse, flattened, two-celled. *Ovary* subglobose, four-lobed, crowned by a nectarial ring or disk, polysporous, not divided into cells, but having the ovula implanted in its substance and arranged in double lines in the form of a cross. *Style* composed of four connate threads, which diverge at top, somewhat longer than the tube. *Stigmas* four. *Berry* globose, with four rounded angles and furrowed between, crowned with the calyx, many-seeded. *Seeds* long, linear, inserted perpendicularly, and cruciately arranged in four double lines corresponding to the angles or lobes of the fruit.

Obs.—The disposition of the seeds in this genus is very peculiar, and forms a good distinctive character.

RONDELETIA.

Pentandria Monogynia.

R. CORYMBOSA. *(W. J.)*

Tetrandra, pedunculis plerumque terminalibus dichotome corymbosis, floribus unilateralibus, foliis obovato-lanceolatis.

Native of Pulo Pinang.

Stem erect, shrubby, from 4 to 6 feet in height, with somewhat compressed villous branches. Leaves opposite, petiolate, obovate lanceolate, acute, attenuated to the potiole, entire, punctate above with callous dots, villous below. Petioles short, thickened at the base. Stipules interpetiolar, long, erect, tongue-shaped, obtuse, villous with a thick middle rib formed by the union of one from each axil. Peduncles terminal, and from the upper axils, supporting dichotomous corymbs composed of unilateral spikes. Flowers erect, sessile, disposed alternately in a double series. Calyx superior, 4-cleft, with short acute laciniæ. Corolla white tinged with red, funnel-shaped, much longer than the calyx, faux naked, limb erect, 4-parted, laciniæ subrotund. Stamina 4, inserted into the faux; filaments very short; anthers linear. Style filiform, exsert. Stigma bifid. Capsule crowned with the calyx, two-celled, many-seeded, with central placentæ.

O. HETEROPHYLLA. *(W. J.)*

Foliis oppositis subrotundo ovatis, altero nano.

Found in the interior of Bencoolen.

This species is readily distinguished by the peculiarity of one of the opposite leaves being always dwarf or abortive; the other is subrotund-ovate, with a bluntish acumen, smooth, pale and whitish beneath. The stem is erect and tomentose. *Flowers* in a small terminal cyme. *Capsule* compressed obcordate.

UROPHYLLUM.

Calyx sub-quinquefid. *Corolla* infunduliform, five-parted, with villous throat. *Stigma* five-lobed. *Berry* inferior, globular, five-celled, many-seeded—Jack's MSS.*

* This genus will be found in Roxburgh's Flora Indica, ed: Carey, vol. ii. p. 184. It as well as both species, bear the affix *Wall.* although

1. U. VILLOSUM, *(W. J.)*

Villous. Branches round. Calyx five cleft.

Pulo-Penang.

A shrub with round villous branches. *Leaves* opposite, petioled, oblong-lanceolate, about ten inches long, terminated by a very long linear acumen, entire, smooth above, villous beneath. *Petioles* short. *Stipules* interpetiolar, longer than the petioles, oblong, acute. *Peduncles* axillary, short, supporting a verticillate capitulum of subsessile flowers. *Bractes* numerous, lanceolate, acute; four longer ones forming a kind of involucrum beneath each verticil.—*Calyx* superior, short, campanulate, five-parted, with one or two smaller additional laciniæ. *Corolla* greenish, rather longer than the calyx, hirsute at the faux; *limb* five-parted; *laciniæ* ovate, acute, thickened at the points.—*Aestivation* valvate. *Stamina* five, shorter than the limb, and alternating with its laciniæ; *anthers* linear, acute, emarginate at the base.—*Style* erect, of the length of the stamina. *Stigma* thick, five-parted. *Ovarium* crowned with a white glandular disc, into which the style is inserted.—*Berry* ovate, villous, five-celled, polyspermous; *placenta* from the inner angle of the cells.—Jack's MSS.

2. U. GLABRUM, *(W. J.)*

Smooth. Branches tetragonal. Calyx sub-entire.

Pulo-Penang.

Malay. *Lodg-Utan.*

This species closely resembles the preceding, but is altogether more slender and smooth. *Branches* four-sided, somewhat dichotomous. *Leaves* opposite, on short petioles, oblong-elliptic, or lanceolate, about six inches in length,

the characters of both genus and species are by Dr. Jack. As Dr. Jack was bonafide the founder of the genus, and as he appears invariably to have attached his own initials to his genera and species, we have rectified the mistake, which has crept into the book above-mentioned.

terminating in a linear acumen not so long as in *U. villosum*, smooth on both sides. *Stipules* long, linear, villous. *Capitula* axillary on short peduncles. *Flower* pedicelled. *Bractes* small, linear, without any appearance of an involucrum.—*Calyx* forming an almost entire margin above the ovarium, which is crowned with a glandular disc. *Berries* globose, smooth.—Jack's MSS.

MORINDA.

N. O. Rubiaceæ.

MORINDA TETRANDRA.

Tetrandra, pedunculis umbellatis terminalibus, corollis quadrifidis intus hirsutis, foliis lanceolatis.

Pada vara. *Rheed. Mal.* 7, p. 51. *t.* 27.

Mangkudu kicheel. *Malay.*

Native of the Malay Islands.

A small diffuse shrub, with long slender branches, nodose at the bifurcations. *Leaves* opposite, short petioled, lanceolate, acuminate, very entire, very smooth, the nerves reddish below, and furnished with ciliated glands in the axils. *Stipules* interpetiolar, truncate. *Peduncles* from five to ten, umbellate, terminal. *Flowers* aggregate on a common receptacle. *Calyx* an entire margin crowning the ovary. *Corolla* infundibuliform, four-parted, the laciniæ densely covered within with long white hairs. *Stamina* four, shorter than the corolla, and alternating with its divisions; filaments very short; anthers oblong. *Ovary* inferior, two-celled, four-seeded. *Stigma* bifid. *Fruit* subglobose, yellow, composed of coadunate berries, angular by their mutual compression, crowned with the vestige of the calyx, four-seeded; seeds osseous.

Obs.—Rheed describes his Padavara to be fourteen feet in height; this is the only particular in which it differs from my plant. In every other respect they agree exactly.

MORINDA POLYSPERMA. (*W. J.*)

Tetrandra, pedunculis axillaribus et terminalibus, corollis quadrifidis intus hirsutis, foliis ovatis acuminatis, baccis bilocularibus polyspermis!

Found on the Island of Singapore.

A shrub with short subdichotomous flexuose branches. *Leaves* opposite, petiolate, ovate, acuminate, obtuse at the base, very entire, very smooth, coriaceous, flat, about three inches long. *Stipules* short, interpetiolar. *Peduncles* axillary and terminal; axillary ones opposite; terminal ones from one to four in a kind of umbel. *Capitula* few flowered. *Calyx* an entire margin. *Corolla* infundibuliform, four-parted, densely covered within with white hairs. *Stamina* four, shorter than the corolla; filaments short; anthers linear. *Style* erect. *Stigma* bifid. *Berries* coadunate, two-celled, many-seeded! Seeds numerous angular.

Obs.—The flowers of this species are perfectly similar to those of the preceding, but the fruit presents a singular anomaly in being polyspermous. Both differ so much from the other species of Morinda that I think they might properly constitute a new and distinct genus.

MYRMECODIA.

Tetrandria Monogynia. N. O. Rubiaceæ.

Calyx subinteger. *Corolla* quadrifida, tubo intus ad insertionem staminum piloso. *Stamina* quatuor, corolla breviora. *Stylus* staminibus longior. *Stigma* simplex. *Bacca* ovata, quadrilocularis, tetrasperma.

Parasitica basi tuberosa, flores basibus petiolorum semitecti.

MYRMECODIA TUBEROSA. (*W. J.*)

Lin. Trans. XIV. 123.

Nidus germinans formicarum rubrarum. *Rumph. Amb.* vi. *p.* 119. *t.* 55, *fig.* 2.

Found at Pulo Nias.

This singular plant is found parasitic upon old trees, in the form of a large irregular tuber, from which arise a few thick, short, fleshy branches. The *Leaves* are crowded at the rounded extremities of these branches, and are opposite, petiolate, obovate-oblong, with a short acumen, attenuated to the petiole, entire, very smooth, somewhat leathery. *Petioles* long, roundish, inserted on a large persistent peltate knob, whose edges expand into a kind of stipule, ciliated along the margin with dense strigose fibres, and cleft above in the axil of the petiole. The *flowers* are sessile, closely disposed in the spaces between the stipular bases of the petioles and half concealed under their projecting edges. *Calyx* membranaceous, superior, nearly entire. *Corolla* white, tubular, quadrifid; segments erect, rather acute; a villous ring within the tube immediately below the insertion of the stamens. *Stamens* four, shorter than the corolla, and alternate with its segments; *anthers* white, two-celled. *Style* longer than the stamens. *Stigma* simple, tomentose. *Ovary* four-celled, four-seeded. *Berry* ovate, smooth, white with longitudinal lines, four-celled, four-seeded. *Seeds* furnished with albumen; *embryo* in its axis.

Obs.—There can be no doubt of this being the plant described by Rumphius, although the leaves are represented more acute in his figure than they are in my specimens.

HYDNOPHYTUM.

Tetrandria Monogynia. N. O. Rubiaceæ. Juss.

Calyx integer. *Corolla* limbo 4-fido, fauce pilosa. *Stamina* 4, brevia, fauci inserta. *Stigma* bifidum. *Bacca* disperma. *Super arbores parasitica, basi tuberosa, floribus axillaribus.*

HYDNOPHYTUM FORMICARUM. *(W. J.)*
Lin. Trans. XIV. 124.

Nidus germinans formicarum nigrarum. *Rumph. Amb.* vi. *p.* 119. *t.* 55. *fig.* 1.

Prio Hantu. *Malay.*

On trees in the forests of Sumatra. *Malacca.*

This grows parasitic on trees in the form of a large irregular tuber, fastening itself to them by fibrous roots, and throwing out several branches above. The tuber is generally inhabited by ants, and hollowed by them into numerous winding passages, which frequently extend a good way along the branches also, giving them the appearance of being fistular. *Leaves* opposite, short-petioled, elliptic-obovate, nearly obtuse, acute at the base, very entire, very smooth, thick, with the midrib flattened, and a few inconspicuous nerves. *Stipules* interpetiolar, linear. *Flowers* axillary, sessile, generally aggregated on a double gemmaceous knob. *Calyx* superior, very short, entire. *Corolla* white, tubular; *limb* four-cleft; *faux* villous. *Stamens* alternate with the segments of the corolla; *filaments* scarce any. *Ovary* crowned with a prominent umbilicate disk, disporous. *Style* longer than the tube. *Stigma* of two revolute linear thick lobes. *Berry* of a semipellucid reddish-yellow colour, ovate-oblong, two-seeded. *Seeds* oblong, contained in a tough integument, with the embryo in the axis of the albumen.

Obs.—I am not aware that these two plants have been described by any botanist since the time of Rumphius, or that any conjecture has been made regarding their place and family from his figure or description. From their common habit as parasites, I should have been much inclined to place them under one genus; but the different number of seeds in each, supported by the difference of a simple and bifid stigma, seems to oppose this, while the distinction is further confirmed by the different disposition and insertion of the leaves, which in *Hydnophytum* are arranged precisely as usual in the *Rubiaceæ*, but in *Myrmecodia* are crowded round the thick fleshy branches in such a manner, that their being really opposite is not immediately apparent, while their insertion on their broad peltate bases is further peculiar.

LASIANTHUS.

Rubiaceæ. Juss.

Calyx 4-partitus, laciniis linearibus. *Corolla* infundibuliformis, pilosa. *Stamina* 4. *Stigmata* 4, linearia crassa. *Bacca* tetrapyrena.

Suffrutices, floribus axillaribus, bracteis oppositis, baccis cyaneis.

LASIANTHUS CYANOCARPUS.* *(W. J.)*

Lin. Trans. XIV. 125.

Villosus, bracteis magnis cordatis.

Found at Tappanooly, on the west coast of Sumatra.

Stem herbaceous or suffrutescent, erect, round, villous. *Leaves* opposite, petiolate, oblong-lanceolate, acute, entire, villous; three or three inches and half long. *Petioles* short. *Stipules* interpetiolar, acute. *Flowers* generally three in each axil, nearly sessile, supported by two large opposite cordate bracts. *Calyx* superior four-, sometimes five-parted; laciniæ, linear, acute, pilose. *Corolla* yellow, tubular, funnel-shaped, pilose both externally and internally. *Stamens* four, sometimes five; *anthers* oblong. *Ovary* crowned by a nectarial ring, four-sporous. *Style* as long as the stamens. *Stigma* of four thick linear divisions. *Berry* as large as a small gooseberry, of a transparent azure blue, pilose, its flesh spongy or farinose, containing four nuts or hard seeds.

LASIANTHUS ATTENUATUS. *(W. J.)*

Linn. Trans. XIV. 126.

Villosus, foliis supra glabris, bracteis lanceolatis.

Found in the interior of Bencoolen.

Suffrutescent, erect. *Branches* alternate, long, spreading, round, villous. *Leaves* opposite, sub-bifarious and somewhat drooping, short-petioled, oblong, attenuated to the point,

* This genus, which is now called Mephetidia, is common in the Province of Malacca.—W. G.

rounded or subcordated, and sometimes a little unequal at the base, nearly entire, but sometimes waved or obsoletely dentate on the margin; smooth above, except on the nerves, which are pilose; softly villous beneath; from three to four inches long by about one broad. *Petioles* very short, villous. *Stipules* interpetiolar, acuminate, villous. *Flowers* axillary; nearly sessile, from three to four in each axil. *Bracts* two, opposite, lanceolate, acute, villous. *Calyx* four-parted, villous; segments linear, acute. *Corolla* yellow, tubular, pilose both within and without; limb four-parted. *Stamens* four; *filaments* short; *anthers* oblong, two-celled. *Ovary* pilose, crowned within the calyx by a prominent nectarial ring, four-sporous. *Style* one. *Stigma* of four thick linear divisions. *Berry* pilose, ovate, crowned with the calyx, smaller than in the preceding, becoming dyed of a dark-blue, of which colour the hairs also partake, containing four one-seeded nuts. *Embryo* cylindrical, in the axis of the albumen.

EPITHINIA. *(W. J.)*

Tetrandria Monogynia.

N. O. Rubiaceæ.

Calyx cylindricus, superus, quadridentatus, persistens. *Corolla* tubulosa, limbo patente quadripartito, fauce villosa. *Stamina* exserta. *Stylus* exsertus. *Stigma* bifidum. *Bacca* sulcata, dipyrena, nucibus oblongis dispermis, semine uno super alterum.

EPITHINIA MALAYANA. *(W. J.)*

Found in Mangrove swamps on the Island of Singapore.

A moderate sized shrub with brown bark and smooth branches. *Leaves* opposite, petiolate, obovate, obtuse, rounded at the summit, attenuated at the base into the petiole, very entire, very smooth, almost without veins, shining above, paler beneath. *Petioles* none. *Peduncles* axillary, dichotomous, many flowered, one flowered in the bifurcations. *Calyx* cylindrical, persistent, almost entire or obsoletely four dentate. *Corolla* white, tube longer than the calyx, limb spreading, four-parted, lobes ovate, rather acute, faux closed with white hairs. *Stamina* four, exsert, spreading, inserted alternately with the lobes of the corolla; filaments short; anthers linear, acute, dark colored. *Ovary* oblong, compressed, two-celled, cells two-seeded, the one placed over the other. *Style* exsert. *Stigma* bifid, with thick linear lobes. *Fruit* inferior oblong, marked with eight deep longitudinal furrows, crowned with the calyx, containing two long narrow oblong nuts, each with two-seeds, the one placed above the other. One of them sometimes proves abortive.

Obs.—I have not been able to refer this to any known tetrandrous genus; it seems to come nearest to Malanea of Aublet, but differs in several essential characters. The position of the seeds is peculiar.

IXORA PENDULA. *(W. J.)*

N. O. Rubiaceæ.

Foliis elliptico-lanceolatis glaberrimis, corymbis longe pedunculatis pendulis.

Bunga yarum. *Malay.*

Native of Pulo Pinang, &c.

A shrub with smooth compressed branches. *Leaves* opposite, short petioled, eleven or twelve inches long, elliptically lanceolate, rather obtuse, very entire, very smooth, shining above. *Petioles* little more than half an inch in length. *Stipules* interpetiolar, broad at the base, ending in a subulate point. *Corymbs* terminal, long peduncled, hanging, trichotomous, many flowered. *Flowers* red. *Bracts* two, small, at the base of the calyx. *Calyx* small, four-parted, slightly tomentose. *Corolla* red, tube long and slender, limb four-parted, lobes ovate lanceolate rather acute. *Stamina* spreading. *Style* filiform. *Stigma* clavate.

Obs.—This is a beautiful species, at once distinguishable by its long pendulous corymbs. Bunga Yarum is the generic Malay name of the Ixoræ.

IXORA NERIFOLIA. *(W. J.)*

Foliis linearibus acuminatis glabris, corymbis terminalibus.

Bung Saluang. *Malay.*

Native of the West coast of Sumatra.

A shrub, with round smooth branches. *Leaves* opposite, short-petioled, linear, tapering to the point, acute, about nine inches long, by little more than half an inch broad, entire with revolute edges, very smooth. *Stipules* interpetiolar, subulate, longer than the petioles. *Corymbs* terminal, erect, trichotomous. *Flowers* red. *Bracts* small, acute. *Calyx* small, four-toothed. *Corolla* tube long, slender; limb spreading, four-parted, segments lanceolate, acute. *Stamina* four, alternate with the laciniæ of the corolla. *Style* a little longer than the tube. *Stigma* clavate. *Fruit* a berry.

Obs.—The long narrow leaves readily distinguish this species; it is a handsome delicate shrub.

PSYCHOTRIA MALAYANA. *(W. J.)*

Pentandria Monogynia.

N. O. Rubiaceæ.

Foliis lato-lanceolatis, stipulis indivisis, paniculis terminalibus corymbosis, corollæ fauce villosa.

Byumbada. *Malay.*

Native of Pulo Pinang.

A shrub with round smooth branches. Leaves petiolate, opposite, broad lanceolate, 10 inches in length, acuminate, decurrent upon the petiole, entire, very smooth. Petioles short, thick, round, surrounded at the base by a prominent ring, from which a thick rib diverges on each side and unites with a similar one from the base of the opposite leaf to form the nerve of the large interpetiolar ovate acute stipule. Panicles corymbose, terminal. Flowers numerous. Bracts broad, membranaceous, embracing. Calyx superior, erect, quinquefid. Corolla white with greenish limb, infundibuliform, longer than the calyx, mouth closed with dense white hairs, limb 5-parted, somewhat reflexed, laciniæ ovate. Stamina 5, erect, inserted on the tube, filaments very short, anthers linear. Style filiform, stigmata two thick and linear. Capsule inferior, two-celled, two-seeded.

PSILOBIUM. *(W. J.)*

Pentandria Monogynia.

N. O. Rubiaceæ. Juss:

Calyx patens, 5-partitus. *Corolla* tubo brevi, limbo 5-partito. *Stamina* basi corollæ inserta. *Stigma* clavatum, 10-alatum, exsertum. *Fructus* cylindricus siliquaeformis, foliolis calycinis persistentibus coronatus, bilocularis polyspermus. *Semina* duplici serie axi affixa.

Fruticosa, pedunculis axillaribus paucifloris, æstivatione valvata.

PSILOBIUM NUTANS. *(W. J.)*

Found in the interior of Bencoolen.

Stem erect, four-sided with rounded angles. *Leaves* opposite, petiolate, lanceolate, attenuated to both ends, acute, entire, smooth. *Stipules* interpetiolar, broad, acuminate, carinate. *Peduncles* axillary drooping, bearing from three to six flowers. *Bracts* forming a kind of involucre at the base of the very short pedicels. *Calyx* superior, very large, composed of five leaflets or very deep segments, which are veined with red. *Stamina* five; filaments short, anthers long, erect. *Style* short. *Stigma* long, exsert, oblong-ovate, longitudinally ten-winged, the five alternate wings smaller. *Fruit* long, cylindrical, siliquose, crowned with the large persistent calyx, two-celled, many-seeded; seeds arranged in a double series in each cell.

PSILOBIUM TOMENTOSUM. *(W. J.)*

Tomentosum, floribus axillaribus subsessilibus.

At Kataun. The fruit is baccate.

LECANANTHUS. *(W. J.)*

Pentandria Monogynia. N. O. Rubiaceae. Juss:

Calyx campanulatus, ampliatus, coloratus, irregulariter divisus. *Corolla* tubo brevi, limbo 5-partito. *Ovarium* biloculare, polysporum, placentis centralibus convexis. *Stylus* bifidus. *Stigmata* 2, linearia, crassa.

Fruticosa, floribus capitatis involucratis terminalibus, aestivatione valvatâ.

L. ERUBESCENS. *(W. J.)*

Found in the interior of Bencoolen. *Malacca.*

A small erect shrub; stem four-sided, two of the angles acute. *Leaves* opposite, short-petioled, ovate-lanceolate, acute at both ends, rather attenuated to the point, entire, smooth, about 8 inches long. *Stipules* interpetiolar, large, ligulate, carinate towards the base. *Flowers* pale red, densely aggregated within the hypocrateriform cup of the involucre, forming a head which is terminal, nearly sessile, and turned backwards. *Involucre* monophyllous entire. *Pedicels* none. *Calyx* superior, coloured, tomentose, thick and fleshy, much wider than the corol, expanding into from two to four irregular, unequal, obtuse lobes; the calyces of the outer flowers are often so much produced on one side as to seem bilabiate. *Corolla*, tube short, segments five, acute, thick. *Aestivation* valvate. *Stamina* 5, inserted on the tube; anthers large. *Ovary* crowned with a prominent nectarial ring, 2-celled, polysporous; ovula arranged round central, semi-cylindrical placentæ. *Style* bifid. *Stigmata* 2, thick and linear.

VIII. LOGANIACEÆ.

FAGRAEA CARNOSA. *(W. J.)*

Foliis subrotundo-ovatis mucronatis carnosis, floribus terminalibus solitariis.

In the neighbourhood of Bencoolen.

A parasitic shrub growing on trees, with smooth greyish bark and somewhat dichotomous branches. *Leaves* opposite, petiolate, subrotund with a short reflexed point, entire with reflexed margins, very smooth, thick and fleshy. *Petioles* compressed, embracing the branch and furnished with an intrapetiolar ligula or *stipule*. *Flowers* terminal, solitary, nearly sessile, embraced at the base by a few sheathing bracts. *Calyx* 5-parted. *Corolla* of a dull yellowish white colour; tube about four inches long, expanding into a 5-parted limb. *Stamina* 5, rising a little above the tube, anthers large. *Style* little more than half the length of the tube. *Stigma* 4-lobed. *Berry* as large as a small egg, seated on the persistent calyx, ovate, rather pointed, two-celled, many seeded; seeds nidulant.

Obs.—This is the fifth species of Fagraea that I have met with in the Malay islands; the others have been already described in Roxburgh's Flora Indica. The *F. racemosa* grows to be a small tree, and the *F. volubilis*, doubtfully proposed by Dr. Wallich as a distinct species, is the same plant. The *F. auriculata* is a large shrub, and from the size of its flowers is the most splendid of the genus. I originally met with it at Singapore, but have since found it also at Tappanuly; the following particulars may be added to the description given by Dr. Wallich.

F. Auriculata. *Flowers* terminal, generally 3, rarely 5, on short thick pedicels, each embraced by four opposite calyculate bracts, of which the outer two are the smallest. *Corolla* very large, yellowish white. *Stamina* inserted near the bottom of the tube. *Stigma* large and flattened. *Ovary* 2-celled, polysporous; the edges of the placentæ revolute. *Fruit* as large as a duck's egg, acuminated by a part of the persistent style; seeds numerous, nidulant.

IX. APOCYNEÆ.

LEUCONOTIS. *(W. J.) Linn. Trans.* XIV. *p.* 121.

Tetrandria Monogynia. N. O. Apocyneæ. Br.

Calyx inferus, 4-partitus. *Corolla* tubulosa, superne angustior, limbo 4-lobo. *Stamina* 4, inclusa, laciniis corolla alterna. *Ovarium* simplex, biloculare, loculis disporis. *Stylus* 1, brevis. *Stigma* annulatem, apice conico. *Bacca* 1—3-sperma. *Smina* exalbuminosa, embryone inverso.

Frutex lactescens, foliis oppositis exstipularibus, floribus dichotome corymbosis axillaribus.

LEUCONOTIS ANCEPS. *(W. J.)*

Akar Morai. *Malay.*

Sumatra. *In forests, Malacca.*

A large shrub. *Branchlets* four-sided, sprinkled with elevated dots. *Leaves* opposite, petiolate, oblong, rounded at the base, rather long-acuminate, entire, a little waved at the edge, very smooth, shining above, paler and sprinkled with elevated dots beneath; nerves connected by submarginal arches; about four inches long. *Petioles* about an inch in length, carinate, connected by a ridge. *Stipules* none. *Peduncles* axillary, two-edged, longer than the petioles, bearing a dichotomous corymb of yellow flowers. *Bracts* small, acute, broad at the base. *Calyx* erect, four-parted, segments rather obtuse, margins membranaceous. *Corolla*, tube long, gibbous at the base, narrowing upwards; lobes of the limb ovate. *Stamens* four, inserted on the middle of the tube, incluse; *filaments* very short; *anthers* long, linear, subsagittate at the base. *Style* reaching to the insertion of the stamens. *Stigma* conical, with a prominent ring. *Berry* superior, ovate, somewhat flattened at the base, smooth, marked near the point with four prominent lines, containing from one to three seeds, the fourth generally abortive; when cut it exudes a great deal of milky juice. *Seed* elliptic-oblong, exalbuminous. *Embryo* inverse, conform to the seed. *Cotyledons* plano-convex, the plane sides having a reciprocal concavity and convexity, and being a little crisped towards the edges; they are deeply cordate above, the auriculate lobes overlapping each other. *Radicle* superior oblong.

Obs.—This singular plant belongs without doubt to the family of the *Apocyneæ*, with which its general appearance and habit entirely correspond. It agrees with *Cerbera* in having exalbuminous seeds; but its ovary is simple like that of *Carissa;* it will therefore hold an intermediate place between these two genera.

RAUWOLFIA SUMATRANA. *(W. J.)*

Pentandria Monogynia.

N. O. Apocyneæ.

Foliis ternis quaternisve elliptico-oblongis superne latioribus glabris, floribus terminalibus umbellatis, corollae fauce villis clausa.

Tampal badak or Simbu badak. *Malay.*

Frequent in the neighbourhood of Bencoolen.

It grows to a small tree, having somewhat the habit and foliage of the Mangga laut, or Cerbera Manghas. The whole plant is lactescent. *Leaves* verticillate generally in threes, sometimes in fours, short petioled, about six inches long, elliptic oblong, broader above and terminating in a short point, very entire, very smooth, rather firm, and having nearly transverse nerves. *Peduncles* three or four, umbellate, terminal, long, round and smooth, bearing compound umbels of small white flowers. *Calyx* small, five-lobed. *Corolla* white, tube longer than the calyx, limb spreading, five-parted, lobes subrotund, faux closed with white hairs which appear to form five tufts. *Stamina* five incluse; filaments very short; anthers yellow, sagittate, acute, conniving over the stigma. *Ovary* furrowed on both sides, two-celled, tetrasporous, surrounded by an obscurely five-lobed nectarial ring. *Styles* two, united together. *Stigma* peltate, capitate, glutinous, papillous. *Berry* globose, smooth, containing two nuts, which are compressed, rugose, gibbous below and tapering towards the top, subunilocular with an imperfect dissepiment; generally one-seeded. *Seed* compressed.

Obs.—This species appears to have considerable resemblance to Rauwolfia nitida, but is sufficiently distinguished by its inflorescence. The wood of this tree is very light, and employed by the Sumatrans for the scabbards of their swords and krises.

TABERNAEMONTANA MACROCARPA. *(W. J.)*

Foliis ovato-ellipticis basi attenuatis, corymbis terminalibus dichotomis, folliculis maximis subglobosis.

In the interior of Bencoolen.

A tree; branches smooth, somewhat compressed in contrary directions between each pair of leaves. *Leaves* opposite, petiolate, from elliptic-ovate to elliptic-lanceolate, tapering to the base, broader above with a short point, very entire, very smooth; nerves transverse, uniting into submarginal arches; 10—12 inches long. *Petioles* embracing the stem and uniting with the base of the opposite one. *Peduncles* 3—4, terminal, dividing at their summits into dichotomous corymbs. *Flowers* rather large, yellowish. *Calyx* 5-cleft, erect, thick. *Corolla* much longer than the calyx; tube gibbous, almost globose at the base, narrowing upwards; limb rotate, 5-parted; segments oblong, oblique. *Stamina* five, within the tube. *Ovary* double. *Styles* two, shorter than the stamina. *Stigma* small. *Follicles* two, baccate, as large as citrons, red, diverging, subglobose, exuding a milky juice when cut, with a ridge along the middle and one at each side which unite in a short blunt point, one-celled, many-seeded; the cell is recurved into the form of a crescent. *Seeds* contained in red fleshy arils or lobules which are angled by mutual compression, oblong, chrysaloid, hollowed on the one side with incurved rounded edges, convex on the other, and longitudinally corrugated. *Embryo* contained in a conform albumen; cotyledons flat, round, cordate; radicle centripetal, cylindrical, longer than the cotyledons.

X. OLEINÆ.

LINOCIERA ODORATA. (*W. J.*)

Diandria Monogynia, N. O. Oleinæ.

Foliis lanceolatis utrinque acutis glaberrimis, paniculis axillaribus foliis brevioribus.

At Natal and on Pulo Mosella.

A large shrub, with subdichotomous branches. *Leaves* sub-opposite, short-petioled, oblong-lanceolate, acute at both ends, entire, smooth and coriaceous, 4—5 inches long. *Panicles* axillary, opposite, much shorter than the leaves; peduncles opposite, 3—5 flowered. *Flowers* subsessile, fragrant. *Bracts* small, oblong. *Calyx* four-parted. *Corolla* white, almost 4-petaled, petals long, linear, united by pairs by means of the filaments, slightly cohering at the other divisions. *Stamina* two; anthers large, emarginate at the apex. *Ovary* two-celled, each cell containing two linear pendulous parallel ovula. *Style* scarce any. *Stigma* bifid.

XI. CAMPANULACEÆ.

PHYTEUMA BEGONIFOLIUM.*

Pentandria Monogynia.

N. O. Campanulaceæ.

Foliis semicordatis inequilateralibus serratis, spicis unilateralibus axillaribus revolutis.

Phyteuma begonifolia, *Roxb. Hort. Beng. p.* 85.

Pulo Pinang. *Mergui.*

A small herbaceous plant. Stem procumbent, 1 or 2 feet in length, thick, villous, chiefly at the summit, with fasciculate hairs. Leaves alternate, petiolate, semicordate, inequilateral, turning to one side, eight inches long, acute, with gross subspinescent serratures, villous beneath, adult leaves smooth above, nerves generally dichotomous. Petioles thick round, furrowed above. Stipules none. Peduncles axillary or supra-axillary. Flowers unilateral, erect, arranged in two rows on a recurved spike, nearly sessile, crowded. Bracts cuneiform, obtuse. Calyx semisuperior, ovate, villous, 5 lobed, lobes obtuse. Corolla white, campanulate, persistent, limb recurved, 5-lobed, lobes obtuse; after florescence the corolla becomes green and enlarges. Stamina 5, erect, short, inserted on the calyx, and opposite to its divisions. Anthers linear acute. Ovarium surrounded by the calyx and connected with it by five longitudinal septa or processes from which the stamina spring, 3 or 4-celled, many-seeded, placentæ from the inner angles of the cells. Style short, thick. Stigma large, thick, three-lobed. Capsule 3 or 4-celled, containing numerous seeds arranged on convex placentæ.

The septa which unite the calyx and ovary appear continuous with the filaments of the stamina. The young parts

* This is Pentaphragma begonifolium, *Wall.*, and is doubtfully referred to Goodeniaceæ.—W. G.

of the plant are densely villous, but the hairs are easily rubbed away. In drying, the plant assumes a bright yellow colour. It appears extremely doubtful whether this plant be truly referrible to Phyteuma; it does not however agree well with any other genus of the family of Campanulaceæ, and it will deserve consideration whether it ought not to constitute a new genus in that order.

XII. VACCINIEÆ.

VACCINIUM SUMATRANUM. *(W. J.)*

Racemis axillaribus foliis brevioribus, foliis elliptico-ovatis integerrimis coriaceis.

Found on the summit of Gunong Bunko, or the Sugar-loaf Mountain, in the interior of Bencoolen.

A small tree, with reddish brown bark and smooth branches. *Leaves* alternate, short petioled, elliptic-ovate, acuminate, sometimes obtuse, entire, edges a little reflexed, very smooth, firm, stiff and leathery, pale green beneath; about four inches long. *Stipules* none. *Racemes* axillary, shorter than the leaves, often from the stem below them; flowers white pedicellate, alternate. *Caylx* small, cup-shaped, slightly four-toothed. *Corolla* oblong ovate, contracted at the mouth; limb short, recurved, four-parted. *Stamina* eight, incluse, inserted on the base of the coral; filaments dilated at the base, pilose, tinged with red; anthers two-lobed, between which are two short filaments or processes, each lobe prolonged upwards into a membranaceous horn or awn which is bifid at top and opens by a pore. *Ovary* semi-inferior, four-celled, polysporous, ovula attached to the inner angles of the cells. *Style* columnar, a little longer than the stamina, incluse. *Stigma* round, obtuse.

XIII. ERICINEÆ.

RHODODENDRON MALAYANUM. *(W. J.)*

Foliis oblongis glabris punctatis, floribus terminalibus, pedicellis cernuis, corolla punctata basi gibba.

Observed on the summit of the Sugar-loaf Mountain in the interior of Bencoolen. *Summit of Mount Ophir?*

This is a large shrub or small tree much branched. *Bark* brown and spotted. *Leaves* alternate or scattered, short petioled, lanceolate-linear, $2\frac{1}{2}$—3 inches long, attenuated to both ends, somewhat bluntish at the point, entire, smooth, thickly sprinkled beneath with brown dots and green above with depressed points; the middle nerve is strong, the lateral ones scarce any. *Stipules* none. *Flowers* from a short terminal bud, which is at first closely invested by numerous imbricated broad bracts, which successively fall off and at length leave the short thick peduncle annulated by their cicatrices. It throws out near the point several nodding one-flowered pedicels, which are dotted in the same manner as the leaves. *Calyx* very small, five-toothed. *Corolla* crimson, tubular, expanding into a five-lobed limb, sprinkled with callous dots, tube gibbous at the base and marked with five furrows. *Stamina* ten, leaning to one side, inserted on the very base of the corol and about as long as its limb; filaments red; anthers yellow, opening at top by two oblique pores. *Style* a little shorter than the stamina. *Stigma* a round head marked with five indistinct rays. *Ovary* superior, oblong, five-sided, covered with brown spots, five-celled polysporous.

Obs.—I found this and the preceding species of Vaccinium on the very summit of Gunong Bunko, a remarkable insulated mountain in the interior of Bencoolen, commonly called by Europeans the Sugar-loaf, in reference to its shape. Its elevation is not estimated to exceed three thousand feet, yet the character of its vegetation is decidedly alpine. This character is probably more marked than it would be at a similar height on the side of a differently shaped hill, owing to the steepness which refuses space for large trees, and the consequent exposure and want of shelter on its sharp conical peak.

XIV. EPACRIDEÆ.

STYPHELIA

LEUCOPOGON MALAYANUM. *(W. J.)*

Pentandria Monogynia.

N. O. Epacrideæ.

Spicis axillaribus multifloris erectis brevibus, drupis globosis 5-locubaribus, foliis lanceolatis mucronatis subenerviis subtus glaucescentibus.

Mintada. *Malay.*

Found abundantly at Singapore. *Sandy littoral tracts of Malacca, also on Mount Ophir.*

A small branchy shrub with hard dry leaves, exhibiting the peculiar character of this family. *Leaves* alternate, sessile, lanceolate, acute, mucronate, very entire, very smooth, shining and convex above, somewhat glaucous below, and when examined by the microscope, appearing to be covered with numerous very minute white dots, firm, with scarcely perceptible longitudinal nerves. *Spikes* axillary, erect, much shorter than the leaves; peduncles somewhat tomentose. *Calyx* supported at the base by two oval acute concave bracts, five-leaved, oblong, acute, leaflets lanceolate, glaucescent, ciliate. *Corolla* infundibuliform, a little longer than the calyx, quinquefid, puberulent, segments lanceolate, bearded above beyond the base. *Stamina* five, short, alternate with the laciniæ; *Filaments* subulate; *Anthers* subpendulous, marked on each side with a longitudinal furrow, simple, and bursting longitudinally in the manner so accurately described by Mr. R. Brown, *Prodr. Fl. N. Holl. p.* 535. *Pollen* globose. *Ovary* surrounded at the base by five distinct erect obtuse scales, five-celled, each cell containing a single oblong ovulum. *Style* erect, villous. *Stigma* subglobose. *Drupe* baccate, subglobose, five-celled, cells one-seeded.

Obs.—The discovery of this species is remarkable as forming an exception to the general geographical distribution of the Epacrideæ, a family almost exclusively confined to Australasia, or at least to the Southern hemisphere. Singapore, situated at the extremity of the Malay peninsula, and forming as it were the connecting link between continental or Western India and the islands of the great Eastern Archipelago, partakes of this character in its Flora, which exhibits many remarkable points of coincidence with the Floras of both regions. I have had occasion to observe resemblances between its productions and those of the Northern frontier of Bengal on the one hand, and of the Moluccas on the other, while the present connects it with the still more distant range of New Holland.

XV. VERBENACEÆ.

CLERODENDRUM MOLLE. *(W. J.)*

Didymania Angiospermia.

Caule erecto tetragono, foliis cordatis acuminatis integerrimis tomentosis, panicula terminali, tubo corollæ calyce vix longiore, calyce fructus ampliato carnoso albo.

Frequent in Sumatra, Pulo Pinang, &c.

A shrub from 3 to 6 feet in height, erect, little branched; stem four-sided, villous. Leaves opposite, petiolate, cordate, acuminate, very entire, softly tomentose. Panicle terminal, oppositely trichotomous, erect, with leaf-like bracts. Calyx five parted, tomentose, laciniæ ovate, acute, erect, with reflexed margins. Corolla tomentose without, tube as long as the calyx, limb 5-parted, spreading, secund, laciniæ nearly equal, crisped at the margin. Stamina exsert, horizontally deflexed to each side. Style erect, as long as the stamina. Stigma bifid. Calyx of the fruit flat, enlarged, fleshy and white. Berry from one to four-seeded, according to the number that abort.

This species approaches nearest to the C. infortunatum, but is abundantly distinguished by the softness of the leaves which are larger and more deeply cordate, by the comparative shortness of the tube of the corolla and by the white calyx of the fruit.

Besides this species I have met with another in various parts of these Islands and particularly at Acheen, which has been figured in Andrews' Repository, under the name of Clerodendrum pyramidale. It is a large shewy plant. A still more beautiful species, and perhaps the most elegant of the whole genus is the C. nutans, so named by my friend Dr. Wallich, Superintendent of the Botanic Garden at Calcutta, who received it from the North Eastern frontier of Bengal. I found it not uncommon at Pulo Pinang, and this is not the only instance in which I have had occasion to observe a coincidence between the plants of these distant countries. This species is characterised as follows:—

C. Nutans, Wall. Foliis lanceolatis acuminatis glabris, paniculis longissimis terminalibus nutantibus, pedunculis remotis divaricatis paucifloris.

These panicles or racemes hang gracefully from the extremity of the branches; the flowers are white, not numerous, the peduncles or primary divisions of the panicle being remote, opposite, divaricate, short, and seldom bearing more than three flowers. It is called Unting unting by the Malays.

CLERODENDRUM DIVARICATUM. *(W. J.)*

Didynamia Angiospermia.

Foliis obovato-lanceolatis acuminatis glabris, paniculis terminalibus erectis elongatis, pedicellis fructûs reflexis, calyce subintegro fructifero vix aucto.

Tida tantu? *Malay.*

Found at Laye on the West Coast of Sumatra.

Stem shrubby, erect, about two feet in height, smooth with opposite branches, which are thickened at the joint. *Leaves* opposite, short petioled, obovate lanceolate, acuminate, entire, sometimes denticulate, smooth. *Panicle* erect, terminal, long, composed of opposite divaricate ramifications, which are subdichotomous, and many flowered. *Pedicels* of the fruit reflexed. *Bracts* large ovate, acuminate, foliaceous. *Calyx* cup-shaped, nearly entire. *Corolla* tubular, limb five-parted secund, the lower segment longer, and of a blue color. *Stamina* long, exsert. *Style* one. *Berry* deep purple, resting on the calyx which is scarcely at all enlarged, four-lobed, four-seeded, from one to three seeds occasionally proving abortive.

VITEX ARBOREA. *Roxb. Hort. Beng. p.* 46.

Didynamia Angiospermia.

Arborea, foliis ternatis, foliolis ovato-lanceolatis integerrimis subtomentosis, paniculis terminalibus, bracteis calyce longioribus.

Lubbun. *Malay.*

Sumatra, &c.

A tree, with somewhat four-sided branches. Leaves opposite, petiolate, ternate, sometimes quinate, leaflets ovate-lanceolate, acuminate, very entire, rigid, covered with a very short tomentum. Petioles long, thickened at the base, pulverulent. Panicles terminal; flowers subsessile. Bracts opposite, ovate lanceolate, acute, tomentose, longer than the calyces. Calyx 5-dentate, tomentose, persistent. Corolla cœrulescent, or nearly white, longer than the calyx, contracted and almost closed at the mouth, limb bilabiate, upper lip two-lobed, lobes diverging, lower lip larger, three-lobed, the lateral lobes reflexed, the middle one larger, subrotund, concave, tomentose at the base, and of a deeper blue than the rest. Stamina 4, didynamous, ascending, longer than the corolla. Style longer than the stamina. Stigma bifid. Berry black, juicy, containing a 4-celled, 4-seeded nut.

The wood of this tree is very hard, and is employed by the inhabitants of Sumatra in the construction of houses. They consider an infusion of the bark as a useful application in cases of ophthalmia.

PERONEMA. (*W. J.*)

Didynamia Angiospermia. N. O. Verbenaceæ. Br.

Calyx 5-partitus. *Corolla* tubo brevi, limbo irregulari 5-lobo, laciniis secundis. *Stamina* duo, exserta; rudimenta duorum sterilium. *Stigma* refractum. *Fructus* siccus, 4-partibilis, 4-spermus.

Arbor, foliis pinnatis petiolo alato, panicula terminali opposite corymbosa.

PERONEMA CANESCENS.

Sunkei. *Malay.*

A large tree, native of Sumatra. *In Forests, Malacca.*

Trunk straight, but little branched. *Leaves* opposite, pinnate, nearly two feet long, with 7—9 pair of leaflets which are alternate or subopposite, lanceolate, attenuated to both ends, acute, somewhat recurved, entire, smooth above, canescent beneath, veins reticulate on the under surface; 8—9 inches long. *Petioles* winged, finely and delicately tomentose, wings decurrent from the insertion of the leaflets. *Stipules* none. The branches are crowned by a vast terminal oppositely corymbose panicle, of which the ultimate divisions are dichotomous with a flower in the bifurcations; the whole is finely tomentose and hoary. *Bracts* small, acute. *Flowers* inconspicuous, whitish. *Calyx* five-parted, segments acute, erect. *Corolla* not much longer than the calyx, limb expanding, irregular, five-lobed, segments secund, the two upper ones diverging, the lowermost considerably longer than the rest. *Stamina* two, reflexed backwards between the upper segments of the corolla; filaments subulate, thickened toward the base; anthers long. *Rudiments* of two abortive stamina. *Ovary* four-celled, ovula erect. *Style* rather longer than the stamina. *Stigma* simple, refracted. *Fruit* seated on the calyx, villous, dry, separating into four portions, each of which contains a single seed.

Obs.—This is a valuable timber tree, the wood being hard and tough, well suited for carriage shafts, which require to combine strength and elasticity with lightness. When long buried in the earth, it is said to become petrified. The genus is related to Vitex, but is abundantly distinct therefrom.

GMELINA VILLOSA. *Roxb.*

Spinosa, foliis rhomboideis subtus villosis, racemis terminalibus, bracteis magnis acuminatis, drupis sphericis dispermis.

Radix deiparæ. *Rumph. Amb.* ii. *p.* 124. *t.* 39.

Kayo Briang.

Native of Sumatra, &c. *Malacca.*

Arborescent. Leaves opposite, broad ovate, sometimes obscurely 3-lobed, rather obtuse, entire, smooth above, villous beneath as well as the petioles and branchlets. Racemes terminal. Bracts large ovate acuminate. Calyx obliquely 4-toothed, marked externally with six green scutellæ or pustules. Corolla yellow, ventricose. Anthers two-lobed. Ovary 4-sporous. Drupe with a two-seeded nut.

SPHENODESME. *(W. J.)**

Didynamia Angiospermia.

Vitices Juss.

Calyx tubulosus 5-dentatus. Corolla 5-loba subirregularis. Stamina 4—5 exserta. Ovarium 4 loculare 4 sporum. Bacca monosperma.

Flores fasciculati, involucrati.

SPHENODESME PENTANDRA. *(W. J.)*

Foliis oblongo ovatis glabris, involucris 5-6 phyllis, fasciculis 6—7 floris, floribus pentandris.

Roscoea pentandra. *Roxb. Cat. Hort. Beng. p.* 46.

Native of Pulo Pinang. *Malacca.*

A climbing shrub with 4-sided, somewhat pilose branches. Leaves opposite, petiolate, oblong ovate, subcordate at the base, acuminate, (sometimes with a retuse acumen), very entire, very smooth. Petioles short, pilose. Fascicles 6 or 7 flowered, peduncled, disposed in panicles, at the extremity of the branches and in the upper axils. Involucres consisting of 5 or 6 oblong, obtuse, membranaceous, reticulated leaflets, which are longer than the sessile flowers. Calyx companulate, 5-plicate, 5-dentate. Corolla infundibuliform, faux villous, limb 5-lobed nearly regular. Stamina, 5, long,

* This genus is distinct from Congea of Roxburgh by the leaves of the involucre being all distinct; the nearly regular corolla, and the five nearly equal stamina. Minor differences exist in the "villi" about the faux of the corolla, the direction of the anthers, and the stigma.

In Congea, besides the decidedly bilabiate corolla, the upper lip of which, moreover, is the largest, two of the leaves of the involucre are united into one, which is also very generally the smallest of the three, so that at first sight there is not the same correspondence between the number of flowers and involucral leaves, as in Sphenodesme and probably Symphorema.—W. G.

exsert. Style filiform, bifid. Ovary very hairy, 3 to 4-celled; cells one-seeded.

There is always one leaflet less in the involucrum than the number of flowers in the fascicle, the central flower having no fulcrum. This species was sent to Dr. Roxburgh from Sylhet, and by him called Roscoea; that name however being pre-occupied, a new one has become necessary. I have therefore given it that of Sphenodesme *(fasciculus alatus.)*

XVII. CYRTHANDRACEÆ.*

In examining some of the numerous Sumatran species of *Cyrtandra*, I was lately led to observe the great inaccuracy of Forster's description and figure of the fruit, which has been the cause of deception in regard to its natural affinities. His error consists in representing the septum as complete, with adnate placentæ similar to what obtains in some genera belonging to *Scrophularinæ;* whereas, in reality, it is bipartite through the axis of the fruit, and the placentæ are no other than the revolute lobes of the septa. This peculiar structure is more distinct in the nearly related genus of *Didymocarpus (Mal. Misc. vol. i.)*, which has capsular fruit, and where the lobes of the contrary dissipiment so completely bipart the cells as to give it the appearance of being quadrilocular. It is obvious that this character is totally inconsistent with that of *Scrophularinæ*, and it does not accord exactly with any of the Jussiæan orders. *Didymocarpus* is related to *Bignoniaceæ* through *Incarvillea*, but it is not

* II. On Cyrtandraceæ, a new Natural Order of Plants. By William Jack M. D. Communicated by Aylmer Bourke Lambert, Esq. F. R. S. V. P. L. S. *Linn. Trans.* Vol. XIV. *p.* 23.—*Read May* 7, 1822.

admissible into that family as defined by Mr. Brown in his *Prod. Fl. Nov. Holl.* I am therefore inclined to think that *Cyrtandra*, *Didymocarpus*, and another genus, which I shall here present under the name of *Loxonia*, which agree remarkably in general habit as well as in carpological structure, may properly form a small and distinct family near to *Bignoniaceæ*. The two first genera are numerous in the Malay islands; and I may remark that, as far as my present observations extend, the *Cyrtandræ* appear to prevail principally to the south of the Equator, and the *Didymocarpi* on the north, where it has even been found, according to the observations of Dr. Wallich, to extend to the alpine regions of Nepal. I shall proceed to give the characters by which this family and its genera are distinguished, and shall add descriptions of all the species that I have as yet had an opportunity of examining.

CYRTANDRACEÆ.

Calyx monophyllus, divisus.

Corolla monopetala, hypogyna, sæpius irregularis, 5-loba.

Stamina. *Filamenta* 4, duo plerumque, nunc quatuor antherifera. *Antheræ* biloculares, per paria connexæ.

Ovarium disco glanduloso cinctum, biloculare vel pseudo-4-loculare, polysporum. *Stylus* simplex. *Stigma* bilamellosum v. bilobum.

Capsula v. *Bacca* bilocularis, bivalvis, polysperma. *Dissepimenta* contraria, biloba, lobis revolutis seminiferis, loculos bipartientibus (inde pseudo-4-locularis). *Semina* nuda.

Herbæ vel suffrutices. *Folia* simplicia, plerumque opposita, altero sæpe abortivo aut nano, exstipulata. *Inflorescentia* axillaris.

In this family the flowers nearly resemble those of the *Bignoniaceæ*, but have most frequently only two fertile stamina, and rarely exhibit any trace of a fifth. In fruit they are abundantly distinct; and the herbaceous stems, simple leaves, and axillary inflorescence, form important and striking differences of habit.

CYRTANDRA, *Forst.*

Calyx quinquepartitus. *Corolla* infundibuliformis, ad faucem ampliata, limbo quinquelobo subirregulari, rarius bilabiato. *Stamina* quatuor, quorum duo antherifera. *Bacca* oblonga, calyce longior; dissepimenti lobis per totam superficiem seminiferis. *Semina* nuda, sæpe foveolata v. punctata.

Folia opposita; altero plerumque abortivo aut nano. Flores sæpissime capitati involucrati.

* Herbaceæ corolla subirregulari.

1. CYRTANDRA MACROPHYLLA.

Tab. II. Fig. 1. *a—g.*

C. foliis subrotundo-ovatis serratis glabris, involucro monophyllo, pedunculis petiolo brevioribus.

Selabang. *Malay.*

Native of the interior of Sumatra.

Suberect. *Branches* thick, four-sided with rounded angles, and two opposite sides deeply furrowed. *Leaves* apparently alternate, but in reality opposite, the petioles springing from the joints of the stem, perfect on one side, but abortive on the other, forming nothing more than a short ligula without a leaf; subrotund-ovate, acute, serrated with rounded blunt serratures, smooth on both sides, dark-green above, whitish beneath, with strongly prominent nerves: a foot in length by about nine inches broad. *Petioles* eight or nine inches long, thick, embracing the stem at the joint, and uniting with the base of the opposite petiole, which is only one or two inches long, and tapers into a point without ever expanding into a leaf. *Peduncles* opposite, from the axils both of the perfect and abortive petioles, slender, not so long as the petiole, supporting a round dense head of flowers which is embraced at the base by a monophyllous, three or four-parted involucre, and by several large bracts within it. *Flowers* white, numerous, nearly sessile, aggregated into a round head. *Calyx* tubular, somewhat woolly, divided at the mouth into five linear segments, generally more deeply cloven on one side. *Corolla* infundibuliform much longer than the calyx, expanding at the mouth; *limb* divided into five rather unequal lobes. *Stamina* two, shorter than the corolla, and inserted on its tube, joined by their anthers; the rudiments of two abortive stamina. *Anthers* of two parallel lobes, which are woolly at their base. *Ovary* embraced at the base by a nectarial ring, long, two-celled; cells bipartite by the revolute lobes of the dissepiments. *Style* as long as the stamina. *Stigma* infundibuliform. *Berry* oblong, somewhat curved, cylindrical, acuminate, two-celled, many-seeded; seeds arranged round the revolute lobes of the septa, small, roundish.

2. CYRTANDRA MACULATA.

C. foliis subrotundo-cordatis acutis serratis supra glabris, corollæ lobis tribus inferioribus macula purpurea.

Sumatra.

A low herbaceous plant. *Leaves* opposite, one abortive, the other petiolate, round-cordate, acute, serrated, smooth above, somewhat villous beneath; about four inches long, by four and a half broad. *Flowers* capitate, involucred, axillary. *Calyx* tubular, five-toothed. *Corolla* much longer than the calyx, white, with a large purple spot on each of the three lower lobes; *limb* five-lobed, sub-irregular. *Stamina* two fertile, two sterile. *Style* one. *Berry* oblong, many-seeded, seeds disposed round the lobes of the dissepiment.

3. CYRTANDRA BICOLOR.

C. foliis elliptico-lanceolatis basi cordatis supra glabris subtus villosis purpureis, pedunculis petiolo brevioribus.

Sumatra.

Stem herbaceous, sub-erect. *Leaves* opposite, long-petioled, one of the petioles generally abortive, elliptic-lanceolate, cordate and rounded at the base, acute, edges revolute, smooth and dark-green above, purple, villous, and very soft beneath; nine or ten inches long. *Petioles* about the same length as the leaves. *Peduncles* axillary, reflexed, about two inches long, bearing a head of from six to ten pedicellate flowers, embraced by a short deciduous involucre. *Calyx* tubular, quinquefid. *Corolla* white, large; *limb* sub-irregular, five-lobed. *Stamina* two, with two abortive filaments. *Style* one. *Berry* oblong, many-seeded; lobes of the dissepiments seminiferous.

4. CYRTANDRA HIRSUTA.

C. foliis elliptico-ovatis basi cordatis crenatis utrinque pilosis, capitulis paucifloris hirsutis, involucro bipartito.

Sumatra.

Herbaceous, ascending, pilose. *Stem* round. *Leaves* opposite, one of them generally abortive, and hence apparently alternate, long-petioled, round-oval, or elliptic-ovate, cordate at the base, rather obtuse, crenate, pilose, with remote erect hairs; about five inches long and three broad. *Petioles* round, as long as the leaves, embracing the stem at the joints, and uniting with the base of the opposite one, which is generally an abortive leafless stalk of an inch in length. *Peduncles* axillary, reflexed, villous, shorter than the petioles, supporting a head of from two to five flowers, invested by an involucre composed of two opposite ovate leaflets united at the base. *Calyx* tubular, hirsute with brown hairs, quinquefid. *Corolla* white, pilose without, much longer than the calyx; *tube* curved, expanding into a large infundibular mouth; *limb* five-parted, somewhat two-lipped; *segments* nearly equal. *Stamina* two fertile, shorter than the corolla; two abortive rudiments. *Anthers* connate. *Style* about the length of the stamina. *Stigma* thick, depressed, and transverse. *Ovary* surrounded by a nectarial ring, long, two-celled; *cells* bipartite by the revolute lobes of the dissepiment, to which the seeds are attached all round.

5. CYRTANDRA GLABRA.

C. foliis lato-ovatis serratis glabris, capitulis breve-pedunculatis, involucro monophyllo.

Interior of Bencoolen.

Herbaceous. *Leaves* alternate from the abortion of the opposite petiole, rather long-petioled, broad-ovate, acuminate, rather acute at the base, serrated, smooth; about seven inches long by five broad. *Peduncles* axillary, short, supporting a head of large white flowers. *Involucre* monophyllous, closely embracing the flowers. *Calyx* five-cleft. *Corolla* much longer than the calyx, expanding into a wide funnel-shaped faux; *limb* five-parted, nearly equal. *Stamina* two, conniving, shorter than the corolla; the rudiments of two others. *Anthers* united. *Style* longer than the stamina. *Stigma* dilated, sub-bilabiate. *Berry* as in the genus.

6. CYRTANDRA INCOMPTA.

C. hirsuta, foliis elliptico-ovatis serratis, floribus capitatis hirsutis, involucro diphyllo.

Langkabang. *Malay.*

Native of Sumatra.

Herbaceous, erect, shaggy with brown hair. *Leaves* alternate from the abortion of the opposite leaf, of which there is sometimes a rudiment observable, long-petioled, elliptic-ovate, acute, serrated, villous; six inches long. *Petioles* about three inches long, densely villous with brown hair. *Peduncles* axillary, solitary, shorter than the petioles, bearing a small compact head of sessile flowers, the whole densely woolly. *Involucre* of two ovate, acute leaflets. *Calyx* tubular, covered with brown wool, quinquefid. *Corolla*

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villous without, infundibuliform; *limb* five-parted, nearly equal. *Stamina* two, conniving, joined by their anthers. *Anthers* with erect parallel lobes. *Ovary* embraced by a nectarial ring. *Style* one. *Berry* as in the genus. Seeds foveolate.

This plant is remarkable for the shagginess of all its parts.

7. CYRTANDRA AUREA.

C. foliis oppositis subrotundo-ovatis acuminatis serratis sericeo-pilosis, capitulis densis subsessilibus.

At the foot of Gunong Bunko, interior of Bencoolen.

A large strong erect species; *stem* thick, four-sided, with rounded angles, pilose with appressed hairs. *Leaves* opposite, both perfect, long-petioled, subrotund-ovate, very large, acuminate, serrate, sericeously pilose, particularly on the under surface. *Heads* axillary, sub-sessile, densely many-flowered. *Involucre* closely investing the head, and nearly as long as the flowers. *Flowers* yellow. *Calyx* tubular, angled, nearly as long as the tube of the corolla. *Corolla* sub-campanulate; *limb* nearly equal, five-lobed. *Stamina* two, with two sterile filaments. *Style* one. *Stigma* bilabiate. *Berry* oblong, two-celled, many-seeded, as in the genus.

Obs.—The yellow colour of the flowers is an unusual occurrence in this family; white is almost without exception the prevailing colour.

8. CYRTANDRA PELTATA

C. foliis peltatis ovatis acuminatis.

Sumatra.

Stem ascending, round, smooth. *Leaves* long-petioled, the opposite petiole abortive, peltate, ovate, rounded at the base, acuminate above, obtusely serrate, smooth, paler beneath, eight or ten inches long. *Heads* axillary, very short-peduncled, involucred. *Calyx* five-cleft. *Corolla* white, infundibular; *limb* five-lobed, sub-irregular. *Stamina* two, sterile filaments two. *Ovary* embraced by a nectarial ring. *Style* one. *Berry* oblong, many-seeded, as in the genus.

9. CYRTANDRA CARNOSA.

C. foliis lanceolato-oblongis basi obliquis carnosis oppositis, altero minimo subrotundo.

Creeping or scandent, obscurely four-sided, smooth. *Leaves* opposite, unequal; the one lanceolate-oblong, oblique at the base, entire, thick, fleshy, veinless, smooth above, tomentose beneath, about seven or eight inches long; the other small cordate, subrotund, acuminate. *Head* axillary, short-peduncled, three to seven-flowered. *Involucre* of two ovate acuminate leaflets. *Flowers* white, very short-pedicelled. *Calyx* short, five-toothed. *Corolla* much longer than the calyx, infundibular; *limb* five-lobed, nearly equal. *Stamina* two fertile, shorter than the corolla; *filaments* curved, broader above; two sterile; *lobes* of the anthers slightly unequal. *Style* simple. *Stigma* dilated. *Berry* two-celled, many-seeded; placentation as in the genus.

** Frutescentes, corolla bilabiata.

10. CYRTANDRA FRUTESCENS.

C. erecta, foliis oppositis lanceolatis serratis glabris, pedunculis axillaribus trifloris.

Suffrutescent, erect. *Leaves* opposite, petiolate, broad-lanceolate, acuminate, serrate, smooth; seven to nine inches long. *Peduncles* axillary, generally three-flowered, not so long as the petioles. *Bracts* linear, at the base of the pedicels. *Calyx* five-parted; *segments* subulate, erect. *Corolla* purplish, bilabiate, the lower lip longer, three-lobed; *lobes* very shallow. *Stamina* two fertile, two sterile. *Stigma* dilated, sub-bilabiate. *Berry* cylindrical, longer than in the other species, two-celled; *lobes* of the septa revolute, biparting the cells, and seminiferous on their whole surface. *Seeds* naked.

Obs.—This species and the following differ considerably in habit from the other *Cyrtandræ*, and have more resemblance to *Didymocarpus frutescens;* from which, however, they are distinguished by their baccate fruit, and by the insertion of the seeds upon the whole surface of the lobes of the dissepiment; while in *Didymocarpus* they are attached only to the edge. These species might perhaps be separated from *Cyrtandra* on account of their bilabiate corolla and longer fruit.

11. CYRTANDRA RUBIGINOSA.

C. erecta, foliis obovato-lanceolatis serratis, pedunculis axillaribus fasciculatis unifloris, cum calycibus viscoso-pilosis.

Frutescent, erect. *Stem* obsoletely four-angled, the young parts bristly. *Leaves* opposite, petiolate, obovate-lanceolate, acuminate, acutely serrate, smooth, the nerves pilose on the lower surface. *Peduncles* several, axillary or below the leaves, generally one-flowered, shorter than the petioles, covered with viscous hairs. *Bracts* linear, acute. *Calyx* tubular, pilose, like the peduncles, with greenish viscous hairs, five-parted; *segments* linear. *Corolla* of a dusky purplish colour, pilose without, bilabiate, the lower lip longer, divided into three small shallow lobes; upper lip bifid. *Stamina* two fertile, two sterile; *filaments* broader above. *Style* one. *Stigma* obtusely two-lipped. *Berry* cylindrical, many-seeded; placentation as in the genus.

DIDYMOCARPUS. *Wallich.*

Calyx 5-fidus. *Corolla* infundibuliformis, limbo quinquelobo, subirregulari, rarius bilabiato. *Stamina* 4, rarissime 5, quorum duo nunc quatuor antherifera. *Capsula* siliquæformis, pseudo-quadrilocularis, bivalvis, hinc dehiscens; dissepimenti contrarii lobis valvulis parallelis iis denique æmulis (ideoque fructum bicapsularem mentientibus) margine involuto seminiferis. *Semina* nuda pendula.

Folia simplica opposita, raro alterna, æqualia, floribus axillaribus pedunculatis vel racemosis.

1. DIDYMOCARPUS CRINITA. *Malay Miscell. vol.* i.

TAB. II. FIG. 2. *a—i.*

D. erecta, foliis alternis longis spathulatis acutis serratis pilosis subtus rubris, pedunculis 2—5 axillaribus unifloris basi cum petiolis coeuntibus.

Timmu. *Malay.*

In the forests of Pulo Penang.

Root long and tapering. *Stem* short, erect, thick, rough beneath, with the vestiges of fallen leaves. The whole plant is covered with hairs. *Leaves* alternate, crowded, subsessile, long, spathulate, nine to ten inches in length, acute, obtuse at the base, serrated, rugose, hairy, brownish-green above, purplish-red beneath; middle nerve strong and thick, forming a short petiole at the base. *Stipules* none. *Peduncles* two to five in each axil, one-flowered, round, two inches long, uniting at the base into a short thick unilateral rachis, densely pilose, and adhering beneath to the petiole. *Bracts* linear, two, alternate on each peduncle. *Calyx* five-parted, hairy, reddish; laciniæ erect, linear, acute, the upper one smaller. *Corolla* white, tinged with purple externally, much longer than the calyx, infundibuliform; *tube* somewhat gibbous at the base, incurved, expanding above; *limb* subbilabiate; upper lip two-lobed; lower three-lobed, larger, internally streaked with yellow; all the segments roundish, obtuse, not very unequal. *Stamina* inserted within the tube, two fertile with the rudiments of two abortive ones, the former scarcely so long as the corolla, conniving at their summits. *Anthers* composed of two divaricate transverse lobes. *Ovarium* linear, surrounded at the base with a white tubular entire nectarial ring or cup, and produced into a tomentose style of the same length as the stamina. *Stigma* obtuse, truncate. *Capsule* long, linear, silique-shaped, cylindrical, acute, somewhat tomentose, one to two inches long, two-valved, two-celled; dissepiments contrary, with two lobes, which are parallel to the valves, revolute and seed-bearing at their margins, and parting the cells in such a manner as to give the appearance of a four-celled siliqua. *Seeds* numerous, naked, small, and subrotund.

Obs.—The deep-red colour of the lower surface of the leaves, and the crested disposition of the flowers in their axils, render this a very remarkable species. The æstivation is imbricate, the two lateral lobes of the lower lip being the outermost.

2. DIDYMOCARPUS RACEMOSA.

D. foliis oppositis lanceolatis utrinque attenuatis duplicato-serratis supra glabris, pedunculis axillaribus plerumque bifidis, floribus racemosis, pedicellis binatis.

At Tappanooly, on the west coast of Sumatra.

Stem short, erect, simple, rough with the vestiges of old leaves. *Leaves* crowded, opposite, sub-petiolate, spreading, about nine inches long, narrow-lanceolate, attenuated towards both ends, duplicato-serrate, strongly nerved; upper surface smooth, with the exception of the middle rib, which is furnished with long hairs; all the nerves of the under surface pilose. *Petioles* short, embracing the stem; densely pilose above. *Peduncles* axillary, generally solitary, erect, shorter than the leaves, covered with purple, glandular hairs, generally dividing into two racemes, composed of many pedicellate flowers arranged in pairs. *Bracts* lanceolate, accuminate, serrate, ciliated. *Flowers* white, as in the genus. *Calyx* five-parted, erect, reddish, hairy. *Capsules* linear, straight, generally deflexed, nearly cylindrical, rough with short erect hairs, pseudo-quadrilocular. *Seeds* naked.

Obs.—This species has great resemblance in general habit and in form of the leaves to the preceding, but differs widely in the inflorescence, which is here very peculiar. The peduncles divide into two branches of equal length, on each of which flowers are arranged by pairs, forming two racemes supported by a common peduncle.

3. DIDYMOCARPUS REPTANS. *Mal. Misc. vol.* i.

D. prostrata reptans, foliis petiolatis ellipticis crenulatis, pedunculis 1—3 axillaribus unifloris, staminibus duobus fertilibus.

Timmu Kichil. *Malay.*

Found in the forests of Pulo Penang with the preceding.

Stem prostrate, round, villous, striking root at every joint, often a foot in length. *Leaves* lying flat, opposite, petiolate, oblong-oval or elliptic, rather obtuse, sometimes slightly cordate at the base, slightly crenate, covered with white hairs, green above, paler and sometimes reddish beneath. *Petioles* villous. *Peduncles* one to three, axillary, one-flowered, erect, as long as the leaves, pilose, furnished with two bracts near the summit. *Calyx* five-parted, with erect acute laciniæ, the uppermost smaller. *Corolla* white infundibuliform, subirregular, similar to that of *D. crinita*, but smaller as well as the whole plant. *Stamina* two fertile, conniving above, two sterile. *Anthers* approximate, reniform, two-celled. *Nectary* surrounding the base of the ovarium, obsoletely five-toothed at the margin. *Style* equal to the stamina. *Stigma* simple. *Capsule* long, straight, silique-shaped, pseudo-quadrilocular, as in the genus. *Seeds* numerous, naked.

4. DIDYMOCARPUS CORNICULATA. *Mal. Misc. vol.* i.

D. erecta, foliis alternis obovatis acuminatis serratis floribus fastigiatis secundis, pedunculo axillari elongato.

Found at Tappanooly in Sumatra.

The *stem* is nearly erect, from one to two feet in height, herbaceous or somewhat shrubby, villous. *Leaves* alternate, petiolate, obovate, acuminate, narrowing to the base, serrated, pilose above, villous below. *Peduncles* axillary, solitary, elongated, bearing several dense fascicles of flowers, all turned to one side, depressed or bent at an angle to the peduncle, and spreading in a kind of half-circle, somewhat in the manner of the *Lotus corniculatus.* *Flowers* many, white; *pedicels* articulate below the calyx, covered as well as the calyx with glandular hairs. *Bracts* linear, acute. *Calyx* five-parted; *segments* linear. *Corolla* white, much longer than the calyx, infundibuliform, wide at the faux; *limb* somewhat oblique, bilabiate, the lower lip longer, three-lobed. *Stamina* two fertile, connected above by their anthers, whose lobes are transverse. *Style* as long as the stamina. *Stigma* capitate. *Capsule* silique-shaped, two-celled; *cells* bipartite (as if four-locular), two-valved, generally bursting at one side, many-seeded. *Seeds* naked.

The disposition of the flowers and fruit is peculiar, the capsules spreading horizontally like radii in a sort of semicircle, of which the peduncle is the axis.

5. DIDYMOCARPUS ELONGATA.

D. herbacea erectiuscula didynama, foliis oppositis ovatis utrinque acutis serratis, spicis axillaribus secundis, pedicellis binatis remotis, corolla elongata.

Found on Pulo Bintangor, an island lying off the west coast of Sumatra.

A small erect herbaceous plant, about half a foot high, pilose. *Leaves* opposite, petiolate about five inches long, ovate, acute at both ends, serrated, papillous, and pilose with rather long hairs above, villous beneath with short hairs. *Petioles* channelled above and ciliate along the edges of the furrow. *Stipules* none. *Peduncles* axillary, solitary, bearing an unilateral spike rather longer than the leaf. *Pedicels* in pairs, each pair rather remote. *Bracts* linear, at the base of the pedicels. *Calyx* five-cleft; *laciniæ* linear, acute, erect, tomentose, as well as the whole spike. *Corolla* tubular, somewhat curved, white, with a purplish tinge, slightly tomentose without, bilabiate; upper lip two-lobed; lower rather elongated, three-lobed. *Stamina* four, didynamous, each pair connected by their anthers. *Anthers* two-lobed, reniform. *Style* shorter than the stamina. *Stigma* thickened, emarginate. *Capsule* long, silique-shaped, pointed two-valved, two-celled; *cells* bipartite (pseudo-quadrilocular): *seeds* attached to the revolute edges of the placentæ, which from the pseudo-partitions of the cells, numerous, small, not winged.

Obs.—The remotely flowered secund spikes, and the nearly tubular corolla with elongated lower lip, distinguish this from all its congeners.

6. DIDYMOCARPUS BARBATA.

D. fruticosa, foliis oppositis ovatis subinæquilateralibus hirsutis, pedunculis gracilibus axillaribus fasciculatis 2—6-floris, staminibus quatuor apice barbatis: duobus sterilibus, calyce infundibuliformi.

Native of Sumatra.

Fruticose, erect, the older branches round, the younger somewhat compressed and furrowed on two opposite sides, scabrous. *Leaves* opposite, petiolate, ovate, somewhat inequilateral at the base, acuminate, entire, covered with bristly hairs above, each inserted on a small papilla or gland, villous beneath, with prominent nerves; about four inches long. *Petioles* about half an inch long. *Peduncles* axillary, fascicled, long and slender, smooth, forming an ascending curve, bifid or trifid, sometimes again divided, so as to be dichotomous, 2—6-flowered. At each division of the peduncle is situated a funnel-shaped bracteal cup, apparently composed of two opposite bracts united nearly their whole length. In the axillæ, at the base of the peduncles, the bracts are distinct and woolly. *Calyx* infundibuliform, persistent, smooth; *mouth* quinquefid. *Corolla* much longer than the calyx, infundibuliform; *limb* five-parted; *laciniæ* subrotund, nearly equal. *Stigma* four, of which two only are fertile and connected together by their anthers; the filaments of both are furnished at the summit with a tuft of wool. *Anthers* with transverse lobes. *Style* nearly as long as the fertile stamina. *Stigma* sub-lobate. The base of the ovary is surrounded by a nectarial ring, as in the genus. *Capsule* silique-shaped, four-furrowed, long, somewhat arcuate, pseudo-quadrilocular, many-seeded. *Seeds* naked, elongated, pendulous, inserted on the involute margin of the lobes of the dissepiment.

Obs.—The pseudo-quadrilocular structure of the capsule is here remarkably distinct; it is a well-marked handsome species, having numerous flowers supported on long slender ascending peduncles.

7. DIDYMOCARPUS FRUTESCENS.

Mal. Misc. vol. i.

D. caule suffrutescente erecto, foliis oppositis longe petiolatis ovato-lanceolatis utrinque attenuatis supra glabris subtus canescentibus, floribus axillaribus fasciculatis didynamis.

Native of Pulo Penang.

Stem generally simple, suffrutescent, densely covered with ferruginous appressed scales or chaffy hairs. *Leaves* opposite, long-petioled, ovate-lanceolate, acuminate, attenuated to the base, slightly serrated, eight or ten inches long, smooth above, hoary and tomentose beneath, with appressed hairs. *Petioles* three inches long, furrowed above, thickened at the base, villous. *Stipules* none. *Peduncles* axillary, fascicled, one to three-flowered, shorter than the petioles, purplish. *Bracts* lanceolate acute. *Calyx* tomentose, with glandular hairs, tubular, five-parted; *laciniæ* linear, spreading above.

Corolla white, tomentose without like the calyx, infundibuliform, incurved, all the laciniæ subrotund, obtuse. *Stamina* four, didynamous, arcuate, approximate at their summits, each pair connected by their anthers. The filaments of the upper pair are thickened below their middle. *Anthers* white, adnate to the filaments, consisting of two lobes nearly parallel. *Style* of the length of the stamina. *Stigma* truncate. *Capsula* long, linear, silique-shaped, two-valved, two-celled; *cells* two-parted by the septiform lobes of the dissepiment, which are revolute and seminiferous at their margina. *Seeds* numerous, naked.

LOXONIA.

Calyx 5-partitus. *Corolla* infundibuliformis, limbo quinquefido bilabiato. *Stamina* quatuor fertilia, corrolla breviora. *Stigma* bilobum. *Capsula?* ovata, calyce inclusa, bilocularis, polysperma; dissepimenti contrarii lobis revolutis seminiferis. *Semina* nuda.

Foliis oppositis altero nano, plerumque inæquilateralibus, floribus racemosis.

1. LOXONIA DISCOLOR.

L. foliis supra glabris, subtus retrorsum scabris purpurascentibus, racemis simplicibus elongatis.

Found in the interior of Bencoolen.

Herbaceous. *Stem* tomentose, purple, round, somewhat flexuose, recurved. *Leaves* opposite, bifarious, the one minute and reniform, the other sub-sessile, semicordate, ovate-oblong, falcate, acuminate, four or five inches long slightly serrated; serratures recurved, in old leaves almost obsolete, smooth, and of a very deep-green above, retrorsely scabrous and purple beneath. *Racemes* simple from the axils of the smaller leaves drooping backwards, long, slender, unilateral, tomentose, purple; *pedicels* short, alternate. *Calyx* five-parted, covered with red hairs; *segments* erect, acute.

Corolla smooth, of a delicate yellowish-green colour, streaked on the inside with purple lines, much longer than the calyx, bilabiate; lower lip three-lobed; upper two-lobed; lobes shallow; faux furnished with two perpendicular villous lines from the incisions of the lower lip; a villous ring within the tube immediately below the insertion of the stamina. *Stamina* four, all fertile, didynamous, shorter than the corolla; the opposite anthers connected together. *Style* one. *Stigma* two-lobed. *Capsule?* inclosed in the persistent calyx, ovate, two-celled; cells divided by the revolute lobes of the dissepiments. *Seeds* naked, roundish, foveolate.

Obs.—The parietes of the capsule are very thin, and I have not yet been able to observe exactly their dehiscence.

2. LOXONIA HIRSUTA.

L. hirsuta, foliis semiovatis latis, pedunculis 2—4-fids, floribus racemosis.

Native of Sumatra, interior of Bencoolen.

Stem recurving, somewhat flexuose, hirsute. *Leaves* opposite, sub-bifarious, very short-petioled, the one small and semi-cordate, the other semi-ovate, broad, acuminate, slightly serrated, rugose, hirsute on both sides; about five inches long and two or two and a half broad. *Peduncles* from the axils of the small leaves, looking backwards, dividing into from two to four unilateral racemes, shorter than the leaves. *Calyx* five-parted. *Corolla* bilabiate, five-lobed. *Stamina* four fertile, didynamous. *Anthers* with transverse lobes. *Style* simple. *Stigma* obtusely two-lobed. *Ovary* two-celled. polysporous, the lobes of the dissepiments revolute and seed-bearing.

ÆSCHYNANTHUS.

Calyx ventricoso-tubulosus, 5-fidus. *Corolla* limbo subirregulari. *Stamina* 4 antherifera, exserta, sæpius rudimento quinti. *Capsula* longissima, siliquæformis, bivalvis, pseudo-4-locularis, seminibus numerosis (aristatis).

Suffrutices debiles, foliis carnosis, floribus coccineis.

The capsules of this genus nearly resemble those of *Didymocarpus*, and exhibit with great distinctness the peculiar character of this family. The seeds are attached to the whole of the inner surface of the lobes, and are singular in being awned. The exsert stamina and crimson flowers are further deviations from the usual habit of its congeners.

1. ÆSCHINANTHUS VOLUBILIS.

A. caule volubili, calycibus glabris.

Found in the neighbourhood of Bencoolen.

Stem suffrutescent, weak and twining, round, smooth. *Leaves* opposite, petiolate, oval, acute at both ends, very entire, very smooth, rather fleshy; nerves indistinct; two or two inches and a half long. *Petioles* downy on the edges. *Stipules* none. *Peduncles* axillary, two-flowered; *pedicels* longer than the peduncle. *Bracts* two, opposite, large, ovate. The axil is sometimes occupied by a flower-bearing branchlet, which has the appearance of a many-flowered peduncle. *Calyx* tubular, somewhat campanulate, smooth, five-cleft at the mouth, persistent. *Corolla* of a crimson colour, longer than the calyx, sub-ringent; *tube* curved; upper lip erect, two-lobed; segments small and approximate; lower three-parted segments larger and reflexed. *Stamina* five, of which four are fertile and exsert, the middle one sterile; the fertile stamina are at first connected by their anthers, but afterwards diverge from each other. *Ovary* surrounded by a fleshy nectarial ring, which is marked with five lobes. *Style* nearly as long as the stamina. *Stigma* sub-bilabiate; *Capsule* silique-shaped, eight to ten inches long, two-valved, two-celled; *cells* bipartite by the revolute lobes of the septa; *dissepiments* composed of two laminæ easily separable.

Seeds very numerous, attached to the inner surface and edge of the lobes, small, oblong, furnished with a long thread or awn at each end, and having a rounded apophysis above.

2. ÆSCHYNANTHUS RADICANS.

A. caule radicante, calycibus villosis.

Simbar burong. *Malay.*

Found in the forests of the interior of Sumatra growing on the trunks of old trees, with its root sometimes on the ground, sometimes on the tree.

Branches long and slender, radicating at the joints. *Leaves* opposite, short-petioled, varying from ovate to elliptic-lanceolate, sometimes almost cordate at the base, acute, very entire, the margins somewhat reflexed, villous, thick, fleshy and veinless, whitish, and finely punctate with depressed dots beneath; from one to two inches long. The old leaves become quite smooth, particularly on the upper surface. *Peduncles* axillary, sometimes also terminal, generally two-flowered, villous. *Flowers* drooping, of a deep crimson colour. *Bracts* two, at the base of the pedicels. *Calyx* tubular, villous; mouth quinquefid. *Corolla* more than twice as long as the calyx, villous without; tube gibbous at the base, contracted opposite the middle of the calyx, infundibuliform above and somewhat curved; limb subringent; upper lip erect, two-lobed; segments small and approximate, lower three-parted. *Stamina* four, exsert; *anthers* two-celled, each pair united by their apices; there is no rudiment of a fifth stamen. *Style* a little longer than the stamina. *Stigma* thick, somewhat funnel-shaped. *Capsule* pedicellate, about eighteen inches long, cylindrical, two-valved, two-celled, cells bipartite by the revolute lobes of the septa. *Seeds* very numerous, aristate at both ends, precisely as in the preceding species.

(To be continued.)

*Recherches sur les Poissons Fossiles.** *Par* Louis Agassiz, *Professor d' Histoire Naturalles à Neuchatel.*

To appreciate the study of fishes in general, and of fossils in particular, it is necessary to consider the position of this class in the animal series. Placed superior to the Radiated animals, (Radiata), and the Molluscs, they present more complete organization, and are subject to greater peculiarities of structure; we also find their remains to present more exact geological limits, than those of the inferior animals. We do not find the class of fishes present the same genera, nor even the same families, throughout all the series of geological formations, with the species often differing but slightly in their appearance, as we do in the class of the Zoophytes; on the contrary, from one formation to another, this class is represented successively by genera very different, referable to the families which also disappear suddenly, as if the complication of a superior organization were unfitted for long perpetuation without essential modifications of character; or rather, as if animal life tended more rapidly to diversity in the superior orders of the animal kingdom, than in the lower gradations of nature. On this account it is that fishes, like mammalia and reptiles, have the species but little extended; in general they are confined in the series of strata, to short vertical distances, even in the different genera, without passing insensibly from one formation into another, as we find to be the case with certain shells. One of the facts the most interesting that I have observed, is, that I am not acquainted with a single species of fossil fish which is found successively in two formations, although I am acquainted with a great number, which have an extensive horizontal distribution. Yet the fossil fishes are more advantageous to Geology, than any other fossils, from the circumstance of

* Continued from vol. iii. p. 344.

finding their remains in all formations, and the opportunity they afford of comparing those differences which present themselves throughout great lapses of time in animals constructed in general on the same plan, and belonging to a single class of which we are already able to enumerate a great number of fossils species, referable for the most part to types which no longer exist, and whose affinities with living species are equal to those which connect the Crinoides to the ordinary Echnoderms, the Nautiles and the Sepia to the Bèlemnites and to the Ammonites, the Pterodoctyles, the Ichthyosaures and Plesidaures to our Saurians, the living Pachydermata to those which inhabited of old the borders of the lakes in the environs of Paris, or the plains of Siberia. The fishes of the tertiary strata are those on which I have dwelt least, because they approach nearest to living fishes, and that their study falls rather within the province of works, which we are already in possession of on Ichthyology. Although we see enormous numbers of living fishes which they approach, it is found very difficult in their state of preservation to identify them, or rather to appreciate exactly their distinctive characters, to which I have in general confined my observations. I have not found one single species that could be satisfactorily identified with those of our seas, except one little species which we found in clayey boulders in Greenland of an uncertain geological age.

The species of the Norfolk Craig, of the upper Sub-apennine formation, and of the *Molasse*, belong, for the most part, to genera common in the tropical seas: such for instance as the Platax, the large Carcharias,* the Myliobates with large chevrons, etc.

In the inferior tertiary formation, in the London clay, in the *Calcaire grossier* of Paris, and at *Monte-Bolca*, already a third or more of the species are found to belong to genera

* White Sharks.

which no longer exist. In the comparative table that is shortly to be published, the names of fossil genera and of species of all the geological epochs are to be indicated equally with the localities in which they have been found, and a particular column will be assigned to the genera corresponding with those of the present actual creation. More than two-thirds of the species hitherto discovered in the chalk, are referrible to *genera* which have entirely disappeared; we even here begin to find some of those singular forms which prevail in the oolitic series. Nevertheless, the fishes of the chalk approximate more closely than those of the oolite, to the general character of the tertiary fishes; so much so, that in a general approximation of geological formations, it appears to me more natural to associate the formation of the chalk, and of *gres vert* with the tertiary strata, than to class them in the group of secondary beds. In the lower beds of the chalk, there is no longer a single genus which has living species; and even those beds of the chalk which have, contain a great number fossil.

The oolitic series, to the lias inclusive, forms a very natural and well-defined group, which ought to contain also the red marl formation, in which I have not found a single species referrible to the genera of the chalk. After this epoch, in descending always, of the two orders which prevail in the present creation, one is no longer found; while those forms which are fewest in our day, are represented suddenly in very great number. As to the Ganoids, those which are found here, have the genera with the symmetrical caudal; and are such only as have the teeth grooved on both faces, with large spinous prominent rays. For it is certain now, that the great rays which Messrs. Buckland and de la Beche have called *Icthyodorulithes*, did not belong to either Silures or Balistes; but they are the dorsal rays of large sharks, of which we find the teeth in the same beds.

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In descending from the lias to the lower formations, we observe a great change in the posterior extremity of the Ganoïdes. All have the vertebral column prolonged to the extremity of the caudal fin in an unequal lobe; and this peculiarity belongs to all the more ancient fishes; vide. fig. 1 page 77. One other observation is worthy of remark, namely, that we do not find carnivorous fishes, that is to say, fishes armed with strong conical and sharp teeth, in beds anterior to the coal formations. They rather appear to have been omnivorous, their teeth being rounded, or in obtuse cones, or crowded, *(en brosse.)* We may safely hope one day to be able to collect a great number of facts, relative to the habits and internal organization of these animals. The discovery of Coprolites has already afforded an insight into the character of the organic beings which afforded food to these pirates of the ancient seas; for in the Coprolites which are numerous in the repositories of Sauroïd fishes, we readily discover the scales of the fishes which they devoured, and sometimes these scales are determinable. Even the intestines are preserved, as in the case for instance of a kind of Mègalichthys, where we see a portion of the intestine; the bundle of pyloric appendices, and the ends of intestines of species of Leptolepis, and of the Thrissops of Solenhosen, known under the name of Lumbricaria, are not rare in the schists of this interesting locality. In the fishes of the chalk, examples may be seen in the collection of Mr. Mantel where the entire stomach is preserved, with the different membranes by which it is separated into coats. In a great number of fishes of the chalk, of the isle of Sheppy, and of the oolitic series, the capsule of the eye ball is still entire; and in many species of Monte-Bolca, of Solenhosen, and of the lias, we see very distinctly all the little laminæ which constitute the branchæ (or gills). It appears however that the peculiar nature of particular rocks, contribute to preserve some parts rather than others.

It is in the series of deposits inferior to the lias that we begin to find the largest of those monstrous Sauroid fishes, whose osteology resembles so much the skeletons of the Saurians, whether by the more intimate sutures of the bones of their cranium, or by their large longitudinally striated and conical teeth, or by the manner in which the spinous apophyses are articulated with the body of the vertebræ, and the sides to the extremity of the transverse apophyses.

The analogy which we find between these fishes and the Saurians, is not merely confined to the skeletons in one or two genera, which still maintain their existence. I have found a very peculiar internal organization of their soft parts, which approaches still more to the group of reptiles, as will appear presently. There is in fact in the *Lepidosteus osseus*, a glottis, the same as in the Sirens and Salamandrous reptiles, a cellular air, or swimming vessel, with a trachea or wind-pipe, as the lungs of an Ophidian. In short, their covering appears to resemble that of the crocodiles, from which they are not always to be easily distinguished.

The small number of fishes found in the transition beds, do not allow us yet to assign a particular character to them. However, the species in the collection of Mr. Murchison, already shew, that their types do not extend to the coal formation.

What is most remarkable in all the fishes below the oolitic series, (except their analogy with the reptiles,) is the great uniformity of types on the one hand, and on the other, the great uniformity of the different parts of the same animal among themselves, which are consequently difficult to distinguish, such as the scales, the bones, and teeth. If it were allowable here to hazard a conjecture on such a state of things from what is now presented to us, there would appear to be some reason to think, that the principle of animal life was slowly developed under the form of ordinary fishes; and that reptiles, birds, and mammalia, gradually advanced, or branched out from these singular Sauroid fishes, which participate at the same time with fishes and reptiles, and that the mixed character of this class was lost on the appearance of the numerous reptiles which succeeded them, as we see in the Ichthyosaurians and Plesiosaurians, participating in their osteology with the character of the Whales in the class of Mammalia, while the great terrestrial Saurians approximate to the Pachydermata, which seem to have been much more slowly developed.

This observation also agrees with those ideas of the philosophy of nature, in which a regular organic developement is represented in all created beings, constantly varying with the different conditions of existence presented from time to time on the surface of the globe, according to the changes to which that surface itself is subject.*

From such facts as these, may be seen throughout the geological series of formations, two great divisions which terminate at the *grès vert.* The first, the more ancient, afford few traces of the Ganoïdes and Placoïds. The second, an approach towards existing beings, presents forms and organizations much more diversified; particularly the Ctenoïds and the Cycloïds, and a small number of species in the two preceding orders which insensibly disappear, and of which the living analogues are considerably modified. We do not find the fishes of the first great period to present amongst themselves any difference corresponding with that which we now observe between the fishes of fresh water lakes and rivers, and the fishes of the seas; such distinctions of fresh water and salt water strata extend no lower than the oolitic series, so that the waters of remote times, were probably circumscribed by less solid basins than at pre-

* The views of the author are here not perhaps sufficiently worked out, and the philosophy to which M. Agassiz refers in the preceding paragraph, although apparently derived from Lamarck, is still far from satisfactory.

sent, and consequently presented a more uniform character than we find to be the case at present.

The following are M. Agassiz's observations on the classifications of fishes, a subject which he proposes to enter into in more detail, in a more advanced stage of his work on fossil fishes:—

All naturalists are agreed as to the imperfection of the various classifications that have been hitherto proposed for the class of fishes. I shall not enter into a criticism of the subject here, but confine myself to an indication of some of the peculiarities of the classification observed in this work, leaving to ichthyologists to appreciate their value. The only thing I now ask is, that it may be remembered that the sketch here presented is incomplete, and that it is intended hereafter, at the end of the first volume, to enter into the necessary details on the subject.

I have established in this class four orders, which I believe to be the representatives of one another, and that each enjoyed a particular reign at different geological epochs. Each of these orders contains fishes possessed of cartilaginous skeletons,* each of them contain genera with spinous rays in the dorsal,† as well as other genera of which all the rays are soft;‡ finally, each of these orders have the apodal genera§ and abdominal genera,|| and in each of these orders, there are also thoracic and jugular fishes. We thus see the divisions here proposed are not unfounded, even to the ossification of the skeleton, and the structure of the vertical, and the position of the double fins, or those that are placed in pairs; but recognise all these characters as in those systems which have up to this time been followed. I have endeavoured to find in the differences presented by the

* As Sharks and Skaits. † As Siluridæ.

‡ As the sea Gobies. § As the Eels.

|| As the Carps. Thus each order represents the various leading types of the entire class.—Ed.

scales, an exact means of tracing the natural affinities of all fishes. It is quite indisputable, that the animals of this class have in their squamous integuments, a peculiar character which forms a distinct and independent system, enveloping the animal, and entering into the most intimate relations between the being and the external world by which it is environed, as the feathers of birds and the hair of Mammalia, etc. We conceive, therefore, that parts which change with the condition of existence, in which the beings live, should possibly, for this reason, correspond also with all the peculiarities of internal organization, and therefore lead to correct conclusions.

Here are the orders and the names of the principal families comprised in our classification :—

First Order: The Placoïdes.—So named, because of the irregularities presented in the solid parts of their integuments; these are deposits of enamel, of considerable dimensions, or in numerous little points, as the shagreen of Rais, Sharks, etc.

The family of *Cestraciontes*, Agassiz, only contains a single genus of which there are any species at present existing on the earth, the genus Cestracion: the others are fossil, the *Hybodentes*, Agassiz, are also fossils; then come the *Squales* or Sharks, the Rais and the Cyclostomes.

Second Order: The Ganoïdes.—This division contains families in appearance very different, but which have, however, much affinity when examined closely, and arranged according to their habits. The character which they all possess in common is, the angular form of their scales, which are composed of two substances; namely, horny or bony plates deposited one under the other, and covered by a thick bed of enamel. These scales are formed exactly as the teeth.

We must place here the *Lepidoides*, Agass. which are all fossils, the Sauroïds id. likewise fossil, except two genera, the Lepidostes of Bichir; and the *Pycnodonts*, Agass. also fossil;

the *Sclerodermes*; the *Gymnodonts*, the Lophobranchs, the Goniodonts, the Silures and the Sturgeons.

Third Order: The Ctenoïdes.—If we reflect on the striking difference of form which we sometimes observe in the genera of this same family, we will not be surprised to find united in the group, families whose external aspect is very variable. The most numerous have the scales formed of laminæ having the posterior border pectinated, that is to say, the *hinder* part of the border which is visible. The numerous layers, which are superimposed one to another overlap so, that the inferior lamina projects always beyond the superior, so as to cause the scales almost to touch. This structure is particularly perceptible in the Chetodons and Pleuronectes, so that they seem as if placed too near to each other. It is here that we place the *Percoïdes*, the *Polyacanthes*, the *Sciènoïdes*, the *Sparoïdes*, the *Scorpenoïdes*, and the *Aulostomes*.

Fourth Order: The Cycloïdes.—The families which belong to this order, have scales formed of simple plates, and the borders plain, which does not prevent their external surface from presenting occasionally a great variety of colours on the outer surface of the laminæ of the scales. The scales of the lateral line are formed like all the others; but in place of the flat plates, there are channels placed one to another, and extending backward against the disc of the scale, form a tube from which the mucus, which covers the body flows. This tube is sometimes bifurcated, and sometimes ramified. Here we place the *Labroïdes*,* the *Muges*,† and the *Atherines*,‡ the *Scomberoïdes*,§ the Gadoïdes,‖ the Goboïdes,¶ the Murenoïdes,** the Lucioïdes,†† the Salmons, the Clupes,‡‡ and Cyprins.§§

* The Wrasse family. † Mullets. ‡ Sand Smelts.
§ Mackerels. ‖ Codfishes. ¶ Sea Gudgeons.
** The Eels. †† The Pikes (?) ‡‡ Herring family.
§§ The Carps.—Ed.

Yet we may remark in general, that there is hardly a single family, a small number of species of which do not represent some genus, which is afterwards to appear. I cite, for example, the family of the Labres as they now exist.

In order therefore to account for the affinities of families when explaining the character of genera, I have anticipated here the views I have to give relative to development, in the chapter on classification in another part of the work. I propose afterwards to examine the general bases on which all the classifications in Natural History repose.*

We have now perhaps introduced enough from the *Recherches sur les Poissons Fossiles*, to afford an idea of the great labour bestowed on the subject by M. Agassiz, the great interest and importance of the subject itself, and of the method pursued by M. Agassiz in the inquiry. It remains for us, therefore, to place the subject practically before our readers, as far as it is possible in a brief shape, so as to enable them to follow in our author's footsteps, or at least to con-

* This will be a task of no small importance, and we doubt not the original views of M. Agassiz, together with his experience in one important branch of Zoology, that of fossil fishes, will enable him to contribute several interesting facts relative to the general affinities and relations of this class of animals. Already we perceive several observations of the very highest interest in the *Recherches sur les Poissons Fossiles* of this author, bearing on the great question of natural classification; we allude to the successive repetition under different modifications of the types of the first order of M. Agassiz, the Ganoides, throughout the subsequent orders. This, if it should be confirmed by further labours, we regard as a discovery of greater importance than any that has been recently made in Zoology. But we are far from viewing it as supporting the doctrine of the progressive development of animals, as it is evidently regarded by M. Agassiz, but rather as confirming, from the study of fossil fishes, the existence of Primary Types, one of the principles upon which the system developed in the *Horæ Entomologicæ* of Mr. Leay is based. As this system must of course come under the notice of M. Agassiz in the proposed review, we long for the result.

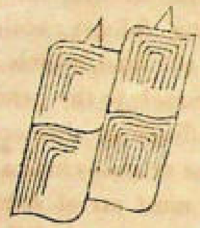
tribute something towards the advancement of a branch of science, so eminently calculated to elucidate the early history of the globe. For this purpose, we have here introduced reduced, and of course imperfect copies of a few of the beautiful plates of M. Agassiz's work, and shall now quote the generic and specific characters of the species represented, under the hope, that the extensive tracts of country composed of Silurian rocks, old red sandstone, and the coal measures of India, will afford some of the numerous PLACOÏD and GANOÏD fossil forms which distinguish the same rocks throughout Europe, as well as such parts of America, as have been recently examined. The notice of Dr. Falconer's collection in the succeeding article, shews that discoveries have already been made in this country of tertiary remains of fishes. This is a good beginning, and may lead us to hope for more important discoveries in the coal measures, the old red sandstone, and the Silurian rocks, which we have reason to suppose are extensively distributed throughout India. We have already remarked that such discoveries do more in a day for the advancement of education, than all the money which Councils of Public Instruction spend in a year, because they afford the most powerful incentives to study and enquiry, furnishing at every step, new insight to the vast changes of which we should otherwise remain in ignorance of, relative to the structure and formation of the earth, and its riches in objects of direct utility to man.

Dapedius Colei, Agass. Pl. V, belongs to the first family of the GANOÏDS, called *Lepidotus*. The family is divided into sections, in the first of which, the caudal vertebræ are extended to the end of the tail; (fig. 1, p. 77,) in the second the tail is regular, (fig. 2, p. 77). *Dapedius Colei* as will be seen in the drawing, belongs to the latter section, which contains two genera, which have been confounded together as a single genus by Mr. De la Beche, in the Geological Transactions.

M. Bronn first pointed the distinction between the species described by Mr. De la Beche; some having crenated sloping teeth, and some pointed teeth: to the latter he gave the name of *Tetragonolepis*, and these distinctions have been adopted by M. Agassiz. *Dapedius Colei*, at first view would appear to an uninitiated observer as something like the Bream; but on closer inspection, the scales are seen to be square, as represented on the following page, and are covered by a coat of enamel—peculiarities which alone distinguish these fossils from all existing fishes. "The osteology," says M. Agassiz, "of the genus Dapedius is most interesting. In a specimen figured by Lord Cole on a fly leaf, and from which I have taken a drawing, we see a great part of the skeleton, the examination of which has enabled me to clear up many questions connected with the anatomy of the family. The bodies of the vertebræ are wanting, as in all the *Lepedoides* of whose skeletons I have seen any portion, but the sides and all the superior spinous apophyses are very well preserved. The sides are dilated and flat at their insertion; the rest, granular and round, are not expanded downward more than half the height of the abdominal cavity. The superior spinous apophyses are composed of many pieces, as in the Caturus; and have the base united to the body of the vertebræ by two little short pieces, which are surmounted again by other more elongated pieces," &c. Then follows a minute description of the various processes of the vertebræ, and their relations with the bones supporting the fins, all which are represented in drawings. Of the head we distinguish the operculem, the sub-operculum, and pre-operculum, or gill covers. The thoracic, the temporal, the jugular bones, and the jaws with their numerous ranges of furrowed teeth, *(dents echancrèes)*, the pterygoid with the teeth in groups on the surface, and the palatine with some bifurcated teeth—the interior surface of the frontal bone, are all minutely described and drawn. So that we have as exact an account of the anatomical structure of these extinct inhabitants of our planet, as of any of the beings now living on its surface. Not only this, but the vast shoals of certain species which have perished at the early period referred to, and whose remains are found accumulated together in particular places, together with the coprolites or excrements, which are also found with the remains of the animals themselves, afford us as perfect a knowledge of their habits, as we possess regarding any of the fishes of our own day.

One species, *Dapedius politus*, is found in the lias at Lyme Regis, along with numerous remains of Pholidophorus, and the teeth and rays of *Cestracions* and *Hybodonts*, represented by De la Beche in the Geological Transactions. The collections of Messrs. Philpot at Lyme Regis, of Lord Cole, Sir P. Egerton, Professor Buckland, Mr. Murchison, Mr. Stokes, Mr. Baker, Mr. Weaver, Messrs. Cumberland and Johnston, as well as the Museums of York, Bristol, Whitby, and Naresborough, all contain numerous specimens. Of the genus Dapedius, M. Agassiz figures four species, and describes no fewer than six or seven. Of *Dapedius Colei*, he remarks, it may be easily distinguished from the others by the appearance of the outer surface of the head, which is almost perfectly smooth at the anterior border of the operculum; and on the occiput, and sides of the lower jaw there is a small compact granulation, which is extended to the anterior borders of the scales of the nape, and belly. The rest of the scales are perfectly smooth, nor do we remark any trace of the little hollows on their surface, such as those which characterise *Dapedius punctatus*, and the species generally of this locality, but on the contrary, we distinguish the concentric lines which are formed by their laminæ of growth.

The annexed fig. represents the large scales on the flanks.



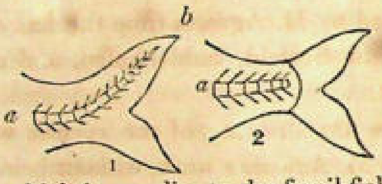
Examples of the scales of all the different species of the family are given by M. Agassiz, but this single instance of their remarkable forms, as compared with the scales of fishes of the present day, may be quite sufficient to mark the peculiarity of these interesting fossils.

Pholidophorus latus, Pl. III. This we have taken as an example of another genus, of the family *Lepedoides*, nearly allied to the last, for the purpose of shewing the somewhat magnified representation of the scales, fig. 2, 3, and the articulations of rays of the caudal fin also enlarged, fig. 4. This specimen is from Eichstädt, and is taken from an example in the collection of Count Munster. This genus is characterised by the small dorsal placed opposite to the ventrals; caudal forked, equal lobes, scales extended slightly on the base of the upper lobe: teeth crowded. Seven species are described by M. Agassiz from the lias of Lyme Regis in England, of Seefeld, Sohlenhofen, and of Oberland on the continent.

It is impossible to view the drawing of the species we have here introduced from M. Agassiz's work, without being struck by the great general resemblance to the existing form of Cyprinus, nor can we contemplate the great difference in all the details of structure which Cyprinus and Pholidophorus present under the same general form, without referring them to something like corresponding types in two distinct orders or groups. It is to be hoped that as in the case of Dapedius, M. Agassiz may be able to trace the form of the stomach in the genus Pholidophorus also, and ascertain if that organ be provided with cecal appendages, the absence of which, as well as of teeth, constitute the chief distinguishing character of Cyprinus.

Thrissops intermedius, Münst, *Pl.* II. We have here introduced this figure as another example of the family. The genus is characterised by M. Agassiz as follows: scales large and very thin, dorsal opposite to the anal, which is very long. The same characters apply precisely to the genus *Opsarius*, M'Clell., which consequently affords another corresponding type. We do not say, that these relations indicate any direct affinity, but they are such as must arrest attention, whether we regard them as corresponding types in different orders of the same class, or as progressive degrees of development. They are curious analogies in animals appearing at remote intervals of time on the surface of the earth.

Ophiopsis procerus,* Ag. Pl. I. This plate we have introduced to shew the peculiar elongation of the extremity of the body towards the upper corner of the caudal fin, which is so remarkable in fossil fishes, and which perhaps will appear more striking in the annexed representation of this part of the skeleton. Fig. 1 is the tail of *Platysomus*, Ag. in which the vertebral column *a*, is seen prolonged to *b*—the upper corner of the caudal fin, a character



which is peculiar to the fossil fishes of the coal formation and new red sandstone. Fig. 2, on the contrary, represents the manner in which the vertebral column *a*, terminates in all fishes possessed of a bony skeleton in the present creation, as well as in the tertiary fossil fishes. So marked a peculiarity of the spinal column in the early fossil species of this class was not without some object adapted to the peculiar state of existence in which they lived; this may deserve a few remarks which we do not find in the work of M. Agassiz.

* The small figure in the corner of this plate is represented as a young individual; the drawing is taken from a specimen from the lias of Lyme Regis.

The circumstances requiring such an extraordinary form of the bony skeleton of fishes, whatever they were during the period of the coal formation, no longer exist in regard to these animals. But we find the cartilaginous fishes of the present day, the Sharks, the Rais, and Sturgeons, present a similar peculiarity of structure in relation to the caudal termination of the vertebral column; and reasoning from the known habits of these species, and the manner in which they employ the peculiarity in question, we may be thus led to satisfactory conclusions as to the manner in which it served the osseous fishes, whose remains are found in the strata of the coal formation.

In regard to their habits, suppose we divide fishes into such as prey upon each other, or derive their food exclusively from substances found in water, and such as obtain it partially at least from insects not inhabiting water, and which consequently require an effort to rise into the air.

This latter habit would require a great development either of the *lower* lobe of the caudal, or of the anal fin, as we see in the Perilamps, or fishes of our own day, which feed exclusively on insects. On the other hand, the peculiarity of fossil fishes now in question is of an opposite character, and only calculated for plunging to greater depths beneath water, and for violent struggles within that element.

From this view of such structure we may conclude, that aquatic insects were rare during the period of the coal formation, although the remains of Arachnidans in these strata, would render the existence of land insects probable. This indeed, is in strict harmony with the great scarcity of fossil insects in the rocks of the coal formation.

M. Agassiz remarks, that besides other peculiar characters which the family of *Lepidoïdes* possess in common, there are some with the caudal fin inserted obliquely, as in the foregoing figure, and others in which it is inserted on a symmetrical base, as in fig. 2, the former he names Heterocerous, the latter Homocerous *Lepidoïdes.* "It is a very remarkable circumstance in regard to the genera of which these two sections consist, that all the species with oblique caudal hitherto discovered, without exception, are found in strata anterior to the lias, a circumstance that cannot be accidental; for we see the same peculiarity displayed in an almost equal number of species of the same period, belonging to another order of fossil fishes, Saurïdes, as well as in all the fossil fishes of the order Placoïdes, by which the Ganoïds and Sauroïds are accompanied in the same strata. So that some unknown condition of existence in those remote times," says M. Agassiz, "would appear to have exercised its influence on the development of organic life, to determine a conformation so singular, and yet so general, throughout this class of animals." We have ourselves, in the preceding remarks, offered our own views on the subject. It is only necessary to repeat, that we see the structure of animals everywhere corresponding with their functions, while these are adapted to the various relations of surrounding objects. It is therefore a legitimate conclusion to draw, that as the remains of these fossil fishes are distinguished by the same peculiar form of the spinal column as the cartilaginous fishes of the present day, they likewise inhabited deep water, whether salt or fresh, and were highly rapacious in their habits.

The latter part of the conclusion at least corresponds with that to which M. Agassiz himself has been led, but we are not yet prepared to agree with M. Agassiz, as to the evidence afforded by fossils in general, or by fossil fishes in particular, of the progressive development of organic life, from a simple, to a more complex and perfect structure. This view has been frequently suggested, and as often refuted, and we thought it had been finally abandoned for the last thirty years. The peculiar development of the caudal vertebræ in these ancient fossils, presents to our view no indication of a less degree of perfection, than the abrupt termination of the vertebral column at the base of the caudal fin, in the fishes of the present day.

Tetragonolepis dorsalis, Ag., and *Tetragonolepis ovalis*, id. Pl. IV. The genus to which these species belong, differs only from Dapedius (of which we have already given an example) in the form of the teeth, these being in Dapedius somewhat grooved and blunt, and in the present genus, pointed. The osteology does not appear to M. Agassiz to be essentially different in the two genera; the head in particular presents the closest analogy, the bones having the same connection, the jaws the same form, only that the teeth are pointed in the present genus, instead of being grooved as in *Dapedius*. Tetragonolepis comprises numerous species; above seventeen are already figured and described by M. Agassiz. They nearly all belong to the lias formation, there being but a single species found in the inferior oolite resting on the lias. Many of the specimens examined were from Lyme Regis in England, but some were also from various parts of Europe.

Tetragonolepis ovalis, one of the examples, Plate IV, is from the lias formation of the vicinity of Boll in Switzerland, where it was examined by M. Agassiz, in the Museum of Dr. Hartmann of Gœppingen, by whom it was discovered. The peculiarities which distinguish it from other species, are rather differences of general form, than of particular details. It is more elongated than any other species of the genus known to M. Agassiz; it is oval anteriorly, more elongated, and straitened towards the tail. The head is proportionally smaller, and considerably more elongated than any of its congeners. Its mouth is also a little more cleft, and its teeth are also more elongated than in other species, and have all their points uniform. The bones of the head in the example lithographed, are only visible on the inner part of the face at the left side. At the inferior margin of the inter-opercule and sub-opercule, we see seven large flat branchial rays. What is most curious in this example is, that portion of the branchial arches and the combs of the branchies are perfectly well preserved, and visible between the branchiostegous rays and the orbit. It is impossible to recognize in the structure of the branchial rays, the least difference from the pectinated branchics of ordinary fishes of our own epoch. The orbit is surrounded by the sub-orbital plates. Almost all the bones of the cranium are lost; but we find in front a fragment of the ethmoid, and of the anterior frontal, the surface of which as well as that of the super-occipital plates presents little round tubercles with superficial openings, to the number of four, which allow of our ascertaining the form and dimensions of the head. In other specimens, says M. Agassiz, I found that all the bones of the cranium, and particularly the opercular pieces, present very close tubercular granulations.

The only part of the trunk which presents the external surface complete, is towards the tail; along the dorsal and the anal we see a small space where the solid parts of the body have entirely disappeared, and have not left their impression. The scales are very small along the back, and on the sides of the tail; those of the flanks are much larger, and particularly much higher than broad, except towards the breast and under the pectorals, where they are almost equilateral. Their surfaces are interspersed with irregular asperities, almost like little round tubercles disposed in irregular slightly raised lines. All their sides are straight, and their articulating claws strong.

The dorsal commences rather before the middle of the back, and terminates at a distance from the caudal, equal to the base of the caudal. The anal is large and short, and extends nearly to half the length of the dorsal, but these two fins terminate opposite to each other. The fin rays are slender, bifurcated only at the extremity, and their articulations transverse, and very close; at the anterior extremity, there is a series of little fulcra, very close. The ventrals which are very small, are placed opposite to the anterior border of the dorsal. The pectorals, also small, have the rays proportionally slender. The caudal is of middling length for the size of the fish, its insertion is slightly oblique, because the rays of the inferior lobe are inserted at the extremity of the spinous apophyses, which is extended less behind than the base of the rays of the superior lobe. All the fin rays are more slender in proportion in this, than most other species of *Tetragonolepis*. They are bifurcated in many, from the middle of their length, and articulated very close to their insertion. The fulcra which border the superior lobe are thick at the point of insertion of the rays of the fin, but seem to diminish rapidly towards the extremity; those which are extended the whole length of the inferior lobe, are very small at the base of the fin.

Tetragonolepis dorsalis, Ag. Pl. IV. The original from which this plate was taken, M. Agassiz found in the British Museum, and is from the lias of Gloucester; numerous specimens have been found; they are very easily distinguished by their oblong oval form, and the elongated rays at the anterior border of the dorsal. The head is short but large: on the surface of the bones we remark certain ridges of a fine granular series, particularly on the operculum. The thoracic girdle is also granulated, but the scales are perfectly smooth; the enamel of which they are covered is so thin that we can see the edges of the laminæ of growth. They are of medium size, particularly on the sides and parieties of the abdomen, but much smaller on the tail, and along the back, their edges are straight and entire; they are not deticulated on their posterior border. The lateral line is very visible; it is extended almost straight with only a slight bend towards the back from posterior superior angle of the operculum, to near the middle of the base of the tail. The dorsal commences a little in front of the middle of the back, and terminates opposite to the posterior extremity of the anal fin, which is scarcely more than half its length. The anterior extremities of the fins are more elevated than the posterior. The anterior rays of the dorsal in particular, are about double the length of the posterior. The largest are, however, preceded by some other little rays which succeed one another in front, gradually diminishing in length. The rays of these two fins are slender, bifurcated in the upper third of the length, and have their articulations transverse at the distances. The caudal is large in proportion, its insertion is slightly oblique, and the rays of the superior lobe sensibly shorter, their base being covered with the scales of the pedicle of the tail, which is extended more in the superior than inferior lobe. The rays of this fin are slender, and branched below the middle, and divided into articulations like those of the dorsal and anal fins; along the upper and lower borders, we observe a number of small fulcrums.

The posterior border is nearly square. The ventrals are placed opposite to the anterior border of the sub-operculum, these fins are otherwise indistinctly preserved.

These notices, together with the plates, may afford an idea of the care and exactness with which the subject is executed.

(To be continued.)

Notice of a Fossil Fish,—the supposed Rana diluvii testis, or "Fossil Batrachian" of DR. CANTOR. *By* J. M'CLELLAND. Pl. IX.

The return to Calcutta on his way to Europe of Dr. Falconer, Superintendent of the Botanic Garden at Seharanpore, with collections of plants and animals as well as fossils, reminds us of the progress made in India during the last ten years, in scientific researches and discoveries connected with Geology, and Fossil Zoology. The portion of Dr. Falconer's collection of fossils which he was kind enough to open for inspection previous to his departure, was the fossil fishes from the rich locality of the Sivalick Hills. These remains consist chiefly of the fragments of spines, external bony plates, vertebræ, and skulls of Siluridæ, together with heads more or less perfect of fossil fishes allied to the living genus Ophicephalus; and with these the opercula and pectoral region of a large specimen, probably of the family Cyprinidæ. A careful examination of these fragments would be necessary to determine the species exactly; but from the inspection we have had of them, we are quite satisfied that these remains refer to extinct species. Dr. Falconer seems to be of opinion that they are recent forms. They all appear to have been fresh water species, and may, or may not have belonged to existing genera. These fishes, like the fossil mammalia of the same beds, are all tropical forms. Some of them may perhaps be found to correspond with genera now existing in the rivers of India, but like the mammalia found in the same locality, they refer we think in most cases to extinct species, and in some, to extinct genera.

But these together with other questions of equal interest, Dr. Falconer will be able to determine on his return to Europe, where he will have the ablest assistance in working out the large collections which do him and his colleagues at Seharunpore the highest degree of credit.

In connection with these remarks, we may be allowed perhaps to refer to the fossil described as the head of a Batrachian by Dr. T. Cantor, in the Journal of the Asiatic Society of Bengal, vol. VI. 1837, p. 538. We have carefully examined this fossil with the assistance of Dr. Falconer, and can answer for its being nothing more than the jaws, the front part of the head, and branchial apparatus* of a siluroid fish, not exceeding the dimensions which several species of Siluridæ are known to attain, both in India and Europe.

From the form of this fossil, as well as the number of spines and shields of fishes that have been found in the same field, it may be conceived to have approached nearest to that genus of Siluridæ, called Pimelodus; although the species is doubtless distinct from any living, or previously noticed fossil species. The great distinguishing character of the fossil, is the breadth and flatness of the head. We have observed however, in the collection of Dr. Falconer, several fragments indicating species of many of the same genus, but none of them approaching in size to this fossil.

The muzzle is semicircular and flat, with several irregular ranges of thinly scattered, conical, hooked teeth in both jaws. The two branches of the lower jaw are firmly united to each other in front, by means of broad articulating surfaces reflected backwards towards

* The branchial apparatus 4, 5, 6, Fig. C, which is characteristic of the real nature of the fossil, was quite overlooked by Dr. Cantor.

the apex formed by the junction of the two hyoid bones,* and from thence with an abrupt curve are directed rather forward, so as to leave a hollow or depression in front of the symphysis, from which the jaw extends with a gradually increasing curve towards the angle of the mouth. The *rami* of the lower jaw 3, 3, fig. C, are compressed and rounded externally, internally flat or slightly concave towards the base of the jaws, each limb of which seems to be about one and half inches in depth. The upper margin in which the teeth are inserted is narrow, and rounded transversely. The teeth were fixed to the dentary surface by expanded consolidated bases, and their conical pointed surfaces are incased in a deposit of enamel which encloses them like a sheath from the apex to near the base, where the enamelled surface is detached from the expanded pedicle of the teeth by a narrow line, fig. e.; the teeth are all hooked or curved inward, the largest measuring from half, to three quarter of an inch in length, being placed in front of the upper jaw, and at the base of the lower. No teeth have as yet been discovered on the palatines or vomer.

The hyoid bones† 4, 4, fig. C, approach each other in front at a small straight angle; they are rounded on their lower and outer surfaces, flattish on the inner, and present a narrow ridge on the upper and outer margins. The rounded margins of these bones are directed obliquely downward and inward, and the narrow edges upward and outward. The breadth of the hyoid bone is about an inch, the thickness about 6-10th of an inch.

The branchial rays‡ 5, 5, fig. C, are given off from the inner and lower margins of the hyoid bones. The three first of these rays only, remain on either side, and are flat and deep; being in breadth about 3-10ths of an inch; in thickness, 1-10th; the first ray on each side is two inches in length, and seems to have been still somewhat larger.

* Dr. Cantor founded his Batrachian opinion of the fossil on the separation of the rami of the lower jaw at the symphysis; but this observation we have been unable to confirm. One limb of the jaw was certainly separated from the other, but this was done artificially in attempts to clear the matrix. Clearing this away a little further, it was found that with the matrix a portion of the bone had also been removed on one side of the symphysis, and this seems to have misled Dr. Cantor.

† Mistaken by Dr. Cantor for the Pterygoids.

‡ Overlooked by Dr. Cantor.

The linguial bone* 6, fig. C, is large, broad, and flattish, and is narrow and undivided at the apex. The hinder margin is but little arched, is uneven, presenting a few irregular points. The breadth of the linguial bone at the base is almost two inches, and its length one and three-quarter inches.

The upper surface of the fossil fig. A, presents the same anomalous structure as the corresponding portion of Siluroid fish, No. 1, the anterior orbitar process, 2 anterior frontal bone, No. 4, ethmoid bone, 3-3 nasal bone on either side, 5-5 maxillary bones with 6, 6 fossa for the insertion of cirri. To establish the correct names of the bones above referred to in the fossil, it would be necessary to refer more particularly to the comparative osteology of Siluroid fishes, which, as nothing has as yet been done on the subject, as far as I know, would be more than could be expected in a casual notice of this nature.

But without entering into further details, sufficient exactness for the present object has been secured, by a careful comparison of the fossil with the recent head of *Silurus boalis*, and *Silurus rita*, Buch., two species which, although not so closely allied to the fossil as some others which we might have examined, were still sufficiently near, to present all, or nearly all, its corresponding characters. The only peculiarity the fossil presents as compared with the species above referred to, is the process No. 5, fig. A., which we cannot venture to explain, further than by supposing it to represent the superior maxillary bone on either side.

Fig. B represents the front view of the fossil: all the figures are about half the natural size.

Of the importance with which this subject has been regarded, no better instance need be adduced than the remarks of the Editor of the Journal in which the first account of this fossil appeared, the late Mr. James Prinsep, who informs his readers in a note, "That the fossil is so extraordinary as to require no apology for outstripping strict rules, (as in the case of the Sivatherium), and introducing Dr. Cantor's account of it to the Journal, from the text of the Re-

* This was also overlooked by Dr. Cantor.

searches for which it was intended, before the latter appear." The great rarity of the fossil remains of Batrachians, as well as the gigantic dimensions of the fossil, as compared with the corresponding part of recent frogs, certainly required an unusual degree of evidence to satisfy the mind for the first time, to the existence of an animal of this nature in a fossil state, but particularly of the gigantic dimensions ascribed to it by Dr. T. Cantor, who describes this supposed frog to have been, exclusive of its limbs, *at least three feet four inches long*. Very extraordinary fossil monsters have, it is true been discovered, but then they present, as far as we can judge from their remains, no relation to the present order of things, but formed of themselves distinct orders peculiar to the times and circumstances in which they lived. The idea of fossil giants, in the ordinary acceptation of the term as applied to this supposed fossil frog, though often suggested by writers of romance, has never been established on scientific evidence. Nor were Dr. Cantor's doubts as to whether the monster was a tree, or a land frog, by any means calculated to conciliate our confidence in the general conclusions at which he arrived on this subject, since we could not conceive how frogs of three feet four inches long, exclusive of limbs, could conceal themselves on the branches and leaves of trees.

Desirous of reconciling his mind, if possible, to what otherwise certainly did appear very doubtful on this subject, Dr. Falconer on his arrival in Calcutta, begged of me to accompany him to the Museum of the Asiatic Society, to inspect the fossil, as already stated; when, after a careful examination, it appeared on comparing the specimen with Dr. Cantor's description, that he had fallen into all the numerous errors on the subject above noted.

Journey to India by the North of Europe, &c., during the years 1823, 1826, 1827, 1828, *and* 1829. *By* M. C. BELANGER, *Chevalier of the Legion of Honor, &c. late Superintendent, Royal Garden at Pondichery, &c.*

The zoological results of this journey published under the auspices of the Ministers of Marine and Interior, are by M. Bèlanger himself, assisted by MM. Isidore Geoffroy St. Hilaire, Lesson, Valenciennes, Deshayes, and Guerin, in the several departments in which these gentlemen are distinguished. The work consists of an octavo volume, and a quarto volume of plates. It is preceded by the following verbal report to the Academy of Sciences by M. F. Cuvier, which affords a better general view of the nature and object of the work than we could give. We wish our own Government would take a lesson from the French, who seeing the interest of science neglected in the colonies of other rival nations, with an enlightened policy peculiar to the French, depute their own philosophers to supply the desideratum.

I have now, says M. F. Cuvier, to render to the Academy a statement of the zoological results of M. Bèlanger's Journal in the East Indies, which has been required of me. On a former occasion, we have stated how much M. Bèlanger has benefitted various branches of science; and by his long and laborious excursions, enriched the study of Natural History, to which object his zeal has been directed amidst numerous dangers, even under the influence of a malady to which he fell a victim, from his love of science to which he was devoted, and which he pursued under no other aid than such as he secured for himself. It is our duty to-day to devote to him the numerous materials which are distinguished in the reports of which we are going to speak, and to assign to them that place which they are destined to occupy, in the vast edifice of Zoology. With regard to the animals of India however, we should remark that for many years past, this department of Natural History has been so much enriched by the travels of Duvaucel, M. Diard, and of Sir Stamford Raffles, and by those of Leschenault, Reinwardt, Kuhl, and Van Hasselt, as would make it an extreme injustice to appreciate the results of a recent journey in these countries, otherwise than by the number of new and important objects collected. In fact, it is the activity of travelling naturalists more than their science that contributes to the value of their collections, for it is seldom that they are able to distinguish those rare species by their organization, the discovery of which conduces to modify the general laws of science; but science is sustained by their perseverance and their courage, and it is in this point of view particularly that the devotedness of M. Bèlanger is entitled to our gratitude; his claims therefore to this sentiment on the part of naturalists, have been surpassed by few travellers.

M. Bèlanger affords in a preface, a rapid outline of those travels by which his own were preceded; he expresses his gratitude to those *Savans* who assisted him; affords the plan according to which the zoological portion of his collections were executed; explains the obstacles to which his researches were exposed in Persia; and in fact, affords an itinerary of his different explorations in India.

Less conversant with Zoology than with Botany, he has elsewhere devoted himself exclusively to this last branch of Natural History, and to the historical part of his travels. M. Bèlanger is associated in the description of animals with many honourable men, who by their previous labours, have given the best guarantee to the public for the value of the additions which M. Bèlanger's discoveries have made to Natural History.

It is our colleague, M. Isidore Geoffroy Saint Hilaire, who has engaged to make known the Mammalia. But he has not confined himself to the description of new species due to the researches of M. Bèlanger. He has taken occasion to enrich the science by the consideration of new facts relative to Mammalia in general. Also in an introduction, he adverts to some of the more abstract views of Zoology. On the characters of the new animals as compared with those of animals known before, which constituted the special object of his subject, he is led to offer general observations on Geographical Zoology from the materials afforded by M. Bèlanger, as well as from those of different countries of the globe with which we have become acquainted by means of other travellers. Then follows a general table of the Quadrumana, in which the generic and specific characters of these animals are found, those which inhabit Africa, as well as such as belong to Asia. To complete this table, M. Geoffroy Saint Hilaire describes five new species of Indian Monkeys; these are the *Semnopethicus Vellerosus,** Geof. *S. Cuculatus,*† Geof., the *Macacus aureus*, Geof., *Macacus arctoïdes*, Geof.; still viewing his labours under the same point of view, our colleague traces briefly the history of the various labours devoted to the investigation of the Bats, and makes us acquainted with one new species of Vespertilio, the Vespertilio of Bèlanger, discovered by our traveller at Pondichèry, where it is known under the name of *Terinjily.* He describes also two new species of Kingfishers, due to the researches of M. Duvaucel, at Sumatra, and to those of M. Dussumier on the continent of India.

Observations on the natural characters of insectivorous animals precede the general remarks on the genus Tupaïa, and by this denomination our colleague intends the Indian insectivora to be designated, and not the Squirrels which in

* The furred Monkey. † The hooded Monkey.

these countries are named as the foregoing, *Tupaia.* He then describes a species or a variety of this genus brought from Pegu by M. Bèlanger. A very laborious notice of the Sloths? (Sores,) terminates the history of the insectivora. We find in this part of the work a critical review of the large species of India and Africa, which is a recapitulation partly of the Memoir of 1826, which our colleague has published on the same subject in the *Annales du Musèum.*

The *Carnivora* afford the subject of two articles; in one of these our colleague establishes the genus *Mèlogale* on a very remarkable species of the family of Martins, which he names *Mèlogale personata ;* and in the other he describes a new species of Cat, the red spotted cat, Felis rubiginosa, Geof. These two Mammals have been discovered by M. Bèlanger, the first at Pegu in the vicinity of Rangoon, the second near Pondichèry.

It is by the Rodents that he terminates the Mammalia collected during the travels of which we are treating. M. Geoffroy describes in this group, the red-rumped Squirrel of Pegu, *Sciurus pygerythrus*, Geof. and the *Spermophilus concolor*, Geof. of Persia, due to the researches of our traveller.

M. Lesson, to whom was confided the elucidation of the birds, like M. Geoffroy, has not confined his observations merely to the animals collected by M. Bèlanger. This journey has afforded also to M. Lesson the fortunate opportunity of elucidating certain points of the doctrines of Ornithology. His share of the labour commences with a very comprehensive discourse on the geographical distribution of birds on the surface of the globe, in which he developes his views relative to the formation of the globe itself, as well as the succession of living beings by which it is peopled. This is followed by the description of thirty-nine new, or imperfectly known species, which belong chiefly to the collections of M. Bèlanger. We mention amongst those which we owe to the discoveries of this naturalist *Morphnus hastatus*, Less. of Bengal; the *Circus rufus* of Bengal; the *Melias tristis*, Less. of Pegu; the *Cuculus lugubris*, Horsf. the female from Java; the *Picus carente*, Less. of Pegu, where it is called *Temagaoumè*; *Edela ruficeps*, Less. of Java; *Lanius collurioides*, Less. of India; *Lanius sordidus*, Less. of Pegu; *Garrulax Belangeri*, Less. of Pegu; and *G. rufifrons*, Less. species which the author has isolated under the generic name of Garrulax, because they form a very distinct type, according to M. Lesson, which ought to find a place in the family of Cassicans after the Myophone, and in the group of Choucaris; the *Muscicapa* (muscylva) *albogularis*, Less. of Pondichèry; the *Pastor peguanus*, Less.; the *Fringilla pyrrhoptera*, Less.; the *Francolinus spadiceus*, Less. (Perdix spadiea, Lath.) from the vicinity of Pondichèry; finally the *Otis aurita*, Lath. and the *Chenelopex coromandelianus*, Less. These species are worthy of the interest of naturalists, and many of them have been figured in the Atlas volume of plates, of which there are ten dedicated to Ornithology.

M. Lesson was also charged with the publication of the Reptiles, apparently consisting altogether of species collected by M. Bèlanger; these to the number of thirty-three belong to sixteen genera, of which we find one new genus allied to Trionyx, which he has named Tetraonyx, characterized by a broad membrane between the toes, which are four, all supplied with nails. M. Lesson takes occasion also to furnish descriptions of certain species of Hydrophis, which he proposes to unite with the Ophidiens in a family which he calls Nauticophis; this family he proposes to divide into two tribes, including the five genera into which these animals appear to be separated.

Amongst the most remarkable Reptiles which science owes to the travels of M. Bèlanger, we may mention a species of Emys dedicated to this traveller. The species upon which the genus Tetraonyx is founded, the long-necked

Tetraonyx, (T. longicollis,) discovered by M. Bèlanger in the Irrawaddi at Pegu; a Crocodile, *Crocodilus palustrus*, Less. which is only seen in the marshes on the borders of the Ganges; two species of Gecko, *G. eleutherodactylus*, Less. of Bengal, and the *Gecko triedrus*, Daud. from the environs of Pondichèry; the *Naja kaouthia*, Less. a magnificent species, the *Coluber bancorage*, Less. and *C. Korrosid*, the *Microcephalophis gracilis*, Less., a species of marine serpent found by M. Bèlanger on the coast of Malabar, and in the Gulph of Martaban; the *Rana Sanguine-maculata*, Less., and two other species of Rana; viz. *R. brama*, Less. and R. hexadactyla, id., belonging to the South of India; lastly, the *Bufo isos*, Less., a common species in Bengal.

M. Valenciennes, to whose knowledge and zeal has been confided the description of the fishes, supplies in an abridged form certain general views on the Ichthyology of the Indian seas, and in particular of the coast of Malabar, explored with so much success on this occasion by M. Bèlanger, to whom this branch of science is indebted for numerous interesting materials. M. Valenciennes has only, however, described eighteen species of fishes, selected from upwards of two hundred, which form the rich collection of our traveller. These descriptions of species are all preceded by elucidations of the characters of the genera to which they belong. It is to be regretted, that M. Valenciennes has not taken advantage of the pages devoted to the illustration of these collections, of making us acquainted with a greater number of species, and particularly of the species of those families, which have not yet been treated of in the *Histoire Naturelle des Poissons*, to which, for their generic characters, it is sufficient to refer the reader.

M. Deshayes, entrusted with the description of the Molluscs, directed the first part of his labours to summary reflections on the importance of the study of these animals, as applied to the chronological history of the terrestrial globe, a theme of immense importance, which embraces the greater part of Geology, and which M. Deshayes here alludes to incidentally, but which he has elsewhere developed as the importance of the subject deserves.*

In the second part, the author describes twenty-one new species of Molluscs, discovered by M. Bèlanger. All the species are figured, and amongst them we remark *Helix Bèlangeri*, Desh.; *H. Semifusca*, of Pondichèry, id.; *Cylostoma indicum*, id. of the Isle of Elephanta near Bombay; *Cyclost. Aurantiacum*, id. of Pondichèry; Planorbis exustus, id. of the coast of Malabar; *Paludina Bengalensis*, Lamark, found on the river Ganges; Buccimum Blainvillei, Desh. of the coast of Malabar; and the *B. conoidale*, id. of the Straits of Sunda; the *Nerita intermedia*, Desh.; and the *Ranella margaritula*, id. of the Malabar coast; the *Pyrula fulva*, id.; and the *Purpura squamosa*, id. both of the Isles of Sunda, but the latter also on the Eastern coasts of India.

M. Deshayes concludes this catalogue *raisonnée* by a tabular view of the fossil shells of Europe, as compared with the living species now inhabiting the Mediterranean and Indian seas. His views, derived from a comparison of the species common to the Indian and Mediterranean seas, afford a solution of the problem of the ancient communication between those seas.

M. Guèrin, who has had the insects as his part of the zoological collections of M. Bèlanger proposes in the first chapter, a general revision of the genera and species belonging to the tribe *Fulgorelles*, (or fire flies,) and affords his ideas of the classification of insects chiefly inhabiting India. The second chapter is devoted to the description of a selection from the new species, the fruit of M. Bèlanger's travels, many among them occupying an important place in the

* The reader is here referred to an outline of M. Deshayes' views on this subject in the *Calcutta Journal of Natural History*, vol. iii. p. 206.

chain of existence, and even fill up voids which to this time have existed amongst their congeners. We mention particularly the *Palalepta levigata*, Guer. of the Coromandel coast; the *Oryctes martabani*, id; the *Popilia Maculata*, id. of Java; the *Gnoma atomaria*, id. of the Coromandel coasts; the *Lania carcelii*, id. of Java; *Scutellera Reynaudii*, id. of the same country; the *Cercopis viridans*, id.; the *Megachile rufiventri*, id.; and the *Odynerus dimidiatus*, id. of the coast of Coromandel; the *Apis zonata*, id. of the same country, where they form hives of a curious construction of the most compact clay; and, lastly, of the *Agarista Belangeri*, id. of Java.

Such are the contributions to Zoology, which we owe to our colleague M. Isidore Geoffroy Saint Hilaire, and to MM. Lesson, Valenciennes, Deshayes, and Guerin, for the part which they have taken in the elucidation of the collections of M. Bèlanger in Persia and the East Indies. Assuredly, the arrangements to prevent the collections from being lost, could not have been confided to better hands. Yet it is to be regretted, that the first author of these travels, he who with so much labour collected the materials and the documents, which afford the subject of this collection, should be so faintly identified with the publication; but all that those who have performed the part of his collaborateurs could do, was to give his name to new species in all the various orders. Be it as it may, science has derived from this portion of the travels of M. Bèlanger, an acquaintance with six new genera, and four hundred and twenty-three new species of Persia and India, and in these species, as in the genera, there are some which supply important places. An atlas, consisting of forty plates, remarkable for their execution, represent forty-nine of the most curious and novel species described in the body of the work, rendering it still more valuable to naturalists. This atlas is equal in the value of its contents to any of the numerous collections of drawings relative to the Natural History of India, that have as yet been published on the Fauna of this vast country.

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*Faraday's Experimental Researches in Electricity.** *By Lieut.* R. B. Smith, *Bengal Engineers.*

[Fifth Series.]

In the year 1800 it was discovered by Messrs. Carlisle and Nicholson, that the voltaic battery had the power of resolving water into its constituent elements. This observation has justly been considered the foundation stone of electro-chemical science; for no sooner it was made, than numerous other bodies were subjected to the decomposing influence of the battery; their relations to it ascertained, the laws regulating decomposition determined, and a broad basis of facts prepared on which a sound theory might ultimately be founded. Happily for science, the subject of electro-chemical decomposition early attracted the notice of Humphrey Davy, and in his hands led to the series of brilliant discoveries which insured for him such an unexampled degree of scientific fame. By what seems to be a natural consequence, efforts to explain the mode of action by which the many new, and sometimes paradoxical results of decomposition were effected, kept pace with the accumulation of facts, and numerous theories were in consequence proposed. These varied much from each other, were often inconsistent with facts, and occasionally so with themselves. Even in the case of Davy himself, there seems to have been much obscurity in theoretical views, for although he sometimes speaks in clear, distinct, and decided terms, yet at other times he states his doctrines so vaguely, that as Faraday remarks, probably a dozen precise schemes of

* Continued from vol. iii. p. 361.

electro-chemical action might be drawn up, differing essentially from each other; yet all agreeing with the statement given of them in his celebrated Bakerian Lecture of 1806. Nor was this an indefinite assertion on Faraday's part, for on being reproached by Davy's brother with injustice towards the memory of that great chemist, he actually produced twelve such schemes, and effectually established the justice of his statement.

In the larger number of the theories of electro-chemical decomposition, the results are attributed to attractive and repellant powers resident in the poles, or metallic terminations of the battery; thus, for example, in the case of the decomposition of water, the positive pole attracts the oxygen, and repels the hydrogen, while the negative pole attracts the hydrogen, and repels the oxygen. Not only was the general fact of such polar actions assumed, but the diminution of force according to distance from the central points of attraction and repulsion, namely, the poles of the battery, was considered experimentally determinable.

Faraday's first step in the series of researches now under analysis, is to prove that electro-chemical decomposition does not depend on any direct attraction and repulsion of the poles upon the elements of the substance, near or in contact with them. "I have," he remarks, "in a recent series of these researches proved (to my own satisfaction at least) the identity of electricities derived from different sources, and have especially dwelt upon the proof of the sameness of those obtained by the use of the common electrical machine and the voltaic battery. The great distinction of the electricities obtained from these two sources, is the very high tension to which the small quantity obtained by the aid of the machine may be raised, and the enormous quantity in which that of comparatively low tension, supplied by the voltaic battery, may be procured; but as their action, whether magnetical, chemical, or of any other nature, are essentially the same, it appeared evident that we might reason from the former as to the manner of action of the latter; and it was to me, a probable consequence, that the use of electricity of such intensity as that afforded by the machine, would, when applied to effect and elucidate electro-chemical decomposition, shew some new conditions of that action, evolve new views of the internal arrangements and changes of the substances under decomposition, and perhaps give efficient powers over matter as yet undecomposed."

Under the above impression, Faraday proceeded to experiment on decomposition by means of the electrical machine, using the form of apparatus with the discharging train, described in a former paper. He first proved that the elements of decomposed bodies were transferred to great distances from pole to pole, and provided the same *quantity* of electricity passed between the poles, the intensity of the chemical action was not interfered with by the intervals at which these were placed apart from each other. Thus, whether the bodies under decomposition were placed in immediate contact, or separated by an interval of seventy feet, connection being maintained between them by means of an insulated string wetted in a decomposable solution, the results were the same for the same quantity of electricity transmitted. He next employed only a single metallic pole, using the end of the piece of moistened string as the other pole, and still decomposition followed as before. The simple and beautiful experiments detailed shew distinctly, that the process of decomposition was not dependent on the simultaneous action of two metallic poles, since a single one was fully efficient, and the transfer of the elements took place in accordance with the well-known law of the direction of the current.

The presence of water has been supposed by many, to be an essential condition of electro-chemical decomposition, and it was asserted by Sir Humphrey Davy, that " there are no fluids known, except such as contain water, which are capable of being made the medium of connexion between the metals or metal of the voltaic apparatus." Faraday's fourth series of researches completely settles this point, by shewing that there are hundreds of bodies equally influential with water in this respect, and that the latter is therefore only one of a numerous class of substances, instead of being the *only one* and *essential*. He conceives that its exclusive character was obtained in consequence " of the general necessity of a fluid medium," of its being the *only one* of this class of bodies existing fluid at common temperatures, " its abundant supply as the great natural solvent," and its constant use in that character in philosophical investigations, because of its having a smaller interfering, injurious, or complicating action upon the bodies either dissolved or evolved, than any other substance.

Having determined the preceding points, Faraday proceeds to the question of theories of electro-chemical decomposition, and he premises the developement of his own, by a brief account of those of others, in so far as he is personally acquainted with them. On these theories we do not now intend to decide, as incidental notices of their leading features will necessarily be introduced when discussing that proposed by Faraday, and more than simple notices is unnecessary.

"That electro-chemical decomposition," Faraday remarks, " does not depend upon any direct attraction and repulsion of the poles, (meaning thereby the metallic terminations, either of the voltaic battery or ordinary electrical machine arrangements,) upon the elements in contact with or near them, appeared very evident from the experiments made in air, when the substances evolved did not collect about any poles, but in obedience to the direction of the current, were evolved, and I would say, ejected, at the extremities of the decomposing substance. But notwithstanding the extreme dissimilarity in the character of air and metals, and the almost total difference existing between them, as to their mode of conducting electricity and becoming charged with it, it might still be contended, although quite hypothetically, that the bounding portions of air were now the surfaces or places of attraction, as the metals had been supposed to be before. In illustration of this and other points, I endeavoured to devise an arrangement, by which I could decompose a body against a surface of water, as well as against air or metal, and succeeded in doing so unexceptionably in the following manner." For the subsequent details of this interesting and important experiment, we must refer to the researches themselves, as it would occupy too much space to transcribe them here. The result was, however, decisive, and one element of the substance decomposed (Sulphate of Magnesia) made its appearance at the surface of the water employed, instead of the usual metallic pole. "As, therefore, the substances evolved in cases of electro-chemical decomposition may be made to appear against air, which according to the common language is not a conductor, nor is decomposed, or against water which is a conductor, and can be decomposed as well as against the metal poles, which are excellent conductors, but undecomposable, there appears but little reason to consider the phenomena generally, as due to the *attraction* or attractive powers of the latter, when used in the ordinary way, since similar attractions can barely be imagined in the former instances."

Electro-chemical decomposition is well known to be an effect essentially dependent upon the *current* of electricity, and various have been the views taken of the nature of this current. Some, with Franklin, consider it one and undivisible, others assume it to be compounded of two distinct fluids, the positive and the negative, distinct in their nature, and also distinct in their effects. Thus MM. Riffaut and Chompré for instance, consider the positive and negative currents as each causing decomposition, and maintain that the former is more *powerful* in producing this effect than the latter. M. Grotthuss considers that the elements of water, when about to separate at the poles, combine with the electricities, and become gases; while M. de la Rive maintains the exact reverse of this, namely, that these elements while passing through the fluid, are compounds with the electricities: when evolved at the poles, they are de-electrified.

"I have sought," says Faraday, "amongst the various experiments quoted in support of these views, or connected with electro-chemical decompositions or electric currents, for any which might be considered as sustaining the theory of two electricities rather than that of one, but have not been able to perceive a single fact, which could be brought forward for such a purpose: or admitting the hypothesis of two electricities, much less have I been able to perceive the slightest grounds for believing that one electricity in a current can be more powerful than the other, or that it can be present without the other, or that one can be varied, or in the slightest degree affected, without a corresponding variation in the other. If upon the supposition of two electricities, a current of one can be obtained without the other, or the current of one be exalted or diminished more than the other, we might surely expect some variation of the chemical or magnetical effect, or of both: but no such variations have been observed. A current has not, to my knowledge, been produced, which could act chemically and not magnetically, nor any which can act on the magnet, and not *at the same time* chemically.

Judging from facts only, there is not as yet the slightest reason for considering the influence which is present in what we call the electric current, whether in metals or fused bodies, or humid conductors, or even in air, flame, or rarefied elastic media, as a compound or complicated influence. It has never been resolved into simples or elementary influences, and may perhaps best be considered of *as an axis* *of power having contrary forces, exactly equal in amount, in contrary directions.*" This remarkable, and when once thoroughly comprehended, most distinct definition, ought to be carefully reflected upon, since unless it is understood and impressed upon the mind, it is scarcely possible to follow Faraday's views.

We have here arrived at the point where the theory of electro-chemical decomposition is entered upon, and we will endeavour to develope it as simply and distinctly as we possibly can. It has already been stated, that nearly all who have speculated on the subject, have conceived the power producing decomposition to be *external* to the substance decomposed, in other words, to be resident in the metallic terminations of the electric circuit. According to Faraday, however, the effect of decomposition on any substance, is produced by an *internal corpuscular action* in that substance, exerted according to the direction of the electric current, and is due to a force either *superadded to*, or *giving direction to the ordinary chemical affinity* of the bodies present. "The body under decomposition," he remarks, "may be considered as a mass of acting particles, all those which are in the course of the electric current contributing to the final effect; and it is because the ordinary chemical affinity is relieved, weakened, or partly neutralised by the influence of the electric current in one direction parallel to the course of the latter, and strengthened or added to in the opposite direction, that the combining particles have a tendency to pass in opposite courses."

In this view the effect is considered as *essentially dependent* upon the *mutual chemical affinity* of the particles of opposite kinds. Particles *a*, *a*, could not be transferred or travel from one pole N, towards the other P, unless they found

Fig. 1.

particles of the opposite kind *b*, *b*, ready to pass in the contrary direction: for it is by virtue of their increased affinity for those particles, combined with their diminished affinity for such as are behind them in their course, that they are urged forward: and when any one particle *a* (Fig. II.) arrives at the pole, it is excluded or set free, because the particle *b* of the opposite kind, with which it was the moment before in combination, has, under the superinducing influence of the current, a greater attraction for the particle *a′*, which is before it in its course, than for the particle *a*, towards which its affinity has been weakened.

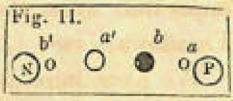

Fig. II.

That the decomposition and transfer of elements were dependent on the chemical affinity of the substances present, Faraday has shewn very distinctly by experiments on Sulphuric Acid diluted with water, and combined with Soda. "The variation," he remarks, "of electro-chemical decomposition, the transfer of elements, and their accumulation at the poles, according as the substances submitted to action consist of particles opposed more or less in their chemical affinity, together with the consequent influence of the latter circumstances, are sufficiently obvious in these cases, where Sulphuric Acid is acted upon in the *same quantity* by the *same* electric current, but in the one case opposed to the comparatively weak affinity of water for it, and in the other to the stronger one of Soda. In the latter case, the quantity transferred is from two and a half to three times what it is in the former: and it appears therefore very evident, that the transfer is greatly dependent upon the mutual action of the decomposing bodies."

Having stated in general terms his theory of decomposition, Faraday proceeds to apply it to particular instances, and in the first place shews satisfactorily why, in all ordinary cases, the evolved substances *appear only at the poles:* for the poles are the limiting surfaces of the decomposing substance, and except at them, every particle finds other particles having a contrary tendency with which it can combine.

In those theories which refer decomposition to the attractive powers of the poles, it appears at once anomalous, that in so many instances these poles, although capable of withdrawing one particle of a decomposed substance from another, should yet be incapable of retaining that particle. " If, in accordance with the usual theory, a piece of platina be supposed to have sufficient power to attract a particle of hydrogen from the particle of oxygen with which it was the instant before combined, there seems no sufficient reason, nor any facts, except those to be explained, which shew why it should not, according to analogy with all ordinary attractive forces, as those of gravitation, magnetism, cohesion, chemical affinity, &c. *retain* that particle, which it had just before taken from a distance, and from previous combination. Yet it does not do so, but allows it to escape freely." Faraday's theory, on the other hand, explains this apparently anomalous circumstance simply and distinctly. The effect is the direct consequence of the nature of the action, for the evolved substances are *expelled* from the decomposing body as a consequence of an *internal* force, not drawn out by an *external* attractive power: and whether the poles be metal, air, or water, still the substances are evolved, and are sometimes set free; while at others, they unite to the poles according to the chemical nature of the latter, *i. e.* their chemical relation to those particles which are leaving the substance under operation.

When the power of the voltaic battery to produce decomposition was first discovered, nothing caused greater astonishment than the apparent suspension of all natural affinity between the particles of bodies, whose affinities for each other were known to be, under common circumstances, of the strongest possible character, while the process of decomposition was in progress. Acids were passed through alkalies, and alkalies and earths through acids, so that the distinctive properties of each seemed temporarily destroyed. In no particular does the theory of Faraday contrast more favourably with its predecessors than in this, since according to his views, what was formerly an unintelligible *wonder*, becomes an *essential condition*, and it appears that the more alkali there is in the course of an acid, the more is the transfer of the latter facilitated from pole to pole, "and perhaps," he adds, "a better illustration of the difference between the theory I have ventured, and those previously existing, cannot be offered than the views they respectively give of such facts as these."

As a general consequence of the preceding, it may be stated, that the more directly bodies are opposed to each other in chemical affinity, the more ready is their separation from each other in cases of electro-chemical decomposition, *i. e.* provided other circumstances, as insolubility, deficient conducting power of their proportions, do not interfere, and hence it is possible that failure in producing decomposition may arise not from the strength, but from the weakness of the affinity which holds bodies together.

In concluding his fifth section, Faraday makes a few remarks on what are usually called the poles of the battery. "These," he states, "are merely the surface or doors by which the electricity enters in or passes out of the substance suffering decomposition. They limit the extent of that substance in the course of the electric current, being its *terminations* in that direction: hence the elements evolved pass so far, and no farther.

"Metals make admirable poles, in consequence of their high conducting power, their immiscibility with the substances generally acted upon, their solid form, and the opportunity of selecting such as are not chemically acted upon by ordinary substances.

"Water makes a pole of difficult application except in a few cases, because of its small conducting power, its miscibility with most substances acted upon, and its general relation to them in respect of chemical affinity. It consists of elements which in their electrical and chemical relations are directly and powerfully opposed, yet combining it from a body more neutral in its character than any other. So that there are but few substances which do not come into relation by chemical affinity with water or one of its elements: and therefore either water or its elements are transferred, and assist in transferring the infinite variety of bodies which in association with it, can be placed in the course of the electric current. Hence the reason why it so rarely happens that the evolved substances rest at the first surface of the water, and why it therefore does not exhibit the ordinary of a pole.

"Air, however, and some gases are free from the latter objection, and may be used as poles in many cases, but in consequence of the extremely low degree of conducting power which belongs to them, they cannot be employed with the voltaic apparatus. This limits their use: for a voltaic apparatus is the only one yet discovered, which supplies sufficient quantity of electricity to effect electro-chemical decomposition with facility."

We have now finished the analysis of the fifth series of Faraday's researches, and here we purpose bringing our remarks upon the masterly work to a close. Nine series still remains, but to analyse these would require more time and space, than circumstances admit of our devoting to them, and we entertain insuperable objections to commenting on a work of this nature in a superficial or cursory manner. To the volume itself, we would direct all those whose interest may have been excited, and we can safely assure them of one of the richest of intellectual treats, and a series of new ideas developed with striking perspicuity in a style, chaste, philosophical, and singularly attractive.

In conclusion we would again remark, that the essential requisite for a thorough comprehension of Faraday's theory of electro-chemical decomposition is a clear conception of the electric current as "an axis of power having equal and contrary forces." This conception being once distinctly and vividly impressed upon the mind, no difficulty will be experienced in undertaking all the varied phenomena of decomposition, and the efforts made in mastering the key, will be more than rewarded by the new view, its possession will afford access to.*

Camp, 3d February, 1843.

From J. G. MALCOLMSON, ESQ., *F. R. S. to the Editor of the Calcutta Journal of Natural History, Bombay, Nov.* 10, 1842.

MY DEAR SIR,—I have just received your 10th Number, and think that a remark of Captain Campbell, relative to myself, accompanying some extracts from Dr. Boase's letters, requires, a short answer. But although the occasion is unpleasant, my object is merely to solicit Captain Campbell to place less confidence in authority, and to employ his talents and his great opportunities in a course of careful research by which the science to which he is devoted may be advanced, instead of attempting, by somewhat hasty observations, to rebuild forgotten hypotheses, or to *invent* a science from the foundation, like the palace of air presented to Thor, by the giant Skrimis in Jhölhim land, "things that dreams are made of."

It is evidently Captain Campbell's duty to learn what has been done; *what has been proved* by evidence which none can dispute, before he writes and acts as if the opinions received by all good geologists, were of the class of crude speculations long current in Saxony and Edinburgh; things that any man may invent at his pleasure.

* Our readers will regret the close of this series of papers on the analysis of Faraday's Researches in Electricity, which evince so close and philosophical an examination of the subject by Lieut. Smith.—EDS.

The first extract from Dr. Boase, page 926, relative to fossiliferous rock resting on granite, is too confused to be well understood; and to one familiar with the recent lucid, but not always temperate, discussions on this subject, it is painful to find in three short sentences so much bad reasoning and careless statement. Nor is Captain Campbell's preceding remarks any better; viz. that it is singular that the information of fossil strata resting on the Dartmoor granite should reach India, at the time of the discoveries at Sydrapettah, "for from my knowledge of the geology of the country lying west of "this locality, I consider it most probable that, like the Dartmoor "formation, the fossiliferous beds are superposed immediately on gra- "nite." It may be so, but why state a fact believed to be important on such vague information, or rather on no information; as it is common in most countries to find a patch of fossiliferous rock in the neighbourhood of granite, with a series of rock of all ages between. It was Captain Campbell's duty, either to have examined for himself, or to have said nothing of it. But the fact itself, if it be a fact, is only of local interest, as the same occurs every where, as well as in the Carnatic or Deccan. I need refer only to the oolite coal of Sutherland, the lias of the same coast, and the celebrated junction of the old red sandstone and granite of Caithness, all classical examples investigated by Macculloch, Sedgwick, and Murchison. I have myself observed the same thing in various parts of Scotland, even in the various divisions of the old red sandstone, which I have discovered to be distinguished by characteristic fossils, all of which rest in different places on granite, or on granite veins passing through primary strata.

But it is generally known that any rock may rest directly on granite; an instance of which is the northern drift, or the alluvia of rivers and torrents, or another extreme and equally striking instance is in the volcanic rocks, and endusial limestones of Auvergne, or what may be more interesting to us, the tertiary rocks of the Hyderabad and Nagpore countries, described by myself.

Captain Campbell says, that the only notice on the points of investigation on which Dr. Boase remarks, is an observation of mine to the effect, that at the Mucklegundy Ghaut, limestone containing shells was observed lying upon granite of a reddish colour. Capt. Campbell adds, that the observation is very imperfect, as "it does not appear whether "the rock, was part of an extensive granitic formation, or only part of "the granitic beds occurring in what I have termed the 'schistose "series;' neither does it appear, that Dr. Malcolmson endeavoured to "observe whether the fossiliferous bed was traversed by veins from the "granite, or whether it was metamorphised in any way, or changed "in appearance or mode of aggregation, by association with the bed "of granite." I do not acknowledge the justice of this criticism, as the information I have given on this locality, is as full as was required, or could be obtained. I have stated, that the limestone rock seemed to be altered by the basalt which covered it, and facts are given which rendered it probable, that the granite was connected with other masses of that rock, although it was not visibly continuous. As to granite veins passing through this tertiary limestone, it would have been a fact too deeply interesting to have been overlooked by a less careless person than I acknowledge myself to be; and with respect to Captain C.'s "schistose series," I cannot allow that others are obliged to adopt either his new language, or his views, either new or old, on such subjects; although every fact clearly and intelligibly stated, must be taken into consideration by all *who follow* on the same tract. But to return to Dr. Boase, it was his duty also, to have examined for himself, before he denied that rocks containing fossil remains reach the granite, and are altered by heat; and when he carries his assertion further, and states that what are called igneous rocks, do not alter the strata into which they enter, it is only going back to the days of the Neptunists, and cannot be replied to without folly. But Dr. Boase when he left off observing, in order that he might write systems, appears also to have ceased at the same time to read, else whence the ignorance displayed in the following passage: "Suppose my general views to prove erroneous, as in the above instance, "then I must admit that primary crystalline schists are only secondary "strata, changed by the action of heat; but in so doing I contend, "that granite itself is in the same predicament; that is, that the whole "of the primary rocks have then resulted by the action of fire on "fossiliferous strata. It may come to this, but in the meantime, the "facts are not sufficient to justify our jumping at such a conclusion." Here is a theory proposed as new, which has been advocated by Lyell, in his eloquent and popular works, and Dr. Maculloch, in his profound system, written in 1821, although not published till ten years later.

I therefore entreat Captain Campbell to describe with care and in common language, the districts he may have opportunities of examining; and not to imagine that one man can build up a science such as this, or that all that has been done by the many profound geologists, chemists, mineralogists, travellers, and naturalists in all countries, can be overlooked by any one who himself aspires to contribute his share to the good work. He cannot have a better model than that furnished by Dr. Voysey or Dr. Benza, (except in the Continental Nomenclature of the latter), both of whom were intimately acquainted with the districts visited by Captain Campbell. Dr. Boase's example, on the contrary, is to be shunned rather than followed.

I take this opportunity of referring to a remark in the 6th Number of your Journal, page 236, relative to the following passage in my paper on the Deccan :—

" With regard to the age of the silicified wood of Pondichèry, no " facts have yet been ascertained, that can justify any conclusion; " it is, however, to be hoped, that a gentleman familiarly acquaint- " ed with the tertiary and volcanic rocks of Greece and Italy, will " soon communicate positive information regarding the geological " relations of the sandstones containing the silicified trees ; and the " fossil shells ; the conical hollows, obsidions, and other indications of " volcanic action, said to exist in that neighbourhood. The shells " I have seen, differ from those of Central India."—*Geological Transactions, vol.—page* 272.

Mr. Kaye observes, that he did not know who the gentleman could be, and I find that others were equally in the dark ; in consequence, I suppose, of the paper having been so long written previous to the publication of the volume of Geological Transactions in which it appeared. The person referred to was that accomplished geologist Dr. Benza, the only person in the South of India, then or now, to whom the remark could apply ; and whom I had hoped, thus to induce to enter on this most interesting enquiry. I had myself been asked to engage in it by Mr. Prinsep, but I was sensible that Dr. Benza could do greater justice to it; nor do I regret that I did not enter on it, as Messrs. Kaye and Cunliffe's papers are so excellent.

Mr. Prinsep appreciated Dr. Benza's merits as they deserved, and in a letter to me, he lamented that the "Asiatic Society of Bengal "had no Gold Medal to bestow, as none could doubt that Dr. B.'s "paper on the Neilgherry Hills had a just claim to the distinction." When I wrote, I was ignorant that he was already attacked by the malady under which he soon after sank, without having published any thing on the subject.

I never visited the locality, yet with regard to the matrix of the fossil wood, and of the true character of the wood itself, my opinion, founded on specimens was correct, and I therefore could not but feel regret at the turn the discussion on this subject had taken at Madras in 1840. I had carefully examined, several years before, the fossil wood from this locality, had sections made of various specimens, in some of which the vegetable structure was even better seen than in recent wood. I had also had an opportunity of shewing them to Mr. Robert Brown, and of conversing regarding them with Adolphe Brongniart. The structure of many specimens is exogenous, and may be inferred to belong to the tertiary period.

Knowing all this, it was a subject of regret to find these discussions at Madras revive the olden times when Leonardi da Vinci had to contend so zealously for the animal origin of the shells of the Sub-Appenines, against those who asserted them to be the result of, I know not what, mystic or plastic forces. But I had hoped that the discovery of his error in this instance, would have rendered Captain Campbell more cautious in plunging into controversies against opinions adopted by all who have written or observed well.

Note.—It may be worth while to notice some remarks of Captain Campbell, relative to an error alleged to have been committed by myself, *after* Buchanan, Voysey and Benza, as to the mineral composition of the pillars of the tomb of Hyder at Seringapatam. It is but a dispute about the name of a specimen, of no real importance to a geologist, and although I have much confidence in Captain Newboldt's opinion, adopted by Captain Campbell, I still do not consider the point settled, as to these pillars being composed of a steatite, as I think is reported, for I have not the paper to refer to at the moment. When one considers how constantly, and easily the primary rocks, especially those composed of hornblende and steatitic minerals alternate, or graduate into each other, a discordance on this point is not to be wondered at. As to my own share of the error, it was only adding these pillars to other examples of the architectural use of a particular rock, which I had elsewhere carefully examined, on the authority of three of the best geologists who have ever been in India. It is twice that I had seen these pillars, but during the few hours I spent there, I was too much occupied in the many objects of historical and moral interest around me, to think of detecting a flaw in the observations of my

A Notice of "*Indian Cyprinidæ,*" *being the Second Part of the Nineteenth volume of the Asiatic Researches. By Mr.* John M'Clelland, *Bengal Medical Service. Read February* 17, 1841, *to the Boston Society of Natural History, by* Dr. Humphreys Storer.

We are almost entirely ignorant of the fresh-water fishes of many of those countries, whose marine species are tolerably well known to ichthyologists. The reason is obvious—the smallest sea-port has its market constantly supplied with those species which are used for food—the great proportion of such species, are taken along the shores of the different countries, and but very few fluviatile fishes are considered of sufficient value to be procured—so that, we are compelled to learn from the zealous naturalist, who is actuated by other motives than the expectation of pecuniary reward, the characters and habits of such species as inhabit the streams and rivers and lakes. He therefore who attempts to elucidate a subject so desirable to be known, recommends himself by the mere effort, to our regard—should he succeed in his attempt, we ought not to withhold our gratification.

Agassiz, whose name is a guarantee of the value of his labors, is at this moment preparing a magnificent work upon the "Poissons d'Eau Douce de l'Europe Centrale." In our own country, Dr. Kirtland, like a true naturalist, with an enthusiasm proportionate to the obstacles he encounters, is endeavoring to present you with the "Fishes of the Western waters"—and I feel confident, when his entire paper shall be published, although future research may, and undoubtedly will point out errors, that it must be invaluable to the American ichthyologist.

While these observers are prosecuting their enquiries, we are surprised to receive an elaborate paper upon the "Indian Cyprinidæ,"

predecessor; and had I had more time, I should almost as soon have thought of knocking off the nose of the Apollo Belvidere to ascertain if the marble were Grecian or Italian (a curious enquiry too,) as to have injured one of these noble pillars, to have learned whether it contained a dark green talc or a crystal of hornblende. I do not forget Wordsworth's famous lines relative to the man who would "peep and botanise out o'er his mother's grave." But why should an Indian geologist with mountains around him yet untouched by the hammer, waste his time in putting to rights some little slips of those who have worked in quite a different spirit.

read to the Asiatic Society in Sept., 1838, and published in their "Researches" the following year. This paper, to which I would now call your attention, was prepared by Mr. John M'Clelland, assistant surgeon in the Bengal medical service. Our author was induced to undertake the elucidation of this subject, by perceiving that Cuvier had adopted only such of the Indian Cyprinidæ as were figured in Dr. Buchanan's work on Gangetic Fishes—leaving the remaining three-fourths of the species described in that work, as not well determined—and feeling satisfied that these descriptions of Buchanan were so general that they could not by any one be distinguished, he resolved to make the attempt to identify them, by collecting all these species, and minutely studying their characters. "After perseverance for the better part of three years," to use the words of our author, "occasionally giving it up in despair, I succeeded in identifying most of the species unfigured by Buchanan, as well as in having made two series of finished drawings of them, one set for England and one for India." After his paper was ready for publication, our author learned that some of Buchanan's drawings of his Gangetic Fishes, were in the government house at the botanic garden in Calcutta—and upon investigation, found a collection "amounting to one hundred and fifty beautifully executed, and including nearly all the unpublished species on which my painters had been so long employed, with the specific names in Buchanan's handwriting marked under the figures, so as to leave no doubt or difficulty in referring them to corresponding descriptions in the Gangetic Fishes." Fortunate indeed was it for science, although gross injustice to Buchanan, that these drawings should have been thus long concealed; had all the figures appeared in his "Gangetic Fishes," they would have supplied the deficiency in his descriptions, and the rich volume before us, would have never been undertaken. Now, after having for years examined the swamps and stagnant pools, and the mountain streams of India—after having enlisted his numerous friends in his service, and possessed through their efforts and his own, not merely all the species described by Buchanan, but many previously unknown—Dr. M'Clelland is not satisfied merely to cry out ευρηκα, but embodies here a great amount of information obtained during his researches, and throws new light upon the ichthyology of the East.

The Cyprinidæ, are arranged by Cuvier in the "Regne Animal," as the first family of the Malacopterygii abdominales—and are characterized thus—they are "recognized by the slightly cleft mouth; the weak jaws, generally edentated, and whose border is formed by the intermaxillaries; by the deeply dentated pharyngeals which compose the trifling armature of the jaws, and by the small number of the branchial rays. Their body is scaly, and they have no adipose dorsal, such as we shall find in the Siluri and in the Salmons. Their stomach has no cul-de-sac, neither are there any cæcal appendages to their pylorus. Of all the fishes, they are the least carnivorous." This family is divided by Cuvier into seventeen genera, characterized for the most part by the form of the mouth, and the position of the dorsal fin. After a minute examination of the digestive apparatus of these fishes, Dr. M'Clelland has pointed out a natural arrangement, which goes far to simplify their study. He ascertained that upon the greater or less development of the intestinal canal, he could determine the food taken by the different genera —whether it was animal or vegetable; and that the position of the mouth corresponded with this arrangement of the canal. That such of the family as lived entirely upon vegetable food, possessed the greatest developement of the intestines—and their mouths were horizontal or directed downwards; and that those which lived upon insects, had the least development of these organs—and their jaws were directed upwards.

He has accordingly formed three subfamilies, into which he divides the Cyprinidæ. The first, he calls *Pæonominæ*, or herbivorus Cyprins—from *poionomos*, that feeds on herbs. This subfamily is thus characterized—" mouth slightly cleft, either horizontal or directed more or less downward. The stomach is a lengthened tube continuous with a long intestinal canal; colorus plain; three rays in the branchial membrane. *Obs.* Their food consists chiefly of confervoid plants and other productions of the vegetable kingdom." The *Pæonominæ* contain five long established genera; viz. *Cirrhinus*, *Barbus*, *Cyprinus proprius*, *Gobio*, and *Gonorhynchus*. From the

Barbels, our author has formed a subgenus, which he calls *Oreinus*, from *Oreinos*, pertaining to mountains.

The second subfamily is called *Sarcoborinæ*, from Σαρκοβορος, carnivorous. This subfamily is composed of five genera. Two of these genera were previously established; viz. *Leuciscus*, (Klein,) and *Abramis*, (Cuv.)—three other genera are formed by our author. The first of these, he calls *Systomus*, from *Systomos*, that has a narrow mouth. *Characters*. "Intermaxillaries protractile, dorsal and anal short, the former opposite to the ventral and preceded by a spinous ray; body elevated, and ma.ked by two or more distinct dark spots, or diffuse spots either on the fins or opercula, prominence on the apex of the lower jaw obscure."

The genus *Perilampus*, from Περιλαμπω, to irradiate, or shine brilliantly, is thus distinguished. "Head small, obliquely raised above the axis of the body; dorsal placed opposite to a larger anal; apices of the jaws raised to a line with the dorsum, which is straight; the ventral margin is much arched, sides usually streaked with blue; fins without spinous rays. *Obs.* In this genus the intestine is small, and very little longer than the body. The species all subsist exclusively on insects, which they seize by leaping above the surface. They vary from two to four inches in length."

The third genus of our author, is *Opsarius*, from οψαριον, *piciscutus*, a small fish; its characters are thus defined: "Mouth widely cleft; body slender, and usually marked with transverse green streaks or spots; dorsal small without spines, and placed behind the middle, and long, lower margin of the body more arched than the upper. *Obs.* Intestine very short, and extends almost straight from the stomach to the vent."

In the genera of this sub-family, the mouth is situated directly opposite to the position it had in the former. They are all insectivorous—the *Opsarions*, which also devour smaller species of fishes, particularly *gudgeons*, are so voracious, that "it is no uncommon thing to find an Opsarion so overgorged that the tail of its prey remains protruding from the mouth, to be swallowed after that portion which is capable of being received into the capacious stomach is sufficiently digested to admit of the introduction of the remainder."

Another striking distinction between the individuals of these two sub-families, is pointed out to us in their colors. "The whole of the sub-family *Pæonominæ* are remarkable for their uniformly plain colors, consisting of olive green, bluish gray, or brown, extended along the back, and softened off on the sides, so as to leave the lower surface of the body an impure white, partaking more or less of the colors of the back." "Of the species, not one possesses a brilliant spot of any pure color." But as we leave the herbivorous group and enter the carnivorous, we find numerous bright, dark spots, and the opercula and fins to be stained with yellow and red, in deep and natural tints; and the more carnivorous the genera, the more remarkable is the brilliancy of their colors.

The third sub-family, is called *Apalopterinæ*, from απαλος, soft, and πτερον, a fin or wing. It "consists of those genera, the species of which have either elongated cylindric bodies or flat heads, as the *Loaches* and *Pæciliæ*. They are without spinous rays in any of the fins, the intestine is short, and enveloped in a copious mucous secretion; three to six rays in the branchial membrane." There are four genera.

The first genus of this sub-family is called *Platycara* from *platus*, broad, and *kara*, head. Its characters are "head flat, with the eyes placed on the upper surface, fins thick and opaque, pectorals large, anal small, caudal bifid, mouth without teeth and placed on the lower surface of the head, three rays in the branchial membrane. *Obs.* The stomach and intestine form a continuous fleshy tube, not much exceeding the length of the body; they are found in elevated mountain streams."

The second genus is *Psilorhynchus*, from *psilo*, thin or attenuated, and *rynchus*, a snout or beak. It is distinguished by "muzzle elongated and flattened, eyes placed on the edges of the head, mouth small and suctorial without cirri, opercula small, caudal bifid, dorsal opposite to the ventrals."

The third genus *Pæcilia*, includes the genera *Pæcilia*, *Lebias Fundulus*, *Molinesia*, and *Cyprinodon*, contained in the "Regne Animal." A single subgenus is formed from this genus, which is called *Aplocheilus*, from Απλος, simple or single, and χειλος, the lip, and having the following characters—" intermaxillaries fixed, apices of the jaws broad, flat, and directed upwards; five rays in the branchial membrane; fins transparent. *Obs.* A short dorsal is placed opposite to the last ray of a long anal, the ventrals are very small; the intestine and stomach form together a small tube scarcely longer than the body."

The fourth genus *Cobitis*, (Linn.) is divided into two subgenera; the first, our author calls *Cobitis propria*—here, we find the " caudal entire, large, and ornamented as well as the dorsal, with bars or spots; prevailing color of the body, various shades of brown, disposed in more or less dense nebulæ." To the second subgenus, our author has given the name of *Schistura*, from Σχιστος, split or separated, and ουρα, cauda. Its characters are " caudal bilobate, dorsal and ventrals opposite, and short; with or without suborbitar spines; sides ornamented with fasciated bars, mostly green. *Obs.* The intestine is somewhat longer than that of the true Loaches, *(Cobitis propria,)* being usually reflected once upon the stomach."

We have thus exhibited a mere outline of the important improvements proposed by Dr. M'Clelland in the natural arrangement of the *Cyprinidæ;* but besides his classification, our author has presented us a general synopsis of the species, and illustrated them with lithographic figures, from drawings mostly his own, all of which are sufficiently well-executed to convey accurate ideas, and many of them are highly creditable. Besides furnishing nineteen colored plates, containing nearly one hundred figures, the volume before us is enriched by a single plate, exhibiting the peculiar forms of the jaws in several genera of the sub-family *Pæonominææ*, and the differences of form and proportion of the alimentary canal in each of these great sub-families.

Almost one-half of the entire volume is devoted to an " account of the species," and it constitutes by far the most interesting portion. We here find, not merely a scientific description of each fish, with its Latin and native name, and its geographical locality, but its habits are elucidated with great clearness and evident acquaintance; its value as an article of food, from its delicacy or abundance, and the possibility and importance in many instances of its being transported from one locality to another for economical purposes, are pointed out with the zeal of a philanthropist; while the perseverance and fidelity with which our author has studied the minute anatomy of his subjects, must claim from all readers their admiration.

Published as this treatise is, by a Society whose "Transactions" have become so voluminous, and are with difficulty procured, it cannot be extensively circulated or known among American naturalists; I would notice therefore a few points of general interest, selected from the portion of this paper just referred to.

In some parts of India, many of the species of fishes are found in immense quantities. Our author, after describing *Cyprinuschola*, remarks: "Casting a net into a pond in Middle Assam, not presenting any remarkable appearance of containing fish, about one hundred and twenty were brought up at a single draught"—(nine species captured are here mentioned). "The extent of the pond may have been four hundred yards, and that of the net three yards; and supposing half the fish to have escaped from under the net, the number in the pond would have been thirty-two thousand. When we consider the vast extent of surface occupied by waters equally productive, both in Bengal and Assam, we may form a conception of the inexhaustible supply of fish that might be procured for consumption in other parts of the country where they are less plentiful." p. 384. Several species are useful not merely as an article of food; speaking of *Cyprinus cursis*, Dr. M'Clelland observes, "It is a beautiful fish, common in Bengal and Assam as high as Sudyah, but being full of bones, is little valued as an article of food. If it be less useful in this respect than other Cirrhins, it is more serviceable than we are aware of, in common with the numerous Gudgeons in clearing the indolent waters of the plains from a redundancy of vegetation with which they would otherwise be choked up." p. 330. Many of the species are of great value as excellent and nutritious food, and might be rendered infinitely more so, could they be salted when taken, or be transported and allowed to propagate in other portions of the country. Thus the *Barbus megalepis*, which is an admirable fish, is "peculiar to remote unpopulated districts, where no attempts are made to cure; they are consequently lost to the wants of other places, where an unlimited demand for dried fish must prevail at all seasons, but particularly during the rains and hot weather, when fresh fish become scarce. There can be no doubt that if some relaxation of salt duties could be made in favor of those who would embark in such a business, a profitable and useful trade might be established to a far greater extent than we can at present form any notion of. The season for fishing is short, and without means of saving more than can be consumed when fresh, the fishermen have nothing to stimulate them to any exertion beyond that of earning during their brief season, a sufficient sum to support them during the rest of the year. Had the fisherman the means of preserving the result of his labor, his chief market would commence when the fishing season ends, and his industry would then become a permanent benefit to himself and to the country at large. Sea fisheries would be of still higher importance, although neither should be neglected. The cold season, from November to February, is the time at which fishes are chiefly taken; the waters being then low, the fishes are confined to narrow channels, and are often completely cut off from the larger streams and left in pools, in which they are easily secured. When passing Solano Mookh with the Assam deputation in January, I saw boats laden with most of the five kinds of Barbels just described, from one to two and a half feet in length; but as Sudyah, the nearest market at which they could probably be disposed of, was thirty miles distant, and a strong current to be opposed in reaching that place, and no means of curing the fish, the owners entertained little hopes of realizing any thing whatever by them." p. 339.

To the important subject of transporting fishes from one pond or river to another, our author has given much attention, and his suggestions are worthy the notice of the government of India. We are told, that " throughout the Mysore country, as well as in many of the western provinces, large tanks or reservoirs occur, many of them from three to thirty miles in circumference, and being indispensable for irrigation, may be supposed to be nearly universal in all populous districts not watered by rivers. These reservoirs are considered by the Honorable Col. Morison, C. B., as among the greatest national monuments to be found in India. They are capable, according to Buchanan, of supplying water for from eighteen months to two years, and thus of maintaining the surrounding corps should no rain fall within that period.

" They are drained by an ingenious system of sluices and aqueducts of the most simple but complete construction, which afford a perfect control over the distribution of water. During the dry season they are pretty much exhausted, and may, if necessary for repairs, be left perfectly dry. This would afford an excellent opportunity for destroying crocodiles and all the various destructive fishes, sparing only the more profitable kinds, which are limited to two or three species only; and by repeating this operation for several seasons, or as often as may be necessary, all but those we wish to propagate would soon be exterminated.

" By a wise law of nature, the carnivorous animals of every class are less prolific than the harmless, and may therefore be the more easily subdued. Nearly all the destructive fishes are viviparous, bringing forth comparatively few young; whereas, the more profitable kinds, or those which should be the objects of our care, are all oviparous, and bring forth their young from spawn.

" A single female carp weighing only nine pounds, has been found by Dr. Locke to contain no less than six hundred thousand ova; and by Schneider, one, ten pounds weight, was found to contain seven hundred thousand ova or eggs.

" The fecundity of the *Ruee*, *Catla*, and *Mrigala*, has not yet been ascertained, but from their close affinity to the carp, we may suppose them to correspond in this respect with that species; the question, however, is one that may be easily ascertained by weighing a grain of the roe and ascertaining the number of globules it contains, while these will be to the whole roe what one grain is to its entire weight. The result will shew that these species are capable of yielding, by their extraordinary fertility, a source of food as inexhaustible as the sands of the ocean, could we only bring their propagation and the safety of the young sufficiently within our control.

" In the reservoirs above described, we have every facility for effecting this object on a scale of great magnitude, without in any way interfering with the other uses of the water." p. 458, et seq. " The only alteration in the present form of the reservoirs to adapt them to the purposes in view, would be to enclose the lowest portions of the bottom of each with stakes long enough to reach above the highest surface of the water, and close enough together to prevent the entrance of crocodiles, otters, and the like, should any such exist in the neighbourhood. The spawning season of the *Ruee* and other *Cirrhins*, appears to be in the dry weather; the contrivance here suggested would therefore protect them at that time, and if there should be any danger of the whole of the water drying up, wells of sufficient size and depth might be formed within the enclosure, to which the fishes would retire during droughts, while the shallow waters around the wells would afford space enough for the deposit of spawn.

" Much of our success would depend on keeping those enclosures as free as possible from all but the species we desire to propagate. At the commencement of the dry season, before the fish begin to enter the enclosure, the interval between the stakes might be closed with straw, and as the water becomes sufficiently low without, most of the rapacious kinds may be removed or destroyed; none should be allowed to remain but that species alone which may be the object of our care. This done, the only further attention necessary, would be to save the fish in the enclosure from birds during the remainder of the dry season.

" Should our success be complete, from every moderately sized female *Ruee* we should have, on the commencement of the rains, from five to ten hundred thousand fry, which, as the waters rise, would be quite able to take care of themselves till the next season, when it would be necessary again to destroy the rapacious kinds as before." " On the fishes of Bengal, Assam, and other provinces subject to the inundations of the larger rivers, we can exercise no control, nor is it desirable that we should, even were it in our power, the supply of fish being plentiful and constant enough; but in the higher parts of the plains, near the foot of the mountains, where the larger *Cirrhins* and *Barbels* retire during the dry season for the purpose of spawning, fisheries might be carried on with advantage to a considerable extent." p. 461.

As some species of the Indian fishes are found only in clear and rapid streams, they would not probably thrive well, if at all, in tanks where the waters would be still. Should it be considered desirable to propagate to any extent such species, our author suggests, that " the most suitable *vivarium* for such species might be formed by stopping up a clear mountain stream to a certain depth, and filling the irregularities of the bottom with sand, gravel and stones; there should be a current in the water, and to prevent the escape of the fish, a grating should be fixed below; at the opposite end a stronger grating, if necessary, to prevent the introduction of rubbish during floods, as well as the escape of the fish, should the fall not be sufficient for the latter purpose." p. 347. Occasional remarks are found relating to the altitude at which fishes are known to live in India. Speaking of the *Oreinus guttatus*, Dr. M'Clelland observes, it is found " in rivers in different parts of Boutan, between the elevation of two and five thousand feet. It may occur higher, but Mr. Griffith remarks, that in valleys above five thousand feet, though fine, clear streams are common, yet fishes of any kind do not occur in them, and the natives assured the mission to which he was attached, that no fish existed at such elevations." p. 345. The *Gonorhynchus petrophilus* " inhabits streams in Kemaon at an elevation of six thousand feet above the sea, and has been observed by Lieut. Hutton at similar elevations in the mountains north of Simla, as well as by Dr. Campbell in Nipal." p. 371.

And again, " whether any other kind of fishes may yet be found in still higher altitudes than those at which the Gonorhynchs and Mountain Barbels disappear, is a problem in the distribution of this class of animals, that travellers in the Himalaya and other lofty regions must decide. In the limpid streams which Mr. Griffith passed with Capt. Pemberton, at elevations of from six to eight thousand feet in Boutan, no inhabitants were found; and both here and at Simla, as well as in Kemaon, the Gonorhynchs and Mountain Barbels have not been found at greater altitudes than six thousand feet above the level of the sea, where we may presume they disappear; but from that altitude downwards to the plain, they constitute the prevailing forms that have hitherto been met with in the waters." p. 369.

It is well known that several of the marine fishes, under peculiar circumstances, produce derangement in the systems of those who eat them; it appears that similar affections are the result of feeding upon some of the Indian Cyprinidæ. Thus we are told " that many of the natives abstain from the use of the *Cyprinus cursis*, imagining that if eaten on the same day with milk it will occasion a disease called elephantiasis." p. 329.

The *Oreinus progastus* "is said by the natives of Assam to occasion swimming of the head and temporary loss of reason for several days, without any particular derangement of the stomach. It is the most herbivorous of the Barbels, and like some of the Gudgeons, tends rapidly to decay after death, and in the abdominal cavity a copious oily secretion is found, which is probably the cause of its bad effects." p. 344.

Our author observes, that in some species "the whole of the abdominal viscera float in a dark, oily kind of fluid;" and he remarks, that either this fluid, or the great proportion of vegetable matter contained in the intestines of the Gudgeon and Gonorhynchs, tends rapidly to putrefaction; to which cause, as well as to the neglect of removing the viscera from those species immediately after they are caught, I ascribe the bad effects which have by some been observed to result on certain occasions from their use." "Mr. Bruce, of Assam, also mentioned to me, that he knew of instances of indisposition supposed to be occasioned by a variety of Bangon. All Bangons and Gonorhynchs should therefore have the viscera removed soon after they are taken, and the dark, oily fluid washed away; when, if it be necessary, they will keep fresh as long as any other kind of fish; but if this be neglected, the stomach rapidly putrefies, in which state, if it be necessary to use these fish, the thin parts adjoining the ventral fins should be removed." p. 371.

I might proceed to point out much, which could not fail to interest you, but it was not my intention to present an elaborate paper. I wished merely by glancing generally at the work before me, to shew you how creditably the author has performed his task; he deserves, and will I trust, receive in the pages of the scientific journals of his native country, a faithful critique.

Before closing this report, I would revert to a single circumstance which is highly honorable to Dr. M'Clelland. It appears that Dr. Buchanan, during a long residence in India, had made a large collection of papers and drawings illustrating the natural history of that country, which were taken from him, as he was about to leave India, by the Marquis of Hastings, and deposited in the government house at the botanic garden in Calcutta—so that he was obliged when he reached Edinburgh, to publish his Gangetic Fishes without most of his plates. Dr. M'Clelland, when he finally knew of the existence of these drawings, was surprised to ascertain that Hardwicke in his "Illustrations" had freely copied many of them, without giving the slightest credit to Buchanan, and had even annexed to them new names, although the names of their discoverer were attached to the drawing, and in his own handwriting. But the names were not merely changed; "during the twenty years Buchanan's drawings lay at the botanic garden, before they were transferred to Hardwicke's Illustrations, many of the colors appear to have undergone a change, such as light blue and green becoming dark brown; not aware of this, the copyist has not only imitated the altered colors, but added a little to their intensity; the consequence of which is, that the figures thence obtained in the expensive work referred to, are made to appear in black, when they should only be a pale grey or green." p. 355, *note*. Mortified to find, that a departed naturalist had thus been robbed of a portion of his well-earned fame, and proud to be the means of rescuing from oblivion the labors of Buchanan, Dr. M'Clelland has not only in every instance, when practicable, referred to his plates in the most generous manner, but has even presented us with some of the original plates, although he had made similar drawings previous to their discovery. His whole conduct in this transaction is noble and disinterested; and while the naturalist, after reading this volume, acknowledges his obligations for the information received, he will also feel for the author a deep and abiding esteem.*

Robinson's *Patent Sugar Mills.* Pl. VI.

In a Memoir recently presented to the Academy of Sciences of Paris, by M. G. Péligot, it was demonstrated that the constituent parts of the Sugar-cane, of the species called Otaheite, are 90 per cent. of juice, and 10 per cent. of fibrous or woody matter.

At any period, researches, the object of which would be to determine with exactness the different quantities or proportions of the component parts of the Sugar-cane, would have commanded in a special manner the attention of that part of the public interested

* American Journal of Science, 1841, p. 92.

in such inquiry; but at the present time they acquire a new degree of interest by the circumstances in which we are placed.

M. Péligot therefore deserves commendation for having undertaken these researches, and the more so, as he has been able to rectify some very material errors in the important art of extracting sugar from the cane. The authors who had hitherto studied the analysis of the Sugar-cane juice considered it as water holding in solution sugar, gum, albumina, mucilaginous matter, a kind of soapy substance, acids, and divers salts; according to their notions it was a liquid of a very compound nature, and from thence they inferred that it was so difficult to extract the sugar from it. M. Péligot, on the contrary proves that the juice of the Sugar-cane, when filtered, is composed simply of four parts of water and one of crystallizable sugar; that it is nothing but sweetened or sugared water, or at least that the other saline or organic substances which are found therein do not exceed 17 parts in 1000 by weight.

By the sugar mill ordinarily employed to express the juice, the quantity obtained only averages from 45 to 55 per cent. It is true, that some canes may contain less than the above proportion of juice, and that in some few cases better results may be obtained from the mills; but it is admitted on all hands, that the general result is very much below what it ought to be. A large proportion of the saccharine juice remains in the canes after the present operation, which is lost to the manufacturer, or only goes to increase the combustible character of the canes when used as fuel.

Nor is the deficiency of production the only defect of the present sugar mills; those persons who have had any experience in the colonial sugar manufactures, know full well the loss and annoyance which continually arise from the frequent breakage of the machinery.

To our readers it may be observed, that owing to the carelessness of the parties employed, and the imperfection of the machinery, breakage is a common accident, and one which, from the very inadequate means of repair to be met with in the colonies, frequently causes the loss of the "crop" or entire year's labour and expenditure of the planter.

With a view to remedy both these defects, an arrangement of machinery is proposed to be substituted for that heretofore used, the joint invention of a planter of twenty years' experience, and present eminence, and of an engineer of talent and application, resident in a British sugar colony during the last five years. The details have been perfected here, and the invention has been patented in England,* France, and their dependencies and plantations abroad, and is in process of being secured by patent in all the sugar-producing countries and colonies.

Fig. 1, of the engravings on our front page, is a side elevation of this patent Sugar Cane Mill, No. 1, and feed apparatus complete, with one side frame removed for distinctness. In this arrangement it will be seen, that the canes are subjected to three pressures, by which the whole, or nearly the whole of the juice is expected to be expressed; its extraction being still farther assisted by the application of a jet of boiling water, or of steam, being thrown upon the canes previous to their entering between the third pair of rollers.

Fig. 2 is a side elevation of a patent Sugar Cane Mill, No. 2, with its endless band for feeding the canes to the rollers. (One side frame being again omitted.)

These engravings, although representing but imperfectly two modifications of the machines, will give a better idea of them than any lengthened description. It will be at once perceived by persons having an acquaintance with the subject, that there is nothing complex or experimental in the new mill, and that it is adapted to operate more effectively than the common one.

The distinguishing peculiarities of the new mill, and the advantages claimed for it by its ingenious patentees are as follows:—

1st. That the canes are fed into the mill, or, in other words, put between the pressing cylinders by an apparatus or machine, attached to and worked by the mill itself, by means of which they are supplied regularly, evenly, and lengthwise; instead of being fed in by the hands of the attendant blacks intermittingly and in unstratified bunches, now too little and then too much, which has the double disadvantage of hindering the action of the cylinders upon a portion of the canes passing through, and of severely straining the machinery.

2nd. The canes undergo three distinct and consecutive pressings, at each of which the juice expressed is separated from them by being

* Vide abstract of specification, page 446 of our 931st Number.

thrown *back*, while in the common mill the canes are subjected to but two pressings, at the first of which the expressed juice is thrown *forwards* with the canes, and but very partially separated from them, leaving nearly the whole to be separated at the second pressing, which, as shewn above, fails in obtaining the juice to a great extent.

3rd. The pressing cylinders or rollers are tied or held to each other by *malleable iron* straps or bars, which relieve the *cast iron* side-frames from the great strain they are subject to in mills of the usual construction. Should any of these straps break, they are easily and promptly replaced.*

Extract from the Cernéen Newspaper of Nov. 10th, 1842, regarding the Vanilla produced at Mauritius, on the estates of Mr. GENEVE, *Black River. Communicated by* WILLIS EARLE, ESQ.

'Mr. Bojer, at the last sitting of the Mauritius Society (of Natural 'History), exhibited some beautiful vanilla fruit or pods, the produce 'of the last gathering made by Mr. Genève at the Rivière Noire, with 'the view of inducing the Society to encourage as much as possible the 'culture of this plant, which offers great advantages to the country, 'on account of the little expence attending plantations on a large 'scale, and of the extremely high price of Brazil vanilla.

'This latter, Mr. B. says, bears no comparison with that of Mauri-'tius in respect to the perfume, and the beauty of the fruit, and yet 'it sells for 90 to 100 francs per lb.! ! †

'A pod of M. Genève's weighed gross, $2\frac{3}{4}$ drams.‡ Six pods 'thus weigh about an ounce, or 96 to a pound avoirdupois, and if '('un pied,') a foot? of vanilla gives 1000 flowers at the end of 'three years, its importance may be easily calculated. Mr. Bojer 'ascribes the rarity and consequent dearness of vanilla, to failure 'arising from the excessive developement of a certain membrane, 'covering the stigma or female parts,§ which prevents fructification,

* Mechanics Magazine, Oct. 1841.

† But only sometimes at this rate I suppose.—W. E.

‡ Mr. B. says the fresh fruit, whereas that of the Brazils must be old; but I have not seen either the plants or the fruit.—W. E.

§ The pollen being shed rapidly, and often when the stigma is thus enveloped, as explained to me by Mr. B. in conversation.—W. E.

'and says, that he has recently, by means of a slight incision reme-
'died this fault, which appears to be almost general in the conforma-
'tion, and finds that in all the plants so operated upon, he has by
'thus mechanically assisting nature, entirely restored the due rela-
'tions between the organs of fructification.*

'A letter from M. Genève shews, that formerly out of 10 grèffes
'or shoots rich in flowers, scarcely one or two pods would be
'produced, but that now, thanks to Mr. Bojer, each stem (grèffe)
'after losing half its flowers, yields as many as 10 pods. M. G.
'adds, that in less than 15 days, 10 or 12 vanilla plants have formed
'*(now?)* 236 pods, and that he expects to have from them 325 to 350,
'a very satisfactory result,—and which could have been *doubled*,
'had the operations been performed in due time.'

From the same.

I suppose you saw the remarkable Meteoric, if not Cometic appearance in the heavens, yesterday evening, and which astonished us not a little.

I first observed it on leaving the office, at about 6¼ to 6-20 P. M., I then imagined that it was a streak of smoke from some steamer illumined by the sun, and afterwards that it was one of those radiations sometimes seen, when the sun has just set, or is setting under clouds, but it had a brighter appearance, and in fact seemed as a luminous cloud-like ray, of prodigious length, converging towards or almost towards the place of sunset.

I expected, therefore, to see it melt away, but on the contrary, it became brighter and better defined with the increasing dusk, and it grew gradually shorter, by the earth's motion, as it seemed to decline, and sink into the horizon.

By the time I got to the gardens, it had assumed all the appearance of a Comet's brush, but was fast setting behind our Casuarina trees, when I took the probable bearing of the point, where I think it may have cut the horizon, and which I think lay by compass, between W. b S. and W. b S. ½ S.

* Mr. B. informed me, that the vanilla, a parasitic plant, the mango tree, the iron-wood tree, and some others grow in the Isle of France.—W. E.

The angle it made with the horizon, I roughly estimated at $47\frac{1}{2}°$ to $50°$.

The time of the ray or tails final setting I know not, but suppose $1\frac{1}{3}$ to $1\frac{1}{2}$ hour before the moon.

The time of my taking the bearing, and angle of incidence of the above, was about 7° 35′ P. M., I think.

It occurs to me, that a few nights ago, I saw something like the above, but only for a very short time, owing to the general cloudiness that then prevailed.

This morning, I was on the look out before 5 A. M., to see if there was any thing very remarkable, rising before the sun, and saw of course the beautiful morning star, Venus, and soon after I observed, what I suppose to be Mercury; but with a much larger disk than I gave him credit for, through a Dolland's hand telescope of moderate power. He rose bearing E. S. E. below, and to the Northward of Venus, and was of a comparatively dull reddish hue; I suppose, he may be at this season further than usual from the sun; but being no astronomer, and having no Ephemeries to consult, can only guess in ignorance.

March 7th, 1843.

Hodgson's *Illustrations of the Zoology of Nipal and Tibet*.

We have been assured by those who have been favoured with the sight of 31 sheets of Hodgson's Illustrations, and can safely say, that for rigid scientific accuracy, united with much spirit and grace, they are inferior to nothing that has yet appeared in England. The figures only want being rounded by shading, to make them perfect, and the artist who has engaged to execute them in lithograph, will readily *add that*,—doing moreover whatever further be held needful to make the drawings really contributory to scientific use, as well as to popular taste, for he has a rich store of specimens at his disposal, whereby to correct, compare, and complete his proposed work, at all points.

The draftsman employed by Mr. Hodgson, to whom we owe these drawings, (Raj Man Sinh, we name him with respect,) is a native of

Nipal, and to all patrons and promoters of Indian talent, the proposed work will have a double value as an unrivalled specimen of Indian docility and ability. The home artist, who undertakes to transfer the drawing to stone, is Mr. F. Howard, the celebrated illustrator of Harris, and Mr. Howard is anxious and ready to begin his task. He proposes to commence with Quadrupeds, and to go on to birds, to give first 100 of the former, and then so many of the latter, as the public shall continue to call for. His terms for 100 Mammals, to be published each alternate month, are fifty rupees, or ten rupees per part of twenty Illustrations, twenty inches by twelve each in size. He requires 200 subscribers, and he hopes that subscribers will not object to pay half in advance, or twenty-five for the Quadrupeds to begin with, when a century of birds will be proposed on the same terms. Whatever is necessary to exhibit the essential conformation of each type or genus, will be given separately, as the scull or stomach, or bill or feet; and care will be taken that each and every Nipalese or Tibetan form or genus is exhausted before the plates are suffered to run to too great a number. Thus for five rupees per mensem, payable every second month, or for an advance of twenty-five rupees on the Mammals, the other twenty-five to be paid on completion, every gentleman interested in science, or fond of field sports, may obtain 100 Quadrupeds beautifully executed, and fully explanatory: and then, upon the same terms, as many birds: and we may add, that there is hardly an Indian Quadruped, that will not fall within the scope of the work; and but few Indian birds. We shall be happy to receive intending subscribers' names, and references for payment in England, or at the Indian presidencies.

The Glacial Theory.

When noticing the *Annals and Magazine of Natural History* in the October No. of the *Calcutta Journal of Natural History*, 1841, we adverted to the views then beginning to prevail relative to the effects of glaciers.

The subject still continues to engross the attention of geologists, and most of the scientific journals are occupied with the results of their enquiries, and we here propose to offer an outline of the present state of the question.

The glacier theory, says Professor Forbes, *Edinburgh New Philosophical Journal*, No. 63, page 85, whether it regards the present or the past history of those mighty and resistless vehicles of transport and instruments of degradation, yields to no other physical speculation of the present day in grandeur, importance, interest, and I had almost said, novelty. It is, says M. Agassiz, scarcely any longer a mere theory; it rests on a whole series of phenomena apparently very different, but whose relations are evident to all observers: these are the erratic blocks, the mounds of loose materials, the ancient moraines, the polished and striated surfaces, the furrowings of rocks in a constant direction, which facts have been emphatically named the *erratic phenomena.*

"Since the domain of observation has been fairly entered," says M. Agassiz, "the investigation has advanced with gigantic strides. The beauty of the subject, the vast field which it embraces, the exciting questions belonging to it, have awakened on all hands, zeal, interest, curiosity, and ambition. There is now not an academy, not a scientific society, in which the erratic phenomenon has not been discussed and supported by new facts; and such has been the activity displayed by the *savans* of every country, that the most succinct abstract of the works and memoirs on the subject which have appeared within the last two years, would greatly exceed the limits of an article like the present. M. de Charpentier, in his *Essai sur les Glaciers et le Terrain Erratique*, has described in detail the traces of ancient glaciers in the great valley of the Rhone and its lateral valleys, and also at a multitude of other points in Switzerland; M. Studer has observed them on the southern side of the Alps; and Mr. Martins in the Grisons. The French geologists assembled at Grenoble in 1840, studied them in the Alps of Dauphiny, and made them the subject of their discussions at the meeting held at Lyons in 1841. The polished rocks, in particular, seem to be very distinct on Mount Cenis, where they have been detected by Mr. Trevelyan and by Captain Le Blanc. MM. Renoir, Hogard, and Le Blanc have continued to observe the erratic phenomenon in the Vosges; MM. Max Braun, and Du Rocher have noticed it in the Pyrenees; and I myself have done so in the Black Forest. The Swiss and French Jura has in this respect been made the object of continued study by MM. Gressly, Guyot, and Desor, who have proved that the erratic blocks of the Alps extend far beyond the limits assigned them by MM. de Buch and Charpentier; and, lastly, I have discovered erratic blocks, accompanied by polished and scratched surfaces, in a host of localities in the Alps, where they had not previously been known to exist.

"The great phenomena of the north, although attributed to other causes, do not the less belong to the same subject; and, since the investigations of MM. Alexander Brongniart and Sefström, they have been made the object of continued researches by MM. Böthlingk, Nordenskiöld, Eichwald, Durocher, Robert, Martins, Murchison, De Verneuil, and Kaiserling. Finally, the American geologists, also, have very recently noticed a vast net-work of polished rocks and erratic blocks in the United States.

"But it is more particularly in Great Britain that the most unexpected discoveries have been made. Who could have supposed that in these islands, equally remote from the glaciers of the Alps and the ice of the north, traces of the action of ice should have been found! And, nevertheless, all the phenomena which indicate the former existence of glaciers are there just as evident, and just as well preserved, as in the neighbourhood of the glaciers of the present day. England likewise,—thanks to the activity and the zeal of her *savans* —already possesses quite a literature on the subject of glaciers; and it would be necessary for me to cite the names of most of the geologists of that country, were I to mention all the individuals there who have occupied themselves with this question.

"The purely theoretical part of the erratic phenomenon has also attracted much attention; and the discussions to which it has given rise in many places, and particularly in the Geological Society of France, have contributed, on their part, to render the study still more interesting, by connecting it with the great problems of the cosmic system."*

* Edinb. New Phil. Journ. No. 66, p. 218.

When we study the arrangement of erratic blocks in certain valleys in Scotland, we feel inclined to imagine ourselves in Switzerland, says the same writer.

"These mounds or ramparts abut against the walls of the valleys, frequently forming at the mouths of the valleys a series of concentric belts, which occur precisely at those places where, supposing that the valley had at one period been occupied by a glacier, it ought to have terminated by the terminal moraines pushing against one another. Similar mounds are observed at the mouth of nearly all the valleys of mountainous countries. The most remarkable in the British islands are, in Scotland, those of the banks of Loch Awe and of Loch Etive, especially in the vicinity of Bunaw ferry; in England, those of the environs of Penrith and Kendal; and in Ireland, those which traverse the road that skirts the base of Cuilcagh to the west of Florence Court. The latter are more distinct than any that I have seen in the United Kingdom. The nature of the blocks composing these moraines, proves that they have not come from a great distance; but that they have been detached from the upper part of the valley, and transported by some cause to its extremity. It is among these blocks, sometimes of very considerable size, that we find the most angular. Now, if we consider the arrangement of the valleys, which proceed in all directions from the most elevated chains, and all of which present the phenomena of erratic blocks, and of more or less continuous moraines, we cannot for a moment doubt, that the cause of this transport has extended its effects by radiating from the interior of the elevated points of the district towards the plains. This is a fact of capital importance, for it proves that the phenomenon of transportation is to a certain extent a local phenomenon, inasmuch as it is connected with the neighbouring chains of mountains. Each great group of mountains in Britain has thus its system of erratic blocks limited to the extremities of its valleys. It is thus that Ben Lomond on the one hand, and Ben Nevis on the other, have their system of blocks independent of that of Ben Wyvis; Schihallien and the Grampians have equally theirs, as also the Pentland Hills, the Cheviots between Scotland and England, and the mountains of Cumberland and Westmoreland; lastly, the mountains which rise above Belfast, those of the country of Wicklow, and Cuileagh, also seem to me to form so many separate groups, as regards the dispersion of their erratic blocks. But these relations of the blocks to the chains of mountains are only one of the peculiarities of their arrangement; it is indeed that very one which has been least insisted on, and with which the defenders of the theory of currents have the least occupied themselves; and yet they ought above everything to have endeavoured to explain it, because it includes facts the most contrary to their theory. How is it really possible to attribute to an eruption of the ocean, or to the effects of a continual *soulèvement*, the dispersion of different groups of erratic blocks arranged like a fan around each particular system of mountains? How, moreover, is it possible to conceive the existence of so many deep lakes, by whose beds, however, all these currents must nevertheless have passed, in order to perch the erratic blocks on the flanks of the mountains, rather than accumulate them in the bottom of the valleys?

" A circumstance which further adds to the importance of these scattered blocks and continuous mounds, is, that the valleys in which they are met with have generally their walls more or less worn, rounded, smoothed, polished, and scratched. Now, this particular appearance is evidently to be attributed to the same cause which transported the blocks; for these two series of facts are everywhere intimately connected together.

" It was in England and in Sweden that the first polished surfaces were observed, and these were everywhere attributed, until recently, to the action of great currents, without any regard being paid to the improbability of a current, or rather currents, spouting like springs from the top of all the valleys, and being sufficiently powerful to convey from their place of origin blocks sometimes of immense dimensions. It can easily be imagined, that, at a period when almost all geological phenomena were attributed to the action of water, no endeavour was made to search for another cause for the transport of erratic blocks. But if a comparison had been instituted between the polished surfaces and the effects produced by currents, very remarkable differences between them would have been discovered. As I have said elsewhere, rocks polished by glaciers of the present day present surfaces gently rounded, smooth, and continuous over large spaces, sometimes even perfectly flat, and passing uniformly over the most resisting portions of rocks as over the softest, without forming sinuosities or edges. They are, moreover, furrowed, in the direction of the movement of the glacier, by furrows more or less deep and rectilinear, and scratched by fine striæ, perfectly rectilinear, and evidently parallel to one another and to the furrows; and, when the latter offer deviations from the general direction of the valleys, it is in consequence of circumstances which it is easy to appreciate. Such are likewise the polished surfaces remarked at the bottom and on the flanks of the valleys which are encompassed by erratic blocks and moraines, even when they are no longer occupied by glaciers. But such are not the appearances exhibited by rocks worn by water; although smooth, they are never polished, and their undulated and sinuous surfaces present hollows or irregular excavations wherever the nature of the rock favoured erosions; no portion of the surfaces worn by currents of water has exhibited to me those long rectilinear striæ so characteristic of the polishing of glaciers. These differences between the abrasion occasioned by glaciers and that caused by water, are very well explained by the difference presented by a current of water, which, while it bounds along, follows all the sinuosities of its bed, and a rigid mass of ice which advances slowly on account of its consistence. The conformity which I have already pointed out between the aspect of polished valleys whose flanks are charged with erratic blocks together with continuous mounds, and whose mouths are closed by concentric barriers of blocks, and the aspect of the valleys at present occupied by glaciers flanked by their lateral and terminal, ancient and recent moraines, and whose bottoms are polished, striated, and furrowed in the direction of the movement of the glacier; this conformity, I say, is the principal argument that has caused me to attribute to the existence of glaciers which no longer remain, the phenomena similar to those produced by the glaciers of the present day, and which we meet with in so many localities far distant from glaciers. The granitic and porphyritic rocks of many valleys in Scotland exhibit polishings equally brilliant with those at present observed on the slaty serpentines of the flanks of the glaciers of Monte Rosa."*

* Edinb. New Phil. Journ. No. 66, p. 222.

For the manner in which such polishings and grooves are effected by glaciers, we may refer to p. 449, of the *Calcutta Journal of Natural History*, 1842. Dr. Buckland, to whom these polished surfaces were pointed out in Switzerland by Professor Agassiz, as the effect of glaciers, remarked, that he had seen similar phenomena on the surfaces of rocks both in Scotland and England, but which he had attributed to diluvial action. Thus he had observed on the head rocks, on the left side of the gorge of the Tay near Dunkeld, rounded and polished surfaces; and in 1824, in company with Mr. Lyell, grooves and striæ on granite rocks near the east base of Ben Nevis. About the same time, Sir G. Mackenzie pointed out to Dr. Buckland a high ridge of gravel extended across a valley at the base of Ben Nevis, in a manner inexplicable by any action of water; but in which, from his examination of glaciers in Switzerland, he recognizes the form and condition of a moraine. The north and north-east shoulders of Schihallien presents rounded, polished and striated surfaces. Again, on the left flank of the valley called the Braes of Foss, a newly exposed porphyry of the dyke, forty feet wide, exhibited a polished and striated surface parallel to the line of descent which a glacier from Schihallien would take, and in the right flank of the same valley, another and smaller dyke of porphyry presented similar phenomena, and in the intermediate space, the recently uncovered slate and quartzose rock, are rounded, polished, grooved, and striated parallel in the direction, which a glacier would assume. At the west end of Comrie near Strath Earn, blue slate rocks have been also rounded and guttered, as well as the surface of the granite at Invergeldy; though too much weathered, the polished surface or the striæ, both of which phenomena may, however, be seen on a hill composed of trap rock near Surg, in the direction which a glacier descending the subjacent valley would assume.

2. *Moraines.*—Dr. Buckland on the same occasion enters into full particulars of moraines or ridges of loose boulders,

and detached masses of rocks, which skirt several mountains in Dumfrieshire, Aberdeenshire, Forfarshire, and other parts of Scotland, generally, if not always associated with the foregoing polished and striated surfaces, so as to leave little doubt upon the mind, that both phenomena were produced by the same cause.

Dr. Buckland considers the gravel and sand which cover most of the granite table-land from Aberdeen and Stonehaven to be the detritus of moraines; and the large tumuli and tortuous ridges which occupy one hundred acres near Forden to be terminal moraines, as well as the blocks, large pebbles and small gravel spread over the levels of the valley of North Esk, after emerging from the lower Grampians, to be the residue of moraines, re-arranged by water.

The cones and ridges of gravel in Forfarshire near Kirriemuir at the confluence of the Caritz and Proson valleys, have also been produced, Dr. Buckland considers, by glaciers. The vast longitudinal and isolated ridges extending for two or three miles up the valley of Blair Gowrie, and the transverse barriers forming a succession of small lakes in the valley of Savanburn, he considers to be moraines, as well as the lofty mounds forming the ornamental grounds adjacent to Dunkeld Castle; and the detritus covering the left flank of the valley of Tay are, he thinks, to be ascribed to the same cause, as well as the vast congeries of gravel and boulders on the shoulder of the mountain exactly opposite to the gorge of the Tamel. These last were precipitated from glaciers which descended the lateral valley of the Jamæl, on the north side of Schihallien and the adjacent mountains.

Remarkable groups of tumuli, thirty to sixty feet high, are crowded together on the highlands dividing the Tay from the Brau, which exactly resembles some of the moraines in the valley of the Rhone, between Mortigny and Lock. The village of Almurie is considered by Dr. Buckland to stand on a group of low moraines and surfaces of mica slate rounded by glaciers: Strath Earn is flanked irregularly with ridges and terraces of gravel, the detritus of moraines and adjacent hills are rounded and striated. Near Comrie, Dr. Buckland tested the value of the glacial theory by marking, in anticipation on a map the localities, where there ought to be evidences of glaciers having existed, if the theory were well founded, and the results always coincided with the anticipations. Full details of the circumstances are then entered into by Dr. Buckland.* Similar remains of moraines have been observed at Lock Earn, Callender, Edinburgh, in Cumberland and Westmoreland, at Kendal and Lancaster, and the line extends to Shap Fell.

In a report to the Geological Society of France in 1840,† M. Renoir states it to be his settled conviction, that glaciers of much greater extent and force than any now existing, formerly occupied the vallies of the Alps down to an actual elevation of little more than four hundred feet; and that in the chain of the Vosges, the culminating or highest point of which is little more than that of the mountains of Scotland, the effects of glaciers are equally conspicuous and characteristic. The polished guttered surfaces have been observed in situations too numerous to detail, while the vallies are bordered by moraines, of which the following characters are given:—

We now know, from what has been pointed out by Messrs. Venetz, Charpentier, and Agassiz,‡ that the marks which glaciers leave behind them as they retire, are, 1*st*, *Terminal moraines*, composed of sand, gravel, pebble, and even at times a great number of boulders, the whole more or less rolled, forming banks and curved lines throughout the whole width of the valley, whose concavity is turned upwards, higher towards the middle than at the extremities; of a triangular form, and having the exterior face generally more in-

* ‡ Many of the memoirs illustrative of this subject have appeared in the previous numbers of the Edinburgh New Philosophical Journal.

† Edinburgh New Philosophical Journal, January 1841, p. 250.

clined or steeper than the interior. *2dly, Lateral moraines,* nearly of the same composition as the former, but arranged in longitudinal mounds, deposited on the two flanks of the valley at the same height two by two, following all the contours of the windings, entering every sinuosity, and having an inclination which represents that of the surface of the glacier. *3dly, Median moraines,* resulting from the junction of the lateral moraines of two glaciers uniting. These moraines present the form of a triangular prism, whose axis is in the direction of the valley, and the nearer its middle, the nearer the size of the glaciers approaches to equality. *4thly,* Whenever the nature of the rocks permits, the bottom and sides of the valley exhibit perfectly polished surfaces, together with particular indentations, in the direction of the glacier's motion; also *striæ,* or fine parallel lines, likewise running in the same direction, that is to say, in the direction of the valley's inclination, but never following the greatest inclination of its sides. These striæ are particularly characteristic. *Lastly,* Large blocks *not rolled,* often resting, as in equilibrio, on one of their smallest faces, and forming lines, etc. more or less extensive, on the sides and bottom of the valleys.

After describing numerous instances of moraines in the valley of St. Amarin, M. Renoir remarks.

One of the reasons which led me to consider these accumulations of stones as moraines, is, that their absolute height is greater in the middle than towards the rocks which encompass the valley, as is the case with all the moraines of existing glaciers. The cause of this peculiar form is known, and has been stated by the *savans* who have occupied themselves with glaciers; a form peculiar to moraines, and which is the very opposite to that which deposits formed by rapid currents would assume. Moreover, polished rocks appear along the whole right bank of the rivulet Thur, at heights more or less considerable, whenever the rocks have been sufficiently hard to preserve their polish, or when they have been somewhat protected by their position from the action of atmospheric agents. It is true that this polish is no longer perfect, and has, consequently, been incapable of preserving the striæ; but we have noticed, that the same deterioration is observable not far from glaciers, when the rocks are not very hard, or when they have for a long time been left by the glaciers. We see nothing of them on the south-west declivity, because, being there more exposed to the action of the atmosphere, the surface is entirely decomposed, covered with debris, and in a state ready to slip downwards in numerous places.*

3. *Erratic Blocks.*—With regard to the dispersion of erratic blocks in plains, the circumstances connected with this question are no less easy of explanation on the glacial hypothesis. Mr. Lyell has shewn, that heavy masses of rock may be transported to considerable distances on rafts of ice, and thus the block of mica slate, 8 or 10 tons weight, now resting on the soil of the Pentland hills, may have been brought from the Grampians, as no glacier by the mere expansion of its mass could carry this across 50 or 60 miles of low country, and deposit it where it now lies at an elevation of 1100 feet.† There are doubtless many other instances similar to this, for which the glacial theory is not sufficient of itself to account. But if it affords an easy solution to all the ordinary phenomena of erratic blocks, such as the dispersion of the granite of Shap Fell over the face of the surrounding country, as described by Dr. Buckland, it is as much as can be reasonably expected, while the few exceptions that occur may be easily accounted for otherwise. The following are the observations of M. Agassiz on this subject:—

Dispersion of Erratic Blocks in plains.—The phenomenon of erratic blocks and polished rocks is not limited to the chief groups of mountains, but is seen extending over the whole surface of the country where it presents itself; with this difference, that in the lower regions it assumes peculiar characters, different from those which I have described as belonging to mountains and their valleys.

Just as the erratic phenomenon is localized in the vicinity and in the interior of mountains, so does it exhibit uniform characters in the low country and in flat regions, covering vast tracts whose limits

* Edinb. New Phil. Journal, No. 58, p. 256.

† Vide Address of Prof. Hitchcock to a meeting of American Geologists, Edinburgh New Philosophical Journal, 1842, p 79.

cannot with precision be referred to determinate centres. Blocks are seen extending from one mountain-chain to another, across considerable depressions of the surface; the accumulations of blocks transported from one place to another are no longer arranged in linear continuous series as in the valleys, where they form mounds or ramparts, which are moraines properly so called, but they are dispersed irregularly over the surface; the nature of the rocks mixed together in these accumulations no longer indicates an origin so limited as that of those moraines even which are at the mouths of the valleys. The dispersion of these blocks in different countries has not hitherto been described with sufficient care, and more particularly the erratic angular blocks with a rough surface have not been sufficiently distinguished from those that are rounded, polished, and scratched. There are, however, very important differences in this respect. In Switzerland, for example, we nowhere meet with *large* blocks, whether angular or round, whose surface is rubbed, polished, and scratched with rectilinear striæ, at great distances from their origin. Whatever may have been the cause of the transport of the erratic blocks of the Alps and the Jura, it always happens that the great mass of the large blocks have arrived there with rough surfaces and well marked angles, and that the pebbles of smaller dimensions alone are worn, rounded, polished, and scratched with rectilinear striæ. We may easily convince ourselves of this fact by walking along any part of the Jura chain. Another peculiarity worthy of attention is, that with us the large angular blocks generally repose on the more or less considerable masses of rounded and polished pebbles, and that these latter often pass into a fine sand or a clayey paste, which covers directly the polished surfaces of the solid rocks wherever the pluvial water, the melting snow, and the torrents resulting from it, have not caused them to disappear. This arrangement is very well seen in the environs of Neuchatel.

The state of matters is by no means the same in Britain, and more particularly in Scotland. There the erratic blocks of all dimensions are, in certain circumstances, rounded, perfectly smooth and polished, and even scratched with rectilinear striæ, like the polished solid rocks —a feature only observed in the smaller pebbles in Switzerland. It is not to be understood that there are no large angular blocks in England

and in Scotland; but there is this distinction to be made, that these blocks are generally not far distant from their natural position *in situ*, or that they are in small number compared with those which have evidently been acted on by a prolonged mechanical operation. But this is not all: far from being found lying at the surface of the ground, the large blocks are for the most part heaped up in a confused manner along with the smaller ones of all degrees of size, from the dimensions of the smallest pebbles to the colossal volume of the largest erratic blocks, in a deposit of clay unequally distributed over all the low portions of the country. This deposit of clay, which is of very unequal thickness, and exhibits no trace of stratification, is what is termed *till* in Scotland. There is no locality in which I have been able to study the *till* more completely than at Glasgow, where the numerous works carried on in 1840, for the embellishment of the town had exposed it at many points; but everywhere it presents the same character; the rounded, polished, and scratched blocks of very various dimensions, are every where indiscriminately mixed together in a marly or clayey paste. It is evident that it was with this mass, and in this mass, that the rounded and polished blocks have been transported during the whole journey which they have performed together, while the angular blocks have certainly not been rubbed in this manner. Mr. T. Edington has, to the advantage of geologists, brought together, in his park at Glasgow, a magnificent collection of these polished and scratched blocks from the neighbourhood of the town.

Differences of this description in the facts observed at different localities, are an additional difficulty for all those who endeavour to explain them by means of currents. How, indeed, can it be now seriously pretended that a current can convey blocks in such a manner as to rub, round, and scratch one set of them, without their being heaped up according to their weight, and without their being covered by regular beds of finer materials, while the others remained angular, and retained their unequal and rough surfaces? These differences are very favourable to the glacier theory, which explains them in a manner that is quite natural.

Let us return to the glaciers of the present day, and we shall find in some of the phenomena presented by them the greatest analogy to the arrangement of erratic blocks, as I have just described it.

When a glacier moves, it wears and rubs the bed on which it reposes; scratches the smoothed walls; triturates the detached masses which are interposed between the ice and the rock, and reduces them to sand, or to an argillaceous paste; rounds the blocks, which are of an angular form, and which offer resistance to the pressure; and polishes completely those which have broad sides. At the surface of the glacier, matters proceed in quite a different manner. The fragments of rock which are detached from the neighbouring walls, and which fall there, rest upon the ice, and are at most thrown out to its edges. They thus advance with the glacier without being displaced, or at least without being rubbed against one another, excepting those which have become interposed between the rock and the ice, and they arrive at the extremity of the glacier with their angles entire, their edges sharp, and their surfaces irregular. Let us suppose, now, that, in consequence of certain circumstances, one of those immense glaciers charged with debris of rocks, such as the lower glacier of the Aar, or the glacier of Zermatt, should be melted, and it would result that all the angular blocks at the surface of the glacier would repose on the irregular mass of rounded debris which at present lies under the ice. Some of these blocks would likewise be carried to a great distance on rafts of ice, if the melting were sufficiently rapid to cause currents capable of floating large masses of ice charged with blocks. If we suppose, on the contrary, that a glacier or a large sheet of ice, like that which extends over the Col de St. Theodule, were not commanded by numerous mountain peaks, then few or no angular blocks would fall on its surface, but the rounded blocks underneath would not the less be present. If we imagine that, in such a case, particular circumstances should also occur to cause the melting of the ice, there would then be found at the bottom an irregular deposit of rounded blocks, imbedded in the more comminuted materials, along with a few angular blocks above—in short, to the very letter, a sort of till. In this case, again, the melting of the ice would give rise to currents; and the more considerable these currents, the more they would contribute to operate farther on the materials already acted on by the glaciers, whether by conveying to a distance the lighter portions, and depositing them in stratification, or by penetrating them more or less, and giving them a false apperance of stratification. We actually observe something of a similar kind, on a small scale, in the oscillations that occur in the extremity of glaciers which sensibly advance and retreat; as, for example, under the extremity of the lower glacier of the Aar in the Grimselgrund: and, among the localities where glaciers no longer exist, I may cite the lower extremity of Log Treig, and the neighbourhood of Muckairn, between Loch Awe and Loch Etive.

In order to explain the whole of the facts relative to the erratic phenomenon, in the limits within which they have hitherto been observed, it is sufficient to admit that the polar ice formerly extended as far at the North Pole as it now extends at the South. Thus, then, if the influence which has established the difference that exists at present between the extent of the ice at the two poles be a periodical influence, and if it describe one of those cycles of long revolution, which astronomers have been able to determine, we can not only conceive the possibility of a cold in our regions sufficiently intense to produce all the phenomena which I have described, but may even be able to determine its date and duration. I shall not reproduce here my general theory of the periodical refrigeration of our globe, for that would raise useless discussions in the field which the light of observation has not yet sufficiently illuminated; I shall only cite one fact, which tends to make us suppose that there really existed in the North a covering of ice, whose southern limits in Europe, at a certain epoch, reached about 50° N. Lat. I allude to that belt of blocks observed by Russian geologists (see the letter from M. de Meyendorf to M. Elie de Beaumont*), which extends across the centre of Russia, by N. Nowogorod towards Pinsk, as far as the confines of Silesia. It seems to me much more natural to regard this limit as an *isopagetic* line (*une ligne isopagétique*†), than as the southern limit of a current coming from the North, and charged with blocks; and this so much the more, because the phenomenon of the transport of the Scandinavian blocks extends not only into Russia and Germany, but reaches the eastern coast of England. In attributing this effect to the action of a current, it would thus be also necessary to imagine a fan-

* Archiv für Wissenchaftliche Kunde von Russland; von Erman. Berlin, 1841.

† Ισος παγετος, that is to say, of equal ice; in some sense the *isotherme* of the outline of the northern covering of ice; but as the limits of this ancient ice do not coincide with the isothermal lines, I have been obliged to propose a new name.

shaped current; whereas a solid limit, during a certain time, of a covering of ice as extensive as that of the South Pole, obviates all the difficulties presented by such a phenomenon, such as the continuity and the regularity of the outlines, the uniform furrows of the polished surfaces of the North, the passage across the Baltic and the North Sea of the blocks which lie on the surface of Germany and of England, &c. In a second zone of blocks, more to the north than the first, and observed likewise in Russia, to the south of the White Sea, and of the lakes of Onega and Ladoga, we have a direct proof of the successive and slow retreat of this covering of ice, a second isopagetic line more remote than the first. If this covering of ice really existed, it must at last have retired beyond the northern limits of the British Islands, after having enveloped them partially or entirely; but so long as the northern ice had not retired to its present limit, the climate of Europe must have been colder than it now is, and, even when the primitive ice had abandoned the plains, groups of glaciers must have remained in all mountainous countries. Hence it appears natural that during the retreat of this covering of ice, there must have been a period when the mountains of Scotland were the focus of numerous glaciers, which at first descended from their summits into the plains, but afterwards occupied only the interior valleys, before disappearing completely.

There would thus be two very distinct periods to be particularized in the epoch of the existence of ice in the north of Europe,—that during which the general covering enveloped the region, and that when glaciers existed only in the high valleys. The dispersion of erratic blocks over great spaces, across considerable depressions of surface, the formation of the till, the furrowing and uniform striation of the polished rocks of Sweden and of Finland, seem to me the chief phenomena which have been produced by the northern covering of the epoch of ice. The differences which exist as to the erratic phenomenon between the north and the centre of Europe, appear to me to be susceptible of easy explanation by the differences of latitude and of the configuration of the surface. In Britain, the ice, at the time of its greatest extension, seems to have covered completely great tracts of country, and consequently rendered the fall of blocks on its surface, if not impossible, at least extremely rare; so that the great mass of the blocks was necessarily buried under the ice, and was therefore subjected to all the effects of a gradual and long-continued trituration, just as is observed beneath the glaciers of the present day. Mountains of considerable elevation in Scotland—Schihallien, for example—have their summits as polished as their flanks; whereas in Switzerland there exists a limit, at about 9000 feet,* in the centre of the Alps, above which the summits are no longer polished, but where the rugged peaks present a very striking contrast to the lower surfaces, which are polished, or at least *moutonnés.*† In the exterior chains of the Alps, the polishing does not reach to a greater height than 6000 or 7000 feet. It cannot be doubted, that this limit, which is so well marked, indicates the level of the bed of ice at the epoch of its greatest thickness. The rugged peaks, which exceed that height, thus rose like islets in the midst of this sea of ice, and the blocks which were detached from them fell on the surface. Not being confined in narrow valleys, but the whole vast sea of ice being open to them, these blocks were not liable to be knocked against one another in their progress towards the lower districts, and it is thus that they could be transported as far as the Jura, with their surfaces rough and their angles prominent; whereas, the matters which were beneath the ice, were triturated, polished, rounded, and scratched. Now, if in Switzerland, the limit of the great mass of ice extended as high as 9000 feet in the Alps, and if it oscillated between 4000 and 5000 feet in the Jura which no longer presents glaciers, what is more natural than to admit, taking into account the geographical portion of the localities, that, in Scotland, the great proportion, if not the whole, of the surface, was entirely under ice during the whole duration of the glacial epoch. Hence the majority of the detached blocks of the Scotch mountains must have been transported under the ice, and consequently rubbed, rounded, polished, and scratched. I say the majority, for it is probable that some were detached when the ridges were free from ice, and when the valleys alone were occupied by glaciers; and these latter have necessarily remained more or less angular, and have retained their

* All the measurements given in this paper are in *pieds de Roi*, or French feet; and the temperatures are all indicated in centigrade degrees, unless where other measurements or other degrees are specially mentioned.

† *Vide* the Compts Rendus de l'Academie des Science, 1842; tome 14, p. 412.

rough surfaces, just like the blocks of the moraines of the glaciers of the present day. Foreign blocks, whose origin is not British, and which were doubtless transported on the surface of the great sheet of ice, or on rafts of ice at the period of its dissolution, ought to be angular, and, for the most part, are so in reality. In this way, the form of erratic blocks implies, in some degree, at first sight, their mode of transport. I am able to add, as a confirmation of what I have said as to the form of the erratic blocks of Scotland, that the blocks of the Jurassic rocks, which we meet with in the diluvium of the interior valleys of the Jura, are all rounded; a proof that they have been transported under ice; and in fact this ought to be the case, because the polished rocks furnish us with the proof that the sheet of ice covered nearly all the summits of the Jura.

The melting and the retreat of the ice seem to me to have caused, at different times, according to the climatological circumstances, all those deluges, more or less extensive, of which records have been sent down by tradition and history. It is doubtless to these inundations that we must also attribute the dislocation of a large portion of the moraines, especially of those that, by their position, were not beyond the reach of the currents, which, by acting on the detritus at the bottom of the sheets of ice and of the glaciers, have given it, in many localities, a stratified appearance; so much so indeed, that we might be deceived as to the origin of these detrital matters, and attribute their rounded form to the effects of great currents, as has often been erroneously done. I do not believe that I deceive myself when I affirm, that whenever rounded blocks, lying in accumulations of gravel, stratified or unstratified, or scratched by long rectilinear striæ, their aspect is due to the action of the rubbing of glaciers against their beds; and that currents, in acting subsequently on these same matters and rolling them, could not but cause these characteristic marks to disappear by the friction. I therefore regard the rarity of scratched pebbles and blocks, in a deposit of stratified gravel, as a proof of a longer transport by water, and their total absence as a proof of an action due exclusively to currents; whereas, the complete absence of stratification in accumulations of gravel and blocks uniformly rounded and scratched, seems to me to be the exclusive effect of glaciers. Lastly, these characters may be combined when such accumulations are the combined effect of the two causes, as may have been the case on maritime shores, where the glaciers of neighbouring mountains terminated at the coast. It must likewise not be forgotten, that sometimes small lakes are formed on the flanks of glaciers, in which the matters triturated by the glacier are deposited in regular beds, without being carried very far. It is of consequence to keep all these facts in view, when we study the formation which geologists have termed *diluvium*, and whose various phenomena have hitherto been erroneously attributed to one single cause,—currents.

It appears to me probable, according to the facts which I have been able to combine in considering this question, that the organized beings of our epoch were created successively, after the commencement of the retreat of the ice. Wherever the surface of the ground made its appearance between the glaciers, under the influence of a milder climate,—wherever, yielding to the temperature, the ice produced pools of water,—the development of organized beings might take place; and direct observation has already confirmed what the theory required. Mr. Smith of Jordanhill was the first to point out in the post-tertiary clays, which are superior to the till (that is to say, which have been deposited posteriorly to the accumulation of those masses of gravel and rolled blocks in the mud under the ancient glaciers), numerous fossils of species that no longer exist similarly associated on the neighbouring coasts; he has even ascertained the identity of some of those shells with species which have hitherto been observed only in the Arctic seas. A fact so unexpected did not fail to excite my curiosity in a high degree, and I have ever since been unremitting in my endeavours to compare these fossils with living species. Assisted by a collection of living species from Greenland, which I owe to my friend Professor Eschricht of Copenhagen, I have not only confirmed the first impressions of Mr. Smith, but have further found among the fossils of these clays a much larger proportion of Arctic species than could have been expected. Extending this species of research to the most recent fossiliferous deposits of other parts of Europe, I have every where met with a certain proportion of species whose types no longer exist in a living state in the neighbouring seas, but at 12° or 15° of latitude more to the north. Thus, while the shells, which are now found in lat. 65° to 70° on the coasts of Iceland and Greenland, where the mean temperature is several degrees below zero (32° F.), lived in lat. 55° to 60° on the coasts of Scotland and of England, where the mean temperature at present is + 8° (46° .4 F.) ; the species of the coasts of England and of the British Channel which now live in lat. 50° to 55°, lived in Sicily in lat. 35° to 40° ; or, in other words, when the climate of Greenland extended its frosts beyond Scotland, when the mean temperature of the British Islands, in a place of being above + 8° (46° .4 F) cent., scarcely reached zero, the present climate of England, and of the north of Germany, prevailed in those parts of Europe which are now the warmest, and where the mean temperature exceeds + 16° (60° .8 F).

I shall afterwards publish the details of these observations, when they embrace a basis sufficiently complete to form an intimately connected whole ; it is sufficient, for my purpose at present, to have indicated the principal results of these researches, which confirm the opinion of the former existence of a climate much more rigorous than that which now exists in Europe, by proofs independent of those derived from the traces of ancient glaciers. Now, a climate so different, could not have existed without exercising a marked influence on organic life ; and it is thus that the Arctic faunas, in our temperate regions, confirm as fully the existence of ancient glaciers, as the presence of these same glaciers explains the existence of northern animals ; and, nevertheless, the facts which establish the presence of the one, have nothing in common with the facts which prove the presence of the other.*

Parallel Terraces.—These have been observed by numerous geologists particularly in the vallies of the north of Scotland, the Eldon hills. The example of Glen Roy and Glenspean, are taken by M. Agassiz, as best calculated to explain other similar phenomena.

The first, or the least elevated of these three terraces, is 972 English feet above the level of the sea ; and, as it is horizontal, its

* Edinb. New Phil. Journ. No. 66, p. 256

height above the bottom of the valley depends on the point of observation. The second is 212 feet above the first, and the third 82 feet above the second. It is to be remarked, that the two upper terraces make the round of Glen Roy, whereas, in Glen Spean they do not extend higher than the opening of the valley of Loch Treig. I noticed them on the left side of Glen Spean between Loch Treig and the Bridge of Roy, as well as on the flanks of Glen Roy; and I mention this particularly, because they are not indicated at that point in the maps which represent their position. It is evident that these terraces indicate levels of water. The next enquiry is, if the barriers which restrained these lakes have disappeared, or if the valley has been elevated at different times above the level of the water? The perfect horizontality of these terraces, at three different levels, appears to me irreconcilable with the idea of a repeated soulevement of the surface. The ablation of a rocky barrier seems impossible without the influence of a cause which would, at the same time, have occasioned the disappearance of terraces having so little consistence; whereas, in a country which presents so many traces of ancient glaciers, the supposition of a great glacier, descending from Ben Nevis, and shutting up the valley of the Spean, by resting on Moeldhu, which is opposite, combined with the influence of a glacier issuing from Loch Treig, andwhich would bar the valley a second time at that height, would explain all the facts. The glacier of Loch Treig, of inferior size to that of Ben Nevis, would, first of all be lowered at two different times after having for a certain period maintained the water contained between the two glaciers at the level of the two upper terraces. During these two lowerings, the waters would run to the east, proceeding by the valley of the Spey, owing to the inconsiderable height of the *col* which separates that valley from Glen Spean. Whenever the glacier of Loch Treig disappeared completely, the water would be able to extend to the end of Glen Spean, and likewise invade Loch Treig; which explains the continuity of the lower terrace, while the two upper ones terminate abruptly opposite Loch Treig. Afterwards, when the great glacier of Ben Nevis no longer reached Moeldhu, the waters would run to the west, and water would remain only in the hollows which are now occupied by Loch Treig and Loch Laggan. The sudden termination of the three terraces, on the two sides of the Glen Spean near the Bridge of Roy, will likewise be understood from this explanation. The supposition now made is confirmed by a fact which there is no other mode of accounting for; viz. that the bottom of Glen Spean in front of Loch Treig is not only polished with that polish characteristic of glaciers, but is moreover scratched transversely, that is to say, at right angles to the direction of the valley, by a cause which evidently proceeded from Loch Treig. I do not believe that a locality exists, where the facts indicate, in a more special manner, the cause which has produced them. The horizontal terrace of Glen Gloy is susceptible of a very natural explanation by a glacier issuing from the valley of Loch Arkeig, crossing Loch Lochy, and damming up Glen Gloy above Low Bridge. This supposition would also clear up the difference of level between the terraces of Glen Gloy and those of Glen Roy, and would obviate the necessity of imagining *soulevemens* of the neighbouring valleys, which communicate in the same manner with the ocean, and do not nevertheless exhibit any trace of terraces.

In following up these facts in all their variety, we are easily enabled to explain the numerous terraces which we meet with in Scotland, by supposing barriers of ice at the mouths of the valleys; whether it was that the lateral valleys closed them by their glaciers, as at the Bridge of Roy, or that the waters of the sea, by heaping up ice on the coasts, offered a temporary obstacle to the running off of the waters of the land, or intercepted large sheets of salt water. The presence of an Arctic fauna, in the deposits superior to the till, which might be formed in these creeks of the sea, would thus present nothing but what is quite natural.*

Movement of Glaciers.—To ascertain this and several other points connected with the structure and effects of recent glaciers, which it became necessary to know, in order to appreciate the effects in the appearances we have described, MM. Agassiz, Guyot, Forbes, De Charpentier, Desor, Heath, and others visited the glaciers of the Bernese, Oberland, on various occasions in the spring and autumn. One of the first objects of these visits was, to ascertain the sound-

* Op. Cit. p. 237.

ness of M. de Saussure's conclusion, that the motion and decay of glaciers are occasioned by the radiation of heat from below, whereas it is necessary to the proposed theory, that their waste should be extended or thrown out laterally, like rain or hailstones from the eaves of a house. The first results of enquiries on the glaciers of Roseulaui, and of Aar, as well as of the Grimsel, convinced M. Agassiz, that the little water which flows from beneath the glaciers is chiefly from springs, often if not generally, thermal. That it is in too small quantity to allow of the conclusion, that it is derived from the melting of the glaciers, and besides the lower surfaces of these are always composed of congealed mud and stones, so that water derived from the melting of the lower surfaces of glaciers would be thick and turbid, while the water of springs is clear; and as that which he has seen to flow from beneath glaciers, presents this last property, M. Agassiz concludes, that it cannot be derived from them, but from springs. Again, the structures of glaciers, M. Agassiz and his companions found to be lamellar, grooved internally by numerous channels and deep pools, produced by the melting of the snow on the surface, and that these pools and channels by freezing, in their turn, produce a dilatation externally in the glacier, as well as a gradual movement downwards on the face of the rocks. The downward movement occasions the grooved and polished surfaces on the surface of the rocks, over which the glaciers pass in the moraines, already noticed, *(Cal. Jour. Nat. Hist. vol.* II, *p.* 449,*)* while the dilatation carries the blocks and stones, which are congealed within it, gradually towards its projecting eaves, on approaching which they are cast down in the form of moraines. We pass over the lively picture which M. Agassiz and his friends afford of their living on the glaciers during the time they were engaged in their observations. The *Hotel des Neuchatelois* is the pompous name bestowed on a cabin twelve feet long, six broad, and four high, situated on the Grimsel, at an elevation of 7500 feet, and more than two leagues above the extremity of the glacier; it has pure ice for its foundation, on which broad stones of the moraine are placed for a floor, the walls and roof being composed of heavy blocks of stones. In August 1840, the *Hotel des Neuchatelois* was 2457 feet from a certain point of the mountain termed *Abschwung*. This measurement when it was taken, was engraved by M. Agassiz on one of the blocks, on his return to the Grimsel in the following month of March 1841. M. Agassiz found this measurement to be 2623 feet, the block had therefore advanced 166 feet, from which M. Hugi calculates the motion of this glacier at about 220 feet per annum. This movement is occasioned, M. Agassiz states, by the infiltration, and daily congelation of water, which causes dilatation and progression outward, to which the whole glacier is subject. Thus M. Agassiz, in August 1840, found the distance from the *Hotel des Neuchatelois* to the *Cabone de Hugi*, (another hut placed on the middle of the glacier, but farther out towards its edge,) to be 1890 feet; in August 1841, the distance between the two huts amounted to upwards of 2000 feet.

We shall again revert to this subject, and probably notice some of the opposite opinions and controversies arising out of it.

Table of Indian Coals, analyzed in the Laboratory of the Hon'ble Company's Dispensary; in continuation of Prinsep's Table, Journal Asiatic Society, 1838, page 177. From Reports of the Coal Committee 1841.

No.	Locality.	Quality.	Specific gravity.	Composition in 100 parts. Volatile matter.	Carbon.	Earthy and Ferruginous matter.	From whom received.
60	Moulmein, ...	Cannel Coal, ..	1.177	42.8	54.6	2.6	Mr. Blundell, May 7, 1839.
61	Hoong, south of Ramree 6 miles, ...	Caking Coal, ..	1.32	36.	49.	15.	Captain Bogle, June 1, 1839.
62	Tyroo ghat, Assam,.. ..	Ditto, ...	1.3	40.	55.	5.	Captain Jenkins, August 3, 1839.
63	Palamow Mirall, ...	Slate Coal.	1.26	44.	50.	6.	Mr. Tytler, Steam Department.
64	Palamow,..	Slaty Crop Coal, ..	1.48	32.	58.	10.	Ditto specimen Marked *Palamow*.
65	Palamow 'Singra,'	Slaty ditto ditto, ..	1.2	25.	63.*	12.	Ditto ditto, Sept. 10, 1839.
66	Mergue, ...	Caking Coal excellent,.. ..	1.27	55.	40.	5.	Mr. Blundell's Assistant, Lieut. Hutchinson, August 27, 1839.
67	Byrung Ponjee, Sylhet, ..	Ditto, excellent, ..	1.3	34.	6.45	15.	Major Lister, Sept. 4, 1839.
68	Ditto, variety, ...	Slaty inferior, ..	1.4	25.	29.	46.	Ditto ditto ditto.
69	Ditto ditto, ...	Surface Coal, ..	..	30.	50.	20.	Ditto ditto ditto.
70	Ditto a different sample,..	Caking Coal, ..	1.3	51.	42.	7.	Ditto, January 2, 1840
71	Chuppra on the Soan, ..	Slate Coal, mixed,	1.5	32.	57.5	10.5	Mr. Ravenshaw, January, 1840.
72	Borneo, ...	Slate do, excellent,	1.27	59.6	34.	6.4	Capt. Johnston, April 18, 1840.
73	Boorhath, Assam, ...	Caking Coal, ditto,	1.2	45.	52.7	2.3	Lieut. Strong, June 24, 1840.
74	Ditto, another bed, ...	Cannel Coal ditto,	1.28	44.	48.	8.	Ditto ditto.
75	Cheduba, Aracan, ...	Ditto ditto, inferior,	1.30	46.8	41.	12.	Captain Bogle, July 1840.
76	Khota, Singrowly, ...	Middling, ...	1.29	54.	32.2	13.8	Capt. Wroughton, Sept. 22, 1843
77	Jubbulpore, ...	Excellent, ...	1.49	50.	47.1	2.9	Dr. Spilsbury.
78	Near Dearee, the Soan, ..	Middling, ...	1·42	37.6	58.1	4.3	Mr. Ravenshaw, Nov. 24, 1840.
79	Qulimany, (Cape)	Surface Coal, ..	1.6	23.2	40.16	36.6	From South Africa, (Mozambique.)
80	Tavoy River, ...	Cannel Coal, ..	1.72	62.	28.26	9.74	Mr. Blundell, February, 1841.
81	Chittagong or Tippera Hills,	Good Slaty Coal ..	1.375	64.6	24.4	11.	Mr. Sconce, April, 1841.
82	Petchelee Gulf, ...	Anthracite.	1.71	20.	74.	6.	Received through Capt. Johnston. April, 1841.
83	Doobradgepore, ...	Slaty Coal, ...	1.4	42.	38.	20.	Mr. Jas. Pontet, May, 1841.
84	Jaipore, Upper Assam, ..	Superior, ...	1.3	48.	46.2	5.8	Mr. F. R. Hampton, July 8, 1841.
85	Pulo Chermin, Borneo, ..	Very superior, ..	1.34	64.	32.5	3.5	Marine Board, Nov. 8, 1841.
86	Pulo Keng, Arreng Borneo,	Inferior, ...	1.39	43.	30.½	26.½	Ditto 8th ditto ditto. [1842.
87	Bikrampore, Cachar, ..	Superior, ...	1.3	64.8	33.2	2.	Capt. Guthrie, Engrs. March 7,
88	Gudada River, Dhubary,..	Inferior, ...	1.4	57.4	24.6	18.	Discovered by Mr. Js. Bedford, Asst. Revenue Surv., Feb. 1, 1842, received from Major Jenkins.
89	Bunarossee, Caribari Hills,	Brown Coal, burns [freely,	1.4	50.	40.6	9.4	Ditto ditto March, 1842.
90	Mirampara, or Balajora Caribari Hill, ...	Ditto, ...	1.2	64.	26.	10.	Ditto ditto March, 1842.
91	Salkora, Caribari Hills, ..	Good Brown Coal,	1.3 to 1.4	70.	25.4	4.6	Ditto ditto March, 1842

J. McCLELLAND, *Assistant Surgeon,*
Secretary Coal Committee.

* The large proportion of Carbon in this Coal would render an excellent fuel if mixed with Cherra Coal, in which bitumen preponderates, while both might be had more reasonably at Dinapore than Burdwan Coal.

Meteorological Register kept at the Surveyor General's Office Calcutta, for the Month of December, 1842.

The Observations after Sunset are Ion'ble Company's Dispens

December, Days of the Month.	Moon's Changes.	Observed at 9 H. 50 M.					Observed at 4 P. M.					Rain Gauges.		Observations made at 8 P. M.				Observations made at 10 P. M.			
			Temperature.			Wind.		Temperature.			Wind.				Temperature.				Temperature.		
		Barometer.	Of the Mercury.	Of the Air.	Of an Evapg. Surface.	Direction.	Barometer.	Of the Mercury.	Of the Air.	Of an Evapg. Surface.	Aspect of the Sky.	Upper.	Lower.	Barometer.	Of the Mercury.	Of the Air.	Of an Evapg. Surface.	Barometer.	Of the Mercury.	Of the Air.	Of the Evapg. Surface.
		Inches	°	°	°		Inches	°	°	°		Inches	Inches	Inches	°	°	°	Inches	°	°	°
1		29,945	72,0	76,7	68,0	W.	29,870	75,1	78,6	71,0	Clear.			30,100	72,5	72,0	71,25	30,100	72,0	71,75	71,0
2	●	,981	72,2	77,0	69,2	W.	,889	76,0	82,0	72,0	Clear.			,100	73,0	72,75	72,25	,100	72,5	72,0	71,0
3		,961	72,0	75,0	68,5	N. W.....	,875	77,0	79,0	70,5	Clear-			,100	73,0	72,2	72,0	,100	73,0	72,0	72,0
4		,937	70,5	74,2	66,8	N. W.....	,872	76,2	79,0	70,6	Clear.			,150	71,5	70,75	69,0	,100	71,25	70,25	69,0
5		30,014	71,0	75,0	68,8	N. W.....	,929	73,9	78,0	68,5	Clear.			,150	71,25	70,75	69,0	,150	71,0	70,0	69,0
6		,053	69,4	72,0	66,0	N.	,962	73,0	78,5	71,8	Clear.			,150	73,0	70,75	70,25	,150	72,5	70,5	70,25
7		,046	70,4	74,4	69,0	N.	,940	73,8	79,8	73,0	Clear.			,100	72,75	72,5	71,5	,105	72,5	72,25	71,0
8		,033	71,6	76,0	70,0	N. E.	,930	74,4	80,0	73,0	Cirro Cumuli.			,150	73,0	72,75	71,25	,150	72,5	71,0	70,5
9		,030	71,8	76,0	70,0	N. E. ...	,929	75,0	71,5	70,0	Cumuli.			,150	72,0	71,5	71,25	,150	72,0	71,75	71,25
10	☾	,030	71,4	74,0	69,0	N.........	,914	73,8	76,0	72,0	Cumuli.			,150	71,25	71,0	70,5	,150	71,0	70,75	70,1
11		29,970	70,5	71,2	67,0	N.........	,890	75,5	79,5	73,0	Cumuli.			,100	72,5	72,0	71,0	,100	72,0	71,73	70,0
12		,934	72,0	75,0	70,0	N.........	,853	74,9	78,6	73,0	Cumuli.			,100	72,75	72,5	71,75	,100	72,25	72,0	71,0
13		,965	71,8	75,0	70,0	N.........	,870	74,2	79,9	73,0	Generally Clear.			,100	73,0	72,75	72,0	,100	73,0	72,25	71,5
14		,990	71,5	76,0	70,2	N.........	,905	74,5	81,0	74,2	Generally Clear.			,100	73,0	72,75	72,0	,100	72,75	72,25	71,25
15		,981	72,0	76,4	70,0	W.	,900	74,5	81,0	74,0	Partially Haze.			,100	73,0	72,5	72,0	,100	73,0	72,5	72,0
16		,993	71,2	78,0	71,0	N. E.	,906	75,2	81,2	73,0	Clear.			,100	73,25	72,75	72,3	,100	73,0	72,5	72,0
17		30,005	71,2	76,0	70,4	N. E. ...	,925	74,6	80,6	73,0	Clear.			,100	73,0	72,25	72,0	,100	73,75	71,5	71,25
18	○	,038	72,0	74,4	69,0	N.........	,944	75,8	79,2	73,2	Generally Clear.			,075	73,0	72,5	72,0	,075	73,0	72,25	72,0
19		,010	71,5	75,8	70,0	N. E.	,925	74,8	79,0	73,0	Clear.			,100	73,0	72,5	72,0	,100	72,5	72,0	71,0
20		,013	71,8	76,4	70,5	N. E.	,900	74,8	81,0	74,6	Cumuli.			,100	73,5	73,0	72,5	,100	73,0	72,75	72,0
21		29,973	73,0	76,0	72,0	W. S. W.	,893	73,6	80,0	74,7	Generally Clear.			,125	74,0	73,75	73,0	,125	74,0	73,25	72,0
22		,941	73,0	76,5	72,4	W.	,861	73,8	78,3	74,0	Cloudy and Haze.			,075	74,0	73,6	73,0	,075	74,0	73,5	72,0
23		,893	74,0	75,0	72,0	W.	,821	75,9	78,6	74,0	Cloudy.			,050	74,0	73,75	73,0	,050	73,5	73,25	72,0
24	☽	,878	73,9	78,0	73,6	S.	,775	78,4	81,0	75,1	Cumuli.	0.66	0,76	,025	74,5	74,75	73,0	,025	74,25	74,0	73,5
25		,,	,,	,,	,,	,,	,,	,,	,,	,,	,,			,100	72,5	71,75	71,0	,100	72,0	71,25	70,0
26		,997	70,0	70,0	66,0	N.	,929	71,0	72,2	67,5	Cloudy.			,100	70,25	69,5	69,0	,100	70,0	69,25	69,0
27		30,025	67,2	65,3	62,0	N. (sharp)	,933	68,0	64,8	61,5	Cloudy.			,100	70,0	69,0	68,75	,100	70,0	69,0	68,5
28		29,978	67,5	69,8	64,5	N. (sharp)	,881	69,7	74,0	68,2	Clear.			,105	67,5	67,0	66,5	,105	67,0	66,25	66,0
29		,929	68,0	70,7	66,4	N.........	,841	70,2	76,1	70,0	Clear.			,075	69,75	69,0	68,75	,075	79,50	69,0	68,0
30		,941	68,5	72,0	67,0	N. E.	,841	72,0	77,2	70,5	Clear.			,050	69,5	69,5	68,0	,050	69,5	69,5	65,14
31		,875	68,9	72,3	68,0	N.	,778	70,3	79,1	72,0	Clear.			,025	70,0	69,75	69,0	,025	70,0	69,25	68,5
Mean.		29,979	71,1	74,3	68,9		29,889	74,0	78,2	71,8		0,66	0,76								

N. B. From a comparison of the two Barometers, the Mercury in that at the Dispensary stands 1-10th of an inch higher than that in use at the Surveyor General's Office.

Meteorological Register kept at the Surveyor General's Office, Calcutta, for the Month of January 1843.

The Observations after Sunset are made at the Honorable Company's Dispensary.

January, Days of the Month.	Moon's Changes.	Observed at 9 H. 50 M. Barometer.	Observed at 9 H. 50 M. Temperature. Of the Mercury.	Observed at 9 H. 50 M. Temperature. Of the Air.	Observed at 9 H. 50 M. Temperature. Of an Evapg. Surface.	Observed at 9 H. 50 M. Wind. Direction.	Observed at 4 P. M. Barometer.	Observed at 4 P. M. Temperature. Of the Mercury.	Observed at 4 P. M. Temperature. Of the Air.	Observed at 4 P. M. Temperature. Of an Evapg. Surface.	Observed at 4 P. M. Wind. Aspect of the Sky.	Rain Gauges. Upper.	Rain Gauges. Lower.	Observations, made at 8 P. M. Barometer.	Observations, made at 8 P. M. Temperature. Of the Mercury.	Observations, made at 8 P. M. Temperature. Of the Air.	Observations, made at 8 P. M. Temperature. Of an Evapg. Surface.	Observations made at 10 P. M. Barometer.	Observations made at 10 P. M. Temperature. Of the Mercury.	Observations made at 10 P. M. Temperature. Of the Air.	Observations made at 10 P. M. Temperature. Of an Evapg. Surface.
		Inches	°	°	°		Inches	°	°	°		Inches	Inches	Inches	°	°	°	Inches	°	°	°
1		29,858	69,0	73,0	68,9	N.	29,798	73,0	81,0	74,5	Clear.			30,000	71,0	70,75	70,0	30,000	70,75	70,25	70,0
2		,802	70,0	74,0	70,0	E.	,746	74,0	83,8	76,0	Clear.			,000	73,0	73,0	71,0	,000	73,0	72,5	71,0
3		,906	71,5	75,9	68,8	N. E.	,834	73,5	80,5	72,1	Clear.			,025	72,5	72,0	71,7	,025	72,25	71,5	71,0
4		,910	71,0	75,8	70,0	E.	,821	72,9	80,2	73,1	Clear.			,050	72,25	71,75	71,0	,050	72,0	71,0	70,75
5		,922	70,2	70,5	66,0	N.	,834	72,0	75,1	70,0	Cirro Cumuli.			,050	72,0	71,5	70,0	,050	72,0	71,25	69,75
6		,970	68,0	70,6	65,0	N (sharp)	,870	71,2	75,9	69,7	Clear.			,100	70,5	70,5	69,25	,100	70,25	70,0	69,5
7		,998	67,0	70,0	64,0	n.e.(sharp)	,910	69,9	74,0	68,0	Clear.			,125	70,0	69,25	69,0	,125	70,0	69,0	68,75
8	☾	30,014	66,5	69,0	63,8	E.	,910	70,0	74,8	98,0	Clear.			,100	70,5	70,0	69,25	,100	70,5	70,0	69,25
9		29,981	67,4	70,4	65,0	N. E.	,858	70,8	77,0	70,7	Clear			,100	70,75	70,25	69,5	,100	70,5	70,0	69,5
10		,977	67,6	72,0	66,5	N. W. ..	,858	72,8	78,6	72,2	Cumuli.			,075	70,75	70,75	69,25	,075	70,75	70,0	69,0
11		,950	69,4	72,0	67,0	N.	,881	73,0	78,4	72,0	Clear.			,075	70,75	70,0	69,14	,075	70,75	70,0	69,14
12		30,018	68,8	73,0	67,0	N. E.	,917	70,5	76,4	69,8	Clear.			,175	69,5	79,0	68,0	,175	69,0	68,75	68,25
13		29,981	68,5	73,0	66,0	N. E. ...	,882	73,9	79,6	72,2	Clear.			,100	70,0	69,75	67,75	,100	69,5	69,0	67,25
14	○	,981	68,0	71,0	66,8	E.	,861	70,8	79,8	72,1	Clear.			,000	71,0	70,50	69,0	,100	70,75	69,0	70,0
15		,962	69,0	74,2	68,3	N. E.	,854	72,5	79,8	72,4	Clear. [muli)]			,100	69,25	69,5	68,5	,100	69,0	68,75	68,25
16		,894	68,5	73,0	67,0	E.	,830	72,8	77,0	70,2	Cloudy (Cirro Cu.			,050	71,0	69,5	69,0	,050	69,75	69,25	68,75
17		,914	69,8	70,0	65,8	N. E.	,865	70,3	72,0	67,8	Drizzly.	0,39	0,46	,025	69,0	69,0	68,0	,025	69,0	69,6	67,75
18		,906	67,0	67,8	65,0	N. E.	,850	67,5	65,0	63,0	Nimbi.	1,11	1,16	,050	68,0	67,75	67,25	,050	68,0	67,5	67,25
19		,946	67,6	66,9	64,8	N. E.	,910	68,2	68,5	66,3	Drizzly.	0,05	0,05	,100	68,75	68,25	67,75	,100	68,5	68,25	67,75
20		30,037	69,0	71,0	68,0	N.	,954	71,0	76,8	72,0	Clear.			,075	70,0	70,14	69,0	,075	70,0	70,0	69,0
21		,053	68,0	69,0	64,0	N. (sharp)	,941	69,5	74,0	67,0	Clear.			,175	68,75	68,75	69,0	,200	68,25	68,25	67,5
22	☽	,078	66,8	68,0	62,5	N. (sharp)	,958	70,5	75,0	69,0	Clear.			,175	68,0	67,75	67,25	,175	68,0	68,5	67,25
23		,090	67,0	70,0	64,0	N.	,990	69,0	77,3	70,0	Clear.			,075	69,0	68,5	68,0	,175	69,0	68,25	68,0
24		,175	68,0	72,5	68,0	N.	30,022	72,0	80,2	73,0	Clear.			,250	70,5	70,5	69,75	,250	70,75	70,0	69,5
25		,121	68,8	74,2	70,0	N.	29,978	71,3	82,0	74,0	Clear			,200	71,75	71,25	70,75	,200	71,5	71,25	70,25
26		,045	71,8	77,3	72,0	W.	,933	73,9	84,0	76,0	Clear.			,150	73,25	73,5	73,0	,150	73,25	73,25	72,75
27		,041	71,0	73,8	69,0	N.	,930	73,9	82,5	74,0	Clear.			,125	73,5	73,5	72,75	,125	73,25	73,25	72,25
28		29,982	71,6	77,0	70,0	N.	,887	73,5	83,0	74,8	Cumuli.			,100	73,75	73,5	73,25	,100	73,75	73,5	73,25
29		30,017	70,0	72,5	66,0	N. E.	,922	74,9	79,3	71,0	Clear.			,140	72,0	71,5	69,25	,140	72,0	71,5	69,25
30	●	,053	70,2	73,5	66,0	N. E.	,913	74,4	80,2	72,0	Clear.			,175	71,25	71,5	70,5	,170	71,0	69,75	69,5
31		,021	69,5	72,5	67,0	N.	,918	72,2	80,6	71,9	Clear.			,150	71,5	71,25	70,75	,150	71,5	71,0	70,75
Mean.		29,987	68,9	72,1	66,9		29,892	71,8	77,8	71,0		1,55	1,67								

N. B. From a comparison of the two Barometers, the Mercury in that at the Dispensary stands 1-10th of an inch higher than that in use at the Surveyor General's Office.

Meteorological Register kept at the Surveyor General's Office, Calcutta, for the Month of February 1842.

The Observations after Sunset made at r at the Hon'ble Company's Dispensary.

February. Days of the Month.	Moon's Changes.	Observed at 9 H. 50 M. Barometer.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of an Evapg. Surface.	Wind. Direction.	Observed at 4 P. M. Barometer.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of an Evapg. Surface.	Wind. Aspect of the Sky.	Rain. Gauges. Upper.	Rain. Gauges. Lower.	Observations made at 8 P. M. Barometer.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of an Evapg. Surface.	Observations made at 10 P. M. Barometer.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of an Evapg. Surface.
		Inches	°	°	°		Inches	°	°	°		Inches	Inches	Inches	°	°	°	Inches	°	°	°
1		29,998	69,5	73,5	68,0	N.	29,898	72,0	81,0	72,6	Cumuli.			30,100	72,0	71,7	70,0	30,025	72,0	71,5	70,0
2		,922	70,0	73,9	68,5	N.	,825	72,8	81,4	73,5	Cumuli.			,050	73,0	72,75	72,25	,050	72,0	72,0	72,0
3		,853	70,5	76,0	70,0	N. W.....	,770	73,0	84,0	75,0	Cumuli.			,000	73,0	72,75	72,5	,000	73,0	72,5	72,5
4		,849	71,0	75,0	71,0	W. S. W.	,766	74,4	82,3	73,0	Generally Clear.			,000	73,0	73,0	72,0	,000	73,0	72,75	72,0
5		,893	71,0	75,0	68,5	N. W.....	,794	75,0	82,8	72,0	Generally Clear.			,025	73,5	73,25	73,0	,025	73,0	72,75	72,5
6		,870	71,0	74,0	71,0	N.	,758	74,5	84,0	74,2	Cumuli.			,000	74,0	73,75	73,5	,000	73,75	73,5	73,5
7	☾	,894	75,0	78,0	74,0	S.	,700	78,1	86,0	79,2	Cumuli.			29,850	76,0	75,5	75,0	29,850	76,0	75,5	74,75
8		,830	75,5	79,5	75,0	W. S. W.	,722	77,4	87,5	79,0	Clear.			30,000	74,0	73,75	73,25	30,000	73,25	73,0	72,25
9		,816	74,4	79,0	73,4	W.	,730	77,6	89,2	79,4	Clear.			,000	77,75	77,5	77,25	,000	77,25	76,75	76,75
10		,841	75,0	80,4	72,0	N.	,734	77,5	90,0	80,4	Clear.	0,06	0,09	,000	77,0	77,5	76,0	,050	76,5	77,25	7,55
11		,869	75,0	80,0	73,8	N.	,770	75,6	80,0	73,5	Cirro Cumuli.	0,05	0,07	,000	75,0	74,75	73,5	30,000	75,0	74,5	73,25
12		,877	73,9	74,0	70,2	N. W.....	,700	75,0	86,0	77,0	Clear.			,000	75,75	75,5	75,2	,000	75,0	74,75	74,25
13		,874	74,4	77,2	72,3	S. S. W.	,805	75,6	88,8	79,0	Clear.			,000	76,0	76,5	75,0	,000	76,0	76,25	74,75
14		,873	74,0	79,5	71,0	E.	,790	76,4	88,6	79,0	Clear.			,050	76,75	76,5	76,0	,050	76,5	76,25	76,0
15	○	,894	75,0	77,0	74,0	S.	,790	78,8	87,0	78,2	Cumuli.			,000	77,5	77,25	77,0	,000	77,25	77,0	77,0
16		,889	76,0	78,4	74,0	W.	,805	78,5	80,7	73,9	Cirro Cumuli.			,000	76,0	76,5	76,0	,000	76,0	76,25	75,25
17		,853	74,0	75,0	71,0	S.	,746	78,6	82,3	76,1	Cloudy (Cirro Cu-			29,975	77,5	77,25	75,5	29,974	77,5	77,2	75,0
18		,854	74,7	78,2	72,4	N.	,798	79,4	86,2	79,0	Clear. [muli.)]			30,050	76,75	76,5	76,25	30,050	76,5	76,25	76,25
19		,966	76,2	79,4	74,1	N. E.	,838	79,2	87,0	83,0	Cumuli.			,050	76,75	77,0	76,0	,050	76,75	77,0	76,25
20		,953	76,0	79,0	76,0	N. E.	,865	78,5	85,7	76,0	Clear.			,125	76,5	76,5	75,0	,125	76,5	76,25	74,5
21	☽	,941	76,4	81,3	72,3	N.	,885	78,5	87,0	76,9	Generally Clear.			,150	75,5	75,5	75,25	,150	75,25	75,0	75,0
22		,905	74,0	80,6	73,0	N. E.	,820	77,5	86,0	82,1	Clear.			,100	75,0	75,5	73,25	,100	75,0	75,25	7,40
23		,930	76,0	79,0	72,7	W. S. W.	,846	79,4	87,0	77,0	Cumuli.			,650	77,0	76,75	76,5	,050	76,75	76,25	76,25
24		,873	77,3	80,5	74,0	S.	,793	81,7	82,4	75,0	Very Cloudy.	0,22	0,27	,050	76,0	75,5	74,25	,050	76,0	75,0	74,15
25		,925	75,0	76,4	72,5	E.	,846	78,4	79,0	75,0	Very Cloudy.	0,07	0,10	,000	77,0	76,5	75,0	,000	77,0	76,25	74,5
26		,898	77,5	81,0	76,0	S. W.	,829	81,0	84,0	78,6	Cloudy.	0,09	0,11	,000	79,0	78,5	77,5	,000	78,0	78,0	76,25
27		,874	77,2	82,0	77,0	W.	,803	79,8	88,0	78,7	C umuli.			,000	78,75	78,5	78,0	,000	78,25	78,0	78,0
28		,846	77,5	82,0	76,8	W.	,758	81,5	88,7	77,9	Cirro Cumuli.			29,950	72,0	78,5	69,25	29,950	79,0	78,25	78,0
Mean.		29,885	74,4	77,7	72,7		29,795	77,3	85,1	70,9		0,49	0,64								

N. B. From a comparison of the two Barometers, the Mercury in that at the Dispensary stands 1-10th of an inch higher than that in use at the Surveyor General's Office.

QUANTITY OF RAIN FALLEN IN THE YEAR 1842.

	Inches.
January, ...	0,00
February, ...	0,00
March.	3,76
April, ...	3,73
May, ...	1,82
June, ...	26,24
July, ...	9,61
August, ...	21,96
September, ...	4,08
October, ...	3,96
November, ...	0,19
December, ...	0,76
Total Fall of Rain, ...	76,11

THE

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[Reprint of Dr. William Jack's writings, continued from No. 13, page 62.]

XVIII. LEGUMINOSÆ.

BAUHINIA EMARGINATA. (*W. J.*)

Foliis cordatis subrotundo-ovalibus glaberrimis acumine brevi obtuso emarginato, floribus octandris, staminibus tribus superioribus fertilibus.

Dadaub, *Malay*.

Native of Sumatra.

A strong woody climber. *Leaves* alternate, petiolate, cordate, subrotund-oval, terminating in a short blunt emarginate acumen, very entire, 4 inches long, 7—9 nerved with reticulate veins, very smooth. *Petioles* rather short. *Cirrhi* long, simple, revolute. *Racemes* terminal or sometimes lateral, corymbose, many flowered; pedicels long, tomentose. *Calyx* five parted, tomentose, bursting into two or three segments. *Corolla* large, five petalled, spreading, petals nearly equal, unguiculate. *Stamina* eight; three superior fertile, longer, with large two-lobed anthers; four inferior short, with small abortive anthers; the fifth and lowest being a little longer, and entirely sterile. *Ovary* tomentose. *Style* about the length of the fertile stamina. *Stigma* peltate, round.

Obs.—The form of the leaf is very peculiar, and readily distinguishes this species from the others.

BAUHINIA BIDENTATA. *(W. J.)*

Foliis cordatis acuminatis apice bidentatis glaberrimis, corymbis terminalibus, floribus octandris, staminibus tribus superioribus fertilibus.

Native of the Malayan forests where it climbs over trees, and shews its flame coloured blossoms on their very summits.

Shrubby, climbing far over the trees in its neighbourhood; *bark* brown; *branches* round, flexuose; *branchlets* covered with ferruginous tomentum. *Leaves* alternate, petiolate, cordate, acute, bifid at the point, (not two-lobed) divisions approximate with a short thread interposed, very entire, seven nerved, very smooth, the younger ones rather silky beneath with ferruginous deciduous hairs. *Petioles* thickened at the top and base. *Tendrils* simple, revolute. *Corymbs* terminal. *Pedicels* clavate, striated, tomentose. *Calyx* five-parted, tomentose, for the most part bursting irregularly into three divisions. *Corolla* orange-colored, becoming red after expansion, five-petalled, petals nearly equal, sub-rotund, unguiculate, spreading. *Stamina* eight, ascending, of which the three upper are longer and fertile, and the three lowest short and sterile. *Anthers* sub-rotund. *Ovary* pedicellate, compressed, oblong, containing from six to eight ovula. *Style* declinate, incurved at the point. *Stigma* large, capitate and glutinous.

Obs.—This species is at once distinguished by the peculiar form of the leaves which are not two-lobed as usual in the genus, but have the apex divided, so as to make the leaf terminate in two acute points. The flowers are large and shewy.

JONESIA DECLINATA. *(W. J.)*

Foliis 6-8 jugis, foliolis oblongis, floribus fasciculato-paniculatis tetrandris.

Kayu Siturun. *Malay.*

A small straggling tree found generally in thickets, native of Sumatra.

Branches depending, whence the native name. *Leaves* alternate, composed of from six to eight pair of leaflets, of which the lowest are situated on the base of the petiole; they are opposite, from ten to twelve inches in length, oblong, rounded at the extremity, but terminating in a short thick recurved point, entire on the margin, smooth. *Petiole* roundish, thickened at the base. *Stipule* intrapetiolar, embracing the stem, broad at the base, ovate and pointed. *Flowers* in lateral fasciculate panicles; two subrotund bracts below each flower; pedicels slender; the whole very smooth and delicate, and of a light semi-transparent red colour. *Calyx* reddish yellow, tubular; tube narrow; limb four-parted, flat, segments subrotund, about the same size as the bracts. *Corolla* none. *Stamina* four, more than twice the length of the calyx and inserted on its tube, their upper part deep red. *Anthers* deep purple, subrotund, two-celled, each cell streaked with white. There are no rudiments of abortive stamina. *Germen* pedicellate, pedicel accrete to the tube of the calyx. *Style* long, red. *Stigma* round. *Legume* pedicellate, flat, compressed, containing several seeds.

The large branches of delicate flesh-colored flowers render this a very beautiful shrub during the period of inflorescence.

MIMOSA JIRINGA.

Arbor inermis, foliis conjugato-pinnatis, foliolis 3-jugis glaberrimis, paniculis fasciculatis axillaribus, capitulis paucifloris, leguminibus maximis articulato-contortis nigris.

Mimosa Djiringa. *Roxb: Hort: Beng: p. 93.*

Bua Jiring. *Malay.*

Pulo Pinang, Malacca, &c.

A lofty tree, unarmed, with grey bark and round smooth branches. Leaves alternate, conjugato-pinnate, leaflets three-paired, on short thick pedicels, ovate lanceolate, obtusely acuminate, very entire, very smooth, the upper pairs larger. Petioles round somewhat keeled above. An indistinct gland above the base of the common petiole. Capitula few flowered, panicled; these panicles are fasciculate, axillary, or in the axils of fallen leaves. Flowers white. Calyx 5-toothed. Corolla twice as long as the calyx, 5-cleft. Stamina numerous, monadelphous, long, fertile. Style as long as the stamina. Legumes solitary, very large, almost black, about a foot in length, spirally contorted, articulate, two-valved, articulations subrotund, one-seeded, convex and prominent on both sides. Seeds large, subrotund, double convex.

This species belongs to the genus Inga of Willdenow.

INGA BUBALINA. *(W. J.)*

N. O. Mimoseæ. Br:

Inermis, foliis conjugato-pinnatis, foliolis bijugis glaberrimis, capitulis paucifloris paniculatis, paniculis axillaribus et terminalibus, legumine recto cylindrico.

Bua Karbau. *Malay.*

Sumatra, &c.

A tree, unarmed, with grey bark. *Leaves* alternate, conjugato-pinnate, leaflets two paired, ovate, with rather an obtuse acumen, very entire, very smooth, nerves lucid; the upper pair of leaflets the largest. *Primary petiole* short, thickened at the base, bearing a gland at the point; secondary petioles without glands. *Capitula* few-flowered, panicled. *Panicles* axillary and terminal, peduncled, divaricate, shorter than the leaves. *Bracts* small. *Calyx* shorter, tubular, 5-dentate. *Corolla* white, much longer than the calyx, campanulate, 5-parted, segments spreading. *Stamina* many, monadelphous at the base, long and white. *Style* filiform, as long as the stamina. *Ovary* pedicellate. *Legume* dark green, straight, cylindrical, about 4 inches long, thick, obtuse, many-seeded, fetid. *Seeds* crowded, orbicular, piled one above the other, and thus flattened above and below by their mutual compression.

Obs.—This species is nearly allied in habit and inflorescence to the *Inga Jiringa, Mal. Misc. Vol. I.* but differs in the shape of the legume, which has a very offensive smell, but is eaten by the natives in the same manner as that of the Petek *(Acacia graveolens, W. J.*)* Karbau in Malay signifies the Buffalo, whence the specific name.

INGA CLYPEARIA. *(W. J.)*

Inermis, ramulis acutangulis, foliis bipinnatis, foliolis 10-jugis rhomboideis subtus tomentosis, paniculis terminalibus, leguminibus contortis rubris.

Clypearia rubra. *Rumph: Amb: III. p.* 176, *t.* 112.

Jiring muniet. *Malay.*

A large tree. *Branchlets* smooth, acutely five-angled, almost winged. *Leaves* alternate, bipinnate; pinnæ about four pair; leaflets about ten pair, rhomboidal, inequilateral, rather acute, entire, smooth above, tomentose or silky and glaucous beneath, they are of unequal size, the uppermost often two inches long. *Petiole* or rachis acutely 4 or 5-angled, thickened at the base, eglandular. *Panicles* large, terminal; peduncles fascicled. *Flowers* white, pedicellate, in small capitula or heads. *Calyx* small, five-parted. *Corolla* much longer than the calyx, quinquefid. *Stamina* numerous, monadelphous at the base. *Style* one. *Legume* red, flat two-valved, spirally contorted, containing many subrotund somewhat compressed black seeds.

* Parkia R. Br.

Obs.—This species which agrees with that described by Rumphius, is found in forests in the neighbourhood of Bencoolen, but I am not aware that it is there put to any particular use. These two species together with the *I. Jiringa* might perhaps with equal propriety be referred to Acacia, as the seeds are not arilled, though the legume (as in *I. bubalina*) is fleshy and esculent; the stamina are those of Inga, and the paniculate inflorescence is more frequent in that genus than in Acaçia. The distinction between these two sections of the Linnean genus Mimosa is an artificial one, and the characters of the present species are in some degree intermediate between the two.

XIX. CHRYSOBALANEÆ.

PETROCARYA EXCELSA. *(W. J.)*

Heptandria Monogynia. N. O. Rosaceæ. Juss:

Foliis oblongis acuminatis glabris, calycibus ore obliquis, staminibus undecim fertilibus.

Kayu Balam Pangkat. *Malay.*

A large timber tree. *Leaves* alternate, short petioled-oblong, acuminate, entire, smooth 4—5 inches long. *Stipules* longer than the petioles, deciduous. *Racemes* axillary and terminal, forming a panicle towards the top, strict, erect, little branched; flowers very short pedicelled and appressed to the principal peduncle; the whole ferruginous and tomentose. *Bracts* broad, deciduous. *Calyx* infundibular, ferruginous and tomentose, oblique at the mouth, furnished with a ring of stiff hairs which point downwards, lowest on the side to which the fertile stamina and ovary are attached, limb 5-parted subreflex. *Corolla* five-petalled, inserted on the mouth of the calyx and scarcely longer than its limb, petals subrotund. *Stamina* eleven fertile, twice as long as the petals, inserted in one phalanx along the lower edge of the mouth of the calyx, on the upper edge is a ring with eight processes or abortive stamina. *Ovary* adnate to the side of the calyx below the fertile stamina, densely pilose, disporous. *Style* lateral, inserted near the base of the ovary, as long as the stamina. *Stigma* simple. *Drupe* enclosed in the enlarged calyx which becomes adnate to it and crowned by its persistent limb; obliquely ovate, about the size of a filbert. *Nut* smooth, one-seeded, with an abortive cell generally above the fertile one. *Seed* curved corresponding to the cell, albuminous; embryo cylindrical inverse; radicle superior, clavato-cylindrical, longer than the ligulate cotyledons.

PETROCARYA SUMATRANA. (*W. J.*)

Foliis elliptico-oblongis subtus canescentibus, calycis ore regulari, staminibus septem fertilibus.

A tree. *Branchlets* pilose. *Leaves* alternate, short-petioled, elliptic-oblong, 6—8 inches long, terminating in a bluntish acumen, acute at the base, entire, the adult leaves smooth above, somewhat hoary with close short wool beneath, the younger ones covered with deciduous pubescence above, nerves prominent beneath, veins reticulate. *Petioles* about a quarter of an inch in length. *Stipules* longer than the petioles, oblong, acute. *Racemes* axillary and terminal, shorter than the leaves, tomentose; pedicels mostly three-flowered, divaricate. *Bracts* rather large, concave, at the base of the peduncles, pedicels and flowers. *Calyx* tubular or campanulate, tomentose without, pilose at the faux, which is equal and regular, limb spreading, five-parted, segments acute. *Corolla* five-petalled, white, petals inserted on the mouth of the calyx, and as long as its segments. *Stamina* fourteen, of which seven upper are fertile arranged in one phalanx, and the opposite seven abortive; filaments short, flat, anthers roundish, two-lobed. *Ovary* adnate to the upper side of the tube or calyx, pilose, two-celled, containing two erect ovula. *Style* lateral, inserted at the base of the ovary, as long as the stamina. *Stigma* capitate.

Obs.—These two species though nearly related, present abundant points of distinction. In the P. *Excelsa* the leaves are smaller, smoother, and less strongly nerved, while the flowers are larger, the racemes longer, more erect and compact, and the stamina longer and more numerous than in the P. *Sumatrana*.

XX. CONNARACEÆ.

CNESTIS EMARGINATA. *(W. J.)*

Foliolis 5—7 acuminatis apice emarginatis, racemis axillaribus paucifloris, capsulis solitariis glabris, seminis umbillico carunculâ semi-amplexo.

Found in the neighbourhood of Bencoolen.

A small tree, with weak diffuse branches. *Leaves* alternate, pinnate, leaflets 5—7, from ovate to oblong ovate, terminating in a long acumen which is emarginate at the point, entire, very smooth, the middle nerve pubescent underneath; the upper leaflet is the largest, and frequently five inches in length. *Petiole* thickened at top and bottom, almost articulate under the terminal leaflet. *Racemes* axillary, subsolitary, short, few-flowered; pedicels alternate, one-flowered; a bract at the base of each pedicel, small, tomentose as well as the peduncle. *Calyx* five-parted, smooth, persistent. *Corolla* five-petaled, petals oblong, acute. *Stamina* ten, distinct, the alternate ones shorter. *Ovaries* five, smooth, with a line of hairs along the suture. *Styles* five, shorter than the stamina. *Stigmas* emarginate. *Capsule* solitary, four ovaries aborting, embraced at the base by the thickened calyx, orange coloured, smooth, bursting on one side, containing a single black seed. *Seed* furnished at the base with a cup-shaped orange coloured fleshy caruncle which partially surrounds the umbilicus. *Embryo* inverse, without albumen.

Obs.—The umbilical caruncle in this species is similar in shape and situation to that observed in the Connarus lucidus, being smaller than usual in this tribe.

CNESTIS FLORIDA. (*W. J.*)

Foliolis 3—5, rarius solitariis, oblongo-ovatis acuminatis glaberrimis, racemis fasciculatis axillaribus, seminibus arillo subinclusis.

Confer cum Connaro santaloide, Vahl, anne eadem?

Found in Sumatra and the island of Pulo Nias.

A small tree, with somewhat rigid divaricate branches. *Leaves* alternate, pinnate, leaflets 3—5, sometimes solitary, oblong ovate, attenuated into a longish blunt acumen, very entire, very smooth, rather rigid, shining above, veins reticulate; about three inches long. *Racemes* axillary, fasciculate, slender, shorter than the leaves; the lower pedicels 3—4 flowered. *Calyx* almost five leaved, erect, tinged with red towards the base. *Corolla* five-petalled, *Stamina* ten, distinct, nearly equal; filaments flat and broader at the base. *Ovaries* five, oblong, erect. *Styles* one to each ovary. *Stigmas* simple. *Capsule* solitary, the remainder aborting, ovate, pointed towards both ends, somewhat oblique, smooth, bursting on one side, one-seeded. *Seed* almost enclosed in a bright red fleshy aril originating from the umbilicus, and in its expansion enveloping the whole seed. *Albumen* none. *Cotyledons* plano-convex, solid. *Radicle* remote from the umbilicus as in Gærtner's Omphalobium.

CNESTIS MIMOSOIDES. (*W. J.*)

Foliis pinnatis subdecemjugis, foliolis ovali-oblongis emarginatis, seminibus arillo subinclusis.

Connarus mimosoides. *Vahl* and *Willd.*

Found at Tappanuly.

I can scarcely entertain a doubt of this being the very plant referred by Vahl to Connarus, and aptly named mimosoides. Its analogy with the preceding is very close, having the seeds similarly enclosed in a large red aril, and the racemes axillary. I have not seen the flowers, but the four abortive ovaries are quite distinct at base of the perfect one. In all these three species only one capsule ripens, in which particular, as well as having smooth capsules and arilled seeds, they seem to differ from Cnestis.

EURYCOMA. *(W. J.)*

Pentandria Monogynia. N. O. Connaraceæ. Brown.

Calyx 5-partitus. *Corolla* 5-petala. *Stamina* quinque. *Glandulæ* decem staminibus alternae. *Ovarium* 5-lobum, lobis monosporis. *Stylus* 1. *Stigmata* quinque. *Capsulae* 3—5, folliculares, glabrae, monospermae. *Semen* nudum.

Polygama, foliis pinnatis fastigiatis, floribus paniculatis.

EURYCOMA LONGIFOLIA.*

Kayu Kabal. *Malay.*

Found at Tappanuly and Bencoolen in Sumatra, and at Singapore. *Mergui. Malacca.*

This is a small tree, whose branches are thick, rough with the vestiges of fallen leaves and foliose at their summits. *Leaves* crowded at the extremity of the branches, two feet long, pinnated with numerous leaflets, which are oblong-lanceolate, acute, very entire, very smooth; 2—3 inches in length. *Panicles* axillary, very long. *Flowers* male and hermaphrodite on different plants. *Calyx* small, five-parted. *Corolla* longer than the calyx, purple, tomentose without

* The Punowur Pait of the Malays of Malacca. It is considered by Dr. Oxley to be a valuable febrifuge.

with glandular hairs, petals erect with inflexed margins. *Stamina* five, erect, shorter than the petals, alternating with five pair of villous corpuscules which are large and distinct in the male flower, very small in the hermaphrodite. *Ovary* five-lobed, lobes monosporous; in the male very small and abortive. *Style* one, short, curved. *Stigmata* five, thick recurved. *Capsules* from three to five, nearly ovate, smooth, bursting on one side, one seeded. *Seed* naked, (without aril or caruncle) exalbuminous.

Obs.—The corpuscules interposed between the stamina are remarkable in the male flower, being roundish erect yellow bodies, with somewhat the appearance of abortive anthers; in the hermaphrodite, however, they become simple scales. The genus differs from Cnestis in the number of the stamina, the single style, and the smoothness of the capsule; and from Connarus in the number of the ovaries and stigmas, and the want of the umbilical caruncula.

CONNARUS. *Linn.*

This genus with Cnestis has been removed by Mr. R. Brown from the Terebintaceæ of Jussieu, and formed into a separate and very natural family under the name of Connaraceæ. They are rather a numerous tribe in the Malay islands, and besides the following species of Connarus and Cnestis, I have to add the new genus Eurycoma, which appears to be sufficiently distinct from both the former. I am doubtful whether the species which I have refered to Cnestis really belong to that genus, as they have all smooth capsules with arilled or carunculate seeds, or whether they ought not to be separated from those whose capsules are clothed with prurient hair. Some confusion appears also to have existed between the species of Cnestis and Connarus, the ripe capsules of the former being often solitary from the abortion of the remaining ovaries, and I am much inclined to think that Connarus *santaloides* and *mimosoides* of Vahl in particular are in reality species of Cnestis, a supposition which is supported by the analogy of the inflorescence, which is almost without exception terminal in Connarus and axillary in Cnestis. This distinction is of some importance between genera so nearly related.

CONNARUS FERRUGINEUS. (*W. J.*)

Ferrugineo-tomentosa, foliis pinnatis, foliolis oblongis coriaceis subtus ferrugineo-villosis, paniculis terminalibus.

Bunga Burutta. *Malay.*

Native of Pulo Pinang. *Malacca.*

A small sized tree. *Branches* round, covered with ferruginous wool. *Leaves* alternate, pinnate, leaflets nine, subopposite, oblong-lanceolate, acuminate, very entire, margins reflexed, coriaceous, green and tomentose above, ferruginously villous beneath. *Petioles* round, villous, thickened at the base. *Stipules* none. *Panicles* large, terminal, sometimes with a few axillary racemes. *Flowers* numerous, white. *Bracts* roundish often curved, ferruginously villous as well as the calyces and the whole panicle. *Calyx* five-parted, laciniæ erect, oblong, acute. *Corolla* white, sprinkled with red dots, five petaled, longer than the calyx, petals erect, lanceolate. *Stamina* ten, erect, united at the base, the alternate ones much shorter. *Anthers* ovate. *Style* shorter than the long stamina. *Stigma* capitate, three furrowed. *Capsules* follicular, ferruginous, rather inflated, oblique, gibbous behind, opening on one side, one-celled, one-seeded. *Seed* bean-shaped, appendiculate at the umbilicus. *Umbilical* appendage or caruncle large, and glandular. *Embryo* dicotyledonous, conform to the seed, without albumen; radicle at a distance from the umbilicus.

Obs.—This fine species is well distinguished by its thick leathery leaves, and the ferruginous pubescence of their lower surface and of the branches and panicles.

CONNARUS VILLOSUS. *(W. J.)*

Villosissimus, foliolis 5—7 lanceolatis longe acuminatis supra glabris, paniculis terminalibus dense stellato-villosis ferrugineis.

Native of Sumatra.

The whole plant densely and ferruginously woolly. *Branches* round. *Leaves* alternate, pinnate, leaflets 5 or 7, subopposite, oblong lanceolate, narrowing towards the base, terminating in a long acumen, entire, smooth above, villous beneath with stellate pubescence; about six inches long. In young leaves the upper surface is covered with deciduous pubescence. *Panicles* large, terminal, and from the upper axils, densely villous, ferruginous. *Bracts* long, linear, thick curved, villous. *Calyx* five-parted, villous. *Corolla* five-petaled, limb spreading. *Stamina* ten, united into a ring at the base, the alternate ones shorter. *Ovary* densely pilose with plumose hairs. *Style* longer than the stamina. *Stigma* capitate.

Obs.—This plant is covered with denser and rougher wool than the preceding, particularly on the panicles, and the leaves are much longer, acuminate, and not coriaceous.

CONNARUS SEMIDECANDER. *(W. J.)*

Foliis pinnatis, foliolis 3—5 lato-lanceolatis subtus villosiusculis, paniculis terminalibus axillaribusque villosis, filamentis alternis sterilibus.

Mangul, also Akar Sidinka. *Malay.*

Abundant in thickets at various places on the West Coast of Sumatra.

It is a small tree, with wrinkled bark; the young shoots and leaves are softly and ferruginously villous. *Leaves* alternate, pinnate; leaflets from 3 to 5, ovate-lanceolate, acuminate, entire, smooth above, slightly villous beneath, nerves lucid; 3—4 inches long. *Panicles* terminal or from the upper axils, villous and brownish. *Flowers* numerous.

Bracts small. *Calyx* five-leaved, erect, reddish, tomentose. *Corolla* of a light bluish colour, five-petaled; petals longer than the calyx, spreading at the limb. *Stamina*, filaments five fertile, exsert; five-alternate ones short, sterile; all united into a ring at the base. *Style* somewhat shorter than the stamina. *Capsule* tomentose, ferruginous, follicular, two valved, one-seeded. *Seed* with an umbilical caruncle.

Obs.—This is one of the most common species in Sumatra, and like all the rest of the genus frequents thickets and copses, or what is called by the Malays *Belukar*, rather than the great forests.

CONNARUS GRANDIS. (*W. J.*)

Foliis pinnatis, foliolis quinis ovato-lanceolatis glabris, paniculis terminalibus, capsulis magnis glabris.

At Tappanuly in Sumatra.

A moderate sized tree. *Leaves* alternate, pinnate, leaflets generally five, ovate-lanceolate, acuminate, entire, smooth; 8 or 9 inches long. *Panicles* terminal, long, smooth. *Capsules* large, oblique, red, smooth, follicular, bursting on one side, one-seeded. *Seed* with a large umbilical caruncle.

Obs.—I have not seen the flowers.—It has larger leaves and fruit than any other species that I have met with, and is further distinguished by the smoothness of all its parts.

CONNARUS LUCIDUS. (*W. J.*)

Foliis pinnatis, foliolis glaberrimis nitidis emarginato-acuminatis, paniculis terminalibus ferrugineis, calyce persistente.

Sumatra.

A small tree, with long divaricate subscandent branches. *Bark* brown and wrinkled. *Leaves* alternate; leaflets 5—9, ovate-lanceolate or elliptic oblong, terminating in a long linear acumen which is emarginate at the point, entire, very smooth, shining and lucid; 2—2½ inches long. *Panicles* terminal, small and delicate, ferruginously tomentose. *Flowers* pale red. *Calyx* five-leaved, tomentose. *Corolla* five-petaled, petals narrow. *Stamina* ten, monadelphous at the base, the alternate ones short. *Style* one, longer than the stamina. *Capsule* obovate, less oblique than usual in the genus, embraced at the base by the enlarged persistent calyx, smooth, bursting on one side, one-seeded. *Seed* attached nearly at the base, the umbilicus half embraced by the cup-shaped caruncula, which is rather smaller than usual.

Obs.—This is a small delicate species, having smooth shining leaves with emarginate points; the panicles are small, and seldom bring more than one or two fruit to perfection.

XXI. ANACARDIEÆ.

MANGIFERA QUADRIFIDA. MSS. *Jack.**

Leaves lanceolate with attenuate base. *Panicles* loose, axillary. *Flowers* quadrifid monandrous. *Petals* glandular at the middle.

Malay. Assam Kumbong.

Sumatra and other islands of the eastern Archipelago.

A loftier tree than the common Mango, with a straighter trunk, and more compact foliage. *Leaves* alternate, long-petioled, lanceolate, acute, attenuated to the base, very entire, smooth, coriaceous and flat. *Petiols* roundish, somewhat thickened at the base. *Stipules* none. *Panicles* lax, open and spreading, axillary, crowded at the summits of the branches. From two to four panicles generally come out just below the thick termination of the branch, each supported by a leaf. Sometimes there are other panicles below

* Roxb. Fl. Ind. ed. Carey. 2. 440.

these from the axils of the lower leaves. *Flowers* small and white. *Bracts* small, deciduous. *Calyx* four-leaved, somewhat reflex. *Corolla* white, four-petalled, spreading, after flowering conniving, petals ovate-lanceolate, acute, furnished in the middle with an irregular, yellow, glandular crest. *Nectary* of four round, fleshy lobes united into a cup-like receptacle, on which the germen is situated. *Stamina* inserted on the lobes of the nectarium, not within them as in the M. *Indica;* one fertile, as long as the corolla; sterile filaments very short. *Germen* oblique. *Style* declinate, as long as the stamen. *Fruit* roundish, becoming very dark-coloured, containing an ovate seed.

There are generally some male flowers in the panicle, and rarely a flower occurs with a small superfluous fifth petal placed within the rest.—W. Jack.

MANGIFERA FŒTIDA. *Loureir.**

Leaves firm, broad-lanceolate. *Panicles* terminal, ascending, lengthened, smooth. *Flowers* sub-monandrous. *Corols* infundibuliform; *limb* spreading, at length reflexed.—MSS. Jack.

Manga fœtida, *Rumph. Amb.* i. 98. *t.* 28.

Malay. Bachong.

A native of Penang, Sumatra, &c. *Malacca.*

A larger tree than the common mango. *Leaves* very firm and rigid. *Panicles* large and red-coloured. *Stamina* inserted on the lobes of the nectarium, one, sometimes two, fertile. *Fruit* very fœtid, eaten by the Malays.—W. Jack.

MANGIFERA CÆSIA. *Jack.*†

Leaves rigid, broad-lanceolate, attenuate at the base. *Panicles* terminal, erect, tomentose, glaucous. *Flowers* monandrous. *Petals* erect. *Fruit* oblong.—MSS. Jack.

* Roxb. Fl. Ind. ed. Carey. loc. cit.

† Roxb. Fl. Ind. ed. Carey, 2. 441.

Malay. Binjace.

Sumatra. *Malacca.*

A large tree. *Branches* rough with the vestiges of the fallen leaves. *Leaves* fifteen or sixteen inches long, alternate, petiolate, broad-lanceolate, acuminate, tapering to the base and decurrent on the petiole, very entire, smooth, thick and rigid, strongly nerved, the middle rib flattened. *Petioles* short. *Panicles* large, erect, terminal, finely tomentose, of a glaucous reddish-colour. *Bracts* small. *Calyx* erect, slightly tomentose. *Corolla* erect, purple within, paler without. *Nectary* small, slightly lobed. *Stamina* on the nectary, one fertile. *Style* oblique. *Fruit* oblong-obovate, of a reddish white colour.—W. Jack.

STAGMARIA. *W. J.**

Pentandria Trigynia.

Calyx inferus, tubulosus, deciduus, ore irregulariter ruptus. *Corolla* pentapetala, petalis stipiti germinis insertis. *Stamina* quinque, petalis alterna, filamentis longitudine fere corollæ; antheris oblongis. *Ovarium* trilobum, lobis monosporis, 1—2 sæpe abortivis. *Styli* 1—3 ex apicibus loborum ovarii, staminibus breviores. *Stigmata* obtusa. *Bacca* reniformis, hinc sulcata, cortice varicoso, monosperma. *Semen* exalbuminosum; embryone erecto, pseudo-monocotyledoneo, fissura laterali; radicula incurva.

Arbor succo resinoso caustico scatens, foliis simplicibus exstipularibus, floribus paniculatis.

This genus is nearly related to *Rhus*, but distinguished by the following particulars. The petals and stamina are both inserted on the stipes of the ovary, which is not surrounded by a nectarial ring, as in *Rhus*, and is three-lobed when perfect. The styles are inserted on the lobes of the ovary, and do not spring from one point. Their number

* Companion to the Botanical Magazine, I. 267.

depends on the number of perfect lobes of the germen, and it is most common to find only one. The calyx is tubular, deciduous, and bursts irregularly. The structure of the fruit is also different, the seed not being here contained in a nut, and having the embryo erect, not inverse, as in *Rhus.*

On all these accounts, added to the difference of habit, particularly in having simple leaves, I have little hesitation in considering it as a distinct genus.

STAGMARIA VERNICIFLUA. *(W. J.)*

Arbor vernicis. *Rumph. Amb. II. p.* 259, *t.* 86.

Kayo Rangas. *Malay.*

Native of the Eastern Islands; it does not appear to be abundant in Sumatra, but occurs occasionally in the neighbourhood of rivers, as at Nattal and Moco-Moco. *Malacca.*

This tree grows to a considerable size; the branches and branchlets are smooth, round, and marked with small dots. *Leaves* alternate or scattered, petiolate, elliptico-lanceolate, about eight inches long, subattenuate to the base, rather acute, sometimes obtuse, or even retuse at the point, very entire, very smooth, firm, and shining, with lucid nerves. *Petioles* about an inch long, flattened above. *Stipules* none. *Panicles* axillary, on rather long peduncles. *Flowers* numerous, pedicellate, white, having rather a narcotic smell. *Calyx* tubular, deciduous, bursting into two or three irregular segments. *Corolla* much longer than the calyx, spreading, somewhat reflex, five-petaled; *petals* oblong, rather obtuse, adnate at the base to the column which supports the ovary. *Stamina* five, inserted on the same column above the petals, alternating with them, and nearly of the same length; *filaments* thread-shaped; *anthers* short, oblong, two-celled. *Ovary* on a pedicel or column, sometimes three-lobed, but more frequently there is only one distinct lobe, whose position on the pedicel is rendered oblique by the abortion of the other two; each lobe contains a single ovulum attached to the inner angle. *Style* crowning the lobes of the ovary, from one to three, according to the number of perfect ovaries or lobes, shorter than the stamina. *Stigmata* obtuse. *Berry* as large as a fresh walnut, reniform or somewhat spheroidal, but rather irregular in shape, generally furrowed on one side; the rind is rough and brownish, of a spongy texture, often exhibiting on the surface the appearance of various veins, and when cut, exudes an acrid juice; it contains a single seed, similar in form to the fruit, and equally abounding with a corrosive gum or resin. *Embryo* exalbuminous, erect. *Cotyledons* united, having a fissure on one side; *radicle* at the base of the fruit, short, incurved upon the cotyledons at the lower part of the fissure.

Obs.—The wood of this tree is of a fine dark colour towards the centre, and lighter coloured near the circumference. The bark exudes a resin which is extremely acrid, and, applied to the skin, causes excoriation and blisters. The people consider it dangerous to handle any part of the tree, and even to sit or sleep under its shade. This resin, on exposure to the air, soon assumes a black colour, and becomes hard; it is collected and employed as a varnish, and sells for this purpose at a high price. According to Rumphius, it is the tree which yields the so-much celebrated Japan lacquer or varnish, and he considers it the same with that of Siam and Tonquin. Loureiro, however, who had better opportunities of observing the latter, represents the varnish of those countries as the produce of a different tree, which he has described under the name of *Augia*. The varnish of Siam and Cochin China is probably the best; but that of Celebes and Java, which is the produce of this tree, is also employed for the same purposes, and cannot be much inferior, since it bears as high a price, and according to Rumphius, higher. The process of obtaining and using it is thus given by Rumphius:—"The exhalations of this tree are considered noxious, and the people of Macassar and other parts of Celebes in particular, entertain such dread of it, that they dare not remain long under it, much less repose beneath its shade; they say that whoever receives the droppings from it, will have his body swell, and be affected with malignant sores. As, however, it furnishes the so-celebrated varnish, other people boldly repair to this tree, particularly the Chinese and Tonkinese, who employ great precautions in collecting the resin, which is accomplished in the following manner. A number of Chinese proceed, about evening, to the place where the trees grow, which is always at a distance from the resort of men or animals, each selects a few, and inserts into the trunks two pieces of bamboo, sharpened at their points, in such a manner as to penetrate the bark in a somewhat oblique direction. These remain all night, and are extracted before sun-rise the next morning, the trees yielding no juice during the day. The resin is found in greater or less quantity according to the richness or poorness of the soil, and is obtained only at certain seasons of the year, particularly about the time of flowering. The people who collect it unite the produce of their labour, and afterwards make an equal division of the whole on which account this resin maintains a high price, a single pikul (containing a hundred catties) selling, in those provinces of China which do not possess this tree, for two or three hundred dollars; in Tonkin and Camboja, however, it may be had for thirty, fifty, or sixty dollars. It is a custom among the Chinese, when they approach this tree, first to rub its trunk lightly, before inserting the bamboos, wishing by this to show that they are not afraid, for they say that timid persons will sooner feel its noxious effects than those who are bold and fearless.

"The resin is prepared for varnish in the following way:— To one pound of resin add an equal weight of the oil of Tang-yhu, which is a Chinese tree related to the Boonga Tanjong [*Mimusops Elengi*], from whose fruit a red transparent oil is prepared, resembling our Linseed Oil: others put one pound of oil to three of the resin, which are gently heated together, and make a very black varnish. If, however, to one pound of resin, two pounds of oil be added, a varnish of a brownish yellow, and sometimes of a straw-colour, is produced, with which wood is lightly done over, to bring out the grain and veins. Moreover, if while the varnish is heated, red lead, powdered galls, or other dry pigments be added, it gives the same colour to the work upon which it is employed. This liquid varnish ought to be covered with water to prevent its becoming hard. The articles to which the varnish is applied must always be placed in a cool and moist place to dry, which they do slowly; but when once hardened, the varnish never becomes soft again, except by the suffusion of hot water, which often dissolves it.

"The Chinese carry this prepared resin in large pots from Siam and Camboja to Japan, where it is disposed of to great profit.

"The Japanese are the most skilful in preparing and ornamenting all kinds of wooden articles with this varnish, of which they annually use large quantities, their black lacquered works are dispersed, on account of their elegance, to all parts of the world."

Loureiro says, that the black lacquer is produced by the varnish in its natural state, unmixed with any foreign ingredient, and that it is only for producing red and other colours that pigments are added. He gives his *Augia* as a native of China, Cochin China, Camboja, and Siam; Rumphius' tree is a native of Java, Celebes, Bali, and other parts of the Archipelago.

Under the article Sanga, in the Encyclopedie Methodique, a part of Rumphius' account of this tree is given, but by a singular mistake of the reference to the plate, it is conjectured to be a species of *Hernandia*, an error which the slightest attention to the terms of the description ought to have prevented. In the first volume of the same work, the *Arbor vernicis* is made a species of *Terminalia*, under the specific appellation of *T. Vernix*, and the supposition has not been rejected by later authors. It is needless to add, that it has not the least relation to *Terminalia*.

XXII. SAPINDACEÆ.

MILLINGTONIA.* *Roxb.*

Calyx 5—phyllus, foliolis duobus exterioribus minoribus. *Corolla* 5—petala, petalis duobus minoribus squamiformibus. *Stamina* quinque, quorum tria sterilia difformia basi petalorum majorum inserta; duo fertilia basi minorum adnata, filamentis apice scyphum gerentibus cui antherae bilobae insident. *Ovarium* nectario annulari cinctum, biloculare, loculis disporis. *Drupa* nuce plerumque monospora. *Embryo* erectus, curvatus, albumine nullo aut parco.

Obs.—It will be perceived that I have made a considerable and material alteration in the terms of the generic description from that given by Roxburgh, *Fl: Ind: I. p.* 102, which I conceive to be necessary towards explaining the true relations of the various parts of the flower, and thereby

* The explanation of Mr. Jack and of Dr. Arnott does not appear to me to apply to Millingtonia simplicifolia, in which, from observations made in Upper Assam in 1837, there would appear to be a composition of two of the three acknowledged petals. This, though it may appear to increase the complexity of the flower, will be found perhaps to simplify it essentially. It seems to me, moreover, not improbable that in this genus, as it now stands, there are two modifications of structure of the flower, which may hereafter lead to the formation of another genus.—W. G.

affording the means of tracing more correctly its natural affinities. The principal point is to determine the real nature of what Roxburgh calls the nectarial scales at the base of his petals; I have no hesitation in considering them as abortive stamina, which the examination of the flower before expansion places, I think, beyond a doubt. In that state the whole of the stamina connive over the pistil, the anther of the fertile ones is turned inwards, so as not to be visible, and there is no considerable difference of appearance between them and the sterile ones. The anther-bearing hollow of the fertile stamina is applied to a corresponding hollow on the side of the sterile ones, and at the time of expansion the former separate themselves with a jerk and become erect, while the latter continue in their original position incumbent over the pistil. The petals on which the fertile stamina are inserted are much smaller and narrower than the others, as if exhausted by the greater development of the parts they nourish. These petals are called by Roxburgh outer laminæ of the filaments, which is contrary to all common analogy, while the other explanation might be supported by numerous examples of a similar structure. Thus in place of a diandrous flower with tripetalous appendiculate corolla and bifid stamina, we obtain five as the primary number of all the parts, only modified by the partial abortion of three of the stamina.

MILLINGTONIA SUMATRANA. *(W. J.)*

Foliis impari-pinnatis, foliolis 3—6 jugis ovato lanceolatis, petalis minoribus acutis, fructu ovato.

Found on the island of Pulo Nias.

It is a moderate sized tree with grey bark. *Leaves* alternate, pinnate with an odd one which is rarely wanting; leaflets from 5 to 13, opposite, ovate lanceolate, acuminate, entire, smooth, 6—9 inches long. *Common petiole* flat above and marginate, thickened at the base. *Panicles* terminal, many-flowered, rather coarctate, with stiff rigid divisions, slightly tomentose. *Flowers* white. *Bracts* minute. *Calyx* small, five-leaved, the outer two smaller, resembling bracts. *Corolla* five-petaled, the outer three large, subrotund, the inner two much smaller, lanceolate, acute. *Stamina* five, inserted on the bases of the petals; two fertile, upon the smaller petals, with broad filaments expanding at top into a kind of cup, on which the anther rests, and to whose outer edge it is attached: the anther consists of two yellow lobes resembling masses of pollen which burst transversely. The three sterile stamina which are inserted on the larger petals have thick filaments without anthers, but marked with an oblong cup-like cavity on each side corresponding to the cups of the fertile ones. Before expansion, the five stamina connive over the pistil in such a manner that the cup-like cavities are mutually applied to each other; on expansion the fertile stamina separate with a jerk, by which the pollen is in part dispersed, and the cup becomes erect with the anther resting upon it; the other three never separate but remain conniving over the pistil. *Ovary* embraced at the base by a nectarial cup with five toothlets; ovate, two-celled, each cell containing two ovula attached to the centre of the partition. *Style* short. *Stigma* small. *Berry* ovate, oblique or recurved, somewhat less than an olive, containing a single one-seeded nut. *Nut* obovate-oblong, acute and curved at the base, carinate along one side, and having a large umbilical hollow above the base on the other, smooth, one seeded. *Seed* obovate-oblong, acute at the base, covered with a dry loose brown skin: *albumen* none; *embryo* glutinous on the surface, erect, doubled on itself; *Cotyledons* thin, foliaceous, large, round ovate, reflected backwards upon the radicle, and half embracing it laterally; *Radicle* inferior, very large, thick, pointed, extending the whole length of the seed, and partly doubled up or curved at the top.

Obs.—The cotyledons are wrapped round the embryo in such a manner, as to give the whole somewhat of a chrysaloid appearance. This species has considerable resemblance to the M. pinnata of Roxburgh, but differs in having unequally pinnate leaves, with from 3 to 6 pair of leaflets, in having the smaller petals entire and acute, not tridentate, in the nectarial ring having five simple toothlets, not three bidentate angles, and in having a large ovate fruit with a smooth, not rugose nut. The abortive cell is generally observable near the umbilical foramen.

NEPHELIUM LAPPACEUM.

Marsd. Hist. Sumatra. Pl. IV.

Rambutan. *Malay.*

Frequent throughout the Malay Countries and Islands.

A tree. Leaves alternate, pinnate, leaflets generally from 5 to 7, ovate, acute at both ends, very entire, smooth. Panicles terminal, erect. Flowers numerous, small, white, male and hermaphrodite. Calyx from 4 to 6 parted, spreading. Corolla none. Stamina from 5 to 8, spreading, longer than the calyx, inserted into a disk below the germen. Anthers subrotund. Ovarium two-seeded, abortive in the male flowers. Style one. Stigmata 2, revolute. Fruit geminate, one commonly abortive, the rudiment of which remains at the base of the perfect one, which is subrotund, covered with a coriaceous rind and echinate with long soft spines, one-seeded, the seed covered with a white acid pulp.

The fruit is much esteemed, and has an agreeable subacid flavour. The parts of the flower vary much in number; six is perhaps the most frequent number of the stamina. There is but one style, not two as commonly described. The affinities of this tree seem to have been little understood. It belongs without doubt to the family of the Sapindi, and is closely related to Scytalia, as justly conjectured by the author of the botanical articles in Rees' Cyclopedia.

SAPINDUS RUBIGINOSUS. *Roxb.*

Octandria Monogynia.

Arborescens inermis, paniculis terminalibus, calycibus 5 phyllis, corollis 4-petalis, baccis tribus connatis oblongis.

Kalit layu. *Malay.*

Pulo Pinang.

Arborescent. Leaves alternate, abruptly pinnate, leaflets nearly opposite, subsessile, ovate-lanceolate, obtuse with a small mucro or point, very entire, nearly smooth, with a few scattered hairs chiefly on the under surface. Petioles tomentose. Panicles terminal erect, composed of numerous simple racemes. Pedicels short, generally in pairs. Bracts subulate. Calyx 5-leaved, leaflets subrotund, concave, the two outer ones smaller. Corolla white, 4-petalled, somewhat longer than the calyx, petals ovate, obtuse, appendiculate at the base, appendices furnished with two transverse lines of white hairs. Stamina 8, of which the five upper and longer are incumbent over the remaining three; filaments villous; anthers oblong, yellow. Style 1, short, persistent. Stigma capitate, 4-sided villous. Germina three one-seeded. Berries three, connate at the base, purple, oblong, one-seeded.

HEDYCARPUS.*

Tetrandria Monogynia.

Perianthium 4-partitum, inferum. *Stamina* 4. *Ovarium* 3-loculare, loculis disporis. *Stigmata* tria. *Capsula* baccata, 3-valvis, 3-locularis, seminibus arillo sapido tunicatis. Embryo inversus, albumine inclusus. *Arbor foliis alternis simplicibus, floribus racemosis.*

Note.—This and the following genus are referred in Endlicher's Genera Plantarum to Euphorbiaceæ, whether correctly or not, I cannot at present take upon myself to say.—W. G.

* Lin: Trans: Vol. xiv. p. 118 t. 119.

The stamens are occasionally five in number, with a five-parted perianth and four-celled ovary.

HEDYCARPUS MALAYANUS.

Bera Tampui. *Malay.*

Sumatra.

A small tree. *Branchlets* smooth. *Leaves* alternate, petiolate, broad-ovate, rounded at the base, acuminate, nearly entire, with recurved edges, sometimes obsoletely crenulate, very smooth, deep green and shining above, and paler beneath, strongly nerved; from nine to ten inches long. *Petioles* thickened at both ends, from two to two inches and a half long. *Stipules* ovate, acute, deciduous. *Racemes* principally from the trunk and larger branches, but sometimes axillary, fascicled or solitary, straight, from two to three inches long; pedicles supporting several flowers, tomentose. *Bracts* on the pedicel below its subdivision, small, broad. *Perianth* small, yellowish, villous, somewhat fleshy, four, sometimes five-parted; segments narrow. *Stamens* four, sometimes five, alternate with the segments of the perienth, short; anthers roundish, two-lobed. *Ovary* small, three, sometimes four-celled; each cell containing two ovula attached to the inner angle. *Style* scarce any. *Stigmas* three, sometimes four, fleshy, villous. *Fruit* about the size of a China orange, with a thick rough rind, three-valved, three-celled; cells generally two-seeded, partitions opposite to the valves. *Seeds* enveloped in a white juicy aril, as in the *Lansium*, &c. *Embryo* contained in an ample albumen, inverse. *Cotyledons* flat, foliaceous, cordate, subrotund. *Radicle* superior, short, clavate.

Obs.—This is a fruit which ranks in point of taste and flavour along with the Lanséh, &c., but it is by no means so frequently met with. The genus is most nearly allied to *Pierardia* of Roxburgh, with which it agrees in general habit, in foliage, in the mode of inflorescence, and in the structure of the seeds, but differs in having a valvular fruit and in the number of the stamens. The following description of the Choopa, another highly esteemed Malayan fruit, which belongs to *Pierardia*, will illustrate the affinity between these two genera.

PIERARDIA. *Roxb.**

Perianthium 4-partitum. *Stamina* octo, brevia. *Ovarium* 3-loculare, loculis disporis. *Stigma* trifidum. *Bacca* corticata, trilocularis, loculis 1—2-spermis. *Semina* arillo sapido tunicata. *Embryo* inversus, albumine inclusus.

Arbores, floribus racemosis, foliis alternis simplicibus.

PIERARDIA DULCIS.

Monoica, foliis obovatis.

Bua Choopa. *Malay.*

Sumatra.

This is a middle-sized tree. *Leaves* crowded at the ends of the branches, alternate, petiolate, obovâte, or elliptic-obovate, rounded at the top, with a short blunt acumen, entire, smooth, flat; from eight to nine inches long. *Petioles* thickened and jointed above and below. *Stipules* ovate, deciduous. *Racemes* from the naked branches. Male and female flowers in distinct racemes; in the former the pedicels are generally three-flowered; in the latter one-flowered. *Bracts* small.

MALE.—*Perianth* four-parted, spreading, yellowish, tomentose within, very slightly so without. *Stamens* eight; *filaments* very short; *anthers* two-lobed. *Ovary* abortive.

FEMALE.—*Perianth* considerably larger than in the male, divided to the base into four long thick lobes; sometimes there is a fifth. *Stamens* none. *Ovary* subglobose, three-celled; cells two-sporous. *Style* none? *Stigmas* three, spreading,

* Lin: Trans: Vol. xiv. p. 119 t. 121.

fleshy, hispid. *Berry* subglobose, larger than a cherry, of a yellowish colour, three-celled; cells generally one-seeded. *Seeds* enveloped in a white pulpy aril or tunic. The embryo is inverse, with flat cotyledons in the centre of an ample albumen.

Obs.—This species differs from that described by Roxburgh in being more [illegible], in the form of the leaves, and in the colour of fleshy aril. The Rambeh, of which Mr. Marsden has given a figure in his *History of Sumatra, pl.* vi. *p.* 101, so nearly resembles this, that I think it can only be a variety of the same. The Rambeh belongs to the peninsula of Malacca, and is unknown at Bencoolen; while the Choopa, which is abundant at the latter place, is not found in the former. The racemes of the Rambeh are longer and the fruit smaller than in the Choopa; but a comparison and examination of the two would be necessary to ascertain whether there are any essential differences, and I have not had an opportunity of doing this.

XXIII. MELIACEÆ.

LANSIUM.* *Jack non Blume.*

Decandria Monogynia. N. O. Meliaceæ. Juss.

Calyx 5-partitus. *Corolla* 5-petala, petalis subrotundis. *Tubus staminiferus* globosus, ore subintegro, antheris decem inclusis. *Ovarium* 5-loculare, loculis 1—2-sporis. *Stylus* brevis, columnaris. *Stigma* planum, 5-radiatum. *Bacca* corticata, 5-locularis, 5-sperma, uno alterove loculo tantum semen perficiente. *Semina* integumento extoriore pulposo sapido. *Albumen* nullum; cotyledonibus inœqualibus peltatis.

* Lin: Trans: Vol. xiv. p. 115 t. 118.

Arbores, foliis pinnatis, floribus racemosis.

LANSIUM DOMESTICUM

Langsat or Lanséh. *Malay.**
Lansium. *Rumph. Amb.* i. *p.* 151. *t.* 54.
Marsden's *Hist. of Sumatra, pl.* v. *p.* 101.
Native of the Malay Islands.

A moderate-sized tree. *Branchlets* tomentose. *Leaves* alternate, pinnate; leaflets from seven to nine, alternate, short, pedicelled, elliptic-oblong, broader above, rounded towards the point, and terminating in an obtuse acumen, entire, very smooth; nerves pubescent beneath; from seven to ten inches long. The young leaves are pubescent on the under surface. *Stipules* none. *Racemes* springing from the trunk and naked branches, sometimes solitary, sometimes fascicled, at first suberect, but drooping afterwards by the weight of the fruit; tomentose: flowers sessile, alternate, solitary, tribracteate at the base. *Calyx* deeply five-parted; segments round, concave, imbricated. *Corolla,* five-petalled, yellowish, a little longer than the calyx; petals subrotund. *Staminiferous tube* sub-globose: mouth nearly entire; anthers ten, inserted within the tube. *Ovary* five-celled; cells containing a single or double ovulum attached above to the inner angle. I have never observed two distinct ovula; but the single one is often marked with a furrow, as if composed of two united together. *Style* short, thick, columnar, ten-furrowed. *Stigma* flat, obscurely radiated. *Berry* of a yellowish colour, cortical, seated on the persistent calyx, oblong-ovate, or oval, slightly tomentose, five-celled five-seeded. *Seeds* enveloped in a white semi-transparent pulpy tunic or aril, exalbuminous; cotyledons solid conform to the seed, unequal, irregularly transverse, peltate; the short pilose radicle being inserted into their centre. Two seeds

* *I am not yet certain whether there is a specific difference between the Lanseh of Malacca and to Dookoo of the same place.—W. J.*

are frequently contained in one common integument, so firmly united as to appear but one, until by dissection the two radicles and four irregular cotyledons are discovered. There are seldom more than one or two cells in each fruit that perfect their seed; the others are only filled with the white transparent pulp.

Var. β. *L. aqueum.*

Foliolis subtus villosis, racemis densis, sæpius solitariis, fructibus globosis.

Ayer Ayer. *Malay.*

The Ayer Ayer so nearly resembles the Lanséh in most particulars, that I hesitate to rank it as a distinct species, and content myself with mentioning it as a permanent and well-marked variety. They are principally distinguished by the Malays by their fruit, that of Ayer Ayer being rounder, and the pulp more watery (whence the name), and dissolving more completely in the mouth than that of the Lanséh. Both are highly esteemed by the Malays, and are equally agreeable to the European palate. The juicy envelope of the seeds is the part eaten, and the taste is cooling and pleasant.

This genus has hitherto been known only from Rumphius' figure and description, and its place in the system has therefore continued uncertain. From an examination of the fruit, M. Corea de Serra conjectured it to be intermediate between the families of *Aurantiæ* and *Guttiferæ*, but the structure of the flower determines its true place to be among the *Meliaceæ*.

I have further met in the forests near Bencoolen with a tree which appears to agree very nearly with the *Lansium montanum*, *Rumph. Amb.* i. *p.* 154. *t.* 56. It differs in the number of the stamens, styles and seeds from the *Lansium* described above, but agrees with it exactly in carpological structure and in general habit. Its characters çoincide very nearly with those of Roxburgh's *Milnea.* They are as follow:

Flowers small and inconspicuous. *Calyx* five-parted. *Corolla* five-petaled. *Stamineous tube* subglobose, entire at the mouth; anthers five, within the tube. *Style* two. *Stigmas* two, simple. *Berries* globose, about the size of the domestic Lanséh, 1—2 celled, 1—2 seeded. *Seeds* enveloped in a thin subtransparent pulpy tunic or envelope, which has somewhat the flower of the Lanséh, but with a bitterish and rather disagreeable smell. Carpology as in the *L. domesticum.*

The leaves are pinnate with about seven leaflets, elliptic-oblong, broader above and narrowing to the base, terminating in a long obtuse acumen, entire, very smooth. *Petioles* sprinkled as well as the branchlets with ferruginous pulverulent tomentum. *Stipules* none. *Panicles* axilliary or supra-axillary, shorter than the leaves, composed of a few short branches with small greenish flowers.

Milnea is perhaps scarcely distinct from *Lansium;* but if admitted as a separate genus, the above will constitute a second species differing from *M. edulis,* Roxb. in being digynous, and may be denominated *M. montana.*

MELIA EXCELSA. *(W. J.)*

Decandria Monogynia.

Foliis pinnatis, foliolis integerrimis, paniculis coarctatis axillaribus foliis paullo longioribus.

Pulo Pinang.

A lofty tree, with straight trunk and light grey bark. Branches rough with the vestiges of the fallen leaves, foliose at their summits. Leaves crowded, disposed in a spiral manner, pinnate with an odd one which is often wanting, leaflets subopposite, oblong-lanceolate, inequilateral, obtusely acuminate, very entire, smooth, shining above. Petioles round, smooth, thickened, and somewhat scaly at the base. Panicles axillary, ascending, rather longer than the leaves, not diffuse. Flowers pedicellate, pedicels bracteolate. Calyx very small, 5-parted. Corolla white, five-petalled, spreading, petals linear. Staminiferous tube erect, gibbous at the base, ten dentate, ten furrowed, as if consisting of ten united filaments. Anthers ten, oblong, yellow within the mouth of the tube. Style as long as tube. Stigma capitate.

XXIV. AURANTIACEÆ.

MURRAYA PANICULATA.

Decandria Monogynia.

N. O. Aurantiæ.

Foliolis ovatis acuminatis, floribus terminalibus axillaribusque subsolitariis, baccis oblongis saepius dispermis.

Chalcas paniculata, *Lour: Fl: Coch: p.* 270.

Camunium. *Rumph: Amb: V. p.* 26. *t.* 17.

Kamuning, *Malay*.

This is an abundantly distinct species from *M. exotica*, though unaccountably confounded with it by latter authors. Lourêiro discriminates between them very well, and his description is on the whole good. Rumphius's figure is bad, but preserves several of the distinguishing characters, particularly in the inflorescence and leaves, which however are not sufficiently acuminate. It grows to the size of a small tree, and the wood is much employed for the handles of kreeses, being capable of receiving a fine polish. The leaflets are generally five, ovate, terminating in a long acumen which is slightly emarginate at the point, shining and very entire, the terminal one considerably the largest. In *M. exotica*, the leaflets are more numerous and closer, obovate, blunt, and of a much firmer, thicker substance. The flowers of *M. paniculata* are fewer and larger than those of *M. exotica*, and are sometimes terminal, generally one or two together, from the axils of the upper leaves. The ovarium is two celled; the berries are oblong, reddish, and mostly contain two seeds which are covered with silky hairs. The berries of *M. exotica* are ovate, and generally one-seeded. The whole habit of the two plants is very distinct. The specific name *paniculata* is objectionable, as the flowers are much less panicled than in the other species.

The Camunium sinense, *Rumph, V. t.* 18 *f.* 1. which is commonly met with in gardens in all the Malay Islands is quite a distinct genus from the other two Camuniums, and has been described by Loureiro, *Fl: Cochinch*: *I. p.* 173, under the name of

AGLAIA ODORATA.

It has a five parted inferior calyx, and five petalled corolla. The stamina are five in number, and are inserted in the manner of the Meliaceæ on the inside of an ovate nectarial tube, which is contracted at the mouth, and conceals the anthers. The stigma is large, sessile, simple as far as I have observed, not double, as stated by Loureiro. The ovary appears to be one celled, and to contain two pendulous ovula. It rarely ripens its fruit in these Islands, but according to Loureiro, it bears a small red one-seeded berry. The flowers are very small, yellow and fragrant, in small axillary panicles.

In the Catalogue of the *Hortus Bengalensis, p.* 18, this plant is specified under the name of Camunium *Sinense,* after Rumphius. The Murraya *paniculata* above described is the true Kamuning of the Malays, and the name C. Sinense is only applied by Rumphius in the manner of the old botanical authors, as one of comparison and resemblance, for want of a better of native origin; if therefore the generic name Camunium is to be adopted at all, it ought to be applied to the plant to which it really belongs, and cannot be admitted for one of a different family not indigenous to the Malay Islands. On this account Loureiro's name is to be preferred.

CHIONOTRIA. *(W. J.)**

Decandria Monogynia.

Calyx 5-partitus, inferus. *Corolla* 5-petala. *Stamina* 10, erecta. *Ovarium* 2 loculare, 2 sporum, ovulis pendulis, *Stylus* 1. *Stigma* capitatum. *Bacca* monosperma. *Semen* exalbuminosum apice umbilicatum; cotyledonibus maximis convexo-planis, radiculâ superâ minimâ.

Frutex, foliis simplicibus oppositis pellucido-punctatis, racemis axillaribus.

Genus Aurantiis affine.

CHIONOTRIA RIGIDA.

Native of Pulo Pinang.

A shrub with corrugated grey bark. *Leaves* opposite, very short-petioled, ovate-lanceolate, acuminate, narrow at the base, very entire, very smooth, pellucidly punctate. *Stipules* subulate, acute. *Racemes* axillary, erect, rigid, branched, strict, shorter than the leaves, pedicels short, rigid, many-flowered. *Flowers* greenish, inconspicuous. *Bracts* very small. *Calyx* very small, 5-parted. *Corolla* a little longer than the calyx, 5-petalled. *Stamina* ten, exsert, erect; anthers incumbent. *Ovarium* superior, two-celled, two-seeded, seeds pendulous. *Style* thick, as long as the stamina. *Stigma* capitate, obtuse. *Berry* of the size of a cherry, snow white, globular and somewhat flattened, umbilicate, consisting of a spongy farinaceous pulp, and containing a single large round seed. *Seed* globose, attached superiorly and there umbilicate. *Integument* coriaceous, marked with veins which diverge from the umbilicus. *Albumen* none. *Embryo* inverse, conform to the

* Sclerostylis. Blume?—W. G.

seed. *Cotyledons* plano-convex, of a deep green colour, somewhat rugose externally, and punctate on the inner surface. *Radicle* superior, obverse to the umbilicus, short, straight, cylindrical, obtuse, covered with ferruginous down. It is elongated into a short conical plumule.

XXV. AMPELIDEÆ.

VITIS RACEMIFERA. *(W. J.)*

Tetrandra, foliis quinatis, foliolis spinescenti-serratis subtus incanis, cirrhis oppositifolis racemiferis, racemis compositis longissimis, baccis dispermis.

Akar Charikun, or Bayur Akar. *Malay.*

Native of Sumatra.

A large strong woody climber. *Branches* round, villous. *Leaves* alternate, quinate, leaflets pedicellate, oblong obovate, acute, subspinoso-serrate, the serratures being formed by the spinescent termination of the nerves, smooth above, hoary beneath, frequently with a ferruginous shade. *Petioles* villous. *Cirrhi* opposed to the leaves, very long, simple or bifid, when bifid one branch becomes the peduncle. *Racemes* very long, compound, consisting of numerous densely flowered racemuli inserted on a peduncle formed of the thickened tendril. The whole raceme is often a foot and a half in length. *Peduncles* ferruginously villous. *Flowers* sessile on the partial peduncles, small, green. *Calyx* minute, embracing the base of the corolla, quadridentate. *Corolla* deeply four-parted. *Stamina* four, anthers yellow. *Ovary* surrounded by a fleshy ring, tetrasporous. *Style* scarce any. *Stigma* thick. *Berry* of the shape of an olive and nearly as large, purple, juicy, two-seeded.

Obs. This would be a species of Cissus according to the Linnean division, but that genus has now been united to Vitis by Mr. Brown, as they differ in nothing but the number of parts.

XXVI. PITTOSPOREÆ.

PITTOSPORUM ?*

Calyx beneath, five-leaved, erect. *Corolla* five-petalled: *petals* alternating with the calyx. *Nectary* five-lobed, surrounding the ovary. *Stamina* five, inserted on the nectarial lobes. *Ovary* one-celled, six-seeded. *Capsule* three-valved, one-celled, with three parietal placentas. Some of the seeds abortive. *A pentandrous, monogynous shrub, with alternate leaves and axillary inflorescence.*

PITTOSPORUM ? SERRULATUM. *(W. J.)*

A shrub with smooth branches. *Leaves* alternate, very short petioled, lanceolate, acuminate, slightly serrated, very smooth. *Stipules* lanceolate, acute, very deciduous. *Peduncles* short, axillary, solitary; from six to eight-flowered. They are frequently from the axils of the fallen leaves. *Flowers* yellowish green, fascicled, short-pedicelled. *Bractes* small, acute. *Calyx* inferior, ovate, five-leaved, leaflets ovate, acute, conniving at their apices. *Corolla* yellowish, five-parted, petals inserted on the receptacle, ovate-lanceolate, acute, a little longer than the calyx, and alternating with its leaflets. *Nectary* short, five-lobed, surrounding the germ. *Stamina* five, inserted into the lobes of the

* I have taken the liberty of thus disposing of Mr. Jack's Pittosporea serrulata, which afforded the materials for Celastrus pauciflorus. Wall. (vide Roxbg. Fl. Ind. ed. Carey. 2. p. 400,) "a native of Penang where it is called Boonga Lawung."

nectary, erect, included; *anthers* sagittate, acute, conniving into a ring round the style. *Ovarium* superior, ovate, one-celled, six-seeded. *Style* a little longer than the stamina, tomentose together with the ovary. *Stigma* simple. *Capsule* surrounded at the base by the persistent calyx and the withered corolla and nectary, triangularly globose, three-valved, one-celled; *seeds* attached along the middle of each valve to parietal prominent placentæ, six in number, several aborting, roundish and angular.—W. Jack's MSS.

XXVII. CELASTRINEÆ.

CELASTRUS? BIVALVIS. (*W. J.*)*

Pentandria Monogynia.

Foliis lanceolatis acuminatis integerrimis, pedunculis lateralibus paucifloris, corollis nullis, capsulis bivalvibus monospermis.

A shrub with smooth branches. *Leaves* opposite, petiolate, lanceolate, acuminate, acute at the base, very entire, very smooth. *Stipules* none. *Peduncles* lateral, divaricately dichotomous, few flowered, (5—10 flowered). *Bracts* small. *Calyx* five-parted, bibracteate at the base, laciniæ roundish, imbricated. *Corolla* none. *Stamina* five, erect, united beneath into a five-toothed ring or urceolus; filaments flat; anthers oblong. *Style* erect, as long as the stamina. *Stigma* truncate. *Capsule* ovate, green, smooth, crowned with the style, two-valved, one-celled, one-seeded; valves opening from the base, and falling off from the seed, which is more persistent and remains on the peduncle. *Seed* ovate, contained in a beautiful crimson arillus which is delicately veined. *Albumen* cartilaginous, conform to the

* Penang.—W. Jack.

seed. *Embryo* erect, central, as long as the albumen. *Cotyledons* flat, foliaceous, ovate, obtuse. *Radicle* inferior, obverse to the umbilicus, round, much shorter than the cotyledons.

XXVIII. HIPPOCRATEACEÆ.

SALACIA. *Linn.*

This genus seems to require a little elucidation. It was originally referred to Gynandria, the fleshy nectary on which the stamina are inserted having been mistaken for the germen, and the real ovary, on account of its smallness, having escaped the observation of Linnæus and Loureiro. This is now I believe generally admitted; there can therefore be no doubt of the identity of Roxburgh's Johnia with Salacia, and his *I. Salacioides* agrees so well with *S. Chinensis*, particularly in having entire leaves, that it is questionable whether they are not the same, for it is to be observed that in most of the species the leaves are only subopposite, and may occasionally on the same tree be found both opposite and alternate. Tonsella *prinoides. Willd: Act: Am: Nat: Berol: IV.* is also without doubt a true species of Salacia, if it be not in fact the same plant as the Johnia *Coromandeliana, Roxb: Flor: Ind: I. p.* 173. Calypso *salacioides* of Aubert du Petit Thouars agrees exactly with these in the structure of the flower, but differs in having many-seeded berries. Some of the species of Tonsella appear likewise to have polyspermous fruit, but those which have definite seeds are probably true species of Salacia. It may be questioned whether the distinction founded on the number of seeds be really of generic value where the agreement is so exact in all other respects, especially if it should be found that a gradation exists from the one to the other in the fruit of the different species. This, however, can only be determined by an accurate examination of the ovaries and fruit of the various plants at present ranged under Tonsella.

In the natural arrangement Salacia undoubtedly bears the greatest affinity to Hippocratea, it being scarcely possible to distinguish the two genera when only in flower. It also agrees in many particulars with the Celastrinae, but differs in having exalbuminous seeds. The union of the Hippocraticeæ and Celastrinæ has, however, been suggested by Mr. Brown in his remarks on the Botany of Terra Australis. Under the above view the genus will be characterized as follows:

Calyx inferus 5-fidus. *Corolla* 5-petala. *Stamina* 3, disco carnoso inserta. *Ovarium* 3-loculare, loculis 1—2 sporis, ovulis axi affixis. *Bacca* 1—3 sperma.

Frutices vel arbusculae, foliis subopposititis simplicibus.

I have met with two species in Sumatra, one with anthers sessile on the nectary, which agrees very nearly both with *S. chinensis* and Roxburgh's *I. salacioides:* the other with anthers supported on filaments, and nearly related to *I. Coromandeliana, Roxb.*

XXIX. OCHNACEÆ.

GOMPHIA SUMATRANA. *(W. J.)*

Decandria Monogynia.

O. N. Ochnaceæ.

Foliis lanceolatis vel oblongo-ovalibus acuminatis obtuse denticulatis nitidis subquinque nerviis, stipulis intrapetiolaribus deciduis, paniculis terminalibus.

Sibooru. *Malay.*

Sumatra.

A large shrub or small tree. *Leaves* alternate, short petioled, eight or nine inches in length, from lanceolate to oblong oval, varying considerably in breadth from two to three inches, acuminate, acute at the base, obtusely denticulate, very smooth, shining, middle nerve very strong, lateral veins numerous, transverse, somewhat reticulate, delicate, uniting near each margin into two nerves which run parallel to it almost the whole length, and give the leaf the appearance of being five-nerved. *Petioles* very short. *Stipules* intrapetiolar, broad at the base, acuminate, deciduous. *Panicles* terminal, not much branched; pedicels slender, rarely solitary, surrounded at their base by small acute bracts. *Calyx* five-leaved, persistent, leaflets ovate, acute, smooth, lucid. *Corolla* yellow, five-petalled, scarcely longer than the calyx. *Stamina* ten; filaments very short; anthers long, linear, opening at the top by two pores. *Style* as long as the stamina. *Stigma* acute. *Ovaries* five, surrounding the base of the style, and elevated on a receptacle. This receptacle enlarges as the fruit ripens. The number of abortive ovaries is variable; sometimes only one comes to perfection. The berries are drupaceous, obliquely reniform, somewhat compressed, one-seeded. Seed exalbuminous.

Obs.—This appears to have so much resemblance to the G. Malabarica, *Decand:* Pua Tsjetti. *Rheed. Mal. V. p.* 103. *t.* 52, that I have some hesitation in proposing it as a distinct species. The points of difference are the following: the leaves of this are much longer than those of the Malabar species which are described as almost veinless, while in this the transverse veins unite into two very distinct marginal nerves, which it is difficult to suppose could have escaped observation had they existed in the other. The representation of the inflorescence in Rheede's figure is unintelligible, and his description of it is not much clearer, but as far as it can be made out, it appears different from this. Further examination of the Malabar plant will be necessary to determine whether this is really distinct, and whether the differences above noticed exist in the plant itself, or are mere omissions in the description.

EUTHEMIS. *(W. J.)**

Pentandria Monogynia.

Calyx inferus, 5-phyllus. *Corolla* 5-petala. *Stamina* quinque, hypogyna, antheris oblongis acuminatis apice poro dehiscentibus. *Stylus* filiformis, staminibus æqualis. *Bacca* 5-sperma; seminibus circa axim dispositis, oblongis, intus angulatis, arillo fibroso inclusis, albuminosis, embryone inverso cylindrico longitudine fere seminis, radicula superiore.

Frutices, foliis alternis pulcherrime striatis nervis parallelis, racemis terminalibus, demum peractâ floratione lateralibus et oppositifoliis.

EUTHEMIS LEUCOCARPA. *(W. J.)*

Foliis lanceolatis pulchre spinuloso-serratis, racemis basi ramosis, baccis niveis globosis.

Plawan bruk. *Malay.*

Native of the forests of Singapore.

A shrub of uncommon elegance and beauty, erect, four or five feet in height; branchlets round, smooth, sometimes slightly angled. *Leaves* alternate, petiolate, lanceolate, acute, decurrent on the petiole, spinuloso-serrate, very smooth and shining, beautifully striated with fine parallel transverse nerves. *Petioles* margined, flat and channeled above, dilated at base into a thick rounded prominent rim, which half embraces the stem. *Stipules* lanceolate acuminate, ciliate, very deciduous. *Racemes* erect, with one or two

* Referred with doubt to Ochnaceæ by Dr. Lindley and M. Endlicher. I have no knowledge of the genus.—W. G.

branches near the base, at first terminal, afterwards lateral and oppositifolious by the shooting up of the stem from the base of the peduncle. *Flowers* pedicellate, generally in pairs. *Bracts* ovate, acute. *Calyx* inferior, five leaved, spreading, leaflets ovate, obtuse, ciliate, the two inner ones rather smaller. *Corolla* white, sometimes tinged with purple, 5-petaled, petals twice as long as the calyx, reflexed, ovate-oblong, obtuse. *Stamina* five, inserted below the ovarium: alternating with these are sometimes found five short abortive filaments. *Filaments* very short. *Anthers* longer, erect, conniving round the style, oblong, prolonged into acumina which are sometimes a little contorted, and which open at their summits by a pore, the cells are adnate below to the sides of the filament. *Ovary* oblong, acute. *Style* filiform, erect, equal to the stamina. *Stigma* simple. *Berry* snow white, globular, obscurely angled, crowned with the persistent style which is obliquely deflexed; of a spongy or farinose substance, containing in the centre five seeds which are disposed round the axis, and enclosed in arilli composed of tough longitudinal fibres. *Seeds* (pyrenae ?) oblong, somewhat reniform, hard. *Albumen* conform to the seed. *Embryo* inverse, cylindrical, nearly as long as the seed. *Cotyledons* semicylindric, obtuse. *Radicle* superior, longer than the cotyledons.

The branches are terminated by long corniculate buds in which the gemmation is involute.

EUTHEMIS MINOR. *(W. J.)*

Foliis angusto-lanceolatis leviter serrulatis, racemis simplicibus, baccis rubris angulatis acuminatis.

Found at Singapore along with the preceding.

This is a smaller shrub than the former, branched, and smooth. *Leaves* alternate, petiolate, linear-lanceolate, rather obtuse with a mucro, attenuated to the petiole, slightly serrulate, very smooth, shining, finely striated with transverse veins. *Petioles* short, thickened at the base, channeled above. *Stipules* linear, ciliate. *Racemes* simple, erect, at first terminal, becoming afterwards lateral. *Flowers* alternate, pedicellate, often in pairs. There is a single leaflike bract and several smaller ones at the base of the pedicels, less deciduous than in the preceding. *Calyx* five leaved, leaflets ovate, ciliate. *Corolla* white, spreading, five-petalled, petals lanceolate, acute. *Stamina* five, erect, conniving, hypogynous; filaments very short; anthers yellow, oblong, broader at the base, two-celled, cells adnate to the sides of the filament, prolonged above into an acumen opening at the top by a pore. *Ovary* oblong, acute. *Style* a little longer than the stamina. *Stigma* simple. *Berry* red, five-angled, acuminate, composed of a whitish farinaceous pulp, and containing five seeds, each enveloped in a tough fibrous arillus, and in structure the same as the preceding.

XXX. TERNSTRŒMIACEÆ.

TERNSTRŒMIA.

The Malayan species of Ternstrœmia exhibit a remarkable agreement among themselves, at the same time that they differ considerably from the rest of the genus. They have a trilocular ovarium surmounted by three styles which are inserted on the same point, but are separate to the base. In some, the corolla is monopetalous with monadelphous stamina, in others it is five petaled with distinct stamina. The anthers are two-celled and open at the top by two oblique pores; this is probably the case with the whole genus, though it has been omitted in the generic character, of which it ought certainly to form an essential part. It seems doubtful whether the monogynous species with bilocular fruit and definite seeds ought to be united with those which have three styles, three cells and numerous seed, but an examination of their ovaries and placentation is necessary to decide the question. I have met with four species in Sumatra and the adjacent islands, two of which I have already described in the first volume of the Malayan Miscellanies. Their common appellation in Malay is Ingor-ingor Karbau, or Buffaloe's spittle.

TERNSTRŒMIA RUBIGINOSA. *(W. J.)*

Polyandria Monogynia.

Foliis ovatis spinuloso-serratis subtus incanis, floribus lateralibus et axillaribus fasciculatis monadelphis, pedunculis calycibusque glauduloso-pilosis, fructu triloculari.

S'eengo eengo. *Malay.*

Sumatra.

A tree. *Branches* cinereous, young parts covered with acute scales. *Leaves* alternate, petiolate, ovate acuminate, spinuloso-serrate, smooth above, hoary and white beneath, the nerves furnished with ferruginous paleaceous scales. *Flowers* in fascicles, lateral and axillary. *Peduncles* and calyces covered with glandular hairs. *Bracts* small about the middle of the peduncles. *Calyx* five-parted. *Corolla* white, campanulate rotate, five-parted, divided about half way down. *Stamina* numerous; filaments short, united at the base into a ring which is inserted on the bottom of the corolla; anthers oblong, recurved, affixed by the middle, two-celled, opening at the top by two oblique pores. *Ovary* ovate, acute, covered with glandular hairs, three-celled, polyspermous, placentæ central. *Style* trifid, divided to the base. *Stigmata* simple.

TERNSTRŒMIA PENTAPETALA. *(W. J.)*

Foliis obovato-lanceolatis, spinuloso-denticulatis glabris, floribus lateralibus fasciculatis, pedunculis glabris, fructu triloculari.

Native of Pulo Pinang.

A shrub with grey bark and leafy at the summit. *Leaves* alternate, petiolate, 10 to 12 inches long, obovato-lanceolate, acuminate, spinuloso-denticulate, smooth; the nerves are furnished with a few appressed, innocuous, scale-like spines. *Petioles* about an inch in length, covered as well as the summits of the branches and buds with small ferruginous scales. *Flowers* in fascicles below the leaves, from the axils of the fallen ones of the preceding year; they are pedicellate and white. *Calyx* colored, five leaved, the two outer leaflets smaller. *Corolla* white, five petaled, petals subrotund, a little longer than the calyx. *Stamina* numerous, distinct, inserted on the base of the petals; filaments short; anthers oblong, yellowish white, didymous, truncate at the top and there opening by two pores. *Ovarium* ovate, three-celled, many-seeded, placentæ from the inner angles of the cells. *Style* deeply trifid. (Styles 3 ?) *Stigmata* three.

I have not seen the ripe fruit of this, but have been informed that it produces a white berry.

TERNSTRŒMIA ACUMINATA. *(W. J.)**

Foliis obovato-lanceolatis acuminatis spinuloso-denticulatis glabris, floribus axillaribus solitariis polyandris, pedunculis squamosis, fructu triloculari.

Found at Tappanully on the West Coast of Sumatra.

Branches round, somewhat flexuose. All the young parts green with a few appressed scales. *Leaves* alternate, petiolate, obovate lanceolate, attenuated to the base, terminating in a long acumen or point, spinuloso-denticulate, smooth with

* Saurauj̈æ sp. Arnott, in Hooker's Journal of Botany, I. 375.—W. G.

the exception of a few appressed scales on the lower surface; about a foot in length. *Petioles* short, scaly. *Peduncles* axillary, solitary, one-flowered, scarcely so long as the petioles, covered with small scales. *Calyx* five-leaved, the three outer leaflets with appressed scalets. *Corolla* white, five-petalled, little longer than the calyx. *Stamina* many, inserted on the base of the petals, anthers large, truncate and opening by two pores at the top. *Ovary* three-celled, many-seeded. *Styles* three.

Obs.—This agrees with the T. pentapetala in having the corolla divided to the base, but the leaves are more acuminate, and the flowers are solitary and axillary.

TERNSTRŒMIA SERRATA. *(W. J.)*

Folliis obovato-oblongis cartilagineo-serratis glabris, pedunculis axilaribus binis, floribus monadelphis, laciniis corollæ emarginatis, fructu triloculari.

Frequent on the island of Pulo Nias.

A small tree. Young parts furnished with brownish scales. *Leaves* alternate, petiolate, obovate-oblong, acuminate, serrate with irregular cartilaginous uncinate serratures, smooth, pretty strongly nerved; 7—8 inches long. *Petioles* brown, scaly. *Peduncles* generally two, axillary, one-flowered, slender, about an inch long. *Calyx* five-parted, whitish, leaflets unequal. *Corolla* white, monopetalous, quinquefid, longer than the calyx, cup-shaped, lobes bifid or emarginate, generally oblique. *Stamina* shorter than the corolla, and inserted on its base; filaments united below; anthers oblong, bifid, two-celled, each cell opening at top by an oblique cucullate pore. *Ovary* hairy, three-celled, many-seeded; placentæ central. *Styles* three, longer than the corolla, irregularly bent. *Berry* three-celled, many seeded. *Seeds* angled, foveolate.

Obs.—This differs from the other Sumatran species in having firmer leaves, with stronger nerves and thickened callous serratures. The peduncles are more slender, the styles longer, and the lobes of the corolla obliquely notched.

TERNSTRŒMIA CUSPIDATA. *(W. J.)*

Foliis obovato-ellipticis acuminatis dentato-serratis serraturis apice hamatis, fructibus 5-locularibus, pedunculis axillaribus 1—3 floris.

A tree, young parts ferruginous. *Leaves* petiolate, elliptic ovate, attenuated to the base, broader above, sharply acuminate, serrated, the narrow sharp toothlets generally curved or hooked at their points, smooth, often marked with whitish glandular dots on the nerves, veins, and serratures; 6—8 inches long. *Peduncles* axillary, 1—3 flowered, smooth. *Calyx* 5-parted, segments orbicular. *Corolla* white, monopetalous, 5-parted. *Stamina* numerous; anthers opening by two gaping pores. *Ovary* subglobose, 5-celled, ovula very numerous; placentæ from the inner angle of the cells. *Style* very deeply 5-parted.

Obs.—This species (received from Salumah during the printing of the present sheet) comes very near to the T. serrata; it differs in having the leaves more sharply acuminate, with longer tooth-like serratures, and rather shorter petioles; the peduncles frequently bearing two or three flowers, and not so slender as in the former; and in the 5-celled fruit.

ADINANDRA. *(W. J.)*

Polyandria Monogynia.

Calyx 5-partitus, persistens, basi bibracteatus. *Corolla* pentapetala, petalis basi latis. *Stamina* 30, pluriseriata, subpolyadelpha, interioribus brevioribus; antheris bilocularibus apice mucronatis. *Styles* unicus, subulatus. *Bacca* supera, stylo persistente acuminata, 5-locularis, polysperma, placentis ab angulo interiore loculos bipartientibus.

Arborescens, foliis alternis exstipularibus, floribus axillaribus.

ADINANDRA DUMOSA.

Daun Saribu. *Malay.*

Abundant in thickets throughout Sumatra and various parts of the Malay islands. *Common about Malacca. W. G.*

It grows to be a small tree; the bark is dark brown, and the branches are smooth. *Leaves* alternate, short petioled, elliptic oblong, acute at both ends, sometimes rounded with an obtuse acumen at top, entire or obsoletely serrate, smooth, slightly glaucous beneath, almost veinless; 3—4 inches long. *Stipules* none. *Peduncles* axillary, subsolitary, one flowered, shorter than the leaves, recurved. *Calyx* bibracteate at the base, five-parted, segments thick, subrotund, overlapping each other. *Corolla* white, twice as long as the calyx, erect or conniving, five-petalled, petals ovate oblong, broad at the base, acute. *Stamina* about thirty closely arranged in several circles, the inner ones shorter; filaments divisible to their bases, but closely pressed against each other, sericeously pilose, particularly on their outer side; anthers of the two parallel lobes adnate to the side of the filament, which is prolonged into a mucro at the summit. *Ovary* superior, smooth, five-celled, polysporous; the cells are almost biparted by placentæ which project from the inner angle, and to whose edges the ovula are attached. *Styles* single, subulate. *Stigma* simple. *Berry* globose, embraced at the base by the calyx, and acuminated by the persistent style, five-celled, many-seeded.

Obs.—In general habit and in the texture of the leaves, this plant has some resemblance to Diospyros, but differs widely in fructification.

ADINANDRA SYLVESTRIS.

Adinandra Sylvestris (W. J.) baccis trilocularibus.
Suka ber anak. *Malay.*
A large forest tree found at Moco Moco.

XXXI. HYPERICINEÆ.

ELODEA.* *(Adanson.)*

Hypericinæ. Juss.

This genus, which has been revived by a late author on American Botany, appears to be abundantly distinguished from Hypericum, and to form a good natural division. It is principally characterised by having the stamina united into three phalanges, which alternate with an equal number of nectaries. In the following species the placentation is peculiar: I know not whether the American plants exhibit the same structure, as it is not mentioned in any description which I have seen, but if it should prove on examination that they do, it should form part of the generic character. Loureiro's Hypericum Cochinchinense which undoubtedly belongs to Elodea, appears to be very nearly related to my E. Sumatrana, and his description of the seeds seems to indicate a structure similar to what I have observed. The Hypericum petiolatum of the same author seems also referrible to this genus and to be different from Linnæus's H. petiolatum, which is a native of Brazil. In all the species now referred to Elodea, the generic distinction appears to receive confirmation from certain differences of habit, which may be re-

* Tridesmos, Hooker and Arnott, vide Hooker's Journal of Botany, I. p. 372.—W. G.

marked between them and the true Hyperica, particularly in the colour of the flowers, which in the latter is almost without exception yellow, but in Elodea is often red.

ELODEA SUMATRANA. *(W. J.)*

Foliis subsessilibus oblongis attenuato-acuminatis glabris rigidiusculis, paniculis terminalibus foliosis, staminibus numerosis triadelphis, petalis basi nudis.

Found at Tello Dalam in the island of Pulo Nica.

A large shrub or small tree. Branchlets rather compressed, obscurely four-sided. *Leaves* opposite, almost sessile, oblong, tapering to the point, acute, broad at the base, entire, smooth; nerves proceeding from a middle rib, strong; six or seven inches in length; the surface appears by the aid of the microscope to be dotted with opaque points. *Panicles* terminal, foliose, the lower divisions being axillary; oppositely branched and rigid. *Flowers* dark-red or purple. *Bracts* minute. *Calyx* five-leaved, persistent, leaflets ovate, smooth, the outer ones smaller. *Corolla* cup-shaped, longer than the calyx, five-petaled; petals subrotund, ungues naked, without pore or scale. *Nectaries* three, yellow, inserted below the corolla, and half as large as the petals, subrotund, doubled backwards upon themselves in such a manner as to form a sac which opens behind near the base. *Stamina* numerous; their filaments united for about half their length into three phalanges, which are inserted alternately with the three nectaries; they are a little shorter than the corolla; anthers yellow, two-celled. *Ovary* oblong, three-celled, many-seeded. *Styles* three, diverging. *Stigmata* three, subrotund. *Capsule* oblong, three-celled, each cell containing several seeds as long as the cell and attached to the bottom of the central column; they are thin and flat, disposed regularly one within the other forming concentric circles, which are particularly apparent in the transverse section of the capsule.

Obs.—This curious arrangement of the seeds is not a little remarkable: they lie one within the other like skins of an onion, each occupying the full length and breadth of the cell, but diminishing regularly in size from the outermost to the middle in proportion to the different radius of the circle which it describes round the common centre. They are attached one above the other to the bottom of the cell at its inner angle. The leaves are destitute of pellucid dots, and have their lateral nerves strongly and distinctly marked. The nectaries which alternate with the stamina are very peculiar, being saccate, apparently by being doubled backwards. This species differs from the following and those of America in having no scales at the base of the petals, and from the latter in having numerous stamina. It appears to be nearly related to Loureiro's Hypericum Cochinchinense, which as already observed, belongs to this genus.

ELODEA FORMOSA. *(W. J.)*

Foliis petiolatis lanceolatis subtus glaucis, pedunculis fasciculatis axillaribus, staminibus numerosis triadelphis, nectariis acutis.

Kayo Gaghak. *Lampong.* Sepadas Bunga. *Malay.*

Native of Sumatra.

A small tree with cinereous bark and smooth branchlets. *Leaves* opposite, elliptic oblong, acute, very entire, smooth, glaucous beneath, pellucidly punctate; two and a half inches long; the nerves proceed from a midrib. *Petioles* slender. *Peduncles* axillary and from the axils of fallen leaves, fasciculate, one-flowered, slender, smooth. *Flowers* white with a slight rosy tinge. *Bracts* several at the base of the peduncles. *Calyx* five-leaved, smooth, leaflets acute. *Corolla* five-petaled, longer than the calyx; petals oblong, each furnished with a broad adnate scale a little above the base. *Stamina* numerous, united into three phalanges. *Nec-*

taries three, alternating with the stamineous fascicles, red, acute, carinate behind, fleshy. *Ovary* three-celled, each cell containing several flat ovula lying one within the other, and attached by their bases to the lower part of the axis. *Styles* three, long. *Stigmas* capitate. *Capsules* oblong, crowned by the persistent styles, three-celled, many-seeded. *Seeds* thin, flat attached by their bases to a central triangular column, on which they are inserted alternately in a double series.

Obs.—The arrangement of the ovula is similar to that observed in the E. Sumatrana; they are thin, attached by their bases to the lower part of the cell, suberect, and concentrically disposed, but are inserted rather higher on the axis of the cell than in the former. This species agrees with those of America in having a scale at the base of the petals, but differs in having numerous stamina; it therefore comes nearer to the E. Egyptica *(Hypericum Egypticum Linn.)*

IXONANTHES. *(W. J.)**

Calyx 5 passim 6-partitus, foliolis subrotundis. *Corolla* 5 v. 6-petala, glutinosa. *Stamina* 10 vel 20. *Nectarium* germen cingens. *Stylus* 1. *Capsula* supera, calyce corollâque persistentibus cincta, ovato-acuminata, 5-locularis, 5-valvis, valvularum marginibus introflexis. *Semina* singulo loculo dua, margini interiori dissepimentorum affixa, compressa, in alam membranaceam producta. *Albumen* semini conforme, embryone inverso foliaceo, plano.

Arbores, foliis alternis simplicibus, floribus dichotome corymbosis axillaribus.

IXONANTHES RETICULATA.

Floribus decandris, foliis integerrimis.

Found at Tapanully on the West Coast of Sumatra.

* Appears to be allied to Archytæa, Martius Nov. gen. et sp. 1. 116. t. 37.—W. G.

A tree, with smooth compressed branchlets. *Leaves* alternate, petiolate, elliptic-oblong, emarginate, somewhat attenuated to the base, entire, smooth, firm and rigid with thick revolute edges, shining above, rather glaucous beneath, veins reticulate; about three inches long. *Petioles* short, flattened above. *Stipules* minute, deciduous. *Peduncles* axillary on the younger shoots, much longer than the leaves, smooth, dichotomous at the summit, with a pedicel in the bifurcation, bearing generally about seven flowers, which are small and green. *Calyx* five-parted, segments rounded. *Corolla* glutinous as well as the calyx, five petalled, petals roundish. *Stamina* ten; filaments inserted below the petals; anthers yellow, two-celled. *Ovary* surrounded at the base by a yellow fleshy nectarial ring, five-celled, ten-seeded. *Style* erect. *Stigma* capitate. *Capsule* surrounded at the base by the persistent calyx and corolla somewhat enlarged, oblong, pointed, smooth, five-valved, five-celled, septa formed by the introflexed margins of the valves, cells two-seeded, but frequently only one comes to perfection, they are separated from each other by a ridge which projects from the middle of the valves. *Seeds* compressed, oblong, angular, winged at the lower end. *Albumen* conform to the seed. *Embryo* inverse, central. *Cotyledons* flat, oval. *Radicle* superior, cylindrical, not so long as the cotyledons.

IXONANTHES ICOSANDRA.

Floribus icosandris, foliis crenatis.

Found in the interior of Bencoolen.

A tree. *Leaves* alternate or scattered, short-petioled, lanceolate oblong, emarginate, dentato-crenate, very smooth, shining above; about six inches long. *Stipules* small, deciduous. *Peduncles* axillary, nearly as long as the leaves, bearing a trichotomous umbel or corymb of greenish flowers. *Bracts* small. *Calyx* 5—6 parted. *Corolla* 5—6 petalled, glutinous as well as the calyx, petals spreading subrotund, pale and somewhat transparent. *Stamina* twenty, much longer than the corolla. *Nectarial* ring crenate on the margin by the compression of the filaments which are inserted round it. *Ovary* 5—6 celled, each cell containing two ovula. *Style* a little longer than the stamina. *Stigma* capitate. *Capsule* ovate, pointed, smooth, 5—6 celled, 5—6 valved, margins of the valves introflexed. *Seeds* two in each cell, attached by their middle to the inner edge of the valvular partitions, oblong, membranaceous at both ends, bifid at the lower.

XXXII. DIPTEROCARPEÆ.

DRYOBALANOPS. *Gærtn.*

Monadelphia, Polyandria.

Calyx monophyllus, quinquepartitus, laciniis lineari-lanceolatis, patentibus. *Corolla* pentapetala, petalis basi junctis ovato-lanceolatis, calyce longioribus. *Stamina* plurima, monadelpha, hypogyna, longitudine fere calycis, conniventia; filamenta in annulum brevum coalita; antheræ supra tubum filamentorum subsessiles, longæ, lineares, acutæ, mucrone membranaceo, biloculares. *Ovarium* ovatum, stylo acuminatum, superum, triloculare, loculis disporis. *Stylus* filiformis, staminibus longior. *Stigma* capitatum. *Capsula* calyci grandefacto insidens et cincta laciniis ejusdem in alas spatulatas foliaceas erecto-patentes mutatis, unilocularis, trivalvis, monosperma. *Semen* embryone exalbuminoso, inverso, cotyledonibus inequalibus, chrysaloideo-contortuplicatis.

DRYOBALANOPS CAMPHORA. *Coleb.*

Kapur Barus. *Malay.*

Specimens in flower were sent by Mr. Prince, from Tapanooly, to Sir T. S. Raffles, in 1819, from which the above generic description is taken. I have since had an opportunity of seeing these noble trees in their native forests, but not at the time of flowering, and I am informed that they do not bear above once in three or four years. Mr. Colebrooke's description in the Asiatic Researches, of the tree and fruit, is so complete, that I cannot do better than copy it.

" *Trunk* arboreous. *Bark* brownish. *Leaves*, superior alternate; inferior ones opposite; elliptic, obtusely acuminate, parallel-veined, entire, smooth; three to seven inches long: one or two broad. *Petiole* short. *Stipules* in pairs, subulate, caducous. *Perianth* one-leaved, five-parted, persistent. *Capsule* superior, ovate, woody, fibrous, finely streaked with longitudinal furrows, embraced at the base by the calycine hemispherical cup, and surrounded by its enlarged leaflets, which are converted into a large, foliaceous, spatulate, rigid, reflex wings, one-celled: three-valved. *Seed* solitary, conform to the cavity of the capsule. *Integument* simple, thin, membranaceous, thickened along one side, and thence penetrating to the axis, and continued between the interior fold of the cotyledons. *Perisperm* none. *Embryo* conform to the seed, inverse, milk-white. *Cotyledons* two, unequal, *almond*—fleshy thick, chrysaloid—contortuplicate; the *exterior* one larger, convolute, and cherishing the interior one, smooth without, wrinkled within: the *interior* one much smaller, wrinkled on both sides, uniform or round cordate (as is the exterior one, if its folds be expanded). *Plumule* simple, conical, two-leaved. *Radicle* near the summit towards the back, columnar, a little curved, and ending in a short conical lip; ascending." *As. Res.* XII. p. 539.

To this accurate and ample description, I can only add the particulars which the examination of flowering specimens has enabled me to supply. The flowers are terminal and axillary, forming a kind of panicle at the extremity of the branches. The Corolla is five-petalled, longer than the calyx, the petals, ovate lanceolate, and in some degree adnate or connected together at the base. The Stamina are numerous, and have their filaments united into a ring, in which particular it differs from the genera most nearly related to it. The anthers are nearly sessile on the tube of the filaments, conniving into a conical head round the style, and terminating in acute, membranaceous points. The ovary is three-celled, containing two ovula in each cell. The style is longer than the stamina, and crowned by a capitate stigma.

In Sumatra the Camphor-trees are confined to the country of the Battas, which extends about a degree and a half immediately to the North of the Equator. They are also found in Borneo in nearly the same parallel of latitude, and I have reason to believe that there are some in the neighbourhood of Singapore and Johore. This valuable tree is not known to exist in any other part of the world, and on this account, as well as the difficulty of obtaining its produce, this kind of Camphor bears an exorbitant price. It is all carried to China, where it sells for about twelve times as much as that of Japan.

This Camphor is found in a concrete state, occupying cavities and fissures in the heart of the tree. In order to obtain it, the tree is felled and split into lengths, to allow of the extraction of the crystallized masses. The same trees yield both the concrete substance and an oil, which is supposed to be the first stage of the formation of the Camphor. The Sumatran Camphor is little known in Europe, and it would perhaps deserve examination to ascertain how far its properties differ from those of the common kind. It appears to be less volatile, and its odour is not so diffusive. A quantity of it has been recently forwarded to Sir E. Home, for the purpose of experiment.

For the natural affinities and a more detailed account of the method of procuring the Camphor,* I may refer to the able paper already quoted. It belongs to the same natural family with *Dipterocarpus*, *Shorea*, &c.

* The following particulars concerning the extraction of the Camphor, were communicated by Mr. Prince, Resident at *Tapanooly*, to Dr. Roxburgh, and are extracted from the 12th vol. of the Asiatic Researches above referred to :—

" This tree grows spontaneously in the forests; and is to be found in abundance from the back of *Ayer Bongey*, as far north as *Bacongan*, a distance of two hundred and fifty miles. It may be classed among the tallest and largest trees that grow on this coast; several within daily view measuring six or seven feet diameter. Before it acquires such dimensions, its age is conjectured to be very considerable; but it will produce *Camphor* at a much earlier period, when the tree does not exceed two and two feet and a half in diameter. The same tree which yields the Oil would have afforded *Camphor*, if unmolested; the former being supposed to be the first stage of the latter's forming, and is consequently found in younger trees. The natives have no certain means of ascertaining the tree which produces either the one or the other; although there are some men, styled *Toongoo Nyr Cappoor*, who pretend to that knowledge; but they cannot give any reasons for their judgment, beyond favourable dreams which superstition has rendered infallible: and it must be admitted that the success of this description of people, in discovering and procuring, is greater than the majority of those who go in search of the *Camphor;* the distinction may have arisen from the peculiar favour of fortune to some individuals over others, as in most other circumstances of life, from whence they have acquired a celebrity, otherwise they could give some rational explanation of their superior success. Both *Oil* and *Camphor* are found in the heart of the tree, occupying a vacuum which, in others is frequently filled with pitch; but it does not extend to the whole length; on the contrary, they are found in small portions, of a foot, and a foot and a half long, at certain distances. The method of extracting the Oil is merely by making a deep incision with a *biliong* or *Malay* axe, in the tree, about fourteen or eighteen feet from the ground, till near the heart, where a deeper incision is made with a small aperture; and the Oil, if any in the tree, immediately gushes out, and is received in bamboos, or any

XXXIII. DILLENIACEÆ.

ACROTREMA. (*W. J.*)

Dodecandria Trigynia.

Calyx pentaphyllus. *Corolla* pentapetala patens. *Stamina* quindecim, erecta, filamentis brevibus, antheris longis linearibus apice biporis. *Ovaria* tria, distincta, 2-spora, ovulis angulo interiori affixis. *Styli* tres. *Stigmata* simplicia. *Capsulae* uniloculares.

Herba acaulis pilosa, pedunculis racemoso-multifloris.

Genus Saxifrageis affine, numero partium inusitato distinctum.

ACROTREMA COSTATUM. (*W. J.*)

Found on hills, and among rocks at Pulo Pinang.

Root tapering, sending out a few fibres. *Stem* scarcely any. *Leaves* alternate, spreading, short-petioled, six inches long, oblong-obovate, obtuse, sagittate at the base, dentato-serrate, somewhat ciliate, pilose, furnished with a short

other utensil better approved of; in this manner, a party proceeds through the woods wounding the Camphor-tree till they attain their object. The *Camphor* is procured in pretty nearly the same way. The trees are cut to the heart about the same height from the ground as in the former instance, till the *Camphor* is seen; hundreds may be thus mutilated before the sought-for tree is discovered; when attained, it is felled, and cut in junks of a fathom long, which are again split, and the *Camphor* is found in the heart, occupying a space in circumference of the thickness of a man's arm. The produce of a middling-sized tree is about eight *China catties*, or nearly eleven pounds, and of a large one, double that quantity. The *Camphor* thus found is called *Se Taniong*. It is often the case that the trees which have been cut, and left standing in that state, will produce *Camphor* in seven or eight years after, which is distinguished by the name of *Oogar*, but is inferior in appearance, though of the same quality. The sorts of *Camphor* called *belly* and *foot*, are the scrapings of the wood that surrounds it.

tomentum and also with more remote longer appressed hairs; the nerves are very hairy, parallel, and terminate in the denticulae of the margin. *Petioles* short, sheathing; their margins dilated into membranaceous auricles which might be considered adnate stipules. *Peduncles* or scapes central, erect, from three to six inches high, pilose, recurved at the summit, eight or ten flowered. *Flowers* yellow, pedicellate, racemose. *Calyx* five-leaved, pilose, leaflets ovate acute. *Corolla* yellow, spreading, five-petalled, petals broader above, lanceolate. *Stamina* fifteen, erect, hypogynous; filaments very short. *Anthers* very long, linear, two-celled, opening by two pores at the top. *Ovaries* three, distinct, superior, one-celled, two-seeded, each bearing one style of the height of the stamina. *Ovula* attached to the inner angles. *Stigmata* simple. *Capsules* three.

Obs.—I am at a loss to determine the exact affinities of this plant; it has the habit of the Saxifrageæ, but the number of both the male and female parts of fructification is greater by one-third, and the ovaries are distinct.

TETRACERA ARBORESCENS. (*W. J.*)

Polyandria Tetragynia.

Foliis obovatis integerrimis glabris, floribus paniculatis axillaribus et terminalibus, calycibus pentaphyllis.

Found near the shores of the Bay of Tapanooly in Sumatra.

Arborescent. *Leaves* alternate, petioled, about three inches long, oblong-obovate, rounded at the apex and terminating in a short point, very entire with reflex edges, smooth, shining above, coriaceous and firm, veins reticulate, nerves somewhat pilose on the under surface. *Petioles* short. *Panicles* axillary and terminal, many flowered. *Calyx* five-leaved, spreading, persistent, smooth. *Stamina* numerous. *Capsules* generally three, smooth and shining, roundish ovate, opening on one side containing a single seed attached to the base of the capsule, and enveloped in a pale yellowish laciniate arillus. The vestiges of two or three abortive ovula are observable in the bottom of the capsule.

WORMIA EXCELSA, (*W. J.*)

N. O. Dilleniaceæ Dec.

Foliis ellipticis acutis denticulatis, pedunculis multifloris oppositifoliis, pedicellis clavatis.

Kayu Sipur. *Malay.*

In forests near Bencoolen.

A large tree. *Leaves* alternate, petiolate from elliptic ovate to elliptic oblong, acute, denticulate or obsoletely serrate, smooth; 8—12 inches long. *Petioles* deeply channeled above. *Peduncles* oppositifolious at the summit of the branches, many-flowered; pedicels alternate, clavate. *Flowers* large, yellow, three inches in diameter. *Calyx* 5-leaved, leaflets subrotund, concave unequal. *Corolla* 5-petalled, spreading, petals ovate-oblong. *Stamina* very numerous, the outer ones yellow, spreading, shorter than the inner which are purple, erect and recurved above; anthers, lobes adnate to the filament. *Ovaries* 6—8 connate, polysporous. *Stigmas* as many, flat, recurved, diverging. *Capsules* 6—8, whitish semitransparent, bursting at the inner angle, and then spreading, containing no pulp. *Seeds* attached to the edges of the capsules, enveloped in a red aril.

Obs.—This is a large forest tree which yields excellent timber, the wood having some resemblance to oak.

WORMIA PULCHELLA. (*W. J.*)

Foliis obovatis integerrimis, pedunculis solitariis axillaribus unifloris, floribus pentagynis.

Found at Natal.

A small tree. *Branches* round, rather smooth. *Leaves* alternate, petiolate, oblong-obovate, rounded at top, with a short blunt point, sometimes retuse, very entire, very smooth, thick and rather coriaceous ; about five inches long. *Petioles* smooth, channeled and marginate above, less than an inch in length. *Peduncles* axillary and subterminal, solitary, one-flowered, angled, about two inches long. *Bracts* none. *Calyx* 5-leaved, leaflets subrotund, smooth. *Corolla* five-petaled. *Stamina* numerous. *Ovaries* five, collected into a globe, terminating in as many flat reflexed diverging styles. *Stigma* thickened. *Capsules* five, of a light semitransparent rose colour, bursting at their angles, and then spreading like a corolla. *Seeds* attached to the inner edges of the capsules, a few only coming to perfection, partly embraced by a red pulpy aril which originates from the umbilicus.

Obs.—This species is very beautiful when in fruit, from the delicacy of the colours which the capsules exhibit.

XXXIV. ANONACEÆ.

UVARIA HIRSUTA. *(W. J.)*

Polyandria Polygynia.

Tota hirsuta etiam calyces fructusque pilis erectis, floribus subsolitariis, petalis patentibus subequalibus, foliis ovato-oblongis basi cordatis.

Pulo Pinang.

The whole plant is hirsute with long erect hairs. *Branches* round. *Leaves* alternate, short-petioled, ovate-oblong, acuminate, cordate at the base, entire, simply pilose above, hirsute beneath with stellate fasciculate hairs. *Flowers* lateral, almost solitary, short-peduncled. *Bracts* lanceolate acute. *Calyx* hairy as well as the peduncles and bracts, bursting irregularly, often in two segments. *Corolla* of a deep red color, six-petalled, petals spreading, lanceolate, acute. *Stamina* numerous with long linear anthers. *Germina* numerous; styles and stigmata the same. *Berries* numerous, long pedicelled, oblong, hirsute with ferruginous hairs, many-seeded. *Seeds* arranged in a double longitudinal series.

XXXV. TILIACEÆ.

MICROCOS TOMENTOSA. *Smith in Rees' Cycl.*

Polyandria Monogynia.

N. O. Tiliaceæ.

Foliis trinerviis subtus villosis.

Grewia Paniculata. *Roxb : Hort : Beng : p.* 93.

Native of Pulo Pinang.

A moderate sized tree with rough bark, the branchlets villous and ferruginous. Leaves alternate, short petioled, elliptic oblong, broader above, with a short acumen, three-nerved, dentate, serrate towards the apex, scarcely pilose above, densely villous beneath, the hairs divaricate and often stellate. Stipules linear, generally bifid. Panicles terminal. Flowers for the most part in threes, involucred with deciduous trifid and linear bracts. Calyx five-leaved, spreading, leaflets oblong concave. Corolla yellow, less than the calyx, petals ovate, unguiculate and without nectaries. Stamina numerous, inserted below the germen. Germen stipitate. Drupe containing a nut marked externally with five lines, three-celled, three-seeded.

This agrees perfectly with the excellent description given by Sir J. E. Smith in Rees' Cyclopedia from a specimen preserved in the herbarium of the younger Linneus, unaccompanied with any notice concerning its native country, and also deficient in fruit. Its affinity to the original species of Microcos is fully proved on actual examination of the fruit, and this exact agreement affords a further confirmation of the propriety of separating Microcos from Grewia. The terminal inflorescence and involucral bracteæ form a peculiar and distinctive character: in this species the flowers are generally three together, and are surrounded by three trifid bracteæ, within which are found three other smaller and linear ones.

MICROCOS GLABRA. *(W. J).*

Foliis trinerviis serratis glabris.

Found on the Island of Carnicobar.

It nearly resembles the M. Tomentosa, differing chiefly in having smooth leaves. In inflorescence and fruit it is entirely similar. The young branches are tomentose. There are frequently flowers in the uppermost axils.

XXXVI. STERCULIACEÆ.

STERCULIA COCCINEA. *Roxb.*

Monadelphia Decandria.

Foliis oblongo-lanceolatis obtuse acuminatis glabris, racemis axillaribus et lateralibus nutantibus, laciniis calycinis linearibus patentibus, folliculis coccineis.

Native of Pulo Pinang.

A large smooth shrub. Leaves at the summits of the branches, alternate, petiolate 8—10 inches long, oblong lanceolate, obtusely acuminate, abrupt at the base, entire, smooth on both sides. Petioles thickened at the ends. Racemes lateral from among the leaves at the end of the branch, drooping; flowers alternate, pedicellate; pedicels articulate. Tube of the calyx somewhat ventricose, limb five-parted, laciniæ linear with revolute margins, twice as long as the tube, spreading. Corolla none. Stamina 10, sessile on the stipes of the germen. Ovarium stipitate on a column of the length of the tube, subrotund, five-lobed, crowned with a declinate style. Stigmata five, linear, revolute. Fruit composed of five nearly equal crimson follicles, each of which contains two or three seeds, which are enveloped in a black pulpy arillus.

Dr. Roxburgh's S. coccinea is a native of Sylhet, and is said to have panicled flowers and 4-8 seeded follicles. My plant agrees however so well in every other respect that I cannot consider it to be really distinct, as those differences may be merely the effect of a less favorable situation.

STERCULIA ANGUSTIFOLIA. *Roxb.*

Foliis lanceolatis superne latioribus acuminatis subtus villosis, racemis extra axillaribus nutantibus, laciniis calycinis linearibus apice connexis.

Unting Unting Besar. *Malay.*

Native of Pulo Pinang.

A tree. Branches covered with ferruginous wool. Leaves at the summits of the branches, alternate, petiolate, lanceolate, broader above, acuminate, narrowing to the base and there rounded, entire, smooth (in adult leaves) above, covered beneath with stellate hairs. Petioles thickened at both ends, ferruginously villous as well as the nerve of the leaf. Stipules linear, acute, shorter than the petiole, deciduous. Racemes (*panicles?*) near the extremity of the branches lateral or extra axillary, branched, lax, ferruginous. Bracts linear lanceolate, acute. Calyx deeply 5-parted, tomentose, laciniæ long, linear, acute, connected at their points and gaping at the sides, greenish yellow, with a red spot at the base. Corolla none. Stamina 10, on a curved column. Ovarium stipitate, tomentose, 5-lobed. Style declinate. Stigma five-lobed.

A great proportion of the flowers are male, and I have not seen the perfect fruit.

Dr. Roxburgh's plant was a native of Chittagong.

XXXVII. ELÆOCARPEÆ.

ELÆOCARPUS NITIDUS. *(W. J.)*

Polyandria Monogynia.

Foliis ovato-lanceolatis serratis, racemis axillaribus foliis brevioribus, staminibus quindecim, nuce quinque-loculari loculis plerumque quatuor abortivis.

Bua Manik. *Malay.*

Native of Pulo Pinang.

A tree of moderate size, with grey bark and round smooth branches. *Leaves* alternate, petiolate, three or four inches long, ovate-lanceolate, acuminate, obtusely serrate, attenuated to the base, very smooth. *Stipules* none. *Racemes* simple, axillary, secund, shorter than the leaves. *Flowers* white, short-pedicelled. *Calyx* deeply five-parted, laciniæ linear, acute. *Corolla* five-petaled, fimbriated at the summit. *Nectary* of five yellow retuse glands surrounding the ovary. *Stamina* fifteen, erect; ten are inserted by pairs between the glands of the nectary, the remaining five between those glands and the ovary. *Anthers* linear, bilamellate at the summit. *Style* as long as the calyx. *Stigma* simple. *Drupe* globose, containing a five-celled nut, which is rugose, and marked with five obtuse longitudinal ridges; in general only one cell is fertile and contains a single seed. *Seed* furnished with albumen; embryo inverse, with flat cotyledons and superior radicle.

Obs.—This may perhaps be one of the smaller varieties of Ganitrus mentioned by Rumphius; it differs from *E. Ganitrus* of Roxburgh, who quotes Rumphius III. t. 10, in the number of the stamina, the position of the racemes, and the number of fertile cells in the nut. Compare Adenodus sylvestris, *Loureiro Fl: Cochinch:* p. 294. which agrees in the number of the stamina. I suspect Gaertner must have fallen into an eror in representing the embryo erect in his Ganitrus, in this it is certainly inverse.

MONOCERA. *(W. J.)*

Elæocarpi Species.

Calyx pentaphyllus. *Corolla* pentapetala, petalis apice laciniatis, saepe sericeis. *Stamina* plura, antheris apice dehiscentibus, unicornibus, valvula altera majore. *Ovarium* basi glandulis cinctum, biloculare, polysporum. *Drupa* nuce 1—2 sperma.

This genus whose characters appear to be sufficiently distinct, will include, besides the following new species, several hitherto referred to Elæocarpus, viz. *E. Monocera, Cavanilles,* the separation of which has already been suggested, and of which the specific name may be appropriately adopted for the geuus, *E. rugosus, E. aristatus,* and *E. bilocularis* of *Roxburgh,* probably also *E. grandiflorus* and *E. reticulatus,* Sir *J. E. Smith in Rees' Cyclopedia.* The E. dentatus, *Dicera dentata, Forst:* may also belong to this, if, as remarked by Sir J. E. Smith, *Rees' Cycl. in loco,* the anthers have only one of their valves awned, not both equal, as originally stated by Forster. His capsule may perhaps be only the ovary, which will then agree with the present genus.

MONOCERA PETIOLATA. (*W. J.*)

Foliis longe petiolatis ovato-lanceolatis integris glabris, racemis axillaribus foliis brevioribus, petalis medio intus incrassatis villosis.

Native of Pulo Pinang.

A lofty tree. *Leaves* petiolate, alternate or scattered, eight or nine inches long exclusive of the petiole, ovate lanceolate, generally obtusely acuminate, entire, very smooth, deep green and shining above, with lucid nerves and veins which are destitute of glands. *Petioles* four inches long, smooth, thickened at the base and summit. *Racemes* axillary, as long as the petioles; flowers pedicellate, turning one way. *Calyx* white, five-leaved, leaflets lanceolate acuminate. *Corolla* white, five-petalled, as long as the calyx, petals ovate lanceolate, fringed at the point, sericeous without, thickened along the middle and covered with white hairs within, margins inflexed. Ten thick subrotund yellow glands surround the stamina. *Stamina* numerous, (25—30) inserted within the glands, erect, shorter than the petals; filaments short; anthers longer, linear, bivalved at the apex, the outer valve elongated, the inner short and acute. *Style* filiform, longer than the stamina. *Stigma* acute. *Ovary* ovate, two-celled many-seeded. *Drupe* ovate, containing a smooth, one-celled, 1-2 seeded nut.

MONOCERA FERRUGINEA. (*W. J.*)

Foliis oblongo-ovatis acuminatis integris subtus, cum pedunculis ramulisque ferrugineo-villosis, racemis axillaribus foliis brevioribus.

Found at Singapore.

A tree. *Branchlets* rusty and villous. *Leaves* irregularly alternate, petiolate, oblong-ovate, acuminate, six or seven inches long, entire with revolute edges, smooth above, ferruginously villous below, nerves without glands. *Petioles* from two to two and a half inches long, villous and ferruginous, thickened under the leaf. *Racemes* axillary, shorter than the leaves. *Flowers* pedicelled. *Peduncles* and pedicels ferruginous. *Drupe* oval, of the form of an olive but smaller, with a single rather smooth nut, which generally contains but one perfect seed; sometimes there is a second smaller, and the vestiges of the partition and abortive ovula can almost always be observed. *Seed* oblong, pointed above. Albumen conform; *Embryo* inverse, extending nearly the whole length of the albumen. *Cotyledons* flat, oblong with a distinct nerve along their middle. *Radicle* superior clavato-cylindrical, much shorter than the cotyledons.

Obs.—I have not seen the flowers of this species, but its fruit and general resemblance to the preceding leave no doubt as to the genus, and its characters are sufficiently marked to distinguish it from the others.

XXXVIII. EUPHORBIACEÆ.

ROTTLERA ALBA. *Roxb.*

Foliis rhomboideo-ovatis subtus incanis, paniculis terminalibus laxis, fructibus stellato-pilosis spinis mollibus chinatis.

Baleangin. *Malay.*

Sumatra and Pulo Pinang.

A tree of moderate size. Branches roundish, furfuraceous with appressed stellate hairs. Leaves alternate, petiolate, rhomboidal-ovate, often approaching to three-lobed, long acuminate, rounded and biglandular at the base where the petiole is inserted within the margin, remotely denticulate towards the apex, smooth and green above, hoary and tomentose beneath. The young leaves have stellate deciduous hairs on the upper surface. Petioles long. Stipules none. Panicles terminal, or from the bifurcations of the branches, peduncled, lax, and drooping. Flowers small, numerous, short pedicelled. Bracts small, and together with the peduncles and calyx sprinkled with furfuraceous tomentum.

Male. Calyx 3-phyllous, leaflets ovate acute. Stamina numerous in the centre of the flowers. Anthers subrotund.

Female. Calyx 4, sometimes 5-parted, erect, laciniæ acute. Styles three, diverging, hirsute above. Stigmata simple. Fruit tricoccous, beset with soft flexible spines, and covered with stellate hairs, three-seeded. Seeds subrotund, attached to the superior and internal angle of the cells.

ENCHIDIUM. *(W. J.)*

Monoecia Monadelphia. N. O. Euphorbiaceæ. Juss :

Calyx 5-partitus. *Corolla* 5-partita. *Nectarium* glandulæ decem. *MAS* : *Filamentum* columnare, 10-antheriferum ; antheris radiatim patentibus. *FEMINA*. *Ovarium* trilobum. *Styli* 3. *Stigmata* 6.

Flores masculi et feminei in eadem spica.

ENCHIDIDUM VERTICILLATUM.

Arbor spiculorum. *Rumph : Amb : III. p.* 167. *t.* 106.

Not unfrequent on hills in Sumatra and the Malay islands.

A large shrub ; I have not met with any that had attained to so great a size as mentioned by Rumphius. The *Leaves* are arranged in a kind of irregular verticils at different distances along the branches, as exhibited in the figure quoted ; on the young shoots they are sometimes irregularly disposed along the whole length ; they are petiolate, lanceolate, acuminate, very entire, very smooth, firm and somewhat leathery, of various length, generally about 6 inches long by 2½ broad. *Petioles* from 1 to 2½ inches long, flattened above, striated. *Spikes* from among the upper verticils of leaves, bearing both male and female flowers, the former lowermost, all pedicellate. *Calyx* 5-parted. *Corolla* purple towards the centre, 5-parted, furnished with 10 callous nectaries or glands at the base. In the *male* the filament is columnar, bearing 10 anthers which diverge in a radiated circle round the submit. The *female* has a 3-lobed ovary surmounted by 3 styles with bifid stigmata.

Obs.—There can be little doubt of the identity of this plant with Rumphius's Arbor spicularum, of which he says he was never able to procure the flower. I have seen great numbers of these plants in the woods, but only once was successful in observing the flower, and have never met with the fruit. As the spike however fortunately contained both male and female flowers, its characters have been sufficiently determined to assign its proper place. It comes nearest to Cluytia, but differs in the corolla and in having ten anthers with filaments united into a central column. Both its fructification and habit appear to distinguish it from all the present genera of the Euphorbiaceous family.

XXXIX. STILAGINEÆ.

ANTIDESMA FRUTESCENS. *(W. J.)*

Frutescens, foliis oblongo-ovalibus basi rotundatis supra glabris, racemis terminalibus et axillaribus subpaniculatis geminis solitariisque, nectarii glandulis quinis cum staminibus alternantibus.

Bencoolen.

A small dioecious shrub not exceeding a few feet in height. *Branchlets* tomentose. *Leaves* alternate, petiolate, oblong-oval, rounded and sometimes subcordate at the base, acute, sometimes terminated by a short mucro or awn, entire, smooth above, subtomentose beneath, chiefly on the nerves; three inches long. *Stipules* long, subulate, acute. *Racemes* axillary and terminal, geminate and solitary, somewhat panicled, tomentose; when geminate, the outer raceme is simple, and the inner branched; male racemes generally longer than the leaves, female ones shorter. *Panicles* solitary. *Bracts* shorter than the pedicels. *Male, Calyx* 5-parted, tomentose. *Nectary* of five yellow pilose glands alternating with the stamina. *Stamina* 5; filaments much longer than the calyx; anthers bifid, cells bursting transversely on the summits of the lobes. *Pistil* abortive, pilose. *Female, Perianth* 5-parted. *Ovary* superior, villous, oblong-ovate, compressed, one-celled, vesicular, containing two ovula which are attached close together to one side near the top, and hang forward into the cell which is in great part empty and inflated. *Styles* 2, one often bifid. *Drupe* subglose, purplish, about the size of a pepper corn; nut 1—2 seeded.

Obs.—It has considerable resemblance to Roxburgh's *A. pubescens;* that however is a tree, while this is a small shrub. The most important difference appears to be in the nectary of the male flowers.

XL. FLACOURTIANEÆ.

FLACOURTIA INERMIS. *Roxb.*

Arborescens inermis, floribus hermaphroditis fasciculatis axillaribus, foliis ovatis serratis glabris.

Koorkup. *Malay.*

Sumatra and Pulo Pinang.

A tree of moderate size. Leaves alternate, short petioled, ovate, obtusely acuminate, with large blunt serratures, very smooth, lucid, from six to eight inches in length. Peduncles fasciculate in the axils, many flowered. Flowers hermaphrodite. Calyx 4-leaved, spreading, somewhat tomentose, leaflets subrotund, sharpish. Corolla none. Nectary composed of numerous small subrotund orange colored glands, situated at the base of the calyx and surrounding stamina. Stamina umerous, (20—30) hypogynous, longer than the calyx; filaments white, anthers yellow, subrotund. Ovary superior, ovate, crowned with 4—5 short thick diverging styles; stigmata capitate, two-lobed. Berry reddish purple, with a juicy acid flesh, in which are imbedded from 8 to 10 pyrenæ according to the number of the styles.

The fruit of this though rather too acid to be eaten in its raw state, is much esteemed in tarts and pies.

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*On some remarkable Plants in the H. C. Botanic Gardens, Calcutta.** *By* W. Griffith, Esq., *F. L. S., Memb. Acad. Nat. Curios., Royal Ratisb. Bot. Soc., Assist. Srug. Madras Establishment.*

JENKINSIA.

FAMILIA NATURALIS—THYMELEÆ.

Char: Gen:—*Flores* dioici. *Perianthium* calyculo vel involucello cinctum; masculum hypocrateriforme, fauce impervia esquamata. *Stamina* totidem alternantia! fauci inserta, nullo modo inclusa. *Fœmineum* suburceolatum, pro-

* Acting on the law established in Zoology, on the authority of the Committee of the British Association, (herewith quoted,) and which is applicable with equal correctness to the sister science, I have omitted altogether the MSS. names the plants, now for the first time described, bear in these Gardens, because they do not appear to have been established on descriptions, much less on definition.

" *Names not clearly defined may be changed.*—Unless a species or group is intelligibly defined when the name is given, it cannot be recognized by others, and the signification of the name is consequently lost. Two things are necessary before a zoological term can acquire any authority; viz. *definition* and *publication.* Definition properly implies a distinct exposition of essential characters, and in all cases we conceive this to be indispensable, although some authors maintain that a mere enumeration of the component species, or even of a single type, is sufficient funde 4—5 partitum. *Stigma* terminale. *Ovula* 2, pendula. *Drupa* nuda, putamine areolato. *Albumen* copiosum.

Frutex *volubilis*. Folia *alterna*, *oblonga*. Capituli *florum nudi, racemosim dispositi, longiuscule pedunculati*. Flores *virides, inconspicui*. Baccæ *miniatæ*. Cotyledones *planæ*.

Jenkinsia Assamica.

Descr:—Frutex scandens, volubilis; corticis tenacis superficies paleis brevibus sub-asperata.

Folia alterna; petiolus paululum supra basin articulatus ibidemque incrassatus, teretiusculus; lamina oblongo-obovata, (vel f. superiorum oblongo-lanceolata,) subintegra, sæpius oblique acuminata cum mucrone obtusiusculo, longitudine 6½ uncialis, latitudine 3½ uncialis; venæ secondariæ arcuatim nexæ, interveniis venulis tertiariis subtransversis irregularibus divisis, cæterum reticulatis.

Inflorescentia sæpius supra-axillaris, dioica, racemosa, interdum subumbelliformis. Pedunculi bractea inconspicua suffulti. Flores masculi capituli cujusque numerosi, virides, inconspicui, basi calyculo 5-dentato vel 5-phyllo cincti. Perianthium 4—5 partitum, laciniis nigro punctulatis. Stamina 4—5, cum sepalis alternantia. Filamenta brevia, basi quasi connata et faucem obclaudentia, patentia. Antheræ lineari-acuminatæ, biloculares.

Flores fœminei non visi. Fructus capituli cujusque subquini, pedunculum subuncialem furfuraceum terminantes, drupacei, stipitati, oblongo-ovati vel elliptici, compressi, apice coronati stylo brevi et stigmate terminali discoideo lineis 4 cruciatis notato, basi stipati perianthio persistentiore profunde 4—5 partito reflexo; circa hujus basin calyculus

to authenticate a genus. To constitute *publication*, nothing short of the insertion of the above particulars *in a printed book* can be held sufficient." And with regard to MSS. names it is distinctly stated that they "are in all cases liable to create confusion, and it is therefore much to be desired that the practice of using them should be avoided in future." —Report, 1842. On Zoological nomenclature, p. 9.

ad basin fere 4-partitus, laciniis cum perianthii laciniis alternantibus. Stipes drupæ tubum perianthii implet et apicem versus dentes minutos sepalis alternos exhibet. Caro mediocris. Putamen angulatum, conspicue reticulato-areolatum. Semen pendulum, ovulo abortivo hinc adjecto; tegumentum simplex, tenuissimum, raphe lineari semi-completa* notatum, et chalaza brunnea indistincta. Albumen carnosum, copiosum. Embryonis orthotropi radicula brevis supera, rotunda. Cotyledones planæ. Plumula inconspicua.

Hab.—Sylvæ prope Sadiya, regionis Assamicæ superioris.

This genus is dedicated to Major Jenkins, as a mark of respect for his great exertions in investigating the Botany of the province, over the affairs of which he so successfully presides.

The plant was first found during the visit of the Tea Deputation to Upper Assam, subsequently, (A. D. 1836), I ascertained that it was not uncommon in the forests between Sadiya and the Mishmee Mountains. It also appears to be a native of Sylhet or the Khasiya Hills; the specimen, from which the drawing of the male Plant in the H. C. Library was made, having, I am informed, been procured from that quarter.

The genus appears to me easily distinguishable from any other of the family,† by the calyculus, the structure of

* This is the ordinary form of raphe. But as instances are not uncommon in which the raphe is continued onwards to the true apex of the ovulum, in which case I call it "raphe completa," the above distinction in terms appears to me necessary. From this form again, those require to be distinguished in which the raphe does not apparently cease at the chalaza, but becomes ramified in the outer integument. The most important particular in the raphe completa is, that its termination does not obviously correspond with the apex of the cotyledons.

† The nature of the fruit of this family appears to me not sufficiently attended to in Endlicher's Gen: Plantarum. For instance in Daphne cannabina and viridiflora it appears to me to be a one-seeded berry, the seed coat being the indurated part; yet it is described as a drupe.

the male flowers, the situation of the stamina, and the copious albumen. Lagetta is the only genus recorded as presenting more than one ovulum.

The description of the male flower should be viewed with doubt, since the tube of the so-called hypocrateriform perianth may be a pedicel, which view is suggested by the drawing from which this part of the description was taken. And this is perhaps also suggested by the situation of the abortive stamina of the female flower, which are to be found in the form of minute projections from the surface of the stalk of the fruit close to its apex. This seems to me to indicate a tendency to separation in the verticilli of which the flower is composed.

The other plants of this family that I have met with on the N. E. frontier and Straits of Malacca, localities that, however distant, present remarkable affinities in vegetable forms, are—

Daphne cannabina, Lour. Bootan. Khasiya Hills.
——— involucrata, Wall. Khasiya Hills.
——— sp. ———— Naga Hills.
——— Gardneri, Wall. Bootan.
——— ———————— Mishmee Mountains.
——— viridiflora, Wall. Mergui.
Linostoma decandrum. Wall. Khasiya Hills.
———— pauciflorum.* Singapore.
Enkleia malaccensis.† Malacca.

* Linostoma pauciflorum, foliis obovato-ellipticis apice rotundatis cum mucrone cuspidiformi, umbellis 2—3 floris, tubo perianthii et fauce intus glabris.

Hab.—Colles prope Stativa Singapore.

Frutex subscandens. Folia quam folia L. decandri 2—3-plo minora; floralia magis membranacea. Flores graciliores, et squamæ multo minus staminiformes.

† Enkleia.—*Perianthium* tubulosum, limbo 5-fido, (erecto.) *Squamæ faucis* totidem alternantes, (bifidæ vel bilobæ.) *Stamina* 10; filamenta brevia, antheræ seriei superioris tantum semi-exsertæ. *Stylus* subter-

Thymeleæ appear to me to be essentially distinguished by the imbricate perianthium, and the anatropous ovulum (or ovula,) pendulous from near the apex of the ovarial cavity. Consequently I would not follow Dr. Lindley* in referring to Thymeleæ, Exocarpus and Anthobolus, genera characterised by Mr. Brown as "Santalaceis affinia; fructu supero diversa." The remarkable degree of affinity that exists between Leptomeria, an undoubted Santalaceous plant, and Exocarpus, also appears to me to indicate that characters, derived from the situation of the ovarium, will in this family be found of subordinate value. The decided opposition to the above two assumed essential characters presented by Cansiera,† appears to me conclusive against admitting it,

minalis. *Stigma* inclusum, globosum, papillis aperum. *Fructus* drupaceus, nudus. *Semen* exalbuminosum.

Frutex *scandens.* Folia *alterna vel subopposita, subelliptica, subtus pubescentia; venæ secondariæ distinctæ, reticulatio obscura.* Capituli *florum subconici, longe pedunculati, racemoso-paniculati,* 1-*bracteolati.* Pedunculus *florum medium versus folia bina approximata vel subopposita, inconspicua, canaliculata gerens: fructûs elongatus, et ob folia floralia ampliata scariosa reticulata conspicuus.* Flores *capituli cujusque pauci, inconspicui, in pedicellum brevissimum articulati.* Drupa *saepissime solitaria ! subrotunda, basi perianthio spathaceim fisso sæpius stipata.*

Flos fere Gnidiæ. Habitus plantæ fructigeræ linostomaceus.

Enkleia malaccensis.

Hab. Malacca.

Genus Linostomati propinquum, discrepans laciniis perianthii erectis brevibus et minus petaloideis, staminibus subinclusis, et stigmate papilloso incluso. Folia etiam tantum subopposita, et floralia per anthesin inconspicua, nulloque modo petaloidea.

* Intr: Nat: *or*: Ed. 2. p. 195. Dr. Lindley is of opinion that the superior fruit is of more importance than the position of the ovula. But so far as I know, Botanists had not observed the ovula of either of the two genera alluded to, when Dr. Lindley recorded this remark. It would indeed appear from Endlicher's Genera, that the observations have not been made up to this time.

† Cansiera.—*Perianthium* tubuloso-urceolatum, 4-fidum (æstivatione valvatum.) *Stamina* 4, perianthii laciniis opposita. *Glandulæ* vel

as the majority of Botanists appear to do, among Thymeleæ: and if its obvious affinity with Leptonium* and of

squamæ hypogynæ totidem alternantes. *Ovulum* 1, nucleare, pendulum e placenta centrali libera. *Embryo* inversus in axi albuminis carnosi. *Flores* spicati, solitarii in axillis bractearum.

Frutices *scandentes*. Folia *alterna, ovato-acuminata*. Drupa *perianthio basi stipata*. Cotyledones *(saltem in planta malaccensi) ternæ!*

C. zyziphifolia, pubescens, foliis ovatis breviter acuminatis, drupis globosis.

Hab. Malacca.

Mr. Bentham[1] refers this genus to Olacineæ, describing it as having a minute calyx; it forms with Opilia his second group Opilieæ.

The third group Icacineæ, in which Mr. Bentham, I believe correctly, includes Gomphandra, (which will have, probably, to give way to Stemonurus Blume,) cannot in my opinion be admitted into Olacineæ, owing among other things to the very different position and structure of their ovula, the apex of the nucleus of which corresponds in direction with the radicle of the embryo, exhibiting an instance of "embryo orthotropus, radicula supera." On the want of correspondence in direction between the apex of the nucleus and the radicle of the embryo in Santalaceæ, and the group to which I have alluded in this communication, and on the extraordinary modifications in which it results, at least in Santalum, Osyris and Thesium, I am disposed to attach great importance.

Of the family Olacineæ I have an undescribed genus, (No. 366, 849a Herb. Mergui,) very remarkable for the albumen being divided into a number of lobes, between which dips the very fine integument, which is as remarkable an instance as any hitherto recorded, of the presence of spiral cells and vessels.

Mr. Bentham attributes to Olacineæ a simple pistillum, but to me it appears as compound, as I take it to be in Santalaceæ. So that it may be said that the ovarium of Olax, as well as that of Schœpfia among Santalaceæ, has partial true rather than partial spurious septa.

I have only to add that I came to the conclusion regarding the ovulum of Cansiera and Leptonium, and the affinity of Opilia, before I had the advantage of seeing Mr. Bentham's paper.

* Leptonium.—*Perianthium* urceolatum, (æstivatione valvatum). *Stamina* 4, perianthii laciniis opposita. *Squamæ* hypogynæ 0. *Ovulum* 1, nucleare, pendulum e placenta centrali libera. *Embryo* inversus in axi albuminis carnosi. *Flores* racemosi, terni in axilla bracteæ cujusque.

(1) Linn. Trans. 18. pt. iv. p. 679.

this genus with Opilia, of Opilia with Champereia,* and of the latter with Exocarpus and Leptomeria, be kept in view, it appears probable that these form a group intermediate between Santalaceæ and Olacineæ, into both of which families some of the genera gradually pass. The main characters of this group, considered with regard to Santalaceæ and Olacineæ, I take to be the tendency to singleness of the floral

Frutex *subscandens*. Folia *alterna, oblonga*. Racemi *aggregati, juniores bracteis majusculis membranaceisculis laxe imbricatis stipati*. Flores *minuti, virides, centrales præcociores*. *Tubus* perianthii *carnosus, faux subannularis*. Drupa *oblonga*. Cotyledones *ternæ !*

L. oblongifolium.

Hab. Assamia superior.

Genus Cansieræ proximum, inflorescentia Opiliæ.

* Champereia.—*Perianthium* 5-sepalum, rotatum. *Stamina* 5, basi laciniarum inserta. *Annulus* 5-lobus, hypogynus, inter stamina et pistillum. *Ovarium* superum. *Ovulum* 1, erectum, nucleare, anatropum. *Stylus* 0. *Embryo* inversus in axi albuminis carnosi. *Inflorescentia* paniculata.

Frutices vel arbusculæ *incolæ oræ Tenasserim et freti Malaccensis*. Folia *alterna, ovata vel lanceolata, acuminata*. Flores *minuti, fuscescentes, racemoso-paniculati*. Bracteæ *minutissimæ*. Sepala *revoluto-reflexa*. Annuli *lobi sepalis alterni*. Ovarium *annulo reconditum*. Drupa *oblonga*. Cotyledones *ternæ !*

Genus meo sensu Leptomeriæ et Exocarpo propinquum; a præcedente distinguitur inflorescentia, ovario supero, et drupa ecoronata, a posteriore pedunculo fructûs immutato, disco, habitu et inflorescentia. Opilia dignoscitur calyce (an semper?), glandulis discretis, et inflorescentia. Habitus quodammodo Opiliæ (Groutia) celtidifoliæ.

I have experienced great difficulty in ascertaining from dried specimens the exact nature of the ovulum, more particularly as in my notes made at Mergui some years since, it is represented as an antitropous, erect ovulum. But as in the dried specimens, I find the central body to be gibbous on one side, I prefer, particularly as it corresponds with the affinities of the plants; considering it to be analogous to a true Santalaceous ovulum. Otherwise I am not acquainted with any clear mark of distinction between an erect, nucleary, anatropous ovulum, and an antitropous ovulum, otherwise of the same degree of development, attached to a central placenta, and with its apex presented to the fundus of the ovarium.

envelopes, in combination with the superior ovarium, and the single ovulum. The chief characteristics of the *whole* group (or class?) appear to me to be the valvular perianthium, the central free placenta bearing one or several ovula, the apices of whose nuclei point to the fundus of the ovarium, and the *inverted* embryo in the axis of copious albumen. This will exclude Mackaya. Arnott, which nevertheless has strong affinities with Santalaceæ.

All these plants, so far as can be judged from the comparison of the direction of the apex of the nucleus, and that of the radicle of the embryo, will probably be found to present the same remarkable development of the seed, that has been noticed in Santalum, Osyris, and Thesium. This appears to be more worthy of notice, because in certain Verbenaceæ, in which the placenta and ovula are very like these bodies as they exist in Olax, Schæpfia, Santalum, Osyris and Thesium, the radicle of the embryo points, as it would be expected to do, to the fundus of the fruit; and in Avicenna means are resorted to for preserving this normal direction, as extraordinary as those occurring in the Santalaceæ hitherto observed, by which the inversion of the embryo is brought about.

EXPLANATION OF PLATE XII.

Jenkinsia Assamica.

1. Portion of a male Plant.
2. 2. Flower of ditto.
3. Stamina of ditto.
4. Female capitulum, *in fruit.*
5. A fruit detached with its perianth and involucel.
6. Section of fruit, so as to expose the pyrena.
7. Seed, ventral face.
8. Long section of seed.
9. Transverse section of ditto.
10. Embryo detached, one cotyledon removed.

Figs. 1, 2, 2, 3, from a drawing in H. C. Library.

ROXBURGHIA.

Stemona. Loureiro *Fl. Cochin.* 404. Ubium polypodioides. Rumph. *Hb. Amboyn.* 5. t. 129.

*Tetrandria Monogynia. Roxburghiaceæ, Lindl.**

Char. Gen.—*Perianthium* biseriatim 4-sepalum. *Stamina* 4, antheræ adnatæ, connectivis ultra loculos longe productis cuspidatæ, mediantibus loculis ad bases cuspidum liberifactis effetis intus productis cohærentes. *Ovarium* 1-loculare; ovula 00, erecta, anatropa, placentis 2 basilaribus lateralibus affixa. *Stylus* 0. *Stigma* subpennicillatum. *Fructus* siccus, 1-locularis, bivalvis. *Semina* funiculata, funiculis vesicularibus vel stuposis. *Albumen* copiosum. *Embryo* axilis in parte inferiore albuminis, plumula intus rimam recondita.

Herbæ *perennes, scandentes.* Radices? *tuberosæ.* Folia *sæpius opposita, e basi plus minus cordata ovato-acuminata, costata venis pluribus primariis, venulisque transversis has connectentibus pulcherrime striata.* Flores *axillares, solitarii, vel bini in pedunculo, magni, striati, fœtidi.* Fructus *perianthio persistente suffultus, margine utroque sulco exaratus.*

The observations I have made on R. viridiflora regard chiefly the stamina, pistillum and embryo, the first having been entirely misunderstood by many; the last as detailed by Dr. Lindley, tending in my opinion to disturb the natural relations of the genus.

I have ascertained from observation at all periods, that the real structure of the stamina is what I have attempted to describe in the generic character. And indeed, this is

* The practice of permitting a Botanist's name to be attached to a family, of the definition appended to which he is not the author, appearing to me to be very objectionable, I have substituted Lindley, the name of the author of the definition, for Wallich.

sufficiently obvious in the mature stamen, the appendage not only being a direct continuation of the loculus, but also presenting a continuation of the ordinary central sulcus, indicating the division of the loculus into two locelli, and very generally also the line of dehiscence. I have not been able to ascertain why Roxburgh described the cells or anthers as separable to such an extent from their attachment, so as subsequently to become pendulous from the appendages, in which state they are represented in one of the details of the original drawing of R. gloriosoides.* An anther cell only partially polliniferous is not, I believe, of uncommon occurrence, the deficiency of function possibly, perhaps, affecting indifferently every part of the anther. But the separation of the effete *upper* part occurring, as it does here, in so marked a degree of the adnate form of anther appears to me very curious.

I have also ascertained, that the pistillum is distinctly monocarpellary, a structure otherwise suggested by the obliquity of the ovarium. The most remarkable part of the structure of the pistillum, however, has regard to the placentæ, which I have not found to present in any stage any definable relation with the margins, or indeed with any part of the carpel leaf. In their earliest state, they appear as a disc occupying the fundus of the carpel cavity, and terminating the axis. Shortly after this disc presents a depression in the centre. Subsequently it appears placentiform, with a concave centre, and thickened undulated sides, and at the time when the ovula are becoming anatropous, a double longitudinal section, across the short diameter, presents it as occupying two elevated lines (the sides just alluded to,) which run parallel to the sides of the carpel leaf. This is the state in which the placentæ exist in the expanded flower and in the fruit.

* Icones Roxburghianæ, v. 7. t. 76.

This appears to me best intelligible as a placenta derived from the axis. It will be seen, however, that its parts have the ordinary numerical relation with the carpel leaf, to which, moreover, its development may be considered to be subsequent.

I have not been able to trace any continuity between any parts of the surface of the placentæ and the stigmatic tissue, which, however, resembles that surface in colour and appearance. But it appears to me probable, judging from the situation of the foramen of the ovulum, that conducting tissue does line the inner paries of the ovarial cavity.

The description of the embryo is derived from observations made in June 1835, and since verified.

This genus is stated by Sir J. Smith,* to have been founded by Mr. Dryander, at the suggestion of Sir Joseph Banks, in just commemoration of Dr. Roxburgh, the first Superintendant of these Gardens. It appeared first, I believe, in the Coromandel Plants of Dr. Roxburgh, a work munificently patronised by the Hon'ble Court of Directors, but of which, no complete copy exists in this institution. It was referred to Octandria Monogynia by Dr. Roxburgh, who appears to have considered the filaments as petals, the abortive upper parts of the anther cells as nectaria, and each cell of the anthers as an entire anther; which view appears to have been very generally adopted.†

The next author who appears to have described the genus is Sir J. Smith,‡ who referred the genus to Tetrandria Monogynia, and gave a much more accurate description of the stamina, considering the appendages as abortive anthers.

* Rees' Cyclop. in loco.

† Willdenow. Sp. Plant 2. pt. 1. 321 :—Lamarck Enc. Meth. 6. 319.—Persoon, Synop. 1. 412.—Aiton. Hort. Kew. ed. 2. v. 2. 347.—Sims. Bot. Mag. t. 1500.—Sprengel. Syst. Veget 2. 214.—Poiret. Dict. Sc. Nat: 46. 377.

‡ Exot. Bot. 111. t. 57. Rees' Cyclop. in loco.

Loureiro, who published the genus under the name Stemona,* (A. D. 1790,) referred it to Monadelphia Tetrandria; he notices the appendages as "laciniæ," and appears to have had a correct view of the anther cells, although his description is not exactly applicable to either of the Indian species.

Nevertheless, in M. Endlicher's Genera,† the view entertained by Dr. Roxburgh is reverted to, with the difference, that the anthers are represented as 4, bilocular, and the appendages as connectiva! In addition, the ovarium is said to be formed of two carpel leaves.

There is a good deal of variety of opinion also regarding the locus naturalis of this remarkable genus. Sir J. Smith‡ referred it without difficulty to the Asparagi of Jussieu.

Lamark§, says, it appears to be intermediate between Liliaceæ and Asclepiadeæ, an opinion he doubtless derived from Dr. Sims.||

Reichenbach¶ places it in his family (class) Aroideæ at the end of the second section Taccaceæ, subsection Tacceæ: the merit of this, however, appears to me reduced, by his placing Nepenthes and Sarracenia with Peliosanthes in the last section of the same family.

Bartling** places it among the "genera Monocotyledonea dubia l. incertæ sedis."

Dr. Lindley†† in Wallich's Pl. Asiat. Rariores, characterised it carpologically as a distinct family, Roxburghiaceæ, being evidently influenced a good deal by the supposed absence of the Aroideous form of embryo. The place of this family is considered to approach "the Aroideæ more nearly than any other tribe."

* Fl: Cochinchin. 404.—This genns is also adopted, in the Encyclopedie Methodique. Supp. 5. p. 244, and in the Dictionaire des Sciences Naturelles, v. 50. p. 478, in which last it is referred to Tetrandria Monogynia.

† 157. No. 1197.

‡ Ex. Bot. loc. cit. Rees' Cyclop. loc. cit.

§ Enc. Meth. loc. cit.

|| Bot. Mag. loc. cit.

¶ Consp. Reg. Veget. p. 44.

** Ord. Nat. p. 76.

†† 3.49. t. 282.

Subsequently in his Nixus, he associated Roxburghiaceæ with his Retose class, in which it will be found in his Introd. Nat. Orders, ed. 2. p. 360. Somewhat later it is to be found similarly associated in his class Dictyogens.*

M. Endlicher,† places it among the "genera Smilaceis affinia," *still* however retaining the family name Roxburghiaceæ. Sprengel‡ refers it to the Smilaceæ of Mr. Brown.

The genus appears to me to belong to the class of which Aroideæ are the type. It consequently appears to me singular, that no allusion is made to this genus by Schott and Endlicher, in their Meletemata, in which the *class* Aroideæ is considered, or by Blume in his Rumphia, in which the *family* is noticed in detail.

There are two British Indian species of the genus, which may be thus characterised.

Roxburghia gloriosoides, foliis alternis vel oppositis basi cordatis, fructibus obovatis, seminum exapiculatorum funiculis celluloso-vesicularibus.

R. gloriosoides. Dry. in Corom. Pl. 129. t. 32. Icon. Roxb. 7. t. 67.§ Hort. Kew. v. 2. 348. Roxb. Fl. Indica. 2. 234. Lam. Enc. Meth. 6, 319. R. gloriosa. Pers. Syn. 1. 412.

Flores straminei venis ochroleucis striati. Sepala acuminatiora. Filamenta purpurascentia. Loculi antherarum lutei; connectivorum processus curvati.

Habt. in Mont. Circars dictis. Roxburgh.

Roxburghia viridiflora, foliis oppositis basi cordato-ovatis, fructibus oblongis compressis, seminum apiculatorum funiculis apicem versus stuposis.

R. viridiflora, Sm. Exot. Bot. 111. t. 57. Rees' Cyclop. in loco. Lindl. in Wall. Pl. As. Rar. 3. 49. t. 282. R. Gloriosa. Bot. Mag. t. 1500.

* Elements, p. 236. † Gen. Pl. loc. cit. ‡ Gen. Plant. 2. 815. No. 1586.

§ The drawing in the Cor. Pl. differs remarkably from the original one, of which otherwise it appears to be a copy, in the shape of the leaves which are reniform cordate, and not, as in the original, ovate from a subdeltoid base.

Flores triplo majores, odore ingratissimo, virides, intus ad basin lurido-purpurascentes, venis purpureis striati. Stamina maxima, sub-uncialia, filamenta saturate purpurascentia, connectivorum processus stricti virides, antherarum loculi livide purpurei.

Habt.—Assam: Montes Khasiyani—Chittagong et ad littora sinus Siamensis. Colitur in Hort. Bot. Calcutta.

A third species would appear to exist in Loureiro's Stemona tuberosa,* and a fourth in the Ubium polypidioides of Rumph.† This however, was considered by Buchanan, as appears from a MSS. note on the back of Rumphius's figure in the copy in the H. C. Library, to be the original species, R. gloriosoides.

PLAGIOPTERON.

Char. Gen.—*Sepala* 3—4, minuta, dentiformia. *Petala* totidem (calycina), œstivatione valvata, revoluta. *Stamina* 00, hypogyna, filamenta capillaceo-clavata, antheræ biloculares, terminales. *Ovarium* superum, 3-loculare; ovula cujusque loculi dua, collateralia, erecta, anatropa. Stylus subulatus. *Fructus* nucamentaceo-samaroideus, 3-locularis, loculis dorso (apicem versus) ala lingulata transversa præditis. *Semina*...

Frutex *scandens, pilis stellatis pubescens, habitu Hireæ.* Folia *opposita, exstipulata.* Inflorescentia *axillaris, thyrsoidea.* Flores *parvi, ob filamentis albis conspicui, suavissime odorati.*

Plagiopteron suaveolens.

Descr:—Tota pubescens pilis stellatis, pallide ferruginea. Ramuli teretes. Folia breve petiolata, opposita, oblongo-ovata, cuspidato-acuminata, integra; venæ secondariæ tertiariis plurimis transversis connexæ, intervenulis reticulatis; vernatio conduplicata. Paniculæ subthyrsoideæ, axillares, foliis breviores. Bractea angusta, parva, subtus ramos, ramulos, et florem quemque. Flores numerosi, parvi, exquisite fragrantes; alabastra subglobosa. Calyx 3—4, sepalus,

* Fl. Cochinchin. loc. cit.

† Herb. Ambon. loc. cit.

sepalis dentiformibus, minutis. Corolla 3—4 petala, viridis, petala oblonga, cum sepalis alternantia, æstivatione valvata, per anthesin revoluta, extus dense pubescentia. Stamina 00, subbiseriata, hypogyna, petalis longiora, æstivatione varie flexa, per anthesin erectiuscula. Filamenta capillaceo-clavata, alba. Antheræ terminales, ochroleucæ, demum brunescentes, loculi breves, adnati, (dehescentia quasi transversa). Ovarium superum, rotundum, dense piloso-pubescens, 3-loculare, loculis biovulatis; ovula erecta, anatropa, collateralia, raphe sub-introrsa. Stylus subulatus, glaber. Stigma obscure 3-dentatum. Fructus sub-turbinatus, apice plano stylum exserente, trilocularis, loculi subossei, dorso apicem versus ala transversa lingulata loculis 3-plo longiore subreticulata aucti. In singulo loculo ovula abortiva 2, erecta.

This plant is said to have been introduced from Sylhet in 1829. It has not, I believe, ripened seed in the Garden.

It apears to me to present a curious mixture of characters. With the habit of Hiræa it has a resemblance in the flowers, especially the inner series of the floral envelope, to Rottlera or Trewia; the anthers again resemble those of Stilagineæ, while the pericarpium appears to me to represent in some respects that of Hiptage: the direction of the ovula however is contrary to what occurs in Malpighiaceæ or Euphorbiaceæ. Dr. Wallich appears to have considered it a doubtful Euphorbiaceous plant, a view suggested by the floral envelopes and male organs, but not by the pistillum or fruit, in which there seems no tendency to the characteristic Euphorbiaceous dehiscence. I am disposed to hazard a conjecture, that it will be found to unite Euphorbiaceæ and Malpighiaceæ, the probability of a direct relationship between these two families being suggested, among other things, by their glandular nature. And perhaps the majority of its characters will place it near Malpighiaceæ and Sapindaceæ, although the want of any correspondence in number between the floral envelopes and the stamina, and their indefinite number in particular, will probably appear formidable objections.

It abounds with spiral vessels. Curious cellular bodies are to be found along the margins of the young leaves. The odour of the flowers resembles that of Roydsia suaveolens, and Heliotrope.

EXPLANATION OF PLATE XIII.

Plagiopteron fragrans.

1. Portion of a flowering branch, natural size.
2. Young alabastrum.
3. Alabastrum just opening.
4. Flower.
5. Two Stamina.
6. Anther before dehiscence.
7. Ditto after.
8. Pollen.
9. Ovarium laid open, disclosing the ovula of one cell.
10. Ditto, a double longitudinal section.
11. Ovarium, double transverse section.
12. Ovulum.
13. Fruit.
14. Ditto, one cell opened, shewing the two abortive ovula at the base.
15. Stellate hair.

SIPHONODON.

Char. Gen.—*Flos* hermaphroditus, semi-inferus, æstivatione imbricativa. *Calyx* 5-sepalus. *Corolla* 5-petala. *Stamina* 5, sepalis opposita, antheræ reniformi-cordatæ. *Ovarium* plurilocellatum, e carpellis 5 sursum in canalem (apice denticulatum) connatis, formatum. *Stigma* styliforme, in canalem, apice discoideo excepto, reconditum. *Ovula* in loculis solitaria, obliqua vel pendula. *Fructus* drupaceus, pyrenæ osseæ tot quot locelli ovarii, monospermæ. *Semina* pyrenarum superiorum erecta, inferiorum pendula.

Arbor *mediocris, freti Malaccensis incola, corona conica densa.* Folia *alterna, minute bistipulata, coriacea, crenato-serrata.* Flores *axillares, racemosi vel solitarii, inconspicui.* Fructus *subglobosus, vertice umbilicatus.* Habitus *Celastrineus.*

Siphonodon celastrineus.

Arbor mediocris, corona conica densa. Ramuli flexuosuli. Folia alterna, bistipulata, stipulis (lobi folii) dentiformibus minutis.* Petiolus brevis. Lamina oblonga, obtusiuscula,

* By this term I wish to express my idea of the stipulæ of this particular plant. I am inclined, moreover, to attribute a similar origin to these organs in all cases, and they are by far the most numerous, in which they have, at some period at least, an ascertainable connection with the leaf to which they are referred. At an early period of their development they answer with sufficient exactness to the above term.

In such instances, however, of interpetiolar stipulæ as I have examined, chiefly in tropical Rubiaceæ and in Rhizophoreæ, I have scarcely ever found these organs to present *in initio* the required division, although their composition has been subsequently ascertainable either from the division of the apex, or from the source of the vascular supplies, *which* last is still more, perhaps, decisive of their origin.

The question, so much discussed, of the real nature of some of the component parts of the verticilli of foliaceous organs in Galium and its allies, appears to me to be only capable of solution by examination of the sources of their primary vascular bundles. For I have seen in *Coffea bengalensis* occasional appearances indicating the possible derivation of an apparently true lamina from two stipulæ, which, as usual, derived their vascular supplies from those given off to the leaves.

In connection with leaves I may remark, that their divisions are originally independent of the presence of vascular, or fibrous, or of any elongated form of tissue. Any hypothesis, therefore, which endeavours to establish the relation of cause and effect between the nerves or veins and the divisions of leaves must, it appears to me, be erroneous. So far as I have enquired into the subject of the development of these organs it has been apparent, that all leaves are simple and cellular *ab origine*, the degree of division being dependent on the degree of development, so that the most complex form of leaf, such as a "folium tripinnatum vel supra decompositum" would present at different periods all the different degrees of division, which Botanists distinguish by so many terms. The crenato-serrata cum mucronulis adpressis, semi-conduplicata, coriacea, venis secondariis arcuatis reticulatim nexis; vernatio conduplicato-involuta.

simplest theoretical form of leaf I take to be entire and cellular, the first step in complication resulting from the extension of an axile vein. And as reticulating veins are the last that make their appearance, it may be suggested that a Dicotyledonous leaf will at some period of its development present the appearance characteristic of a Monocotyledonous leaf.

The last observation I have to make refers to the Pitchers or Ascidia of *Nepenthes:* these, from observations on their development, I consider to be modifications of excurrent midribs. That such is their nature at first will, I imagine, on examination, be readily allowed. In this explanation the part which is developed like an ordinary lamina, looks like an ordinary lamina, and which performs the proper functions of an ordinary lamina, is the lamina; the apex of the excurrent midrib is the subulate process at the base of the lid, and the lid is a special development of the upper margin of the originally simple foveola or cavity, subsequently the pitcher. This explanation differs from that of M. Link, Dr. Lindley and Professor Morren, which agree in considering the foliaceous expansion as a dilated petiole—differing substantially, however, in the nature attributed to the pitcher itself and its lid. That hypothesis, indeed, which considers the lid to be the lamina or blade of the leaf, would, in my opinion, be much more consonant with appearances if the lid were considered as resulting from marginal cohesion of a folium unijugum.

I do not extend the above explanation to such instances as *Sarracenia etc.* still less, perhaps, to species of *Dischidia*, in which the pitcher can be traced, through a series of modifications, to the lamina of the leaf itself. In the instances presented by the last genus, whether the leaf be completely convolute, or merely concave, it always appears to perform some function connected with the radicular fibres.

In *Nepenthes distillatoria* the species examined, the apex of every leaf will be found to present the cavity, which is to be subsequently, sooner or later, the ascidium. This, together with the fact that in *N. ampullaria* the leaves of the flower-bearing branches have no *developed* ascidia, these being limited to the short procumbent humifuse branches, may be considered perhaps an objection to the views of Mr. Link of their being floriform organs.

Flores axillares, solitarii, cymosi, vel racemosi, inconspicui, viridi-lutescentes. Pedicelli (florum solitariorum) petiolorum longitudine, medium versus articulati, ad articulos bibracteolati, et ad basin floris clavato-ampliati.

Sepala 5, inæqualia, concava, lutescenti-albida, diu persistentia. Petala totidem alterna, carnosa, margine subcrispata, concoloria, cum calyce perianthium rotatum exhibentia, decidua.

Stamina 5, petalis alterna, brevia; filamenta dilatata, basi mediantibus denticulis latis subinternis in annulum coalita; antheræ conniventes, connectiva reniformi-cordata, loculi angusti, marginales, longitudinaliter dehiscentes. Pollen album, 3-porosum, 3-gonum.

Ovarium semi-inferum depressum, lineis 5-radiantibus petalis oppositis vertice insignitum, pluriloculare, loculi quasi in substantia baseos floris immersi, subbiseriati verticaliter, obliqui, uniovulati. Ovula anatropa, angulo interiori affixa, sæpe pendula; tegumentum unicum. Stylus brevis, canaliformis, apice dilatatus et 5-denticulatus. Stigma discretum, columnare, apice discoideum, canalem styli implens, disco exserto. Fructus superus, ima basi calyce vel hujus reliquiis stipatus, aurantii parvi magnitudine, apice profounde umbilicatus; Caro subsiccus. Pyrenæ tot quot loculi ovarii, compressæ, osseæ, superiores erectæ, intermediæ obliquiusculæ, inferiores pendulæ. Semina non visa.

This remarkable plant I am informed was brought from Penang about 1823. It does not appear to perfect its seeds.

The structure of the pistillum of this plant appears to me very remarkable. At the earliest stage at which it was observed, it appeared to me as a cone, occupying the axis, the base being surrounded by the puncta representing the future stamina.

At a later period I have observed it as a cone, the base surrounded by an annulus, which I consider to be derived from 5 carpel leaves. The subsequent radiating lines (costæ) of these are well developed, their points projecting beyond the concave sinuses.

At a somewhat later period, the base of the central cone will be found concealed by the growth of the above annulus, and at the line of junction between its base and that of the cone, very young ovula may be detected, apparently attached round the whole base of the cone, and not presenting any manifest relations with the carpel leaves. At this time a double long section has not shewn me any solution of continuity resulting from forcibly pulling back the carpel leaves, and thus exposing the ovula.

The next stage presented the central cone with a conical base, a cylindrical intermediate portion, and a dilated head. The carpel leaves will be now found to adhere by their bases to the corresponding part of the cone, so that the ovula cannot be exposed without tearing through tissue; the carpel leaves are also now produced upwards into a hollow cylinder, surrounding the columnar part of the original central cone; this cylinder is somewhat dilated at the apex, which again is 5-toothed, the teeth corresponding to the radiating lines.

At the time of expansion the circumstances remain much the same, the central columnar body remains distinct from the canal enclosing it, the ovula appear attached round the whole of its base, but not upon the same plane. The lines of communication, by which each isolated ovulum is placed in the usual conditions to receive the male influence, will be found to terminate on the circumference of the conical base of the central column.

Of this structure, as it exists at the period of expansion of the flower, four modes of explanation occur to me. It may be conveniently disposed of by the use of the term "ovarium disco* immersum," not unfrequently employed in the generic description of Celastrineæ.

* M. Endlicher pointedly alludes to the necessity of accurately observing these discs. Gen. Pl. p. 1085.

Or the hypothesis may be resorted to, which assumes such a degree of confluent growth of the vertex of a syncarpous ovarium, as shall give rise to a tube similar to that described.

In both these hypotheses the central columnar body is to be considered as the style and stigma.

Or it might be assumed, that the component parts of the pistillum produce the placentæ from their margins close to the base, which placentæ becoming confluent and produced upwards free from any connection with the style, give rise to the central column.

Or lastly, the central columnar body may be considered as a continuation of the placenta, and as the termination of the axis; having no original connection with the carpel leaves. In these two modes of explanation, the canal becomes the style or analogous to it, and the central column a free stigma.

The "disc" hypothesis, however plausible it might appear if Hippocrateaceæ are taken into consideration, except indeed as regards the point of attachment of their filaments, seems to me contradicted by the general appearance of the radiated part, which manifestly belongs to the female organ, and equally manifestly forms part of the fruit. It would also necessarily result from its adoption, which may to those who favour De. Candolle's* hypothesis of the fruit of the Orange, still appear tenable, that the two inner series of developments viz. the teeth interposed between the filaments, and the component parts of the disc, which may be assumed to be of the same nature, would be in opposition, and moreover that the direction of their development would be inverted.

The second hypothesis, though perhaps not altogether improbable, is not, I think, borne out by any appearances during any stage of the development, and is, together with the preceding, contradicted by the solidity and homogenous structure of the column, in this light a style, which has

* Lindley Introd. ed. 2. p. 105.

seemed to me to present no traces of composition, or any such difference in texture between the superficies and centre, as might have been expected to be presented in some part at least; and also by the fact that the lines of communication with the locelli of the ovarium, and which, in my opinion, alone allow of the passage of boyaux, open on the surface of the base of the column.

The third mode of explanation, suggested by the irregularity in position of certain placentæ, and by the views of Mr. Brown*, regarding the origin of the stigma from the

* In a paper on the capsule of Papaveraceæ, and stigma of Cruciferæ by Mr. J. W. Howell,(1) the situation of the stigmatic rays of Papaveraceæ is explained by the assumption of their being compound, an opinion also held by Mr. Brown. There is also another partial coincidence of opinion regarding the improbability of the axis of a carpel leaf bearing ovula.

Mr. Howell, however, arrives at the conclusion that this composition of the individual stigmata of a syncarpous pistillum is only occasional, admitting the existence of simple stigmata in single carpels. Whereas Mr. Brown setting out from the consideration of the simplest form of the vegetable pistillum, advocates the opinion of their being always compound, explaining their apparent opposition by confluence.

From the note by the Editors appended to Mr. Howell's valuable paper, it might be made out that Mr. Howell's observations on the stigmata were of a more general nature than they are; whereas they are limited to Papaveraceæ, and further regard the difference between a Papaveraceous and Nymphæaceous stigma as an arbitrary one, "serving to separate by abruptly defined limits those otherwise nearly related orders."(2)

Both Mr. Brown's and Mr. Howell's observations appeared publicly in 1840; but there can be no doubt that so far as Papaveraceæ are concerned, Mr. Howell is anticipated by M. Kunth, whose observations appeared in 1838, "*in a printed book.*"

On this subject of the stigma, I have lately ventured to offer some remarks, derived from conclusions suggested to me independently of either Mr. Brown's remarks or the paper by Mr. Howell. The sub-

(1) Ann. Mag. Nat. Hist. v. 10. 63. p. 218.

(2) op. cit. p. 249.

placentæ, is not borne out by development, which shews the central cone to be formed before the carpel leaves. Yet so far as my observations go, the placentæ when manifestly, as they so very generally are, referrible to the carpel leaves, are of considerably later development than the leaves to which they belong.

The explanation that seems to me to accord best with observations of the development, and to explain also the general structure in the best way is, that the placenta in this plant is the conical termination of the axis, produced upwards into a styliform stigma, and bearing round its base, at or about the plane of insertion or attachment of the carpel leaves, a verticillate series of ovula. And if it be found to be correct, it appears to me strongly in favour of an opinion lately advanced by me that, even when the style is present, the stigma may be quite independent of it.

This hypothesis does not explain the appearances presented by the expanded flower more fully than the preceding, but then it appears to me to agree with the development, and especially the primary appearance of the central cone, and also with the evidently more intimate relations of the very young ovula with the base of the cone rather than with the margins of the carpel leaves. Moreover, a central axile placenta terminating in a stigma, appears to me

stance of these consist of the possibility of the stigma being a continuation of the placental margins of the carpellum, of its being the external communication of the conducting tissue, which itself communicates with the placentæ, and is in several cases at least manifestly identical with them. That the phrase "stigmata opposite to the placentæ" arises from a cohesion between stigmatic surfaces, analogous to that cohesion which causes in fruits the loculicidal dehiscence. That Orobanche presents owing to this cohesion right and left stigmata, as is proved by development and the situation of the vascular fascicles of the style &c. &c. and that the stigma being an extension of a mere cellular surface need not present any definable form, and that it may exist independently of the style.

more reconcilable with a perfectly isolated stigma, than the occurrence of such a stigma, in connection with carpel leaves, from which it would then be supposed to originate, and with which consequently it should at some period present some degree of connection.*

A necessary consequence of such an isolation of the stigmatic tissues from the style, is that the course of the pollen tubes will be downwards over the surface of the central column. Appearances are I think in favour of this,† which is in accordance with the course of pollen-tubes in many, and perhaps in all cases, in which the stigmatic tissues are not confluent at any part of their extent. The term penetration, therefore, does not apply by any means invariably to any relation effected between the pollen-tube and any part of the female organ, except the ovulum, of which it affects only the nucleus and embryo-sac.

In either view it may be suggested from the small degree of union between the carpel leaves and placentæ, and particularly from their apparently absolute distinctness at an early period, and which is, perhaps, only reconcilable with my hypothesis, that such an arrest of development may occur, as

* I have not been able to satisfy myself of the exact limits of the carpel leaves. The first parts developed have appeared to me those opposite the stamina, in which case the rays may be considered as indicating the lines of union. The alternation in this case is regular. But immediately afterwards the parts opposite the stamina present concave edges limited by the now projecting rays, and the whole appearance suggests that the rays form the axes of so many carpel leaves. And although in this case the two innermost series of development, assuming the teeth between the stamina to represent an inner series of stamina, will be opposed, yet I prefer adopting it to the other view, which supposes the carpel puncta to present concave terminations, in other words, that their sides reach a greater elevation than their axes.

† It is also singular that the inner surface of the tube or style appears in some degree stigmatic, and presents after application of the pollen the usual appearances indicating the first steps of fecundation.

shall present naked ovula in connection with carpel leaves so convoluted and connate as to present a perfectly distinct style.

It is to be considered that the explanation I have attempted to give, is not at variance with those views of the origin of the placentæ that originated, so far as I know, with M. Schleiden, and which are considered by many to afford the best explanation of the free central placenta. In this view the only anomaly is the want of the usual cohesion between the style and stigma: this, as I have said, appears to me less anomalous than it does if the third method of explanation be adopted. On the whole, therefore, I beg to propose this plant to Botanists, as an instance in which the placenta is the termination of the axis, bearing around its base a verticillus of ovula, and produced upwards into a stigma, a single organ, surrounded for the most part by an ordinary style with which it has no connection.

The venation of the carpels appears to me worthy of notice, they have no dorsal vascular fasciculi, deriving such partial supplies as they have appeared to me to present from the vessels supplying the ovula, which vessels appear derived from the fascicles, supplying the stamina or perianth.

Such a mode of distribution of course suggests the idea of a definite grouping of the ovula, and if the primary fascicles are derived from those running to the stamina, they have precisely the situation they should have if they were ordinary placentary fascicles of an ordinary syncarpous pistillum. The supposed grouping, however, I have not been able to detect, the primary fascicles dividing so as to present on a transverse section a circle of vessels surrounding the axis, and moreover *after* supplying the ovula, they pass into the substance of the carpel leaves.

I may also mention the curious circumstances, that though the general direction of the ovula may be considered as pendulous, and though the raphe is in all extrorse, many of the seeds must be erect and have the raphe introrse.

The genus appears to me to agree sufficiently well in character with Ilicineæ, to which family, I believe, Dr. Wallich referred it. It would appear, judging from the description, to present considerable affinities with Byronia.*

It has many points in common with Celastrineæ, with which it agrees entirely in habit.

EXPLANATION OF PLATE XIV.

Siphonodon celastrineus.

1. A Branchlet, somewhat reduced.
2. Flower.
3. Two stamina, viewed interiorly shewing the intervening tooth.
4. Stamen, inner face.
5. Pollen.
6. Pistillum, (vertical view.)
7. Ditto, double long section.
8. Ovulum,
9. Fruit, (as it occurs in the Botanic Gardens).
10. Ditto, longitudinal section.
11. Very young alabastrum laid open, presenting petals, stamina, and central cone.
12. Very young pistillum, lateral view.
13. Another pistillum about the same period: with the stamina spread back, the round dots are intended to represent the ovula which appear to be attached all round the cone.
14. Very young bud, double longitudinal section.

* Endl. Gen. Plant. 1093, No. 5708.

The Sex and Generative Organs of Plants, in connexion with the Science of Morphology. By Von Martius, *translated by* John Macpherson, *Esq. Assistant Surgeon.*

All living things are kept in activity and in motion by two powerful impulses, which are the springs of existence: the impulses of self-preservation and of reproduction.

The first rules life from its beginning to its end: the second awakens later, does not last during the whole period of life, developes itself in many organisations only once, while in others it returns periodically, and disappears with the advance of years. Both impulses are in certain respects opposed to each other, and develop themselves often at their mutual expence; while subject to the impulse of self-preservation, the individual belongs only to itself and to the present; while subject to that of reproduction, it is of use to a something external to itself, and to the future. The latter impulse permits the multiplication of individuals, and secures to every *kind* of living being an uninterrupted continuance, while the individual organisations, decaying and temporary, last only a certain period of time, which is short in comparison with the life of the kind.

Obedient to this last impulse, the individual forms for posterity another individual exactly like itself in all its important relations. By it, life is continued, if not in individuals, yet in the whole; by it, living organisations perpetuate their inner and outer form, their activity and their peculiar vital functions.

To unfold, however, this last impulse for the production of a new life, there is required a certain kind of opposition in the state of action, and in the condition of the individual. Various powers must be put in action, and different shares have to be borne by certain particular parts. Such variety of organisation is, however, a necessary condition of life. What is dead, can alone be quite homogeneous—

what has life, always consists of different parts, (organs,) each of which possesses an especial action, a defined external and internal form, (*Morphosis*); just as self-preservation, so also is reproduction worked out by certain more or less peculiar organs.

Wherever then, in living organisations, there is to be a multiplication of individuals or reproduction, we observe, as already remarked, a certain kind of opposition in the structure of the organism, which commences and completes that multiplication—in short, *organs of reproduction.*

These appear sometimes complete in a single individual, sometimes as belonging to two different ones. In the first case, the organs which are the medium of reproduction are very commonly formed after only one type, and produce new individuals by a gradual alteration in themselves, without any external visible action of different parts on each other, (constituting sexless reproduction.) In much more numerous cases however, two peculiar and differently formed organs, divided on two individuals, act upon each other in the externally visible act of fecundation; and multiplication and reproduction are sexual. Sexless reproduction in the vegetable kingdom, requires always a degree of opposition between the interior and the exterior, between the centre and the circumference of the individual which multiplies itself. The production of a new individual exactly resembling the old one, takes place either by sprouting and separation at the extremities, or by evolution from the interior.

By such an evolution of new individuals, the algæ or flowerless water plants, the lichens and fungi continue themselves. The most general description of this process is as follows: the thickening of the contents of an individual cell, or the union and growing together of several such filled cells into one larger kernel, and its separation thereafter from the mother plant, either with or without previous sprouting.

The germ thus freed commences to form a growth downwards, *i. e.* the root, and to this succeeds the growth upwards. More highly organized plants also, which form layers and runners, follow in so doing the same type.

In all these cases, the production of new individuals results from nothing else but a peculiar alteration in consistency, *i. e.* in the form, relative fullness and closer apposition of the cells and vessels, of which the parent individual is constituted.

Sometimes the structure is thickened in particular spots, where the smallest elementary parts press closer to each other. Sometimes it becomes here and there weaker and thinner, and frees itself from its original connections. The separated sprout or the expelled germ immediately commences an independent life of its own, increases in length and breadth, and becomes at last an individual exactly like its parent, which propagates itself in like manner. The whole process, it is true, is subject, like every act of life to a regular order (*Rhythmus.*) It begins at a certain period, and at a certain period is completed; yet the growth and formation of the young individual proceeds in a long uninterrupted continuous course, like the growth and ripening of a fruit. We are therefore entitled to designate the want of distinctly marked periods of development, and the gradual nature of the changes which take place in the mother plant, as an essential character in the process of reproduction in sexless plants.

In reality, such a new formation proceeds always only from the upper growth of a plant, from the stem and the leaves, or a portion of them, in which stem and leaves are organically united, and blended together, (the Thallus.) Never is an individual developed in the same way from the system that grows downwards, that is from the lower parts or the root. Therefore, an individual newly formed in this way, if it is to continue as an independent plant, must now in the last place form of itself its root, which it has not brought into the world with it. If, however, such a sprout, or what is to a certain extent the same thing, a bud, or an eye, is artificially transferred from one plant to another, then it requires no special root of its own, inasmuch as its bed (*sujet*) serves it as such; it unfolds itself only upwards in stem and leaves. We find in this kind of multiplication, that a young plant treated in such a way, agrees completely in all its properties with the parent individual. Thus the eye or graft of a particular kind of fruit-tree develops itself into an exactly similar kind. In this case, the individual is directly multiplied and propagated, and therefore in the manipulation of grafts and eyes, we have a means in accordance with nature, of multiplying the number of noble fruit-trees, in as much as the bad and wild kinds are ennobled *by the part which is artificially introduced.*

All this is quite different, if the multiplication and propagation of plants takes place by means of peculiar sexual organs. In this case, the new individual is by no means merely the product of the separation from the elder plant of a similarly formed part, but much more the result of the opposing influence on each other of two organs, which are quite different from their very beginning—a male fecundating organ, and a female one, which is capable of being fecundated.. The result or issue, it is true, agrees in reality with the parent in form and in vital manifestations, but develops itself with greater freedom and individuality, and is therefore less like the older organism than in sexless reproduction. Therefore, as Link has especially mentioned, (Philosoph. Botan. Edit. 1, pp. 405, 407): "Sex in the vegetable kingdom continues not the individual, but the kind." Hence arises the difference between parent and offspring in the vegetable world, and the appearance of varieties and kinds under the influence of different external conditions of life. On this ground, in order to cherish and to propagate the more noble kinds of vegetables, the use of the seed is not indicated so much as the sexless propagation by eyes, grafts, &c. In the case of those vegetables, however, which from the shortness of their lives are not suited for this kind of multiplication, for instance grains, flax, &c, as soon as they begin to degenerate, since we cannot ennoble them, we must replace the seed by better, which has been produced under more favorable external circumstances.

In the most lowly organised plants to which we do not ascribe any sex, we meet with several appearances, which are calculated to prove, that the tendency just indicated, was inherent in their germs of reproduction; namely, to continue especially the individual form of the parent-plant; as for instance in the lichens, which multiply themselves at times by means of germs formed in all parts of the leaf without distinction, at other times by germs which are detached from small shields or apothecia, (which is a somewhat higher organization.)

In the first case, the issue retains more that form, which a special formation of the leaf necessitates; in the latter, it resembles more that in which the leaf almost disappears, and in which the new individual appears almost to consist only of apothecia. The same relation is also very likely at the bottom of the fact, that the mosses propagate their varieties with greater certainty by means of their germs than many other plants of higher organisation, to which we ascribe more developed organs of reproduction, in fact, a sex.

The idea that vegetables have sexes is of great antiquity. We find traces of it in the oldest Greek authors, and since the beginning of the 17th century, the doctrine of the sexes of plants has been taught in Germany, (first by Adam Zaluzianski at Prague, and by R. J. Camerarius at Tubingen.) Every one knows that Linnæus founded his system on the sexuality of plants, and since his time, people have been accustomed to recognise in the stamina of plants the male, and in the pistil, the female organs. In most cases, both of these sexual organs are united in one flower. Since that period, a direct action of the organs on each other for the production of the elements of a new plant, the seed, has been invariably assumed, without people exactly knowing how the act of fecundation was accomplished. The supposition of sexes was in those times chiefly supported by the phenomena of bastards or mules in the vegetable kingdom.

Thus for instance, by artificial generation mules have been produced in the vegetable, as well as in the animal kingdom, and at the present time, many industrious gardeners practice this process, to produce large and long lasting flowers. When we are accustomed to see the formation of bastards take place in the vegetable, under similar conditions to those under which they are formed in the animal kingdom, we are inclined to look on this as the most decided proof of the sexualty of plants. In the mean time, of late years, great progress has been made in unveiling the more hidden phenomena of fecundation, and we have been able, by the aid of well constructed microscopes, to penetrate in our researches regarding vegetable reproduction to the very verge of what our faculties are capable of appreciating. The whole process now lies before us as a complete phenomenon, and it remains for the further researches of the observers of this process, only to examine its numerous varieties according to the different external and internal structure of individual plants.

But in order to take a general view of what is known regarding the organs of generation in plants, it is necessary to cast a general glance over the history of the development of plants.

In the higher vegetables, in the part which is turned away from the earth, and which is developed upwards toward the sun, in short that which is provided with flowers, the growth takes place in two chief directions, in that of length and in that of breadth. The first shews itself in the stem and its parts, the branches and twigs, the second in the leaves. Both these parts are necessary to each other. The stem is the support, it endures, and is lasting; the leaf is that which is born, evanescent, and decaying. The stem displays in its interior formation, *i. e.* its construction from cells and vessels, a great degree of symmetry. The leaves are, as regards their construction from such elementary organs, unsymmetrical. For instance, if one compares a complete section or a regular part of a section of a stem with another one of equal size, cells and vessels will be discovered everywhere in the corresponding portions in like number, size and form, and relative position.

It is different with leaves, since their elementary organs are not exactly in the same proportion on one side, and on the other, when counted by the median plane marked by the midrib, and thus, a section from above downwards shews differences in the number, form, and arrangement of the elementary organs.

The stem placed on the root on which it is supported, is by means of the juices, which are conducted through it, the former and nourisher of the leaves; they, on the contrary, being provided with special respiratory organs, help to increase, prepare, alter and ennoble the sap. From the mutual action of these parts on each other, the nourishment and health of the whole results. The juices which carry the matter capable of being organised, are in the progress of growth worked into solid parts, and the stem, as being the enduring and stronger portion of the vegetable, from year to year increases in mass, while the leaves, after they have for a certain time aided in this process, fall off, and are replaced by new ones. The whole of this system of growth, often containing innumerable members, is ruled by the impulse of self-preservation, so long as flowering does not take place. With the approach of flowering, another higher life is awakened in the plant, which becomes thereafter devoted no longer to the individual, but to the kind. In most cases the flower appears after the leaves, and on the stem and its branches above them.

The process of flowering sets up immediately an action antagonistic to the formation of leaves, in so far, that it impedes or prevents their growth. One might thus say, that two different natures stand upon each other, a lower one devoted to the parent, and to the existence of the individual; and a higher one, which labours for the future, in as much as it prepares and completes the germ of new individuals. In carrying out, however, this last purpose, the plant makes use of the same organs as if employed in self-preservation, *i. e.* it uses the stem and the leaves, yet in such way, that they become metamorphosed and subservient to the purposes of sexual action. The stem or twig, (the part which especially represents the tendency to growth in length,) is contracted in length and breadth. It becomes pedicle and peduncle. The other chief constituent of the upper growth, the leaf, is changed into anthers and pistil. Of these two parts, the so-named sexual organs of plants, the former exerts the male, the latter the female action. These two altered kinds of leaves form the flower, which is designed by the antagonistical force of its parts to create a new individual, the seed. They, therefore, by their mutual operation, produce the germ or embryo. Between these altered leaves, which are necessary to reproduction, and the green unaltered leaves, we see in most cases a special ring of leaves, which are also transformed, viz. the flower, which is commonly composed of two forms of leaves, the sepals and the petals. They are to a certain degree preparatory forms, meant to introduce the highest and the last and most complete forms and actions in the plant. This whole system of transformed leaves arranged into one wonderful and beautifully arranged mass, the flower, is especially distinguished by a different colour and shape, and by a more delicate structure, from the green leaves; and the stalk, on whose summit it is arranged, differs from the common stalk, in the proportionately smaller mass, and in the greater fineness and tenderness of its structure; in consequence of which, it does not last longer than the fruit, and in comparison with other branches, receives but small woody deposits. The leaves too of the calyx and of the corolla, the anthers and the pistil, are equally real leaves, just as the stalk of the flower is a real branch. Of these parts we can very often satisfy ourselves, from the so-called monstrous flowers, in which we see in different stages the metamorphosis of the leaves into the parts of the flower, or from the case of the stalk, which we see sometimes grow on into a real branch with green leaves.

While in the regular flowering of a plant, each of these transformations of a leaf takes place in a certain order of development, and suddenly and at once; in such irregular cases, we find one or other of the same leaves in different stages of development, as partly green and partly coloured, and the whole succession of the different transformations in like manner disturbed. All this we often observe in cultivated plants, such as tulips and roses. The stalk, however, in the process of formation of a flower does not by any means undergo such varied changes as the leaves; nevertheless it becomes a changed organ. Its most important condition is, as already remarked, that on the appearance of the flower leaves, the tendency to growth in length ceases in its stem and its branches. The stalk, so soon as the flowering process commences with the appearance of the calyx, becomes much shortened and contracted, so that it now only appears a small knot among the leaves of the flower. This is the so-called receptacle. Thus then the stalk or twig completes with the appearance of the flower its growth in length.

But in the real leaves of the flower, the stamina, and the pistil, peculiar alterations take place, which require the appearance of new parts, of which there was not the least indication before. These are the pollen, which has been compared to human semen, and the ova.

These two parts are to be looked upon as the most important portions of the generative organs in plants, and as their special male and female parts; the manner of their origin and of their mutual operation in order to produce offspring, has of late years been investigated with most satisfactory results from the perfection of microscopic observations.

To comprehend more distinctly the process of generation, we must yet cast a glance over the different parts of the leaf. We may assume that the original type of a completely developed green leaf consists of three parts, the vagina, petiole, and lamina. The vagina, is the part by which the leaf is attached to the stem or branch. It embraces a part of the latter, and so far it is concave towards the inside, convex towards the outside. At its upper end, it terminates in the petiole, where all the vessels run closer together, and form a round or half-round body. From this point, the more ramified and finer vessels branch out in different directions, and while they are bound to each other by a few layers of cellular-tissue, they form the upper skin-like broadened portion of the surface of the leaf, the lamina. This surface is, by means of its numerous openings, especially intended for the inspiration and expiration of air and vapours, and for increasing and preparing the nutritious juices. If now the leaf, altered by the higher impulse of reproduction, takes on the nature of a flower leaf, its three organic parts have other functions bestowed on them. The green leaf which is changed into a stamen looses commonly its vagina; its petiole becomes a filament: its lamina is changed into the anthers. In this last part the most important alteration takes place; the cellular tissue which lies between the upper and under surface of the leaf, undergoes a peculiar swelling and puckering up, and the nutritious juice contained in it, runs together in each cell into a few, generally four excessively small granules. These granules get more and more thickened, and form themselves into the pollen. The exceedingly delicate cells, called collenchyma, in which this new formation takes place, are by degrees absorbed, and at last disappear entirely, so that the small globules in the form of a very fine dust lie free between the layers of the anther, until at last after their pouch is torn, they issue out of their cavity, and commence their generative functions as male semen. If this pollen be now examined, we find that its granules, which form innumerable round elliptic or angular bodies, are small bladders formed of a double skin. The outer coat is the stronger, and is frequently evidently composed of very small cells; nevertheless in this case also it is apparently to be regarded as a simple cell, whose surface is strengthened by a net-like thickening. The inner coat touches the other on its inner surface, and is exceedingly delicate, and almost transparent. The outer coat has a considerable power of self-contraction, is at particular points provided with folds or pores, and at times separates itself partially from the inner one. The latter is very thin, and on fecundation issues out at particular places; namely, at the pores or folds of the outer skin. We now easily recognize that it is filled with a very delicate slimy fluid, in which exceedingly minute corpuscles of round or oblong form swim, moving themselves about frequently and actively. This delicate fluid (fovilla) corresponds to the fecundating fluid in animal semen. The inner coat of the pollen granule lengthens itself in the act of fecundation into the form of an exceedingly fine transparent tube, which now continues its growth, until it has reached the part which we view, under the name of the vegetable ovum, as the future depository of the semen.

The ovum, however, is a product of that leaf of the flower, which has arisen in an entirely different way from the stamen, by a transformation of the common leaf, and which is described as the pistil or female organ. By this transformation, the sheath (vagina) of the green leaf becomes the ovarium, or germen. The midrib becomes the style, and the broad part or lamina, which is of the whole comparatively the most drawn together and changed, becomes the stigma. The pistil generally assumes the middle place in the flower, and completes the very wonderful palace of the plant. It is now in the ovaria that the ova develop themselves. They are generally found near the edge of the vaginal part, which we must imagine to ourselves as rolled together inwards, and grown together at its edges along its whole length, so that thereby a cavity is produced in which the ova are situated. This cavity either lengthens itself upwards through the equally hollow style towards the stigma, or it is here shut in by a fine cellular net which fills up the middle of the style.

The stigma, the highest part of the pistil, appears in most cases in a form which differs materially from the broad portion of a leaf, of which it must be regarded as a transformation. It is comparatively the smallest part of the pistil, often looks like a round little knot, and is commonly formed of cells closely packed on each other, without any distinct skin over the surface. The ova which are formed in the cavity of the ovaria, appear at first as very tender conical warts, and consist only of cellular tissue without vessels. We can, however, distinguish in them even before fecundation a cell, which is remarkable among the other ones by its size and shape. This is the so-called embryo sac. The ova themselves are called in this earliest stage the ovules. At their base, that is, where these little cellular warts issue from the pistil, there appear early one or two swollen looking rings, which by degrees lengthen themselves out in the form of a cone-like membrane around the cone-like ovule, and towards its top, and at last only leave its point free and open. At this period the delicate fecundating tube of the pollen granule comes into contact with the ovules, reaching the embryo through the space left open by those thin coverings. This takes place either by the pollen grains falling of themselves on the stigma of the pistil, or by their being conveyed thither by the wind, by insects, or by other causes, by their fixing themselves on the stigma, and by lengthening their delicate fecundating tubes through between the close packed cells of which it consists, down into the cavity of the pistil; or if it also is filled with cellular tissue, down between its individual cells to the ovum. In this process, the fecundating tubes often assume an extraordinary length as compared with their thickness, and in spite of their exceedingly delicate organization, increase with immense rapidity in length.

The cellular tissue in the style and along their course through the fruit downwards to the ova, is exceedingly close, delicate, and moist, and appears to support and nourish the fecundating tubes on their long journey, as they lengthen themselves. The outer membrane or skin of the pollen granule left behind on the stigma, becomes more thin and empty. The fine fluid in the fecundating tubes, in which exceedingly small granules swim, in short the fovilla, shews itself in the liveliest motion during the penetration of the tubes to the ova. When the pollen tube has once arrived at the ovum, it finds the already described embryo sac ready to come into direct contact with it, and thus there probably results a transfusion of the fovilla into the embryo sac. We recognise at least after the pollen tube has entered into that cell, almost constantly, a muddiness in it, which is caused by a thickening of its contents *i. e.* by a cellular deposit. This fact has been observed by many botanists and by myself, and there is no doubt regarding it. According, however, to one observer, Schleiden, this process takes place somewhat differently: for he says, that when it has arrived at the embryo sac, the pollen tube sinks down in it, pushes it before it, and becomes imbedded in it. When the pollen tube has once come to lie in the sac, and when it has swelled out at its further end like a ball or an egg, it is supposed itself to become the new embryo. Regarding this last point, various opinions prevail among physiologists, and most of them have not expressed themselves decidedly on the subject. But supposing Schleiden right, yet so much remains certain, that from the peculiar action of the pollen tube on the cell destined for its reception, it is converted into a seed, in as much as from the organisable contents of the pollen tube and embroyo sac, cellular tissue is gradually deposited and becomes more and more firm. That part of the pollen tube, which lies outside the embryo sac, or at some distance from it, withers up completely, its separated end blends with the embryo sac, or is absorbed and obliterated, and by progressive depositions, the individual parts of the embryo and its encircling albumen are formed.

Those membranous envelopes which had grown round the ovule from beneath upwards, get harder by degrees; this commonly happens in such a way, that the outer forms the external, and the inner the internal, integument. When these coverings close over the top of the ovum which was originally open, and its internal cellular structure developes itself, it becomes completed and is a seed. This process takes place in the vegetable kingdom with great variety, for sometimes more, and sometimes fewer, than two integuments of the skin are developed; the ovule separates itself in the greatest variety of ways, by consecutive layers of cellular tissue raised above each other, and at last escapes from the pistil, now become a fruit, and begins the life of a new independent being. The foregoing are the most important facts in the present state of our researches at least, regarding the generation of plants.

The whole process forces us to the conclusion, that the formation of the seed takes place by means of very opposite antagonistical action in the conditions and organic force of certain parts. Undoubtedly fecundation and its sequelæ take place very differently indeed in plants from the analogous process in animals. In the lătter, the whole chain of the sexual process is lost in an organ which cannot be seen. The first beginning of the new animal springs suddenly into shape, while we had not before the slightest trace of it.

On the contrary, in the growth of plants, their vegetable matter is seen by us in its first, as well as its last, moments in corporeal and visible state of action. The union of the organizable matter in the plant with the matter of the pollen tubes, the latter of which manifest their great degree of vitality and plastic power by the immense length to which they grow, takes place so as to be perceptible to our sight with the aid of the microscope. The life of a plant is from its earliest moments visible to us, that of an animal commences where it cannot be seen. For these reasons, one may say, that the formation of a new plant is dependent on the union of two different kinds of vegetable matter, which have been refined by peculiar processes. In this case, the origin of a seed might be looked on as similar to various other appearances in the vegetable kingdom; for instance, to reproduction in some small plants, which are looked on as sexless, and which are formed by several small bladders or nuclei filled with slime, which issue from two different plants, roll themselves together, and unite themselves into a larger nucleus, which has the property of sprouting and of growing into a new individual. On the other hand, this process may also be compared with that which takes place on the large scale, and much more plainly in grafts, eyes, &c. We cannot but acknowledge, that nature in the reproduction of vegetables always acts on the same general plan, and that the process, although from its minuteness verging on the border of what is not appreciable by our senses, yet never passes it.

In this respect the sexual antagonism in plants distinguishes itself from sex in animals. In the animal kingdom, higher mental impulses, such as sensibility, inclination, will, influence sexual intercourse, and the several manifestations do not by any means correspond in their appearance with the growth of the animal, but are all along regulated by a higher nature, and most intimately connected with mental emotions. On the contrary, the process of reproduction in a vegetable can only be looked on as a peculiar kind of growth. The same impulse, which rules vegetable life in all its other manifestations, that of increasing in length and in breadth, also operates from the beginning in the production of a plant. In that part, which we compare to the male organ in animals, an unusual activity in growth lengthwise develops itself. The pollen tube, is, in relation to its excessively small diameter, longer than the highest palm tree, or than any tree of the most gigantic proportions. In the ovum, which we regard as the analogue to the female organ in animals, a tendency to growth in breadth develops itself from the beginning, for it deposits one layer of cells round another, and thus increases the part in its dimension of breadth, just as the stem or branch of a tree does the same by the deposition of yearly rings. According to this view of the matter, the production of a seed is nothing but the peculiar union of growth, longitudinally and laterally in the smallest space, and therefore, so to speak, of little *corporeal* importance, although accomplished by the highest degree of power and vitality. But the new vegetable life is satisfied with its *corporeal* endowments, and does not require more occult ones, it begins and ends with *corporeal* matters. We must nevertheless remark that this process, this many-membered play of the *corporeal* form, this drama so rich in different acts and transformations, is under the dominion of a power inscrutable to us. From the first production of the infinitely small embryo in the seed of an acorn, till the period when after hundreds of years it stands before us in the gloom of the forest, and its gigantic proportions inspire us with awe, its life, and the life of every vegetable is ruled and directed by a forming mind: and this secret power meets us every where in the vegetable kingdom. It is in action, from its beginning to its end. We acknowledge that here a sublime riddle lies before us, and with reverential awe we draw ourselves back from it, and admire.

If now we are to reduce this whole process of reproduction to its simplest expression, it appears to be the reciprocal action on each other of two peculiarly endowed cells. The cell of the ovule and that of the pollen tube, or extended inner cellular membrane of the pollen granule. The contents of the latter, the fovilla, that exceedingly fine granular mass surrounded with moisture, play here very much the same part as the so-called cellular nuclei do, in the process of growth. That is, a new cell is formed, (which must be admitted, as being the result of the latest investigation), in this way, that one of the small agglomerate mucus-like granules or little balls, the so-called cytoblast, enlarges itself, and becomes a new cell. Thus the production of a new cell falls within the definition of a bud. Or in other cases, several of these little granules appear simultaneouly to expand themselves into cells, and in such a case, their development from an originally simple nucleus may be compared to a separation and division into several parts. The organic elements of plants, by which these changes in growth and increase of substance are produced, are either themselves surrounded by a cell, which in the progress of development is absorbed by the part which grows after it, or they lie, as in the case of the Cambium or formation sap, outside cells that are already formed, environed by mucus and water. Just as we can trace the mode of the organic increase in the cells transformed to wood, so also can we the form and changes of the pollen granules which in their development and sexual functions appear as free and independent cells. But the embryos of sexless plants also develope themselves in a similar way within a larger or parent cell.

Whatever, however, may be the mode in which the pollen tube acts on the cell about to be impregnated (ovule); whether (according to Schleiden) it sinks down with its lower end into the cavity of this cell, or there is only at ransfusion of the pollen into the latter, the life of the elements of the new plants always begins according to the *universal* forms of growth. There is therefore a point of view, from which we can plainly see, that the formation of the new individual is subject to the laws of growth of the vegetable kingdom. This view receives much confirmation from the process of the formation of the embryos or sporules in several cryptogamia, such as fungi and confervæ. The latter plants consist of long cylindrical tubes, which rest on each other like joints. They form new embryos, by bringing into union with each other two neighbouring tubes or threads at points opposite to each other, by means of an intermediate organ, like the step of a ladder, and bring together in this uniting organ their granular contents, and roll them up into a large granule (the gongylus) which at last, when extricated from its tough coverings, is capable of sprouting out in the water, as a new individual.

The comparison of the sexual process in vegetables with the original formation and development of an animal ovum shews us in a surprising way, that in the latter also the process of development, is quite the same. For the animal ovum is also originally a little bladder, provided with a so-called cellular kernel (cytoblast) whose growth begins with the same process of thinning out, and the gradual enlargement of a small granule within it. We may therefore say, with Schwann, that "a common principle of development presides over all the elementary parts of organized things." And the commencement of vegetable formation under the influence of sex, appears to us only as a higher form of the universal process of development. At the same time we are only authorised to recognise in the highest and most complete vital actions, to which plants can raise themselves, that power, which forms them according to a definite form, or if we choose so to call it, the plastic soul.—*Gelehrte Anzeigen, München, Nos.* 136, 137, 138.

Correspondence.

Correction of the erroneous doctrine that the Snow lies longer and deeper on the Southern, than on the Northern aspect of the Himalayas.—By Capt. T. Hutton.

My dear Sir,—Previous to my "Trip through Kunawar" in 1838, I had frequently heard it contended, that the snow lay longer, deeper, and farther down on the *southern* exposure of the Himalaya, than it was found to do on the northern aspect, and this doctrine having been supported by more than one traveller into these regions, has, I believe, at length been received by the scientific world as absolute fact. You may therefore easily imagine my astonishment, when crossing the higher Passes through Kunawur, Hungrung and Pitti *(vulgo Spittee,)* I found the actual phenomena to be diametrically opposed to such a doctrine, and that the northern slopes invariably carried more snow than the Southern exposure.* Not wishing

* The error we believe originated in the reports of Captain Webb, who surveyed the greater part of the Kemaon, and was adopted by Humboldt, in his celebrated treatise on isothermal lines, who endeavoured to account for it, by the supposed radiation of heat from the elevated plains of Thibet. We have been long conscious of the error here so well pointed out by Captain Hutton, in common with every one who visited the Himalayah.—Ed.

entirely to rely upon my individual observations, I have since applied for information to my friend, Capt. J. D. Cunningham, who being lately deputed on a Political Mission to Thibet, passed a winter in Hungrung, and who fully corroborates my views. I have likewise had access to the late Dr. Lord's notes on the Hindoo Koosh, and find the phenomena observable on that part of the range, to be precisely similar to what I had myself witnessed in Kunawur. Dr. Lord, however, fully relying upon the accuracy of the published information, endeavours to give reasons why the facts of the case should on the Hindoo Koosh, be the reverse of those on the more Eastern Himalaya; but these facts having been misrepresented stand in no need of such explanation, and consequently Dr. Lord's surmise on the subject must fall to the ground. The chief portion of the following notes was contained in my Journal of a trip through Kunawur, &c., furnished to the Asiatic Society, but was for some reason unknown to me, suppressed by the then Secretary, Mr. H. Torrens. As I am inclined to think that the clearing up of the question may be considered of some importance in a scientific point of view, I now send my observations for publication in your Journal. I wish more particularly to call attention to this subject, because it has hitherto gone abroad to the public, that the snow on the Himalaya lies longer and lower down on the southern face, than on the northern; and as both my experience in this matter, and Dr. Lord's remarks on the Hindoo Koosh are directly at variance with this *reputed* fact, I have ventured to quote the above-named gentleman's words, and shall endeavour to remove what I have found to be an erroneous impression.

"At the time of our visit," says Dr. Lord, "the snow which on the southern face extended, in any quantity, to a distance of not more than four or five miles, *on the northern, reached eighteen or twenty*, and at a subsequent period, November 9th, when I made an attempt to go into Turkistan by the Pass of Sir Ulung, and met with *no snow until within ten miles of the summit*, it actually on the northern face extended *sixty miles*, or nearly four days' journey. This is a fact which forcibly arrested my attention, as the reverse is well known to be the case in the Himalayan chain, where snow lies lower down on the southern face than on the northern, to an extent corresponding with 4,000 feet in perpendicular descent. But the Himalaya and the Hindoo Koosh have the same aspect; the same general direction; lie nearly in the same latitude, and in fact are little other than integral parts of the same chain. The local circumstances, however, connected with each are precisely reversed. The Himalaya has to the north the elevated Steppes of Central Asia, and to the south, the long low plains of Hindustan. Hindoo Koosh on the other hand, has to the south the elevated plains of Cabul and Koh-i-damun, between five and six thousand feet above the level of the sea, while to the north stretch away the depressed, sunken, and swampy flats of Turkistan."

Now it will readily be seen, that no just parallel can be drawn between the plains of Turkistan and those of the Bengal Presidency, for the latter are not "sunken and swampy flats;" nor will the elevated Steppes of Central Asia, to the north of the Himalaya, bear a moment's comparison with "the elevated plains of Cabul and Koh-i-damun."

Against the long received opinion, that the snow lies deepest on the southern face, I shall merely oppose the few facts which fell under my observation during my journey into Tartary, and now fully corroborated and confirmed by the testimony of Captain J. D. Cunningham. First then, it must be observed, that in the month of June when I crossed the Roonung Pass, the snow lay deepest and farthest down on the northern exposure. On the southern face of the mountains it was first met with at about 12,500 feet of elevation lying in large fields or patches, and uniting at about 13,000 feet into one broad unbroken sheet, from whence to the summit of the Pass, or 1,500 feet more, (the height of the Pass being 14,500,) it continued so, with the exception of about 50 feet at the crest, where on the southern face there was none at all. On the northern slope, on the contrary, it commenced at the very crest of the Pass, and continued in an unbroken sheet for fully two miles and a half, while beyond this for half a mile more, it was broken and lying in patches. The facts observable here are, therefore, greatly in favour of the northern face, for while the extent of snow is there estimated at three miles, that of the opposite exposure is but two thousand feet.

Again, on the Hungrung Pass, rising behind Soongnum, the southern side had far less snow, both in respect to depth and extent than the northern face, down which it stretched nearly to the village of Hungo, or to a distance from the crest of the range of 3,600 feet in perpendicular descent. Again, in Pitti, *(vulgo Spittee)* above Leedung, while the southern exposure of the Pass which rises behind the village to the height of 15,500 feet, was almost entirely free from snow, except immediately at the summit of the range, the whole northern face was buried deeply to some extent.

On my return to Hungrung in July, the northern side still held patches of snow here and there, while the crests of the mountains were covered;—but to the southward not a vestige of snow remained except far down the glen, where from the falling of repeated avalanches from above, a hard and solid mass had become wedged into an arch or bridge across the brawling torrent that descended from the Pass. Opposite to this, and merely divided by the narrow valley in which stands the village of Soongnum, the northern aspect of Roonung still retained a broad and hardened belt of frozen snows along its crest, while to the southward not a trace of it remained. To the right of Soongnum towards Roopah, on the southern cliffs no snow remained at all, while those with the northern aspect were in most parts still deeply buried, as was also the northerly face of Manerung in Pitti.

From these few facts it will appear, that contrary to the usual belief, the snow is retained longer on the northern than on the southern exposure, exactly corresponding with what Dr. Lord observed on the Hindoo Koosh; and why indeed other than such a result should be expected, I am at a loss to divine. The aspects nearly the same; forming part and parcel of the same great range, surely the same phenomena in this respect might naturally be looked for. Taking it for granted, that the hitherto published accounts of these stupendous and interesting hills, were circumstantially to be relied on, Dr. Lord endeavours, with some degree of plausibility, to give the why and wherefore of this difference by stating, that the local relations of the Himalaya and Hindoo Koosh are precisely reversed. The phenomena, however, having been misrepresented, his arguments will not hold good, and besides we shall find that the inferences drawn by Dr. Lord are by no means correct, for although the high steppes of Central Asia stretch away to the northward of the Himalaya, the country immediately to the southward of them by no means corresponds to the low and swampy tracts on the north of the Hindoo Koosh, between which and the plains of Hindustan he would seem to draw a parallel. The mountains south of the true snowy range, although perhaps generally lower than its own elevated and rugged peaks, are still lofty, and considerably exceed the height of Cabul and Koh-i-damun, being for a distance of more than a hundred miles a mere confused series of mountains upon mountains, without any approach to plains or alluvial valleys, such as are interspersed between and characterise the hilly tracts of Affghanistan. Indeed it is moreover a fact, that to the south of the Roonung and Hungrung Passes, there are mountains of a very superior elevation to either of them, as for instance the Giant peaks of Ruldung, rising to the height of 22,000 feet above the sea, and consequently *exceeding them* by about 7,000 feet, or *nearly one-half of their elevation,* while at the same time *they are more than three times the height* of "the elevated lands of Cabul and Koh-i-damun." Thus it is evident, that no parallel can be drawn between the southern hilly aspect of the Himalaya, and the northern swampy flats of Turkistan; for the former actually far exceed in elevation even the southern aspect of the latter mountains. Nor can any fair comparison be made between the northern steppes of the Himalaya and the southern elevated plains of the Hindoo Koosh, for while the steppes of the north are as high *(if not more so)* as a great portion of what appears as the snowy range, the plains of Cabul and of Koh-i-damun are on the contrary not more than one-third of the height of the Hindoo Koosh.

But the same points which are here insisted on as facts are observable at Simla, without travelling even to the snowy range for proofs, for it is notorious to all who have visited the Hills, that the snow lies longest on the northern face of Mount Jacko, than on any other part of it; and in the summer of 1836, after the severe snow storm which the place experienced in spring, snow was procurable on the northern exposure even on the 10th May, while from every other aspect it had disappeared weeks before.

The same facts are well known likewise at Mussoorie, where the northern slopes are invariably longer covered than any others. It may be said in this latter instance, that the proximity to the plains will not permit the snows to lie long upon the southern exposure, and no doubt this is in a great measure true, but it militates only the more against the arguments adduced by Dr. Lord and others, since according to them, the plains are the cause, or rather furnish the causes, which produce the phenomena they contend for, and which I am endeavouring to refute. The southern course of the sun during the season of snows ought also to weigh in favour of my argument, for it can scarcely ever shine upon the northern face during winter for any length of time; and certainly only for the shortest portion of the day even in summer; and, as it is an indisputable fact, that frost commences again in those high regions the moment the sun's rays are withdrawn, or are screened from the northern heights, it stands to reason, and, I repeat, the *fact*, that the snows should lie longer on the northern, than on the southern exposure.

Another argument also in favour of the snow on the northern side, appears to be furnished in the occurrence of dense forests and vegetation along the southern slopes, while they are nearly altogether wanting on the northern face. Whatever may be the cause of this difference, it is certain that where forests and luxuriant vegetation abound, a greater degree of humidity must be engendered than where no vegetation exists, for plants are known to attract humidity; and again the very occurrence of vegetation must prove a degree of moisture in the atmosphere, for without it they could not flourish. Now the damper the climate, the less likely is the snow to be deep, or to lie long, while the drier it is, the less likelihood is there of its melting. Forests, however, not only attract humidity, but exercise otherwise a material influence on the districts in which they occur, by raising the temperature and warding off inclement gales, and therefore snow would continue a shorter time in a well wooded and sheltered country than in one which was comparatively barren. Such should be the case then, in the Himalaya, whose northern and southern aspects correspond in a great measure to such circumstances. The snows too, are known to melt most readily during the period of the monsoon, when they are dissolved chiefly by the heavy falls of rain. Now the monsoon does not extend to the northern aspect of the Himalaya, and may indeed be said to cease altogether on the Cis-Himalayan or southern face, not even reaching positively and decidedly to Roonung or Hungrung, although no doubt exercising some influence on them. While the rain therefore would exercise comparatively little influence on the northern snows, the humidity and exhalations which would naturally be induced along the belt of southern forests over which the rain was falling, would operate powerfully in reducing the amount of snow on the Cis-Himalayan exposure.

Although the village of Chini, in Kunawur, has hitherto been considered to be beyond the influence of the monsoon, it is nevertheless *within* it, and on my return from Pitti in July, I fell in with mists and light rains more than two marches beyond that point. Dense mists and clouds came rushing up from the south through the break in the Himalayan chain, caused by the valley or glen of the Sutluj, and these mists had caused the disappearance of all snow from southern aspects, while portions still remained on the north, although daily diminishing in quantity. This continues until towards the conclusion of the monsoon, when falls of snow again commence over the more elevated tracts in September, and accumulate with occasional thaws until the return of summer.

To the foregoing proofs, I shall now add the lately received corroborative testimony of Captain Cunningham. The first communication on the subject was dated from Leo, on the Spittee river, April 6th 1842, and is as follows: "I was at Chooret during the coldest part of the year, about 12,000 feet above the sea, continual snow and blow, but as I was in a ravine I never saw the thermometer at sunrise below *minus* 11°. I have since the middle of February been moving about within small limits, partly for the sake of variety, though that's not much amid a monotonous desolation, and partly for the facility of procuring wood and supplies. In this country a southerly wind and the sun together kept *slopes with a southern exposure*, and 12 and 13,000 feet high, *quite clear of snow*, (except when it was actually snowing,) and this too towards the end of January, and beginning of February, or I may say at all times, (for the gusts of wind were most furious, and until I devised certain remedies, I used to be half smothered in my hill tent.) On the northern slopes the snow accumulated, and in narrow dells it may have been hundreds of feet deep. On northern exposures too, extensive slips of pure snow take place, and bury houses and bridges over the Sutlej occasionally, and small streams in hundreds of places. Here I am about 9,000 or 9,500 feet high, wind generally southerly, *no snow whatever on southern slopes within* 15 *or* 16,000 feet, apricot trees budding; but *on northern slopes and in hollows abundance of snow.*"

The second letter is dated from Shalkur on the Pittee river, August 7th, 1842 and is as follows: "About the snow lying longer on the southern slopes of hills (hereabouts) what more can I say? In February (10th and 11th) this year, I made a march of 15 miles from Chooret on the Para to Chungo on the Pittee. *In getting up the northern slopes the snow was, I don't know how deep.* On reaching the summit of a Pass I found no snow, *nor did I find any on the southern slopes;* except in hollow portions or tolerably flat bits. The highest Pass on the road is perhaps 13,500 or nearly 14,000 feet. The effect is attributable partly to the violent southerly winds which blow during December, January and February, and partly to the sun's rays. *In the beginning of May,* in coming from Nako to Chungo in Hungrung, I found *no snow on the southern, eastern or western slopes;* but *on some northern ones which were steep, there was snow three and four feet thick;* elevation about 11,500 feet. At Shalkur up *to the middle of June the snow lay on the northern sides of the gullies or ravines of the hills;* and when out shooting, I have had much difficulty in crossing them; elevation 11,000 to 11,500 feet. I was informed also, that the *northern slopes of the Hungrung Ghat,* between Soongnum and Hungo in Kunawur, *had some snow until the middle of June. On the southern face it had melted six weeks before, except in hollow places.* Just now (August 7th) there is no snow *on western slopes of hills* 17,000 *feet high,* but *there are a few patches on the northern slopes.* The southern and eastern slopes of these particular hills I can't see. You can make what use you please of the above—they are *facts.*"

Thus I think it will now be apparent to any unprejudiced mind, that the hitherto received accounts are erroneous, and that contrary to the usual opinion, *the snow of the Himalayas lies longer and deeper on the northern*, than it does on the southern exposure.

Mussooree, 29th March, 1843.

Letter from a Correspondent on the Falco-Rufipedoides, Dhuti-Dhuter of India.

One of your correspondents has requested me to state what are the Indian Falcons, called Dhooti and Karjoona, and whether either of them is the Falco Subbuteo of Europe. In compliance with his request, I beg to state through your *Journal, pro bono publico*, that neither of these Indian names is applicable to Subbuteo, which species seems to be unknown in the plains, and is rare in the hills. In several years I have procured only two specimens, a fine female measured 12 inches and half in length : bill to the gape $\frac{13}{16}$ tail $5\frac{3}{4}$, closed wing $10\frac{3}{8}$. Tarse to sole $1\frac{7}{16}$. Central toe and nail less $1\frac{3}{4}$. Hind $\frac{13}{16}$. Its structure, typical of Falco, and its colours agree with those of the European Subbuteo. Wings equal to tail, with the 2nd quill rather longer than the 1st, which latter alone is notched, and sharply so, about $1\frac{1}{8}$ inch from its tip : tail rounded : tarse bi-scutellate to the front ; reticulate to sides and rear : toes long, unequal, slender, typically falconine, with the acropodia almost wholly scutellate. Talons medial, unequal, acute ; the inner and hind largest. This bird is blackish, slaty above and rufescent-luteous below : Ears and moustache blackish. Throat and neck in front immaculate : breast and flanks broadly streaked down middle of plumes with blackish ; thighs more narrowly : alars and caudals internally with frequent pale bars : bill plumbeous, cere and legs greenish-yellow, claws black.

The Karjoona of India is Falco-Rufipes, distinguished structurally by its devious and small toes and talons, so like to Tinnunculoides. Its wings are equal to its tail, which is full sized and rounded. It is slaty black above, slaty grey below, the belly and vent deep ochreous red, cere and legs orange red : bill yellow horn : talons pale and equal in size. It is from 11 to 12 inches long, wing $8\frac{3}{4}$ to $9\frac{1}{2}$, the female very much resembles Subbuteo in colour, but may be known at once by lesser size, and by its smaller digits and pale equal talons.

The Dhuti (Mas Dhuter) is unknown, I think, to English or other systematic writers, I called it, some years back, Rufipedoides, from its resemblance to Rufipes, which, however, is chiefly in the colours and size: for in structure it most resembles Subbuteo, its peculiar or own specific marks being a short subfurcate tail, and wings very long, exceeding the tail in the quiescent attitude. Its bill is rather larger than that of Subbuteo or of Rufipes, and its feet exceed the size even of those of the former, though otherwise quite like them. In size it is smaller than either of those birds, length $10\frac{1}{2}$ inch (Mas); bill to gape $\frac{13}{16}$: to brow, $\frac{11}{16}$: tail $4\frac{1}{2}$, wing $8\frac{13}{16}$ to 9, tarse $1\frac{3}{8}$. C. toe and nail $1\frac{3}{8}$. Hind less 1. Above, including the whole cheeks, dark slaty blue, below clear ochreous red: alars and caudals internally with 9 to 10 rufescent bars and dark tips, shafts of plumes dark: cere, orbitar, skin and legs reddish yellow, bill plumbeous, nails black and unequal, inner and hind largest.

May, 1843.

Classified Catalogue of Mammals of Nepal, (corrected to end of 1841,* *first printed in* 1832.*)*

O. *Homo Sapiens.*—Mass of population belongs to Kalmuc subdivision of the Great Mongolian stirps, with some admixture of Indian stock. In the *Tarai* and low valleys of the hills, are some traces of aborigines of Southern race, like the Bheels, Coles, &c. These latter are denominated Thárú, Denwár, Durre, Manjhe, and Brahmoo. Besides all these, there are some scattered half savage tribes in the Hills, living nearly in a state of nature. They are called Kusoonda-chepânga-Hayoo and Soomvár, and have languages and physiognomy peculiar to themselves. They seem to be the fragments of an aboriginal race of southern origin displaced by the present Transnivean population. That population consists of the following tribes speaking divers and now strongly marked dialects, the Khas, the Magar, the Newar, the Limbu, the Lapcha, the Kirantee, the Cachari, or Cis-Himalayan Bhotia.

* Reprinted from the Proceedings of the Zoological Society, with corrections and additions up to the end of 1843 by Mr. Hodgson.—J. M.

The languages and forms of these tribes demonstrate their essentially Northern stock or race; but some of them, and most so the Khas, have been much mixed with the Brahmanical or modern Indian family. The Newars also have received a copious infusion from the South. The two historical events which brought the southern into the Sub-Himalayas, are, 1st the persecution of the Buddhists by the Brahmans; 2d of the latter, by the Mahomedans. The Khas are now the dominant and military tribe; the other soldier tribes are the Muggar and Gurung.

N. B.—As to location, the following initial letters signify as follows:—H. is habitat, and G. after it is general, that is, both *Tarai* and all three regions of the hills. L. is lower hilly region. C. is central hilly region, and N. is northern hilly region. T. is *Tarai* and saul forest, or the plains at the base of the mountains. For a general sketch of features and character of the above four regions, see Catalogue as first printed *apud* Journal, Asiatic Society.

QUADRUMANA.

Simiadæ.

1. *Semnopithecus necnon Cercopithecus.*—Gen. ch. nobis. Facial angle 45 to 50: face flat: nose short with long narrow lateral nares: limbs long: thumbs small, remote: no cheek pouches: 5th tubercle on last molar present or absent: callosities large: canines variable, large: only in grown males: stomach sacculated and banded as well as intestines: tail very long, commonly tufted, and exceeding the length of the animal. Agile, grave, gregarious, not docile.

1. Sp. new, schistaceus nob. (Nipalensis of former catalogue, see remark at end.) Darker and more uniform in hue than Entellus, and stouter built like Maurus. I think there may prove to be two species.

H. T. and L. more rarely. C. and N. even.

2-3. *Macacus? Pithex*, Nob.—Gen. ch. nob. Facial angle 50: muzzle not elongated. Callosities and cheek pouches large. Buttocks often nude. Structure compacter, but generally like that of Semnopithecus; limbs shorter, thumbs larger, orbits more salient, head rounder, canines similarly variable, nares shorter, rounder and more terminal. Stomach simple. Cœcum and rectum saculated. Tail equal to half the length of the animal. Agile, lively, gregarious, familiar, and docile.

2. Sp. new. Oinops et Pelops, nob.

H. of the first, T. L. and C.—of the second, N.

VESPERTILIONIDÆ.

Rhinolphinæ.

4. 8. *Rhinolphus.*—5 Sp. new. Armiger, et Tragatus, et Subbadius, et Macrotis, et Perniger. Nob. H. C. so far as known.

Pteropinæ.

9. 10. *Pteropus.*—2 Sp. new. Leucocephalus et Privorus, Nob. The first is alleged to be identical with Medius Auct. H T. passengers in hills.

Vespertilioninæ.

11.15. *Vespertilio.*—5 Sp. new. Formosa, Fuliginosa, Pallidiventris, Muricola, et Labiata Nob. H. C. so far as known.

FERŒ VEL CARNIVORA.

Felidæ, *genus*—Felis, *subgenera.*

16. 22. *Felis.*—7. Sp. Tigris, Pardus, Leopardus, Auct; et Macroceloïdes, Pardochrous,* Viverriceps et Murmensis, Nob. (Viverriceps is identical with Viverrinus Auct.) Of 1, 2, 3. H. G.; of 4, 5, 7. C.; of 6. T. but Leopards are nearly confined to the hills.

23. *Lynchus.*—1. Sp. new. Erythrotus, Nob. apparently identical with F. Chaus Auct. H. G.

Canidæ, *genus*—Canis, *subgenera.*

24. *Canis.*—1. Sp. domestic, two varieties of the Mastiff and two of the Terrier of Tibet; the Pariar of the plains, and cross-breeds with the first; of 4 first H. N.; of rest, G.

25. 26. *Vulpes.*—2. Sp. Indicus, Nob, et Montanus, Pearson. Indicus is apparently identical with Bengalensis, Necnon Kookri, H. of first T; of second, C. and N.

27. *Sacalius*, Smith, *Oxygoüs*, Nob.—Jackall, 1. Sp. Indicus, Nob. var. of Aureus? H. G. rare in hills. Common in the great populous valley of Nepal proper, seldom seen elsewhere.

28. *Cuön* Nob.—General structure and dentition of Canis, but molars $\frac{6\ 6}{6\ 6}$ only, the 2d tubercular being deficient. Odour and aspect of the last. Head blunter. Tail and ears large. Teats 12 to 14. Venatory, gregarious, does not burrow.

* These are Macrocetis and Nipalensis of prior Catalogue; but both species appear to be new, and have been so pronounced by excellent authority. The brilliant Pardine hues of the latter are an invariable and distinctive attribute; as also in our Prionodon Pardicolor, its analogue and representative.

1. Sp. Cuon Primævus Nob. type.—Canis Primævus of Bengal. Asiatic Society's Transactions, (subsequently named the type. Chrysæus by Smith.) H. L. C. and N.

MUSTELIDÆ.

VIVERRINÆ.

29. 30. *Herpestes.*—2 Sp. new. Nigula Auct. Griseus, Auct.? et Auropi unctatus Nob. The latter is alleged to be identical with Edwardsi. Auct. H. T. and C. respectively.

*Viverra Auct.** Size large, robust habit, never climbs, thumb not remote, nails obtuse.

31. 2. 2. Sp. new. Melanurus et Civettoides, Nob. H. G.

Viverricula, Nob.—Size small, scansorial, habit vermiform, nails more or less raptorial, and thumb remote, pouch as in Viverra.

33. 4. 2.—Sp. Indica et Rasse Auct. H. T.

35. *Prionodon.*—1. Sp. new. Pardicolor Nobis, H. C. and N.

36. 38. *Paradoxurus.*—3 Sp. new. Hirsutus, Nepalensis, et Laniger, H. T. C. N. respectively.

N. B.—First possibly identical with Bondar, but has *no* dark lines on the body.

39. *Ailurus.*—1 Sp. Fulgens Auct. the Wah, H. N.

MUSTELINÆ.

40. 4. *Mustela.*—5 Sp. M. Erminea Auct. and four new, viz. Canigula et Sub. Hemachalanus et Calotis et Auriventer vel Cathia, Nob. H. C.

45. *Martes.*—1. Sp. Flavigula Auct. H. C.

46. 47. *Aonyx.*—2. *Sp.* Horsfieldii et Indigitata mihi, H. C. and N.

48. 51. *Lutra.*—4 Sp. Nair Auct. and 3 new. Tarayensis, Monticola, et Aurobrunnea, Nob. H. of first is T.; of 2 next, L. and C.

52. Helictis.—1. Sp. new. Nipalensis, Nob. (alleged to be identical with Helictis moschautus of Gray, and also with Gulo Orientalis of Horsfield.) H. L.

53. *Mesobema (olim Urva) Nob.*—Teeth as in Herpestes, but blunter; structure and aspect precisely mediate between Herpestes and Hilictis. On either side the anus, a large, hollow, smooth-lined gland secreting an aqueous fœtid humour, which the animal ejects posteally with force. No subsidiary glands, nor any unctuous fragrant secretion. Teats 6, remote and ventral;

* These are differential characters merely, and are ours. See Viverricula.

orbits incomplete. Parietes of the scull tumid, with small cristæ. Snout elongated and mobile. Subplantigrade.

1. Sp. M. Cancrivora, Nob. type: the Gulo Urva of Asiatic Journal, Nob. H. L. and C. This type is allied to Crossarchus and represents Nasua of America. It is nearer to Hilictis than to Herpestes, all points considered, and belongs rather to the Arctogalidæ than to the Cynogalidæ of H. Smith.

Ursinæ.

54. *Ursitaxus, Nob.*—Molars $\frac{4}{4}\ \frac{4}{4}$ of ursine flatness almost on the crown, but the last above transverse, and less than the carnassial tooth. Aspect and size of Taxus. No ears; coarse scant hair; anal glands as in Mydaus. Genital organ bony, and annulated spirally. Typically plantigrade and fossorial. Carnivorous. Teats 4 in a transverse parallelogram.

1. Sp. Inauritus Nob. type. H. L.

N. B.—This form I still think is erroneously sought to be identified with Ratelus Mellivorus, alias Mellivora Ratelus of Africa.

55-6. *Ursus.*—2. Sp. Tebetanus et Isabellinus Auct. H. of first is C. second N.

57. *Prochilus.*—1. Sp. Labiatus Auct. H. T.

Sorecidæ.

58. 60. *Erinaceus.*—3. Sp. Spatangus, Collaris, et Grayii Auct. H. C.

61-4. *Sorex.*—4 Sp. Indicus Auct. et Pygmæus et Soccatus et Nemorivagus Nob. H. G.

65. *Talpa*—1. Sp. new. Micrurus Nob.* H. C. and N.

UNGULATA.

Pachydermes.

66. *Elephas.*—1. Sp. Indicus Auct. two varieties. Isodactylus et Heterodactylus Nob. H. T.

67. *Rhinoceros.*—1 Sp. Indicus Auct. H. T.

Anaplotheres.

68. *Sus.*—1 Sp. S. Schophra Auct. the wild Boar, two varieties, Aipomus, et Isonotus Nob. H. G.

* Specific character uniform velvet black, with silvery grey, gloss iridescent when moist; nude snout feet, and tail, fleshy pink; the last very minute; structure otherwise typical. Snout to rump $4\frac{3}{4}$ inches. Head $1\frac{1}{2}$. Tail $\frac{3}{16}$. Palms and nails $\frac{1}{2}$. Planta and nails $\frac{13}{16}$.

EDENTATES.

69. *Manis.*—1 Sp. new. Auritus Nob. (alleged to be identical with the common Indian type, or Pentadactylus.) H. G.

RUMINANTES.

BOVINÆ.

Genus *Bos*, Subgenera?

70. *Bos.*—Cranium moderate, proportional, or without excess in the cerebral or facial region; frontals shorter than the face, flat, and not broader than long. Occipital plane of the scull quadrangular, never arched along the culminal line, nor indented by the temporal fossæ, smaller much than the frontal plane and forming an acute angle therewith. Horns attached to the highest line of the forehead, rounded, moderate, curved up or down or forward; 13 pairs of ribs; no true dorsal ridge, but sometimes a fleshy hump; dewlap and muzzle large and square.

    1 Sp. and type, Bos Domest: Nipalese varieties of. H. G.

    N. B.—These Bovine characters are all ours. See Journal Asiatic Soc.

71. *Bibos Nobis.*—Cranium large, massive, exhibiting preponderance of the frontal and cerebral portion over the facial; frontals as long as the face, concave, broader than long, and surmounted by a large salient crest ascending above the highest bases of the horns. Occipital plane of the scull spheroidal, very large, larger than the frontal plane, deeply indented in its centre by the temporal fossæ, and forming an acute angle with the frontal plane. Horns attached below the highest line of the frontals, massive but short, ovoid or subtrigonal, and curving ascendantly; thirteen pairs of ribs; a true dorsal ridge co-extensive with the ribs and terminating abruptly; dewlap and muzzle small; period of gestation longer than in Bos.

    1 Sp. and type. Bibos Cavifrons: probably the Bos Gaurus of authors. H. T.

    N. B.—Gavæus, an aberrant species leading to Bos? Possibly the 5th type of Bos Genus.

72. *Bison.*—Cranium moderate, depressed, inclining to Bubaline forms in the excess of the facial portion over the frontal, and in the rounding off of the frontals into the occiput; frontals decidedly broader than long, more or less convex, and forming an obtuse

angle with the semi-circular or trigonal occipital plane, which is strongly ridged by the parietes at its summit, is smaller than the frontal plane, and moderately indented. Horns attached rather in advance of the parietal apex of the cranium, small, rounded, curving ascendantly, or out of the horizontal; 14 or 15 pairs of ribs; a true dorsal ridge, but confined to the withers, and terminating posteally in a gradual slope; dewlap none; muzzle small. Types B. Americanus et Pœphagus.

1. Sp. Pœphagus, in Nepal. H. N. and also Tibet.

73. *Bubalus.*—Cranium large, elongate, compressed or narrow, disproportional, exhibiting great excess (a 3rd) in the facial over the frontal or cerebral portion; frontals short, narrow, convex, usually forming an obtuse angle with the occipital plane, which is large and circular in proportion to the obtuseness of that angle, and to the consequent rounding off of the culminal line of separation; parietals merged, not ridged as in the last, nor culmenal. Horns attached to the ends of the highest line of the scull, always exceeding in length that of the cranium, and usually greatly so, depressed, strictly trigonal, and neither ascending nor descending, but directed horizontally backwards; thirteen pairs of ribs; no true dorsal ridge nor fleshy haunch; muzzle large and square; dewlap medial.

1. Sp. and type, Bubalus Arna, fœm. Arnee, two varieties. Macrocerus, et Speirocerus, Nob. H. T.

Antelopidæ vel Capridæ.

74-5. *Antelopa.*—2 Sp. Cervicapra Auct. et Bennettii Auct? Bharatensis, Nob. Vulgo, the Chouka or Ravine Deer. It seems to be identical with Africana Auct. H. T.

76. *Pantholops Nob.*—Molars $\frac{5\,5}{5\,5}$ incisors erect, strong and rectilinearly ranged. Horns with clear sinus in cores, long, slender, erect, sublyrate, inserted between the orbits, compressed, nodose, and approximated at their bases. Large inguinal purses. No suborbital sinus. Nose ovine, bluff and hairy. Large intermàxillary pouches or subsidiary nostrils. Knees simple. Ears pointed, short. Tail short, full. Hoofs low, broad and padded with large interdigital pores. Size, habits, and general aspect of Antelopa et Gazella. Females hornless, with lesser inguinal purses, and two teats.

1—Sp. new, and type Antelope Hodgsonii of Abel; the Chiru of Tibet. H. N. transnivem.*

77. *Tetracerus.*—1 Sp. Chickara necnon Quadricornis Auct. Chousingha of Hindoos. H. T.

78. *Nemorhædus.*—1 Sp. Proclivus vel Thâr Nob. H. C. and N. Large interdigital and suborbital sinus.

79. *Kemas.*—1 Sp. Goral Hardw. Large interdig. but no suborb sinus.

80-1. *Capra, wild.*—1 Sp. C. Ibex, Himalayan variety; and tame; two varieties of the common Goat and two of the Shawl Goat; or 1, Sinal; 2, Doogoo; 3, Changra; 4, Chapoo. H of 1, is N.; of 2, 3, C.; of 4, 5, N. and Tibet.

82. *Hemitragus Nob.*—General structure, and odour, habits horns of Capra, but having a small moist muzzle and four teats in the females; no suborbital or interdigital pores. H. N.

1.—Sp. and type, Capra, Quadrimammis vel Jharal Nob. C. Jemlaica of H. Smith?

N.B.—Mr. Ogilby has unwisely confounded this type with his Kemas, the characters of which group were, by the bye, first correctly stated by myself, as were those of Hemitragus. The Goral or type of Kemas has, (besides a larger muzzle than that of Jharal,) interdigital pores; the Jharal or type of Hemitragus has none, wherefore Mr. Ogilby was especially bound by his own principles not to confound the two.†

83-4. *Ovis, wild.*—2 Sp. new, Ammonoides Nob et Nahur Nob; and four tame varieties; viz. the Hûnia, Bârwal, Câgo, and Silingia. H. of 1, 2, is N.; of 3, N.; of 4, 5, 6, C.

CERVIDÆ.

Genus Cervus—Subgenera.

85. *Cervus.*—1 Sp. Elaphus of the Saul forest possibly a distinct species, Affinis Nob. Mool or chief. Bara Singha of Hindoos. H. T.

86. *Pseudo-cervus Nob.*—Tail nearly obsolete. Horns branches at the base as in Cervus, above as in Rusa, and qua-drifurcate, size smaller. 1 Sp. Cervus Wallichii Auct. type. Gyana mriga.

N. B.—Alleged to be identical with Affinis, but quite erroneously. H. N.

87. *Rucercus Nob.*—Aspect and size mediate between Elaphus and Hippelaphus. Muzzle remarkably pointed. Horns moderate, smooth,

* Belongs properly to the Zoology of Tibet, of which see separate catalogue lately published.

† Horns round, ringed and black, and horns angular, keeled grey and nodose, are yet and certainly diagnostics of the Antelopes and of the Goats, and by these respective marks also are Goral and Jharal assigned to the one and the other group. The intense caprine odour of the Jharal is a most important mark unerringly diagnostic.

pale; one forward basal process on each beam; no median; summit branched as in Elaphus. Canines in males only.

N. B.—These subgeneric characters are ours, and are confessedly frailly based, but not less so than the admitted distinctions. The whole family requires reconstruction.

1—Sp. new, Cervus Elaphoides Nob. The Baraiya. H. T. (This is identical with the C. Duvacellii of Cuvier.)

88-90. *Rusa.*—Canines in both sexes. No interdigital pores. Heavily maned. Horns with one basal, and one superior, process thick-dark, and peraled. 3.—Sp. new, Jaraya, et Nepalensis, et Hete, rocerus Nob. Samber and Jerrow.

N. B. Jaraya probably identical with Hippelaphus et Aristotelis Heterocerus, alleged to be so with Niger of Buchanan: but Niger where printed, H. T. and L.

91-3. *Axis.*—3. Sp. 1st Cervus Axis Auct. or Axis Major Nob. 2nd Axis Minor, Lesser spotted Deer Nobis, and 3rd Axis Procinus. Smith H. T. The Chittra, Laghuna and Para respectively.

94. *Stylocerus.* 1 Sp. new, Ratwah, Nob. The Kaker and Barking Deer of Europeans. Probably identical with the insular type or Cervus Muntjac. H. T. L. and C. Interdigital pores in hind feet only.

Moschidæ.

95-7. *Moschus.*—No interdigital, suborbital and oringuinal pores, caudal and preputial oderiferous glands.—3. Sp. new, Leucogaster, Chrysogaster, et Saturatus, Nob.

N. B.—Saturatus is probably identical with the Moschatus of Linnæus. H. N. and Tibet.

98. *Moschiola.*—1. Sp. new, Mimenoides Nob. Vulgo Bijay. H. T.

Solipedes.

99. *Equus.*—1. Sp. Several small tame Himalayan and Trans-Himalayan varieties. H. N. and Tibet. See Tibet Catalogue.

Rodentia. Muridæ.

100. 5. *Mus, Rats.*—6 Sp. Rattus Auct.? Rottoides Nob. Decumanus Auct.? Decumanoides Nob. Nemorivagus, et Nitidus, et Hydrophilus, et Niviventer Nob. H. C. and N. so far as known.

106. 9. *Musculus Nob. Mice.*—4 Sp. new, Cervicolor, Dumecolus, Nipalensis, et Dubius Nob. H. C. and N. so far as known.

110. 11. *Arvicola? Neotoma?*—2. Sp. new, Pyctoris, et Myothrix Nob. also probably the Hydrophilus introduced above. H. C. and N.

111. *Arctomys.*—1. Sp. new, Himalayanus Nob. H. N. and Tibet.

13. *Rhizomys.*—2. Sp. new, Badius Nob. H. L. and C.

Sciuridæ.

114. 16. *Sciurus.*—3. Sp. new, Macruroïdes, Locria, et Locroides Nob. H. L. C. and N. indifferently.

117. 20. *Sciuropterus*—4. Sp. new, Magnificus, et Chrysotrix,* et Senex, et Alboniger. H. L. C. and N. rarely L.

121. *Hystrix.*—1. Sp. new, Nipalensis Nob. Leucurus. Auct.? H. G.

122. 3. *Lepus.*—2. Sp. new, Aryabertensis, et Oiostolus Nob. H. of 1st, G.; or 2nd N. and Tibet. (Aryavertta, classic name for Hindoos, more proper than Madhyades, which is the locale of our Sp. as Deccan is of Nigricollis. Macrotis better suits another Sp.) Our first Sp. is like Ruficauda, and our second, Tibetanus of Vigne.

N. B.—These are the Indicus, et Quomodius of former catalogue; but several local names are now dropt.

124. *Lagomys.*—1. Sp. Nipalensis Nob. H. N. and Tibet.

In all 124 species, of which probably 55 to 60 are new. Their descriptions, with four or five exceptions only, are to be found in the Journal of Bengal Asiatic Society, and in that of Mr. McClelland. The remaining four or five yet unpublished are forthcoming shortly. The catalogue is considerably enlarged since it was last published in Lin. Trans. A. D. 1838. Some uncertainty still hangs over the intimate structure of the murine animals, but all the rest have been carefully allocated in the modern genera after full examination of their conformation, while their special habitats have been determined upon accurate information.

I have lately seen a critique by Mr. Ogilby of my labours in this department, but I cannot say it is distinguished by much candour. It is well known, that when Mr. Ogilby wrote, several successive catalogues of mine, embodying the improving results of new information, and greater skill in the appreciation of it, existed; and had Mr. Ogilby consulted the whole of these, *according to their dates*, he might have spared a great part of his censorial remarks. Let Mr. Ogilby consult the very first catalogue, and he will find, that most of his identifications of my so-called new species, with others recorded by authors, had been priorly indicated by myself. Let Mr. Ogilby have patience, and he will still find that several of these species are really new. With regard to Semnopithecus Entellus, Papio Rhesus, Cercopithecus Radiatus, Manis Macrourus, Cervus Equinus, not I, but the late Mr. Bennett,

* Chrysotrix. MS. General size characters and Colours of magnificus, but with a pale golden yellow stripe down the spine. Senex rather less; of much paler hues chesnut mixed with canescent; head pepper and salt hue since published. See As. Journal.

is answerable for the errors committed, where such there be, as I have letters of his to prove; and so too, for the misappropriation in reference to Felis Viverrinus. Of that species, my specimens had reached London before Mr. Heath's, and been seen by Mr. Bennett, who had suggested to me the Viverrine likeness, which I was contending was confined to the head; when to my surprise, for Mr. Bennett was in general singularly fair and courteous, suddenly appeared the description of a novelty ascribed to Mr. Heath. Mr. Gray (apud Hardwicke) had meanwhile justly given the discovery of the species to me, though he retained Mr. Bennett's name for it; but as that name conveyed a false analogy, I have chosen to adhere to my own. In short, Mr. Ogilby's critique is rather too much like a comment on the well-known text, "Wobetide the researcher, who presumes to judge of his own stores."

Extract from the Anniversary Address of the Linnean Society.

"*Aylmer Bourke Lambert, Esq.*, the last survivor of the original members of the Linnean Society, and for nearly fifty years one of its Vice-Presidents, was born at Bath on the 2nd of February, 1761. His father, Edmund Lambert, Esq., of Boyton-House, near Heytesbury, Wilts, married Bridget, daughter of the last Viscount Mayo and his only surviving child, through whom Mr. Lambert inherited the family property and the name of Bourke. He was educated at St. Mary's Hall, in the University of Oxford, and attaching himself early in life to botanical pursuits, joined the Linnean Society at its foundation, and became one of its warmest friends and promoters. In 1791 he also became a Fellow of the Royal Society.

On succeeding to his paternal estate, he was enabled to indulge his taste for botany more freely, and laboured with great ardour and success to increase his herbarium, which at length acquired the character of being one of the most valuable and important private collections in existence. Of this herbarium, and of the several collections from which it was chiefly formed, an account has been given by Mr. Don, who for many years acted as its curator, and who had also charge of Mr. Lambert's extensive botanical library. These collections were at all times most liberally opened by their possessor for the use of men of science, and one day in the week (Saturday) was constantly set apart for the reception of scientific visitors, travellers and others, who either brought with them or sought for information on botanical subjects.

Mr. Lambert's separate publications are two in number: "A Description of the Genus *Cinchona*," London, 1797, 4to. and "A Description of the Genus *Pinus*, London, 1803-24, in two vols. folio. Of the latter work, which is one of the most splendid botanical publications that ever issued from the press, a second edition, with additions, was published in 1828, and a third volume was added in 1834. A small edition, in two vols. 8vo, was also published in 1832.

His other works consist entirely of papers in our 'Transactions.' They are as follows:—

"An account of the *Canis Graius Hibernicus*, or Irish Wolf-Dog.' in vol. ii."

"Anecdotes of the late Dr. Patrick Browne, author of the 'Natural History of Jamaica'," in vol. iv., containing some interesting particulars relative to that intelligent naturalist, from whom Mr. Lambert received and presented to this Society his MS. of a 'Flora Hibernica,' together with a small herbarium, collected in the counties of Mayo and Galway, and a separate collection of Mosses.

"A Description of the Blight of Wheat, *Uredo Frumenti*."

"A Description of *Bos frontalis*, a new species from India," described from a living specimen in the collection of Mr. Brookes, of the New Road.

"Observations on the *Zizania aquatica*," accompanied by a figure from the pencil of Ferdinand Bauer, taken from specimens grown by Sir Joseph Banks in a pond at Spring-grove.

"A further account of *Bos frontalis*," containing numerous particulars of its habits, taken from a Letter written by Mr. Macrae. These four papers are in vol. vii.

"A Description of a new Species of *Macropus (M. elegans)*, from New Holland," from a living specimen in the collection at Exeter Change, in vol. viii.

"Some Account of the Herbarium of Prof. Pallas," in vol. x., which, besides a general account of the collection, then recently purchased by Mr. Lambert, contains characters of a number of new species of plants, which are figured on six accompanying plates.

"Notes relating to Botany, collected from the MSS. of the late Peter Collinson, Esq.," also in vol. x., and affording many interesting notices relating to botanists, gardeners and gardens in England, in the middle of the last century.

"Description of a new Species of *Psidium*" (*P. polycarpon*), which had ripened its fruit at Boyton, in vol. xi.

"Some Account of the Galls found on a species of Oak from the shores of the Dead Sea," and a "Note on the Mustard-plant of the Scriptures," in vol. xvii.

Mr. Lambert's health had for some years been failing, and he had ceased to visit his country-seat at Boyton, but preferred, when out of town, taking up his residence at Kew, where his proximity to the Royal Gardens, and to his friends in town, afforded him more copious sources of enjoyment than he could have found elsewhere. He died at Kew, on the 10th of January in the present year, and his remains were removed to Boyton for interment. He married Catharine, daughter of Richard Bowater, Esq., of Allesley in the county of Warwick, but was left a widower, without any family, some years before his death."

"*Archibald Menzies, Esq.*, who, on the death of Mr. Lambert, became father of the Society, was born at Weem, in the county of Perth, on the 15th of March, 1754. He was early attached to the Botanic Garden at Edinburgh, of which his brother William afterwards had charge; and was enabled, through the kind assistance of Dr. John Hope, then Botanical Professor in that University, who was attracted by his love for natural history and especially botany, to pass through the academical studies necessary for his education as a surgeon. In the summer of 1778 he made a tour, under the auspices of Dr. Hope, through the Highlands and Hebrides, with the view of collecting their rarer plants, to which attention was then strongly directed by the recent publication of Lightfoot's 'Flora Scotica.' He afterwards became assistant to a surgeon at Caernarvon; but soon quitting for a time the practice of his profession on shore, he entered the navy, and became assistant-surgeon on board the Nonsuch, Captain Truscott, in which vessel he was present at the famous victory obtained by Rodney over the Comte de Grasse on the 12th of April, 1782. After the peace of that year he remained for some time on the Halifax station. In 1786 he embarked as surgeon on board the Prince of Wales, a vessel fitted out by the enterprising firm of John and Cadman Etches and Co., and was placed under the command of Lieut. (afterwards Captain) Colnett, of the Royal Navy, for a voyage of commercial discovery to the north-west coast of America. In this voyage he visited Staten Land, where he remained for some time, the Sandwich Islands and China, as well as North-western America, and returned from China by the direct route to England in the beginning of 1789. In the following year he was appointed in the capacity of naturalist, and with the rank of surgeon, to accompany Captain Vancouver, on board the Discovery, in his celebrated voyage; from which, after visiting King George's Sound on the south coast of New Holland, a part of New Zealand, Otaheite and the Sandwich Islands, and exploring by far the greater part of the north-west coast of America, he returned to England in the autumn of 1795. During one of the visits made by this expedition to the Sandwich Islands he ascended Wha-ra-rai and Mowna-roa, two of the principal mountains of the island of Owhyhee, and determined their heights (that of the latter exceeding 13,000 feet) by barometrical observations made simultaneously with others on board the vessel. "Some account" of his ascent of the former was subsequently given by him in the 1st and 2nd volumes of Loudon's 'Magazine of Natural History.' From an early period of the voyage Mr. Menzies added to his duties as naturalist those of surgeon of the Discovery, and it affords a striking proof of his professional skill, that on so arduous a service and in so protracted a voyage, not a single man was lost by disease after quitting the Cape of Good Hope in their passage out.

"From these various voyages Mr. Menzies brought back with him to England large collections of natural history, chiefly botanical. A very considerable number of the plants which he had collected, and especially of the Cryptogamous, to the study of which he was always devotedly attached, were new to science, and have been described from his specimens by Sir James Edward Smith, Mr. Brown, Sir W. J. Hooker and other botanical friends, among whom they were most liberally distributed. His own publications were few in number. In the 1st volume of our 'Transactions' are contained "Description of three new Animals [*Echeneis lineata*, *Fascoila clavata*, and *Hirudo branchiata*] found in the Pacific Ocean" during his first voyage round the world: and in the 4th, "A new Arrangement of the Species of *Polytrichum*, with some Emendations," which, together with an Appendix, afterwards added, forms a valuable monograph of that extensive genus. In the 'Philosophical Transactions' for 1796, he gave, in conjunction with Mr. (afterwards Sir Everard) Home, "A Description of the Anatomy of the Sea-Otter," of which he had brought home a fine specimen, afterwards presented, with many other zoological specimens, and a set of his plants, to the British Museum.

"He subsequently served in the West Indies as surgeon of the Sans-pareil, commanded by Lord Hugh Seymour; but early in the present century he quitted the sea, and continued to practise his profession in London. For some years previous to his death he had retired to Notting Hill, where he passed the tranquil remainder of his lengthened existence, eager to the last to obtain additions to his botanical collection, and enjoying the Society of his numerous friends with a kindness of heart that never failed.

"He died on the 15th of February in the present year, having nearly reached the age of 88, and was buried beside his wife (who died five years earlier, and by whom he had no children,) in the Cemetery at Kensal Green. He left his herbarium, consisting chiefly of Cryptogamous plants, *Gramineæ* and *Cyperaceæ*, arranged with characteristic neatness on paper of an 8vo. size, to the Botanic Garden at Edinburgh, where he had studied; and also gave by his will a bequest of £100 to this Society, of which he became a Fellow on the 19th of January, 1790, and to which he was always most warmly attached.

Among our Foreign Members we have sustained, in common with the whole world of science, a severe loss in the person of.

"*Augustin Pyramus DeCandolle*, a botanist of such distinguished eminence as to demand from us a more than ordinary tribute of respect. Descended from a family which came originally from Marseilles, but had for more than two centuries been settled at Geneva, and which towards the close of the sixteenth century furnished one of that illustrious band of classical printers who united in so high a degree the study of letters with the art of transmitting them to posterity, he was born in the latter city, of which his father had been Premier Syndic, on the 4th of February, 1778. His youthful inclinations were turned towards literature rather than science; but a residence in the country awakened in him a taste for botany, which his attendance on the lectures of Professor Vaucher confirmed, and at the age of sixteen his path in life was determined, and he devoted himself to the cultivation of botanical science.

"In 1795 he paid his first visit to Paris, where he attended the lectures of Cuvier, Lamarck, Fourcroy, Vauquelin, and other distinguished professors; and when Geneva was a few years afterwards incorporated with the French Republic he returned to the metropolis, where he fixed his residence for several years, attending the medical classes and pursuing his botanical studies at the same time under Jussieu and Desfontaines, with both of whom he formed a close and intimate friendship. Soon after taking up his abode in Paris he commenced the publication of his 'Plantarum Historia Succulentarum,' which was speedily followed by his 'Astragalogia;' and in 1802 he began to furnish the text to Redouté's magnificent work, 'Les Liliacées, which he supplied up to the 4th volume. In 1805 he was associated with Lamarck in the third edition of that excellent naturalist's 'Flore Française,' to which he prefixed an introduction, entitled 'Principes Elémentaires de Botanique,' and containing the outlines of a course of lectures which he had delivered in the previous year at the Collège de France. A 'Synopsis Plantarum in Florâ Gallicâ descriptarum' followed in 1806. He had previously, in 1804, connected his medical and botanical studies in an 'Essai sur les Propriétés Médicales des Plantes, comparées avec leur classification naturelle,' of which a second edition appeared in 1816. At an early period of his residence in Paris, D. MeCandolle took an active part in the formation, under the auspices of Baron Benjamin Delessert, of the *Société Philanthropique* for the supply of œconomical soups to the poor and other charitable purposes, of which he continued for several years to be the Secretary. The Society for the Encouragement of National Industry, is also stated to have been formed under his direction and management.

"In 1806, he ceased to be permanently resident in Paris. He received in that year a commission from the Imperial Government to collect information on the state of botany and agriculture throughout the empire, and in pursuance of this commission he took for six successive years annual journeys into the several departments, the results of which are contained in his 'Rapports sur les Voyages Botaniques et Agronomiques faits dans les Départmens de l'Empire Français,' which were published in a collected form in 1813.

"Soon after his appointment to this important task he quitted Paris for Montpellier, where he became Professor of Botany in the Faculty of Medicine in 1807, and a Chair of Botany having been established in the Faculty of Science of that Academy in 1810, he attached himself with renewed ardour to the promotion of his favourite pursuit. Under his direction the Botanic Garden was greatly improved, and a Catalogue, with descriptions of many new species, was published by him in 1813, in which year his 'Théorie Elémentaire de la Botanique' also made its first appearance. Many valuable memoirs, scattered through various publications, but chiefly taken from the 'Annales du Muséum d'Histoire Naturelle,' were in this year collected into a volume.

"After the second Restoration of the Bourbons, circumstances occurred which induced him to quit Montpellier and return to his native city, now restored to independence. A Chair of Natural History was instituted expressly for him, of which he took possession in January 1816, and the Botanic Garden, established towards the close of the last century, with the assistance of funds bequeathed for that purpose by the celebrated Bonnet, was greatly augmented, partly by assistance derived from the Government, and partly by voluntary subscription. Several Fasciculi of the 'Plantes rares du Jardin de Genéve' attest the interest which he took in its success.

"In 1816 he visited England for the purpose of consulting the Herbaria of our country with a view to the general system of plants, the publication of which he then meditated, and during his stay here communicated to the Linnean Society a paper entitled "Remarks on two Genera of Plants to be referred to the Family of *Rosaceæ*." These are *Kerria* and *Purshia*, previously strangely misunderstood, and as strangely misplaced in distant and very dissimilar families. His memoir on this subject, the only one by M. DeCandolle which has a place in our 'Transactions,' is contained in the twelfth volume.

In 1818 appeared the first volume of his intended 'Regni Vegetabilis Systema Naturale,' which was followed by a second in 1821. But the plan of this work was obviously too vast for accomplishment by individual industry, however great; and after the publication of these two volumes, M. DeCandolle recognized the necessity of confining himself within narrower limits. In the year 1814 he commenced the publication of his 'Prodromus Systematis Regni Vegetabilis,' the title of which indicates his intention at some future period to resume the more extensive work. But even this 'Enumeratio Contracta,' as he designates it, proved too mighty a labour, and the remaining seventeen years of his life, all that his unwearied energy could accomplish was the publication of seven volumes, completing probably about two-thirds of the contemplated task. The value of these important manuals, in the present state of Botanical science, can only be estimated by those with whom they are of necessity in daily use. On many of the more interesting families on which they treat, he simultaneously published a series of descriptive memoirs.

"It is the great merit of this important work, that, far more than any other approaching it in extent, it is founded on actual observation. M. DeCandolle's own herbarium was extremely rich; he had visited and carefully examined many of the most extensive collections, and especially those of Paris; and many entire collections as well as separate families, on which he was specially engaged, were from time to time submitted to his examination by their professors. He had thus opportunities of comparison greatly beyond what in ordinary circumstances fall to the lot of an individual. His library too was stored with almost every important publication that could be required for his undertaking. With such ample materials, aided by his untiring zeal and the persevering energy of his character, he steadily pursued his allotted task, and only ceased to labour at it when he ceased to live.

"It was not merely as a botanist that M. DeCandolle deserved well of his country and of mankind. Both as an individual and in the Council of his native city, he was ever active in the promotion of measures of public utility, whether they related to the improvement of agriculture, the cultivation of the arts, the advancement of public instruction, or the amelioration of the legislative code. Even in his botanical lecture he never lost an opportunity of inculcating the importance of these and similar subjects. Those lectures were attended by a numerous class, who caught from their teacher a portion of the enthusiasm with which he was himself inspired. Some idea of the manner in which he brought their subject before his auditors may be obtained from his 'Organographie' and 'Physiologie Végétale,' published in 1827 and 1832, which contain the substance of his lectures on those two great departments of the science.

"For some years his health had been declining, and it is to be feared that the severe and incessant attention which he paid to the elaboration of the great family of *Compositæ* had made a deep inroad upon it. As a relaxation from his labours, he undertook, in the last year of his life, a long journey, and attended the Scientific Meeting held at Turin; but he did not derive from this journey the anticipated improvement in his health, which gradually failed until his death, on the 9th of September last. He has left a son, Alphonse, well known as the author of several valuable botanical publications, one of which, his memoir on the family of *Myrsineæ*, appeared in our 'Transactions.'"

"*Jens Wilken Horneman* was born in 1770, and studied at the University of Copenhagen, where his 'Forsog til en Dansk œconomisk Plantelære' obtained a prize in 1795. In 1798 he commenced a botanical tour through Germany, France and England, and in 1801 became lecturer at the Copenhagen Botanic Garden. He succeeded his teacher Vahl as Regius Professor and Director of the Garden in 1804, and published in 1807 an 'Enumeratio Plantarum Horti Havniensis, and in 1813 and 1815 a more complete synopsis of the plants there cultivated under the title of 'Hortus Regius Botanicus Havniensis. In 1819 he wrote a dissertation 'De indole Plantarum Guineensium."

After the death of Vahl he superintended the publication of the 'Flora Danica,' and several papers by him have been published in the 'Transactions of the Danish Philosophical Society' and the 'Tidskrift for Naturvidenskaberne,' of which he was one of the editors. His lectures and writings have done much to extend the study of botany in Denmark, and havec ontributed to maintain the character acquired for Danish botanists by Kœnig, Forskahl, Œder, Rottböll and Vahl."

Meteorological Register kept at the Surveyor General's Office, Calcutta, for the Month of March 1843.

The Observations after Sunset are made at the Hon'ble Company's Dispensary.

Observed at 9 H. 50 M.					Observed at 4 P. M.						Rain. Gauges.		Observations made at 8 P. M.				Observations made at 10 P. M.			
	Temperature.			Wind.		Temperature.			Wind.					Temperature.				Temperature.		
Barometer.	Of the Mercury.	Of the Air.	Of an Evapg. Surface.	Direction.	Barometer.	Of the Mercury.	Of the Air.	Of an Evapg. Surface.	Direction.	Aspect of the Sky.	Upper.	Lower.	Barometer.	Of the Mercury.	Of the Air.	Of an Evapg. Surface.	Barometer.	Of the Mercury.	Of the Air.	Of an Evapg. Surface.
Inches	°	°	°		Inches	°	°	°			Inches	Inches	Inches	°	°	°	Inches	°	°	°
29,781	78,0	84,4	76,3	N. W....	29,722	82,1	88,0	84,0	W.	Cirro Cumuli.			29,900	80,0	79,5	78,0	29,900	80,0	79,25	77,75
,830	75,6	77,2	73,0	W. S. W..	,781	81,8	90,2	81,2	W.	Clear.			,975	80,0	79,75	79,0	30,000	79,75	79,25	78,5
,853	77,5	83,4	74,0	N. W.....	,778	83,5	90,0	75,0	W. S. W.	Clear.			,950	78,0	77,75	77,0	29,950	78,0	77,5	77,0
,802	79,1	84,0	78,0	W. S. W.	,729	84,3	94,0	81,2	S. W.	Clear.			,900	81,5	81,25	80,0	,900	80,5	80,25	80,0
,749	77,9	78,1	72,0	N. E.	,721	79,8	80,7	73,2	W.	Cloudy and Haze.	0,05	0,06	,900	79,75	79,5	79,25	,900	79,25	79,0	78,75
,845	74,3	74,9	69,8	S. W.	,792	80,5	83,7	74,3	S. W.	Cirro-strati.			,900	78,0	77,5	76,5	,900	79,0	79,25	78,5
,886	77,6	82,2	74,1	N. E.	,818	80,0	89,0	78,8	N.	Cirro-strati.			30,000	79,0	78,5	77,0	30,000	79,0	78,25	77,25
,862	77,9	82,1	75,0	S. W.	,775	81,8	90,3	79,0	W.	Cumulo-strati.	0,32	0,39	,000	79,25	79,0	78,25	,025	79,0	78,5	78,0
,897	76,7	78,0	72,3	W. S. W.	,803	80,9	87,7	78,0	S. W.	Clear. [muli.)			,000	79,0	79,0	78,5	,000	79,0	79,25	78,0
,890	78,0	82,5	76,9	W.	,813	81,3	88,1	79,0	W.	Cloudy (Cirro Cu-			,075	81,5	81,25	80,75	,075	81,5	81,2	81,5
,910	80,3	84,2	75,0	N.	,845	81,4	88,0	78,9	W.	Cloudy (Cirro Cu-			,050	82,75	82,0	81,0	,050	81,5	81,25	81,0
,913	79,2	80,9	74,8	N. W.....	,821	81,0	86,8	79,0	N.	Cloudy. [muli.)			,050	81,75	81,0	80,0	,050	81,5	81,0	80,0
,897	81,0	84,8	77,1	N. W.....	,781	82,5	90,9	81,0	W.	Cumulo-strati.			,000	81,75	81,5	81,0	,000	81,5	81,25	80,75
,857	80,3	85,3	83,9	N. W.....	,770	83,6	89,8	78,8	W.	Generally Clear.			29,950	82,5	82,5	80,0	29,975	82,0	81,5	80,0
,888	80,9	85,2	79,0	S.	,802	84,0	91,0	79,8	W.	Cumuli.			,950	82,0	82,5	80,0	,950	82,5	82,0	79,5
,853	79,4	81 0	74,0	N. W.....	,762	83,5	89,9	80,6	S. W.	Cumulo-strati.			,950	82,5	82,1	80,5	,950	82,5	82,0	80,25
,850	80,4	85,9	77,0	N. W.....	,766	83,3	90,7	80,0	W.	Cumulo-strati.			,950	82,75	82,5	82,0	,950	82,5	82,25	82,0
,837	80,4	87,8	77,4	W.	,753	83,5	90,7	78,5	S. W.	Mists Cloudy.			,950	83,0	82,25	80,5	,950	83,0	82,0	85,25
,793	82,2	83,9	79,0	S.	,702	84,8	94,0	82,6	S. W.	Cumulo-strati.	0,31	0,39	,925	84,0	80,25	82,0	,925	82,0	81,5	79,75
,778	76,9	77,2	73,0	S. W.	,686	81,9	85,4	78,5	S. W.	Cumulo-strati.			,850	81,0	80,5	79,75	,850	80,5	79,75	79,0
,766	78,2	81,0	76,5	W. S. W.	,702	83,8	90,3	80,0	S. W.	Cumuli.			,850	81,25	81,75	80,0	,850	81,0	80,5	80,0
,794	82,4	85,0	81,0	S. (High).	,698	85,4	87,0	82,8	S. (high)	Cloudy.			,900	82,5	82,0	81,25	,900	82,5	82,0	81,0
,765	80,6	84,3	77,2	W. S. W.	,674	84,4	93,1	82,6	S. W.	Cumuli.	0,12	0,18	,950	81,75	81,25	81,0	,950	81,75	81,25	81,0
,781	79,7	83,2	78,8	S.	,685	84,3	91,0	82,3	W.	Cumulo-strati.			,925	81,0	81,0	79,75	,925	81,0	81,0	79,5
,742	79,9	84,0	78,8	W.	,641	83,0	85,2	78,0	S. W.	Very Cloudy, and	0,12	0,18	,825	81,25	80,75	79,75	,825	81,0	80,5	79,5
,682	79,9	86,9	77,3	W.	,602	84,5	93,3	82,0	W.	Cumuli. [Thun.			,800	82,0	81,75	81,0	,800	81,75	81,25	81,0
,757	80,6	88,0	79,0	N. E.	,702	75,5	96,9	83,2	N. W. ..	Clear.			,800	83,0	83,0	82,0	,800	82,5	83,0	82,0
,846	81,7	85,8	80,2	W. S. W.	,793	84,5	94,9	82,0	S. W.....	To the E. Cumuli.			,820	82,75	82,5	82,0	,820	82,5	82,25	81,75
,893	82,4	87,0	81,0	N. W.....	,806	90,0	97,8	84,0	N. E.	Clear.			30,000	85,0	84,75	84,0	30,000	84,75	84,25	84,0
,896	83,6	88,5	75,4	N. (High)	,814	84,7	95,0	81,0	N. W.....	Clear.			29,950	84,0	83,15	82,75	29,950	84,0	83,0	82,75
,802	80,7	87,0	78,0	N. W.....	,725	86,4	95,0	81,7	W.	Clear.			,840	83,75	83,25	83,0	,840	83,5	83,0	82,75
29,829	79,5	83,4	76,6		29,750	83,0	90,3	83,2			0,92	1,20								

N. B. From a comparison of the two Barometers, the Mercury in that at the Dispensary stands 1-10th of an inch higher than that in use at the Surveyor General's Office.

Meteorological Register kept at the Surveyor General's Office, Calcutta, for the Month of April 1843.

The Observations after Sunset are made at the Honorable Company's Dispensary.

Observed at 9 H. 50 M.					Observed at 4 P. M.						Rain Gauges.		Observations, made at 8 P. M.				Observations made at 10 P. M.			
	Temperature.			Wind.		Temperature.			Wind.					Temperature.				Temperature.		
Barometer.	Of the Mercury.	Of the Air.	Of an Evapg. Surface.	Direction.	Barometer.	Of the Mercury.	Of the Air.	Of an Evapg. Surface.	Direction.	Aspect of the Sky.	Upper.	Lower.	Barometer.	Of the Mercury.	Of the Air.	Of an Evapg. Surface.	Barometer.	Of the Mercury.	Of the Air.	Of an Evapg. Surface.
Inches	°	°	°		Inches	°	°	°			Inches	Inches	Inches	°	°	°	Inches	°	°	°
29,773	80,7	87,0	77,0	S.	29,682	85,7	97,0	82,8	W.	Clear.			29,900	84,0	83,75	83,25	29,900	83,75	83,5	83,25
,770	81,5	88,7	80,4	W. S. W.	,677	88,1	99,8	85,0	W.	Clear.			,850	85,0	85,0	84,75	,875	85,0	84,75	84,75
,794	81,5	86,0	78,8	W. S. W.	,710	86,6	99,0	84,0	N. W.	Clear.			,828	81,0	80,75	80,0	,850	80,75	80,5	80,0
,830	81,6	86,9	82,3	S.	,741	88,0	98,4	84,5	S. W.	To the N. Cumuli,			,950	86,0	85,75	85,5	,850	85,75	85,25	85,25
,777	83,0	88,0	82,0	S.	,670	88,6	96,0	87,0	S.	To the E. Cumulo strati.			,850	86,0	85,5	85,0	,850	86,0	85,25	85,0
,729	83,1	88,0	83,0	S.	,670	88,9	95,0	86,0	S. W.	To the NE. Cumulo strati,			,925	86,75	86,0	85,5	,925	86,5	86,0	85,25
,810	81,4	88,0	82,4	S.	,705	88,2	93,0	86,0	S.	Cumuli.			,900	86,75	86,25	86,0	,900	86,25	86,0	86,0
,786	84,4	88,4	83,0	S. (high)	,690	86,2	91,0	84,2	S. W.	Cumuli.	0,19	0,25	,900	83,0	83,5	80,0	,900	83,0	83,0	80,0
,790	82,6	86,0	81,0	S. (high)	,690	85,3	86,4	82,4	S. (high)	Cumuli,			,975	85,5	84,5	80,0	,975	85,0	84,25	80,0
,734	83,5	85,2	81,0	S. (high)	,641	84,0	86,0	82,0	S. (high)	Very Cloudy,			,825	84,0	83,75	82,0	,825	83,75	83,5	81,5
,706	83,5	88,0	83,0	S. (high)	,642	86,6	94,2	87,3	S. W.	Cumulo-strati,	0,14	0,16	,825	85,0	84,5	82,0	,825	84,5	84,0	82,25
,818	81,5	88,0	80,0	N. E.	,742	83,9	95,5	83,0	W.	Clear.			,874	85,5	85,0	84,75	,875	84,75	84,5	84,0
,869	82,1	88,6	82,0	S.	,770	84,5	97,0	83,0	W. S. W.	Cumuli,			,975	86,0	85,5	85,0	,975	85,5	84,75	81,5
,869	83,6	88,5	80,1	S.	,757	88,0	94,6	82,1	S.	Clear.			,975	86,0	84,5	83,2	,975	85,5	84,5	83,0
,797	83,9	88,7	82,0	S. (high)	,733	88,4	93,9	84,0	S.	Clear.			,900	87,0	.86,0	85,0	,900	87,0	86,0	8,45
,794	83,9	90,5	81,0	W.	,730	87,9	97,0	83,2	S.	Cirro Cumuli,			,950	86,75	86,25	85,25	,950	86,25	85,75	85,0
,849	85,0	90,0	82,0	S.	,741	88,8	99,0	86,4	S.	Cumuli,			,950	87,0	86,5	85,0	,950	87,0	86,25	85,0
,845	85,0	90,8	82,9	S.	,742	88,5	102,7	85,0	N. W.	Clear.			,950	89,5	87,25	87,0	,950	89,0	87,25	86,75
,850	84,0	88,0	82,0	S. W.	,777	88,2	92,6	84,3	S.	Cloudy (Cirro Cumuli,)			,975	87,0	86,75	86,0	,930	86,5	86,25	85,0
,875	82,8	83,0	80,4	W.	,798	85,8	92,1	82,1	S. E.	Cirro-strati,			30,000	87,0	86,0	84,75	30,000	87,0	86,0	84,75
,830	85,0	91,0	84,2	S.	,753	90,5	94,4	85,0	S.	Cumulo-strati,			29,950	84,5	84,0	83,75	29,950	84,25	83,75	83,25
,820	85,0	90,5	84,0	S. (high)	,698	87,5	91,0	81,0	S.	Cloudy,	0,07	0,10	,900	83,75	83,25	82,0	,900	83,0	82,75	8,15
,781	78,1	79,2	74,0	S. S. [illegible]	,720	86,5	89,8	83,0	S.	Cumulo-strati,	0,47	1,69	,900	85,0	84,25	84,0	,900	85,0	84,0	83,75
,805	82,0	87,2	83,0	S.	,702	85,5	88,0	82,0	S.	Nimbi.	0,17	0,22	,925	82,5	82,25	80,0	,925	82,25	82,0	80,0
,843	83,0	87,9	83,0	S. W.	,734	86,0	93,1	84,5	S.	Cirro Cumuli.			,900	87,45	84,5	84,25	,900	81,25	84,0	84,0
,850	83,0	89,0	82,5	S. W.	,741	87,0	97,2	85,4	S. W.	To the NE. Cumulo strati,			,900	86,0	86,0	84,75	,900	86,0	85,75	84,75
,805	84,0	90,0	84,0	S.	,700	89,4	95,0	86,0	S.	Cumuli.			,850	87,5	87,0	86,0	,850	87,25	85,75	85,75
,737	86,4	90,5	85,0	S.	,618	90,5	97,0	88,2	S.	To the E. Cumulo strati,			,800	87,75	87,5	86,25	,800	87,25	87,0	86,0
,762	86,0	92,0	85,0	S. E.	,681	89,0	93,0	86,0	S.	Cloudy,			,850	85,75	85,25	83,0	,850	85,5	85,0	83,0
,746	86,5	91,8	86,0	S.	,687	91,3	96,0	88,2	S.	Mists Cumuli,			,850	88,5	88,25	87,0	,850	88,25	85,0	86,5
29,811	83,3	88,0	81,9		29,711	87,5	94,6	84,6			2,01	2,42								

N. B. From a comparison of the two Barometers, the Mercury in that at the Dispensary stands 1-16th of an inch higher than that in use at the Surveyor General's Office.

THE

CALCUTTA JOURNAL

OF

NATURAL HISTORY.

[Reprint of Dr. William Jack's writings, concluded from No. 14, page 231.]

XLI. MYRTACEÆ.

CAREYA MACROSTACHYA. *(W. J.)*

Monadelphia Polyandria.

Arbor, foliis petiolatis obovatis subserratis, racemis lateralibus nutantibus densissime multifloris, floribus sessilibus multiseriatis.

Pulo Pinang.

A tree, with grey bark, and smooth branches. *Leaves* alternate or scattered, petiolate, obovate or oblong-ovate, acuminate, sometimes obtuse with an acumen, narrowing to the base, slightly serrated, very smooth. *Petioles* roundish thickened at the base. *Stipules* none. *Racemes* or spikes lateral, hanging, thick, massive, cylindrical, densely covered with flowers, which are sessile, and arranged in numerous spiral lines; the whole is eight or ten inches in length. *Bracts* none. *Calyx* superior, purple, four-parted, laciniæ rounded, smooth, somewhat ciliated on the margin. *Corolla* purplish red, longer than the calyx, four-petalled, petals ovate, obtuse, inserted into the base of the calyx. *Stamina* white, very numerous, longer than the corolla, united at the base into a thick ring. *Anthers* yellow, didymous, the lobes bursting on opposite sides, so as to give the whole the appearance of a double four-celled anther. *Nectary* surrounding the style within the stamina, hypocrateriform, red and striated within, yellow and entire on the margin. *Ovarium* inferior, four-celled, many-seeded; about four seeds in each cell attached to its upper and inner angle. *Style* red, as long as the stamina. *Stigma* simple. *Fruit* a berry or pome.

Obs.—The inflorescence of this tree is very remarkable, and quite different from the other species of Careya.

GLAPHYRIA. *(W. J.)*

Icosandria Monogynia. N. O. Myrtaceæ.

Calyx superus, quinquefidus. *Corolla* pentapetala. *Bacca* quinque-locularis, polysperma; singuli loculi semina duplici ordine axi affixa.

Arbusculæ, foliis alternis, floribus axillaribus.

GLAPHYRIA NITIDA.

Foliis obovatis obtusis.

Found on the summit of Gunong Bungko, or the Sugarloaf Mountain, in the interior of Bencoolen.

A small branchy tree, with very smooth reddish branchlets. *Leaves* alternate, short-petioled, obovate, obtuse, very entire; three-fourths of an inch or an inch long, very smooth and polished, very firm, coriaceous, shining-green above, pale and whitish beneath with depressed dots, almost veinless, the lateral nerves indistinct and not at all elevated. *Petioles* short, reddish. *Stipules* minute. *Peduncles* axillary, solitary, few-flowered; *pedicels* alternate, rather long. *Bracts* deciduous. *Calyx* superior, persistent, five-parted; *segments* oblong. *Corolla* five-petalled. *Stamens* numerous. *Ovary* five-celled, polysporous, crowned with a nectarial tomentose disk. *Style* one. *Berry* about the size of a pea, five-celled, many-seeded. *Seeds* arranged in a double series in each cell, attached to the axis.

Obs.—This is a very handsome shrub, having much the habit and foliage of the common Myrtle, but the leaves are smaller and firmer. Its character and appearance are alpine, and it is only met with at high elevations; I found it on the summit of the Sugarloaf, and I am informed that it is almost the only shrub met with towards the top of the volcanic cone of Gunong Dempo in Passumah, where it is called *Kayo Umur panjang*, or the Tree of long Life, probably from its maintaining itself at elevations where the other denizens of the forest have ceased to exist. At Bencoolen an infusion of the leaves is drunk as a substitute for tea; and it is known to the natives by the name of the Tea Plant.

GLAPHYRIA SERICEA.

Foliis lanceolatis acuminatis.

Found on Pulo Penang, an island on the Western coast of Sumatra.

This is a moderate-sized tree; its leaves are lanceolate, long-acuminate, entire, very smooth. *Flowers* few, on short leafy peduncles or branchlets, which spring from the axils of the upper leaves. The calyx, peduncles and bracteolar leaflets are sericeous, as also the young leaves and shoots. *Corolla* from five to six-petalled. *Stamens* numerous. *Ovary* from five-to six celled, polysperous.

RHODAMNIA. *(W. J.)**

Icosandria Monogynia. N. O. Myrtaceæ.

Calyx superus, quadrilobus. *Corolla* tetrapetala. *Stamina* numerosa. *Ovarium* uniloculare, pluri-ovulatum, placentis duobus parietalibus. *Bacca* unilocularis oligosperma.

Arbuscula, foliis trinerviis, inflorescentia axillari.

* Monoxera.—R. Wight?—W. G.

RHODAMNIA CINEREA.

Frequent on the Western coast of Sumatra and the islands which skirt it. Its Malay name is Marpuyan. *Common about Malacca.—W. G.*

There are two varieties of this species, the one of which is larger than the other, and has broader leaves which are more decidedly tomentose below. These differences are scarcely sufficient for a specific distinction.

A small tree with greyish wrinkled bark and pilose branchlets. *Leaves* opposite and alternate, petiolate, roundish-ovate in the large variety, and broad lanceolate in the small one, acuminate, very entire, three-nerved, often with a less distinct pair near the margin, smooth above, somewhat hoary beneath, pubescent, particularly on the nerves, but in the small variety nearly smooth, with little more than a glaucous tinge on the under surface. *Petioles* short, tomentose. *Stipules* small, linear. *Peduncles* short, axillary, one-flowered. *Flowers* white. *Calyx* tomentose, persistent. *Corolla* twice as long as the calyx. *Stamina* inserted on the calyx, almost as long as the corolla. *Ovary* one-celled, containing many ovula attached to two parietal placentæ. *Style* one, erect. *Berry* reddish, subglobose, crowned with the calyx, one-celled, containing a few seeds attached to the parietes, many of the ovula proving abortive.

Obs.—This genus which is nearly related to Myrtus, appears to be sufficiently distinguished by its ovary and placentation, from which, rather than from the fruit, the most important characters in this family are to be derived. It is peculiar in having three-nerved leaves, in which particular it has a resemblance to Myrtus Tomentosa, but differs widely from that species in its fruit and ovary.

XLII. MEMECYLEÆ.

PTERNANDRA. *(W. J.)**

Octandria Monogynia.

Calyx ovatus, limbo quadridentato. *Corolla* 4-petala. *Stamina* octo, antheris introflexis, compressis, basi postice calcaratis, bilocularibus, loculis longitudinaliter dehiscentibus. *Ovarium* calyci infra adnatum, 4-loculare, polysporum, placentis parietalibus. *Stylus* declinatus. *Bacca* polysperma.

Habitus Melastomarum, foliis oppositis trinerviis, floribus paniculatis.

PTERNANDRA CŒRULESCENS.

Native of Pulo Pinang. *Malacca. W. G.*

A large smooth shrub with round branches. *Leaves* opposite, short-petioled or subsessile, ovate, acuminate, tapering at the base into short petioles, very entire, very smooth; coriaceous, paler beneath, with three strong nerves, and two less conspicuous along the margins; the transverse veins are few and not prominent. *Stipules* none, but the petioles are connected by an interpetiolar line. *Panicles* oppositely corymbose, short, terminal, sometimes also from the upper axils. *Peduncles* four-sided, smooth. *Bracts* small. *Calyx* united to the ovarium beneath, ovate, reticulately squamous, almost entire or obsoletely four-toothed. *Corolla* blue, lighter at the margin, four-petalled, petals ovate, acuminate, inserted into the calyx. *Stamina* eight, blue; filaments nearly erect, incurved at the apex. *Anthers* large, pointing inwards, compressed, elongated behind into an acumen or spur, cells anteriorly gibbous and bursting longitudinally. The anthers before expansion are turned downwards, as in the Melastomæ, but their points do not reach much below the top of the ovary. *Style* declinate, about as long as the

* Ewyckia. Blume.—W. G.

stamina. *Stigma* conical and rather obtuse. *Ovary* adnate to the calyx, four-celled, polysporous, ovula attached to convex parietal placentæ. *Berry* four-celled, many-seeded.

Obs.—In general habit and appearance this plant has a close resemblance to my Melastoma glauca, and at first sight appears only to differ in having smaller flowers, and leaves with less distinct nerves and veins. In the structure of the anthers, however, it differs essentially from Melastoma, and has some affinity to Memecylon; the fruit and mode of placentation differs from both. The ovary might either be considered inferior, or superior and adnate to the calyx; the analogy of Melastoma has led me to assume the latter.

PTERNANDRA CAPITELLATA. (*W. J.*)

Floribus axillaribus capitellatis.

Found at Moco Moco.

PTERNANDRA ECHINATA. (*W. J.*)

Pedunculis axillaribus terminalibusque, calycibus ovariisque echinatis.

A large tree found at Kataun.* The leaves are three-nerved in all the species.

MEMECYLON CŒRULEUM. (*W. J.*)

Octandria Monogynia.

Foliis cordatis amplexicaulibus, pedunculis axillaribus brevibus, pedicellis oppositis divaricatis brevibus, fructibus ovatis.

Kulit nipees. *Malay.*

Native of Pulo Pinang.

A handsome shrub of 10 or 12 feet in height, with round smooth branches. *Leaves* opposite, subsessile, about five inches in length, cordate, amplexicaul, oblong, acute, very

* Malacca Forest.—W. G.

entire, margin reflexed, coriaceous, very smooth, deep green and shining above, lateral nerves inconspicuous uniting at their extremities into a line which runs parallel to the margin. *Stipules* none. *Peduncles* axillary, solitary, short, few flowered; pedicels short and thick, opposite, somewhat verticillate, divaricate, forming a kind of corymbiform head. *Flowers* blue. *Bracts* opposite, short, acute. *Calyx* superior, colored, smooth, nearly entire, becoming by age more distinctly four-toothed. *Corolla* deep blue, four-petalled, spreading, petals broad, ovate, acute. *Stamina* eight, erect, shorter than the corolla. *Filaments* short. *Anthers* blue, attached by their middle, horizontal, shaped somewhat like the head of an axe, with a knob behind; cells parallel on the anterior edge. Before expansion, the anthers are bent downwards, (somewhat in the manner of the Melastomæ,) and the surface of the germen and bottom of the calyx are marked with their impressions, of which the four inner are the deepest; the ridges between them form 8 sharp prominent rays, and there are 8 other less conspicuous lines formed by the faces of the bilocular anthers. *Ovarium* ovate, one-celled, containing from 6 to 8 erect ovula. *Style* filiform, a little longer than the stamina. *Stigma* acute. *Berry* cortical, crowned by the persistent calyx, ovate, a little oblique at the base, one-seeded, the rudiments of the abortive ovula surrounding the umbilicus. *Seed* ovate, umbilicate at the base and a little oblique. *Albumen* none. *Embryo* erect. *Cotyledons* membranaceous, contortuplicate. *Radicle* cylindrical, nearly as long as the seed, obverse to the umbilicus.

Obs.—The different species of Memecylon have not been well defined by authors; this appears to differ from M. cordatum, Lamarck, and M. grande, Retz: or Nedum schetti. *Rheed. Mal: II. p.* 21. *t.* 15, in having ovate not globose fruit, and in the flowers not being umbelled. In the latter the flowers are small, yellow and numerous, in this they are larger, blue, and much fewer in number.

MEMECYLON PANICULATUM. (*W. J.*)

Foliis petiolatis ovatis obtuso-acuminatis, paniculis axillaribus brachiatis.

Found at Tappanuly and on Pulo Bintang, or on the West coast of Sumatra.

A large shrub, with grey bark and smooth branches. *Leaves* opposite, short-petioled, ovate or oblong ovate, terminating in a rather obtuse acumen, entire, very smooth, shining above, paler beneath, with pretty distinct nerves which unite into a line near the margin; seven or eight inches long. *Petioles* short and thick. *Stipules* none. *Panicles* axillary, sometimes from the axils of fallen leaves, oppositely branched; peduncles four-sided, purplish; there is generally a single one-flowered pedicel placed immediately below each of the principal divisions of the panicle, springing as it were from the same point. *Flowers* numerous, bluish. *Bracts* minute. *Calyx* nearly entire. *Corolla* light blue, four-petalled, petals broad, acute. *Stamina* eight; filaments subulate; anthers blue, prolonged behind into a thick spur, the upper surface of which is marked with a nectariferous cavity; cells on the anterior surface perpendicular to the spur which is nearly horizontal, bursting longitudinally. *Ovary* one-celled, containing about eight erect ovula attached to a small protuberance in the base of the cell; its disk marked with radii corresponding to the faces of the anthers which are incurved before expansion. *Style* subulate. *Stigma* acute. *Berry* globular, one-seeded. *Seed* erect, exalbuminous. *Cotyledons* peltate, hemispherical, their flat surfaces a little irregular or waved. *Radicle* erect, rising perpendicularly between the cotyledons to their centre where it is inserted.

Obs.—This peculiar structure of the embryo is different from what obtains in all the other species of Memecylon that I have examined, where the cotyledons in place of being solid and hemispherical, are foliaceous and contortuplicate.

XLIII. MELASTOMACEÆ.

I. *On the Malayan Species of Melastoma. By* WILLIAM JACK, *M. D. Communicated by* ROBERT BROWN, *Esq. F. R. S. and L. S.*

Read April 16, 1822.

The East Indian species of *Melastoma* have been little investigated in their native soil; and the few that are mentioned in botanical works have for the most part been so imperfectly described, as to occasion much confusion. This splendid genus has now become so extensive as to require being subdivided; but to do this with due regard to the natural series, and to the relative importance of the characters, would demand a critical examination of the whole, and ampler means of reference than are accessible in India. I shall therefore confine myself to such observations as have been suggested by the Malayan species which I have had an opportunity of examining. The whole of these have baccate fruit, and are therefore true *Melastomæ*, as that genus is at present constituted. They vary much in the number of their stamina, but that number is constant in each species. They all agree in having the ovula attached to placentæ, which project from the inner angle of the cells; in the number of the cells corresponding with the divisions of the flower; in the peculiar inflexion of the anthers before expansion; and in having polyspermous berries. The points of difference to be principally attended to are the following: the similarity or dissimilarity of the alternate anthers; the number of the stamina; the anthers being with or without beaks, straight or arcuate; the calyces being hispid or nearly smooth, and having deciduous or persistent segments; the ovary being partially or completely adnate to the calyx. Of these characters, the only one which appears to me to point to a natural division of the species is, that of the equality or inequality of the stamina, occasioned by the anthers being alternately pedicellate and sessile on the filaments, as in *Melastoma Malabathrica*, or being all sessile, as in *M. exigua* and others here described. Those of the first division, with unequal stamina, have generally large and beautiful flowers, hispid calyces, with frequently deciduous segments, stamina always double the number of petals, which are either five or four, and arcuate rostrate anthers which, before the expansion of the flower, have their beaks lodged in cells betwixt the calyx and ovary. Those of the second division, with equal stamina, have seldom such conspicuous flowers, have smoother calyces, with segments generally persistent, eight stamina, rarely or never ten, and occasionally only four; anthers sometimes neither arcuate nor rostrate, and their points in that case do not reach before expansion below the summit of the ovary, which is then completely adnate to the calyx. The genus *Maieta* of Ventenat has been founded upon this latter character alone; but it is obviously insufficient for a generic distinction, as it can only be considered secondary to that of relative length of the anthers, on which depends the complete or partial adhesion of the calyx and ovary: and a little attention to the relations of the different species to each other will show, that a division founded on this latter character could not be established without great violence to their natural affinities. The following species are arranged according to the division now suggested. :—

* Antheris alternis dissimilibus. (MELASTOMA).

1. MELASTOMA OBVOLUTA. *(W. J.)*

M. decandra, foliis ovatis quinquenerviis appresso-pilosis, floribus 3—5 terminalibus, bracteis magnis, calycibus squamosis laciniis ovatis deciduis.

At Tappanooly on the West Coast of Sumatra.

A small branched shrub. *Branchlets* somewhat four-angled, covered with short reddish appressed scales. *Leaves* opposite, petiolate, ovate or elliptic-ovate, five-nerved, pilose, the hairs on the upper surface shorter than those on the lower; these hairs are appressed, and lie in different directions according to the course of the nerves, like the grained fur of animals. The two opposite leaves are often unequal in size. *Petioles* scaly. *Flowers* terminal, three, rarely five, on very short pedicels, each embraced by two large broad-ovate bracts, which completely invest the calyx. These bracts are covered externally with appressed scales, but are smooth towards the margins; they do not fall off till after inflorescence. *Calyx* ovate, covered with long appressed glossy scales; limb divided into five ovate mucronate, obliquely rotate, deciduous segments, which are membranaceous at the edges. *Corolla* large, purple, five-petalled. *Stamina* ten; *anthers* arcuate, beaked, the alternate five pedicellate, with two processes at the base. *Ovary* connected by ten partitions with the calyx. *Style* declinate. *Berry* five-celled, many-seeded.

Obs.—The flat bristles or scales of the calyx are remarkably long in this species; its limb, after the fall of the segments, is acutely five-angled, and the scales that rise from these angles are so long as almost to appear like lesser laciniæ alternating with the true ones.

2. MELASTOMA MALABATHRICA. *Linn.*
Tab. I. Fig. 1. *a—g.*

M. decandra, foliis elliptico-lanceolatis quinquenerviis scabris pilis brevibus appressis, floribus 7—11 opposite corymbosis, bracteis ovatis deciduis calyce minoribus, calycibus squamosis laciniis deciduis.

Kadali. *Rheed Malab.* iv. *p.* 87. *t.* 42.

Fragarius niger. *Rumph. Amb.* iv. *p.* 137. *t.* 72.

Sikadudu. *Malay.*

Abundant throughout Sumatra and the Malay islands, and chiefly occupying open waste lands or coppices.

In giving the above character of this well-known species, I have been obliged to add to the usual specific phrase, in order to distinguish it from the preceding, to which it has so much resemblance that they might easily be confounded together. The leaves of this are longer and less hairy, and the scales of the calyx are much shorter and more appressed than in *M. obvoluta.* The principal distinction however is in the inflorescence, the flowers in this being numerous, generally from seven to eleven, in a kind of corymbose panicle, and the bracts small; while in the preceding the number of the flowers seldom exceeds three, and each is invested by two large bracts, which entirely enclose the calyx, and do not fall off till the petals are fallen. The two following species have also considerable resemblance to the present, but are readily distinguished on inspection by having their calyces covered with erect bristles in place of flat scales.

This species (as well as all the rest) has the ovula attached to placentæ projecting from the inner angle of the cells: as the fruit ripens the cells become filled with pulp, and the placentæ consequently less distinct; this probably occasioned Gærtner to fall into an error in ascribing to *Melastoma* nidulant seeds, and establishing on this a distinction between it and *Osbeckia.*

3. MELASTOMA ERECTA. *(W. J.)*

M. decandra, foliis quinquenerviis ovatis utrinque acutis villosis, floribus 5—7 terminalibus corymbosis, calycibus scabris pilis longis erectis laciniis linearibus deciduis.

Found at Tappanooly in Sumatra.

A small erect shrub. *Branches* round or obscurely four-sided, ferruginous, rough with erect hairs. *Leaves* opposite, petiolate, ovate, acute at both ends, four or five inches long, five-nerved, with an additional marginal line, edges recurved and denticulate, softly tomentose or pilose above, villous beneath, with strong erect hairs. *Petioles* nearly half an inch long, pilose. *Flowers* terminal, somewhat corymbose, pedicellate, generally from five to seven, large. *Bracts* small. *Calyx* ovate, beset with strong erect bristly hairs; *limb* divided into five long, linear, acute, deciduous segments. *Corolla* purplish-red, five-petalled; *petals* large, spreading. *Stamina* ten; *anthers* arcuate, beaked, the alternate ones pedicellate. *Style* declinate. *Berry* pilose, ovate, five-celled, many-seeded.

4. MELASTOMA DECEMFIDA. *Roxb.*

M. decandra, floribus subsolitariis terminalibus, foliis quinquenerviis, calyce decemfido setis mollibus porrectis echinato.

Roxb. Cat. Hort. Beng. p. 90.

Native of Pulo Penang.

A large shrub. *Branches* round, beset with scattered strigose scales. *Leaves* opposite, petiolate, ovate-lanceolate, acute and attenuated to the point, nearly entire, sometimes spinulose on the margin, five-nerved, with some scattered appressed hairs on both surfaces. *Petioles,* as well as the nerves of the under surface, covered with appressed strigæ, channelled above, and ciliate with long hairs along the margins. *Flowers* very large, nearly solitary, terminal, short-peduncled. *Calyx* ovate, densely covered, as well as the peduncle, with long erect soft spine-like bristles, ten cleft: *laciniæ* long, subulate, the alternate ones shorter. *Petals* five, large, red, spreading. *Stamina* ten, arcuate, rostrate; five, larger, with pedicellate anthers, appendiculate at the base. They are lodged in the cells between the calyx and ovary before expansion, as in other species. *Style* filiform. *Fruit* five-celled, many-seeded.

Obs.—This species has considerable resemblance to *M. Malabathrica,* but has larger finer flowers.

5. MELASTOMA STELLULATA. *(W. J.)*

M. octandra, pedunculis axillaribus 1—5-floris, calycibus setosis, setis erectis spinescentibus apice stellato-multifidis, foliis oblongo-ovatis trinerviis subtus tomentosis.

Daduruh Akkar. *Malay.*

West Coast of Sumatra.

A shrub with long slender tomentose branches. *Pubescence* stellate. *Leaves* opposite, petiolate, oblong-ovate, elongated to the point and acuminate, rounded or cordate at the base, three or four inches long, three-nerved, entire, smooth above, ferruginously tomentose beneath. *Petioles* short, ferruginous. *Peduncles* axillary, three sometimes one-flowered, and more rarely paniculately five-flowered. *Pedicels* long, four-sided, tomentose, thickened at the joints and below the flowers. *Bracts* leaf-like, at the divisions of the peduncle, opposite. *Calyx* oblong, somewhat tubular, tomentose, and furnished besides with long erect spinous bristles, with stellate points; *i. e.* whose points are armed with a radiated fascicle of diverging setæ; *limb* four-parted; *segments* oblong, ciliate. *Corolla* four-petalled, spreading; *petals* somewhat acute. *Stamina* eight, unequal; four long, with pedicellate anthers and filaments furnished with a fascicle of hairs at the apex; four short, with sessile anthers and bisetous filaments; all the anthers arcuate, and opening by pores at the top. *Ovary* oblong, in the bottom of the calyx, and attached to it by eight septa forming an equal number of cells, in which the points of the anthers are lodged before the expansion of the flower, four-celled, polysporous; *ovula* attached to central placentæ. *Style* declinate, thickened at the base, as long as the stamina. *Berry* contained in the persistent calyx, to which it becomes adnate, ovate, four-celled, many-seeded.

Obs.—The peculiarity of the bristles of the calyx having stellate points, at once distinguishes this species from all the rest. Besides these bristles, the calyx is covered with a short ferruginous wool, and the segments appear to be persistent. It was sent to me from Saloomah, and is by no means a common species.

6. MELASTOMA NEMOROSA. *(W. J.)*

M. octandra, pedunculis axillaribus 1—3-floris, foliis ovato-lanceolatis quinquenerviis subtus cum calycibus, ramis, pedunculisque ferrugineo-villosis.

Banga utan. *Malay.*

Native of the Malay Islands.

A shrub with long, virgate, round, ferruginous branches. *Leaves* opposite, petiolate, ovate-lanceolate, acuminate, slightly cordate at the base, very entire, smooth and green above, hoary with ferruginous dots beneath; five-nerved, the outer pair of nerves close to the margin. The young leaves are villous on both sides; on the upper with white stellate hairs, which soon disappear, and are rubbed off with the slightest touch; below with reddish ferruginous pubescence. *Petioles* short, round, ferruginous, connected by a prominent interpetiolar line. *Stipules* none. *Peduncles* axillary, solitary, one-to three-flowered. *Calyx* inferior, subovate, closely embracing the ovary, and connected with it by eight septa, rough with ferruginous pubescence; *limb* four-parted; *laciniæ* spreading, acute. *Corolla* four-petalled, of a flesh or light rose colour, spreading; *petals* subrotund, inserted into the calyx alternately with its laciniæ. *Stamina* eight, inserted below the petals, ascending, with arcuate rostrate anthers; four are longer, have pedicellate anthers, with fimbriated appendages at the base; the shorter have sessile anthers, with two setæ or bristles at the base. Before expansion the anthers are incurved, and have their apices inserted into the cells formed between the calyx and ovarium. *Style* ascending, as long as the short stamina. *Stigma* simple, recurved. *Fruit* within the calyx, and adhering to it by the above-mentioned septa, four-celled, many-seeded.

Obs.—This is a very beautiful large flowered species, and is a great ornament to the thickets which it frequents. I have met with it in various places, as on Sumatra, Pulo Nias, &c.

7. MELASTOMA BRACTEATA. (*W. J.*)

M. octandra, floribus paniculatis terminalibus, bracteis magnis ovatis, foliis cordato-ovatis quinquenerviis, calyce stellulato piloso limbo subintegro.

Oosa. *Malay*.

Native of Pulo Penang.

The whole shrub with the exception of the upper surface of the mature leaves is covered with ferruginous points or dots of stellate hairs. *Branches* round. *Leaves* opposite, short-petioled, ovate, acuminate, cordate at the base, entire, smooth above, pilose with stellate hairs beneath, five-nerved. *Panicles* long, terminal, with opposite ramifications. *Bracts* large, pale, and membranaceous, ovate, obtuse, attenuated to the base, as if petiolate. *Calyx* oblong, greenish, adhering to the ovarium by eight septa, limb almost entire, with four obscure toothlets. *Corolla* of a pale, rose-colour, four-petalled, spreading, petals ovate, obtuse, and as if truncate. *Stamina* eight, filaments red, furnished with two bristles at the insertion of the anthers. *Anthers* arcuate, rostrate; four are red, and rather longer than the other four which are yellow and more incurved. *Style* declinate, as long as the stamina. *Stigma* simple. *Fruit* inclosed in the calyx, four-celled, many-seeded.

Obs.—The large bracts which envelop the young flowers distinguish this species; the flowers are not large, but their number compensates for it.

** Antheris omnibus consimilibus. (STOMANDRA).

8. MELASTOMA EXIGUA. *(W. J.)*

TAB. I. fig. 2. *a—f.*

M. octandra, paniculis terminalibus, foliis longe petiolatis ovatis acuminatis glabris quinquenerviis, calyce quadridentato.

Native of Pulo Penang.

An erect branched shrub, with brownish bark and four-sided branches, sparingly sprinkled with rusty down. *Leaves* large, opposite, long-petioled, ovate, acuminate, acute at the base, almost entire, smooth, five-nerved, with strong transverse reticulated veins. *Petioles* long, channelled above, smooth. *Stipules* none. *Panicles* terminal, erect, small, with opposite divaricate ramifications. *Flowers* small and inconspicuous. *Calyx* inferior, tubular, connected with the base of the ovary by eight septa; limb erect, four-toothed. *Petals* four, small, white with a tinge of red, ovate, acute. *Stamina* eight, nearly erect, the alternate ones a little shorter. *Anthers* purple, erect, linear, acute, emarginate at the base (neither curved, rostrate, nor appendiculate). *Style* ascending, as long as the stamina. *Stigma* simple. *Fruit* small, dry, ovate-oblong, four-celled, many-seeded; the placentæ from the axis.

Obs.—This species is remarkable by its very small flowers disposed in a divaricate open panicle, and the comparatively large size of its leaves. The fruit might perhaps properly be considered a capsule, as it appears to be destitute of pulp. The gradations from a berry to a capsule in this family are such, that it is difficult to draw the line of distinction; and it seems questionable whether this difference, when unsupported by other characters, can be considered of generic value.

9. MELASTOMA ROTUNDIFOLIA. *(W. J.)*

M. octandra, foliis maximis subrotundis septemnerviis, floribus capitatis involucratis.

Segoonil. *Malay.*

Found in the Musi country, in the interior of Sumatra.

A shrub. *Leaves* opposite, long-petioled, subrotund, with a sharp acumen at the point, sometimes cordate at the base, about nine inches long, entire, seven-nerved, with a less distinct additional pair near the margin, the middle ones combined a little above the base, nearly smooth, dotted with ferruginous points, particularly on the under surface and on the nerves, deep green above, pale tinged with red beneath. *Petioles* from five to eight inches long, channelled above and ciliate with long soft hairs. *Peduncles* axillary, solitary, shorter than the petioles, supporting a dense head of involucred flowers. *Flowers* numerous, pedicelled, collected into a roundish head. *Involucre*, of five or six large, cordate, broad, many-nerved, ciliate, purple leaves embracing the flowers. *Calyx* tubular, nearly smooth, dotted; limb quadrifid. *Corolla* purple, four-petalled. *Stamina* eight, equal. *Anthers* arcuate, beaked, inappendiculate, having their points inflexed before expansion. *Ovary* connected by septa to the bottom of the calyx, four-celled, polysporous, with central placentæ. *Style* long. *Berry* four-celled, many-seeded.

Obs.—This is a very singular and well marked species, distinguished from all the others of the genus by its large subrotund leaves, and by the peculiarity of having the flowers in a crowded head surrounded by a large involucre. In this particular it deviates widely from the usual habit of the *Melastomæ*. It is rarely met with, and has only been obtained by me from Musi, a district lying immediately inland of Bencoolen.

10. MELASTOMA PALLIDA. *(W. J.)*

M. octandra, floribus paniculatis axillaribus et terminalibus, foliis ovatis quinquenerviis glabriusculis, antheris supra basin affixis.

Native of the Malay Islands.

A shrub with round branches powdered as it were with small dots. *Leaves* opposite, petiolate, ovate, subcordate, acuminate, four or five inches long, five-nerved, entire, smooth above, sprinkled with small dots beneath. *Petioles* short. *Flowers* oppositely panicled, axillary and terminal, white. *Bracts* small, acute. *Calyx* nearly smooth, four-sided, limb obscurely four-lobed. *Corolla* four-petalled, petals oblong, obtuse. *Stamina* eight, equal; filaments with two bristles at the top; anthers curved, beaked, opening by a pore, attached to the filaments a little above the base on the inside, and before expansion turned downwards, so as to have their faces closely applied to the filaments. *Ovary* connected to the calyx by eight septa or partitions, four-celled, polysporous. *Style* nearly as long as the stamina. *Berry* four-celled, many-seeded.

Obs.—The insertion of the filaments is here somewhat different from what is usual in this genus, being, as it were, articulate a little above the base of the anther, and there forming a hinge on which the anther moves. This structure becomes still more singular in the following species, where the filament is inserted nearly as high as the middle of the anther, and is adnate to it from thence as far as the base, being thus recurved upon itself when the anther comes into the erect position. The two species are nearly related, being principally distinguished by the number of the stamina, which are only four in the latter.

11. MELASTOMA FALLAX. *(W. J.)*

M. tetrandra, paniculis terminalibus, foliis ovatis quinquenerviis subtus tomentosis, antheris erectis infra medium affixis.

Native of Sumatra.

A shrub with long rather compressed tomentose branches. *Leaves* opposite, petiolate, ovate, cordate at the base, acuminate, four or five inches long, entire, five-nerved, smooth above, tomentose and ferruginous beneath. *Petioles* about half an inch in length. *Panicles* terminal, erect, many-flowered; divisions opposite. *Bracts* small, acute at the base of the flowers, opposite. *Calyx* adnate to the ovary, four-sided, contracted at the mouth; limb spreading, almost entire, four-cornered. *Corolla* white, four-petalled; petals subrotund, inserted on the calyx. *Stamina* four, filaments erect, expanded into a membrane at the summit, which is adnate to the anther from near their middle to their base; anthers thick, corrugated, nearly straight, without appendices at the base, beaked, opening by a pore at top, attached by their anterior faces to the filaments a little below the middle. Before flowering the anthers are doubled downwards upon the filaments, so as to have the appearance of being pendulous; by the extrication of their beaks, however, the upper part of the filament is reflexed, and the point of insertion, which before expansion was posterior, becomes anterior. *Ovary* adnate to the calyx without connecting septa or cells, the beaks of the anthers not reaching so low; four-celled, polysporous, placentæ from the inner angles. *Style* erect, as long as the stamina. *Berry* ovate, four-celled, many-seeded.

Obs.—Besides being tetrandrous, this species is remarkable for the unusual mode of attachment of the anthers to the filaments, of which a partial example is afforded in the preceding. There is a strong resemblance between the two in habit as well as in this particular. Here we have the ovary completely adnate to the calyx, while in the preceding the anthers reach lower down, and are therefore lodged in cells betwixt them; but the two species are too nearly related in all other respects to admit of being separated on this account.

12. MELASTOMA GRACILIS. *(W. J.)*

M. octandra, staminibus alternis nanis, paniculis terminalibus gracilibus, foliis ovatis acuminatis glabris trinerviis, ramis compressis.

Sedudu akar. *Malay.*

Sumatra.

A shrub. *Branches* compressed, nearly smooth. *Leaves* opposite, petiolate, ovate or lanceolate-ovate, rounded at the base, very acuminate, four-inches long, smooth, dotted with minute tubercles above, three-nerved, with a less distinct marginal pair, the transverse veins conspicuous. *Petioles* short, slender. *Panicle* terminal, oppositely branched, peduncles and pedicels slender, thickened at their joints. *Bracts* linear. *Calyx* ovate, smooth; limb absolutely four-lobed, persistent. *Corolla* bluish-white, four-petalled. *Stamina* eight, the alternate ones considerably smaller; anthers nearly straight, without beaks, furnished at the base with two long linear flat appendices or awns; their points before expansion only reaching to the top of the ovary. *Ovary* adnate to the calyx, four-celled, polyspermous; placentæ from the inner angles. *Style* simple, erect. *Berry* globose, smooth, rather dry, four-celled, many-seeded.

Obs.—This is a slender, delicate, small-flowered species, having considerable resemblance to the following. The alternate stamina are here very small, so as almost to appear abortive; but the form and structure of all the anthers and their appendages are precisely the same. In the first division of the *Melastomæ*, the inequality of the stamina is occasioned by the dissimilar structure of the alternate anthers; in the second, whatever difference may occur in their relative lengths, their structure is precisely alike. No ambiguity can therefore be occasioned by such an inequality as exists in this species, were even its real affinities less strongly expressed in its general habit and secondary characters.

13. MELASTOMA GLAUCA. *(W. J.)*

M. tetrandra, paniculis terminalibus glaucis, foliis quinquenerviis acuminatis basi cordatis glabriusculis.

Osbeckia tetrandra. *Roxb. Cat. Hort. Beng. p.* 88.
Tuniong utan. *Malay.*
Abundant at Pulo Penang.

A shrub of considerable height, with stellulate pubescence. *Branches* spreading, round, pubescent. *Leaves* opposite, short-petioled, recurved, ovate-oblong, cordate at the base, acuminate, entire, very smooth, thinly sprinkled beneath with stellulate hairs, somewhat rigid, five-nerved, with prominent transverse veins. *Petioles* short, tomentose, channelled above and ciliate on the edges, connected by an interpetiolar line. *Stipules* none. *Panicles* terminal, with opposite divaricate ramifications, glaucous throughout. *Bracts* ovate, acute, ciliate. *Calyx* oblong, smooth, glaucous, cœrulescent above. *Limb* entire. *Corolla* of a delicate blue, four-petalled, spreading; *petals* ovate, acuminate. *Stamina* four fertile, ascending; *filaments* appendiculate at the apex; *anthers* long, much curved, rostrate, opening by a pore at top; besides these there are two abortive filaments. *Ovary* connected to the calyx by four septa, between which the beaks of the anthers are lodged before expansion, four-celled, polysporous; *placentæ* from the inner angles of the cells. *Style* reddish, longer than the stamina. *Stigma* simple. *Berry* of a fine glaucous-purple colour, ovate, four-celled, many-seeded.

Obs.—This is a handsome shrub, easily distinguished by the glaucous tint of its panicles, and in general appearance has considerable resemblance to the preceding. Only four stamina are here fertile, but they are accompanied by two small filaments without anthers. The leaves are of a deep green, rather rigid, with strongly-marked nerves and veins. While young, both surfaces are sprinkled with stellulate pubescence, which is easily rubbed off, and disappears with age. The appendages of the stamina are in the form of rounded auricles.

14. MELASTOMA VIMINALIS.

M. octandra, foliis oblongis obtuse acuminatis basi cordatis quinquenerviis, paniculis trichotomis, bracteis oppositis oblongis ciliatis, antheris quatuor alternis sterilibus.

Native of Sumatra.

A large climbing shrub. *Branches* long and drooping, round, pubescent, tinged with purple. *Leaves* opposite, sub-bifarious, petiolate, oblong, cordate at the base, terminating in a long obtuse acumen, entire, smooth above, sprinkled with minute stellate hairs beneath, five-nerved, the outermost pair less distinct than the others; five or six inches long. *Petioles* short, generally furnished with one or two setæ on the edges immediately below the leaf. *Stipules* none; interpetiolar line prominent, naked. *Panicles* oppositely corymbose, trichotomous, terminal and axillary, the whole forming a large foliose panicle at the end of the branch. *Bracts* rather large, opposite, erect, oblong, ciliate, pubescent as well as the peduncles and calyces. *Calyx* oblong-ovate; *limb* nearly entire. *Corolla* white, four-petalled; *petals* acute, subrotate. *Stamina* eight, of which four are fertile, bearing thick, straight, yellow anthers; the alternate four are sterile, of nearly equal length, but having in place of an anther a simple filiform process, which is appendiculate at the base: both are equally incurved between the calyx and ovary before expansion. *Style* subulate, declinate. *Stigma* small. *Berry* sub-globose, purple, four-celled, many-seeded. *Seeds* attached to placentæ, which project from the inner angle of the cells.

15. MELASTOMA EXIMIA.

M. octandra, paniculis terminalibus, foliis maximis glaberrimis elliptico-ovatis quintuplinerviis.

Found on the side of Gunong Bunko, commonly called the Sugar-loaf Mountain, in the interior of Bencoolen.

This is a large shrub with irregularly four-sided branches. *Leaves* opposite, short-petioled, very large, elliptic-ovate, acute at both ends, with a short acumen at the point, entire, very smooth, thick and leathery, quintuple-nerved, fifteen or sixteen inches long. A dense circle of brown-coloured bristles surrounds the joints of the stem within the axils. *Panicles* terminal, large, red, the subdivisions quaternate; *bracts* similarly quaternate and verticillate, ovate. *Flowers* pale flesh-coloured. *Calyx* oblong; *limb* obsoletely four-toothed. *Petals* four. *Stamina* eight, nearly equal; *anthers* similar and equal, purple, furnished with two short yellow appendages at the base. *Ovary* connected with the calyx by eight septa. *Style* simple. *Berries* reddish-purple, four-celled, many-seeded.

Obs.—This is a very remarkable and splendid species, with uncommonly large deep-green leaves, and highly coloured panicles.

16. MELASTOMA RUBICUNDA. *(W. J.)*

M. octandra, floribus axillaribus dichotome cymosis rubescenti-pellucidis, calycis margine integro, foliis oblongo-ovatis triplinerviis glaberrimis.

Native of the forests of Singapore.

A shrub with long branches and cinereous warted bark. *Leaves* opposite, short-petioled, oblong, ovate, acuminate, obtuse at the base, triple-nerved, very entire, very smooth, pale green and punctate beneath. *Petioles* short, thick. *Cymes* somewhat paniculate, axillary, dichotomous, divaricate; *peduncles* and *pedicels* smooth and red. *Calyx* semi-inferior, sub-globose, somewhat pellucid, and of a delicate red, fleshy, smooth, attached to the ovary by eight partitions; margin entire and incumbent. *Corolla* white, almost diaphanous, four-petalled; *petals* oblong, reflexed. *Stamina* eight, erect. *Anthers* long, curved, beaked, bituberculate at the base, red, before expansion having their points lodged in the cells betwixt the calyx and ovary. *Style* as long as the stamina. *Stigma* simple. *Berry* rubescent, four-celled, many-seeded.

17. MELASTOMA PULVERULENTA. *(W. J.)*

M. octandra, floribus terminalibus corymboso-paniculatis rubicundis pulverulentis, foliis ovatis basi bituberculatis glaberrimis trinerviis.

Sibiring. *Malay.*

Found, along with the preceding, at Singapore, and in many parts of Sumatra and the islands which skirt its western coast.

A shrub with smooth brown bark, and furfuraceous branches. *Leaves* opposite, petioled, ovate, obtuse, bituberculate at the base, very entire, very smooth, three-nerved, veins not prominent, coriaceous, paler beneath. *Stipules* none. *Petioles* short, round, furfuraceous. *Panicles* terminal, oppositely corymbose: *peduncles* dichotomous, reddish and papillous. *Calyx* sub-globose, obscurely four-angled, surrounding the ovary, rubescent, pulverulent; *limb* four-lobed. *Corolla* four-petalled, red, sprinkled with yellow powder; *petals* spreading, lanceolato-ovate, with a small toothlet on each side. *Stamina* eight, erect; *anthers* long, red, with white cells, opening by a pore at the top, straight, furnished behind the base with a fascicle of white hairs; before expansion incurved like the other *Melastomæ*, but being without beaks, not reaching beyond the top of the ovary. *Ovary* adnate to the calyx, four-celled, many-seeded; *placentæ* from the inner angle of the cells. *Style* declinate, as long as the stamina. *Stigma* obtuse. *Berry* subglobose, four-celled, many-seeded.

Obs.—These two Singapore species are nearly related to each other, and differ considerably in habit from the other *Melastomæ* chiefly in their extreme smoothness and the greater delicacy of their flowers. The latter is by far the most frequent, and appears to prefer the neighbourhood of the sea. The tubercles of the leaf are formed by the incurving of its base upon the petiole at the point of junction: they are rarely exactly opposite, but generally higher on the one side than the other. The petals have a kind of appendix or toothlet on the margin, a little above the middle. In the former species the petals are singularly transparent and delicate.

18. MELASTOMA ALPESTRIS.

Tab. I. Fig. 3. *a—d.*

M. decandra, paniculis terminalibus, foliis sessilibus glaberrimis crenulatis quintuplinerviis.

Found on the summit of the Sugar-loaf Mountain (Gunong Búnko) in Sumatra.

A small shrub, with smooth sub-dichotomous branches. *Leaves* opposite, sessile, semi-amplexicaul, ovate, elongated upwards, obsoletely crenate, very smooth, coriaceous, pale green, with a purplish shade beneath, quintuple-nerved; three to four inches long. A circle of short brown threads in the axils. *Panicles* terminal, divaricate, flesh-coloured. *Bracts* small. *Calyx* five-dentate. *Corolla* five-petalled, of a delicate flesh-colour, rotate; *petals* obtusely notched at the point. *Stamina* ten, ascending, equal. *Anthers* similar and equal, curved, beaked, dark-purple, having a toothlet or spur behind; before expansion their points reach about half way down between the calyx and ovary. *Style* simple. *Berries* red, five-celled, many-seeded.

Obs.—This is the first decandrous species I have met with belonging to the second division of *Melastomæ* with similar anthers. In habit and in the texture of the leaves it has a close resemblance to *M. pulverulenta*, but its flowers have more resemblance to those of *M. rubicunda;* it must be associated with these two. From the characters of this species, it appears that neither the number of the stamina, nor of the nerves of the leaves, afford subdivisions consonant to the natural series. I met with this plant on the very summit of the Sugar-loaf, along with *Rhododendra* and *Vaccinia*.

SONERILA ERECTA. *(W. J.)*

Triandria Monogynia.

Erecta, ramosa, foliis lanceolatis serratis, racemis terminalibus paucifloris, floribus sessilibus.

Summow. *Malay*.

Native of the Forests of Pulo Pinang.

Root fibrous. *Stem* erect, from six inches to a foot in height, oppositely branched, round, tinged with red, fringed with two opposite longitudinal lines of hairs (like that of the Veronica Chamaedrys). *Leaves* opposite, petiolate, ovate-lanceolate, acute at both ends, serrated, villous with erect hairs, three-nerved, green above, reddish beneath. *Petioles* nearly smooth. *Stipules* none. *Peduncles* terminal, springing from the centre of a four-leaved verticil which terminates the branch, and of which two opposite leaves are smaller. The spike is unilateral, about four-flowered, recurved, smooth; each flower sessile on the upper side of the clavate peduncle, which is there thickened and as it were scooped out to receive it, and is attenuated downwards to the point of insertion into the branch. *Bracts* none or very minute. *Calyx* smooth, trifid, laciniæ acute. *Corolla* of a light flesh color, composed of three lanceolate ovate, acuminate, spreading petals. *Stamina* three, alternating with the petals, erect, scarcely so long as the corolla. *Anthers* two-celled, acute, cordate at the base. *Style* erect, equal to the stamina. *Stigma* obtuse. *Ovarium* long, linear, inferior. *Capsule* oblong, obtusely three-angled, three-celled, three-valved, many-seeded, the dissepiments opposite to the valves. *Seeds* attached to a central columnar three-sided placenta.

Obs.—This plant differs considerably in habit from the other species of Sonerila in having an erect slender brachiate stem, and small lanceolate leaves, not oblique at the base as in most of the genus.

The uppermost leaves are quatern, forming a kind of involucre to the slender peduncle which springs from their centre.

SONERILA MOLUCCANA. *(Roxb)*

Subcaulescens, villosa, foliis oblique cordatis integris oppositis altero minore, pedunculis axillaribus, racemis unilateralibus.

Rox: Fl: Ind: Vol 1. *p.* 122.

Pouh. *Malay.*

A native of the moist shady forests of Pulo Pinang.

A small herbaceous plant whose root is fibrous, and whose stem does not exceed a few inches in length. Every part is thickly covered with red hair. The *Leaves* are petiolate, opposite, one much smaller and rounder than the other, unequally cordate, acute, very entire, of a deep green on the upper surface, red beneath, with quintuple nerves. *Petioles* round, and hairy. *Stipules* none. *Peduncles* generally from the axils of the smaller leaves, erect, bearing from one to three unilateral somewhat recurved racemes, and furnished about the middle with two small opposite bracteolar leaflets. The racemes are at first revolute, but unroll themselves as the flowers open. The flowers are unilateral, arranged in two rows upon short pedicels, and each supported by a linear ciliate bract. *Calyx* superior, covered like the rest of the plant with red hairs, three-parted, laciniæ lanceolate, acute. *Corolla* white, composed of three petals inserted between the divisions of the calyx, ovate, acute, with a few red hairs along the middle of the under surface. *Stamina* three alternating with the petals; filaments linear, ascending; anthers linear, bending towards the style, yellow, two-celled. *Style* declinate in an opposite direction to the stamina. *Stigma* simple. *Capsule* ovate, crowned by the calyx, hairy, three-celled, three-valved, many-seeded, the dissepiments opposite to the valves, the placentæ peltate, pedicellate, affixed to the axis of the capsule.

SONERILA HETEROPHYLLA. *(W. J.)*

Foliis oppositis altero minimo reniformi, altero oblongo acuminato versus basin attenuato ibique semicordato, supra glabris, pedunculis axillaribus brevissimis paucifloris.

Found at Tappanuly on the West coast of Sumatra.

Stem creeping, round, covered with appressed scaly hairs. *Leaves* opposite, almost sessile, one very minute and reniform, the other about three inches long, oblong, broader above, acuminate, narrowing to the base, semicordate, the outer lobe forming a rounded auricle, obsoletely denticulate or nearly entire, a small spinule on the denticulations; three-nerved, smooth above, whitish beneath, with some hairs on the nerves. *Petioles* scarce any. *Flowers* from the axils of the small leaves, sometimes nearly solitary, sometimes four or five on a very short peduncle. *Pedicels* reddish, seated on small tubercles, furnished with glandular hairs. *Calyx* superior, trifid. *Corolla* three-petaled. *Stamina* three. *Capsule* turbinate, three-celled, many-seeded.

Obs.—This species is remarkable by the extreme difference in the size of the opposite leaves, one of which is so minute as almost to escape observation. The same peculiarity exists in the Sonerila Moluccana.

XLIV. LYTHRARIÆ.

LAGERSTRŒMIA FLORIBUNDA. *(W. J.)*

Icosandria Monogynia.

Foliis suboppositis ovato-oblongis glabris, paniculis terminalibus ramosissimis multifloris ferrugineo-villosis, staminibus inequalibus, calycibus turbinatis sulcatis.

Found at Pulo Pinang.

A tree. *Leaves* subopposite, short petioled, rather recurved, seven or eight inches long, ovate-oblong, somewhat acute, entire, smooth, with strong prominent nerves and reticulate veins. *Panicle* terminal, much branched, spreading, many-flowered. *Peduncles*, pedicels and calyces ferruginous, densely villous with stellate hair. The *flowers* are smaller than those of L. Reginæ, but much more numerous and in much larger panicles, pale rose color on their first expansion, and passing through various gradations of intensity, until at length they become nearly purple. *Calyx* covered with ferruginous wool, turbinate, regularly marked with many deep longitudinal furrows or ribs, giving it a fluted appearance, limb spreading six-parted. Before expansion, the calyx is obconical and nearly flat at the top. *Corolla* six-petalled, spreading, petals inserted by short ungues alternately with the segments of the calyx, ovate, not much undulated. *Stamina* red, numerous, inserted on the calyx, six of them longer, thicker and more conspicuous than the rest. *Ovary* thickly covered with white hair, six-celled, many-seeded. *Style* erect. *Stigma* clavate.

Obs.—This beautiful and splendid species may be readily distinguished from the L. Reginæ by the greater size of the panicles, and their ferruginous color. The flower buds in that species represent in some degree a double cone, in this a single inverted cone, being flat and even depressed at top. The L. hirsuta, *Lam:* is also quite distinct from this, having hirsute leaves.

XLV. RHIZOPHOREÆ.

RHIZOPHORA CARYOPHYLLOIDES. *(W. J.)*

Dodecandria Monogynia.

Fruticosa, folliis ovato-lanceolatis utrinque acutis, pedunculis axillaribus trifloris rarius dichotome quinquefloris, floribus 8-fidis, radiculâ subcylindricâ acutiuscula.

Mangium Caryophylloides, *Rumph: Amb: III. p.* 119. *t*: 78.

Found at Singapore and Pulo Pinang.

This is a much smaller shrub than the common Mangrove, and does not divide its roots so much. It is generally found in shallow sandy salt marshes, rising with a tolerably erect stem and branched nearer to the base than the common species. *Leaves* opposite, petiolate, about four inches long, oval or ovate-lanceolate, acute at both ends, sometimes slightly inequilateral, very entire, very smooth, coriaceous; the lower surface appearing under the lens dotted with minute white points. *Petioles* round, furrowed above, smooth. *Stipules* long, enveloping the corniculate buds in the manner of the Ficus, very deciduous. *Peduncles* axillary, solitary, three-flowered, shorter than the petioles; sometimes they are dichotomously five-flowered, having a flower in the bifurcation. *Calyx* semi-inferior, surrounding the ovary, ovate, limb eight-parted, spreading, laciniæ linear, acute, thick, rather incurved at their points. *Corolla* white, eight-petalled, petals nearly erect, alternate with the laciniæ of the calyx, conduplicate, inclosing the stamina by pairs, bifid, furnished with a few threads or filaments at the point, ciliated on the margin. *Stamina* double, the number of the petals inserted on the calyx in a double series, the inner ones shorter, erect, not so long as the petals, enfolded by them until the period of complete expansion, when they burst from their recesses with an elastic force, and disperse their pollen. *Anthers* linear, acute, two-celled. *Ovarium* contained within the calyx, two-celled, tetrasporous; ovula subrotund, affixed near the top of the cells. *Style* filiform, as long as the stamina. *Stigma* bifid with acute laciniæ. *Fruit* contained in the persistent calyx, one-seeded, the other three ovula proving abortive. The seed is at first ovate or roundish, with conform albumen, the embryo inverse, in the upper part of the seed. As the fruit advances, the radicle is elongated and becomes at length nearly cylindric, obsoletely angled, and rather acute at the point. I have generally found three cotyledons, rarely four.

Obs.—Rumphius's figure is by no means a good representation of the plant, but his description of it is correct. It comes nearest to the R. cylindrica, Kari Kandel, *Rheed, Mal: VI. p. 59. t. 33*, which differs from this in having the radicle very obtuse and more exactly cylindrical, and the peduncles generally one or two-flowered. According to Rumphius this species is rather rare, and is called Mangi Mangi Chenke or Clove Mangrove, whence his appellation Caryophylloides, which I have thought proper to retain, as the resemblance holds good in some particulars.

XLVI. HALORAGEÆ.

HALORAGIS DISTICHA. (*W. J.*)

Foliis alternis distichis obliquis integris, floribus axillaribus subsolitariis, petalis tridentatis.

Kayo Kanchil. *Malay.*

This species is not unfrequent in Sumatra, at Singapore, and other parts of the Malay Archipelago.

A shrub with ferruginous pilose branches. *Leaves* alternate, distichous, arranged in two series, one of large leaves and another of very small ones, which resemble stipulæ, being regularly placed a little below the insertion of the large ones so as to lie over their bases; the large leaves are subsessile, rhomboid-oblong, inequilateral, acute, entire, nearly smooth above, pilose with short appressed hairs beneath; from an inch to an inch and a half long: the small leaves are similar in shape, but more acute and little more than a quarter of an inch long, they are arranged on the anterior side of the branch and are closely appressed to it so as to resemble stipules. *Flowers* axillary, generally solitary, subsessile. *Calyx* four-leaved, persistent. *Petals* four, shorter than the calyx, trifid. *Stamina* eight, as long as the petals; anthers two-celled. *Ovary* inferior, four-sided, ferruginous, four-celled, tetrasporous. *Styles* four, equal to the stamina. *Stigmas* simple. *Drupe* oblong-ovate, red, containing a nut with eight longitudinal furrows, and containing a single seed. *Seed* oblong-oval; embryo central in an ample albumen.

Obs.—The general habit of this species is very peculiar, and has much the character of Australasian vegetation, to which country the genus principally belongs.

XLVII. COMBRETACEÆ.

PYRRHANTHUS. *(W. J.)**

Decandria Monogynia. N. O. Combretaceæ. Br.

Calyx 5-fidus, superus, persistens. *Corolla* 5-petala calyce longior. *Stamina* 5—10, erecta, corollâ duplo longiora. *Ovarium* uniloculare, ovulis 3—5 pendulis. *Drupa* caryophylliformis, calyce coronata; nuce oblongâ monospermâ.

Arbor littorea inter Rhizophoras crescens: foliis crassis ad apices ramorum confertis, floribus subcorymbosis.

PYRRHANTHUS LITTOREUS.

Miri batu. *Malay*, and in Sumatra Kayu Api-api.

Native of Sumatra and the Malay Peninsula, growing among Mangroves in salt swamps and near the mouths of

* Petaloma Roxb. Fl. Ind. Lumnitzera Willd. Wight and Arnott. Bruguiera. Petit Thouars.

rivers. It is one of the most ornamental trees that occur in these situations. *Mergui, Malacca. W. G.*

It grows to be a large tree, generally with an irregular crooked trunk. *Leaves* irregularly crowded at the extremities of the branches which are rough with their persistent vestiges, subsessile, cuneiform, retuse, attenuated at the base into a very short petiole, obtusely crenate, often nearly entire, smooth, thick and fleshy, almost veinless. *Stipules* none. *Racemes* short, simple, terminal, subcorymbose. *Flowers* pedicellate, crowded. *Bracts* two, small, acute at the base of each flower. *Calyx* superior, 5-cleft, segments erect, thick, rather obtuse. *Corolla* crimson, 5-petalled, petals spreading, twice as long as the calyx, acute. *Stamina* varying in number from 5 to 10, erect, twice as long as the corolla, filaments red, subulate; anthers oblong, purple, attached by the middle. *Ovary* inferior, about the size and shape of a clove, one-celled, containing from 3 to 5 ovula which are pendulous from the top of the cell. *Style* one. *Berry* or drupe somewhat compressed, obtusely angled, crowned by the thick persistent calyx; nut oblong with two prominent angles, one-seeded. *Seed* exalbuminous. *Embryo* inverse. *Cotyledons* convolute.

Obs.—The number of the stamina is very variable, seven is perhaps the most frequent; five and six are common, but ten the complete number is rare. The number of ovula varies also. The genus is most nearly related to Laguncularia of Geartner, but seems to differ in its corolla and stamina. It has some resémblance to Kada kandel, *Rheed: H: Mal: VI. p.* 67, *t.* 37, a figure which has not I believe been quoted, and may possibly be another species of this genus. Kayu Api-api is the name generally given to this tree in Sumatra, but is applied by Rumphius to his Mangium album, *Herb: Amb: III. p.* 115, *t.* 66, which is a species of Avicennia, probably the A. resinifera of Forster, known in Sumatra by the name of Pelandok Kayu. It appears to be distinct from A. tomentosa, having lanceolate acute leaves, white beneath but not tomentose, and the fruit being much smaller.

SPHALANTHUS. (*W. J.*)

Decandria Monogynia. N. O. Combretaceæ. Br.

Calyx tubulosus, hinc gibbus, deciduus, limbo 5-partito. *Corolla* 5-petala summo tubo calycis inserta et ejusdem laciniis alterna. *Stamina* 10, corolla breviora. *Stylus* tubo calycis hinc accretus. *Ovarium* uniloculare, ovulis paucis ab apice loculi pendulis. *Capsula* 5-alata, monosperma, semine 5-angulato. *Semen* exalbuminosum, cotyledonibus convexo-planis, radicula minimâ conicâ.

SPHALANTHUS CONFERTUS.

Kayu Sumang. *Malay.*

A shrub with round nearly smooth branches. *Leaves* generally alternate, large and reflexly bifarious, short petioled, ovate-oblong, acuminate, subcordate at the base, entire, very smooth. *Petioles* short, somewhat recurved. *Stipules* none. *Spikes* 1—3, terminal, bending in an opposite direction from the leaves. *Flowers* crowded, sessile. *Bracts* lanceolate acute, much shorter than the flowers. *Calyx* superior, very long, tubular, gibbous on one side below, reddish and somewhat tomentose without, limb 5-parted, somewhat reflex, laciniæ acute, broader at the base. *Corolla* 5-petalled, white at first, becoming red after expansion, a little longer than the calyx, petals ovate-oblong, acute. *Stamina* ten, inserted in a double series on the calyx, erect, shorter than the corolla; anthers oblong, yellow. *Ovary* small, oblong, one-celled, containing three pendulous ovula, attached by filaments to the summit of the cell. *Style* green, filiform, rather longer than the stamina, adhering to or concrete with the tube of the calyx on one side along its whole length. *Stigma* simple. *Capsule* large, not crowned with the calyx, oblong, with five membranaceous wings, smooth, one-celled, one-seeded. *Seed* oblong with five-obtuse angles. *Integument* membranaceous, easily separated. *Albumen* none. *Embryo* conform to the seed. *Cotyledons* plano-convex, angled exteriorly. *Radicle* conical, very small.

Ob.—The structure of the seed is here different from what generally obtains in the Combretaceæ, the cotyledons being solid, not convolute.

POLYPETALÆ INCERTÆ SEDIS.

OCTAS. *(W. J.)*

Octandria Monogynia.

Calyx 8-partitus. *Corolla* 8-loba. *Stamina* octo, laciniis corollæ alterna. *Stigma* sessile, 8-radiatum. *Bacca* 8-sperma, supera.

Frutex foliis simplicibus alternis, spicis axillaribus.

OCTAS SPICATA.

Found at Tappanuly on the West coast of Sumatra.

A shrub, with long branches; the young parts tomentose. *Leaves* alternate, petiolate, lanceolate-oblong, acuminate, entire, smooth; five-inches long. *Stipules* small, acute. *Spikes* or racemes two from each axil, rather shorter than the leaves, many-flowered; pedicels in threes. *Flowers* small, white. *Bracts* minute. *Calyx* small, 8-parted. *Corolla* monopetalous, spreading, divided at the margin into eight round lobes. *Stamina* eight, as long as the lobes of the corolla; anthers white, subsagittate. *Ovary* superior, globular, eight-celled, eight-seeded. *Stigma* large, sessile, composed of eight fleshy coadunate lobes. *Berries* about the size of pepper corns, purple, containing eight seeds, which are angled interiorly.

CŒLOPYRUM. (*W. J.*)

Octandria Monogynia.

Calyx 4-partitus. *Corolla* 4-petala. *Stamina* 8, alterna breviora. *Stigma* obtusum, subsessile. *Drupa* supera, nuce biloculari, loculo exteriore lunato alterum fovente. *Semen* unicum, loculo altero vacuo.

Arbor, ramis apice foliosis, foliis simplicibus, floribus racemosis.

CŒLOPYRUM CORIACEUM.

Tarantang. *Malay.*

In forests in the neighbourhood of Bencoolen.

A tree with thick branches, which are foliose at their summit. *Leaves* alternate, petiolate, elliptic, obtuse or emarginate, entire with reflexed margins, firm and leathery, smooth above, pale and tomentose beneath, costate with strong parallel ribs or nerves; 10—12 inches long. *Petioles* about three inches long, marginate and flattened above. *Racemes* axillary, erect, shorter than the leaves, branched; flowers numerous, yellowish, small and inconspicuous, in small racemules or spikelets. *Bracts* small, acute. *Calyx* inferior, spreading. *Corolla* four-petalled, petals longer than the calyx, ovate. *Stamina* 8, the alternate ones shorter. *Ovary* surrounded and nearly immersed in a large fleshy nectarial ring, whose sides are angled by the compression of the filaments. *Style* scarce any. *Stigma* obtuse. *Drupe* ovate, acute, smaller than an olive, containing a single nut. *Nut* two-celled, cells unequal and dissimilar, the outer and lower crescent-shaped, and embracing the other which is smaller, oblong and always empty; the larger cell contains a single conform seed.

Obs.—The structure of the fruit is very peculiar; the empty cell is placed obliquely in the upper part of the nut, the fertile one is as it were wrapped round the other. The extreme minuteness of the ovary prevented me from satisfactorily ascertaining its structure.

XLVIII. BEGONIACEÆ.

BEGONIA. *Linn.*

The island of Sumatra abounds with Begoniæ, a tribe of plants which are chiefly found in moist shady situations at the foot of hills and in the recesses of forests. Being succulent herbs, they are with difficulty preserved in herbaria, and the specimens are frequently deficient in one or other of the parts of fructification. Descriptions from the living plants in their native soil are therefore particularly desirable, and in this view the following account of the species which have fallen under my observation will not be uninteresting. They seem to differ from all those described by Mr. Dryander in the 1st Volume of the Linnean Transactions, and no great additions have been since made to our knowledge of the genus.

BEGONIA CAESPITOSA. *(W. J.)*

Subacaulis, foliis inequaliter cordatis angulatis acuminatis glabris, pedunculis dichotome cymosis, capsulæ alis equalibus obtusangulis v. rotundatis.

At Bencoolen.

Nearly stemless. *Leaves* petiolate, oblique, cordate at the base with rounded slightly unequal lobes overlapping each other a little, somewhat falcate, rounded and sublobate on one side, straighter on the other, attenuated into a long acumen or point, spinulose but scarcely serrated on the margin, smooth, shining above, pale and punctato-papillose beneath; nerves 5—9, branched towards the margin. The leaves are of unequal size and vary somewhat in shape, the old ones being much rounder and more decidedly lobed than the younger ones, which have the point so much incurved, as to be nearly falcate on one side. *Petioles* red, pilose. *Peduncles* often as long as the leaves, smooth, bearing a dichotomous cyme of white flowers. *Bracts* ovate, concave. *MALE.* *Perianth* four-leaved, the inner pair smaller. *Stamina* numerous, collected into a head. *FEMALE.* *Perianth* superior, three-leaved, two exterior large, subrotund, applied to each other as in the male flowers, and enclosing the third which is much smaller and oblong. *Style* trifid. *Stigma* lunato-bifid, yellow and glanduloso-pilose. *Capsule* three-winged, wings nearly equal, obtuse angled or rounded.

BEGONIA ORBICULATA. *(W. J.)*

Subacaulis, foliis orbiculatis cordatis crenatis glabris, pedunculis subdichotomis, capsulæ alis subequalibus obtusangulis.

Interior of Bencoolen.

Nearly stemless. *Leaves* petiolate, subrotund, from three to four-inches in diameter, slightly oblique, cordate at the base where the lobes overlap each other, remotely crenate, rounded at the point, smooth except on the nerves of the under surface, beautifully and finely punctate above. *Stipules* scariose, acute. *Peduncles* erect, subdichotomous, nearly as long as the leaves, *i. e.* about six or eight inches in height. *Flowers* white. *MALE.* *Corolla* four-petalled, the outer pair large, oblong; the inner small. *Stamina* numerous. *FEMALE.* *Capsule* three-celled, many-seeded, three-winged; wings obtuse angled, nearly equal.

BEGONIA SUBLOBATA. *(W. J.)*

Repens, foliis cordatis subquinquelobis vel angulatis dentato serratis margine reflexis glabris, capsulæ alis equalibus obtusangulis.

Found under moist rocks on Pulo Penang, West coast of Sumatra.

Repent with a thick knotty root. *Leaves* alternate, petiolate, cordate, sometimes unequally, large and broad, often six or seven inches long, angulate, sometimes with five acute lobes, sometimes nearly ovate, acuminate, dentato-serrate, edges recurved, very smooth, 5—7 nerved, finely punctate, the dots appearing elevated on the upper surface and depressed on the lower. *Petioles* 4—6 inches long, nearly smooth, furnished immediately below their junction with the leaf with a semiverticil of linear, acute appendices or scales. *Stipules* large, ovate, rather laciniate towards the apex, one on each side of the petiole. *Peduncles* axillary, erect, 6—8 inches long, red, very smooth, terminated by a dichotomous divaricate panicle of white flowers tinged with red. *Bracts* roundish. *MALE. Perianth* four-leaved, leaflets rather thick and fleshy, the two outer ones much larger and subrotund, before expansion completely enclosing the inner two, and having their edges mutually applied to each other in such a manner that they form an acute carina round the unexpanded flower. *Stamina* numerous in a roundish head; filaments short, inserted on a central column which rises from the base of the flower. *Anthers* oblong, cells adnate to the sides of the filaments, bursting longitudinally. *FEMALE. Capsules* with three equal obtusely angled wings, three-celled, three-valved, valves septiferous in the middle, sutures corresponding to the wings. *Seeds* numerous, attached to placentæ which project from the inner angle of the cells.

Obs.—The serratures are hard and cartilaginous and recurved in such a manner along with the margin of the leaf, that when only observed on the upper surface, their place is perceived by an indentation. It seems to resemble the B. grandis, *Dryand:* which differs however in having oblique, doubly serrated leaves, and purple flowers.

BEGONIA FASCICULATA. *(W. J.)*

Foliis inferioribus alternis, superioribus oppositis, oblongo-ovatis basi semicordatis duplicato-serratis pilosis, perianthiis masculis diphyllis, capsulæ alis equalibus obtusangulis.

Found at Tappanuly on the West coast of Sumatra.

Caulescent. *Stem* weak, jointed, thickened at the joints, round, covered with red hairs. *Leaves* petiolate, the lower ones alternate, the upper ones opposite, oblong-ovate, inequilateral, semicordate at the base, acuminate, irregularly serrate, covered above with red erect subspinescent hairs, beneath with softer and weaker hairs. *Petioles* densely pilose. *Stipules* linear, acuminate, pilose. *The flowers* come in fascicles from the middle of the petioles, and these flower-bearing leaves are always opposed to another without flowers; hence it is that the upper leaves are opposite while the lower are alternate. *Fascicles* composed of male and female flowers; pedicels slender, smooth, white. *Bracts* several at the base of the fascicles, acute, pilose red. *MALE. Perianth* diphyllous, white. *Stamina* numerous. *Anthers* yellow. *FEMALE. Perianth* superior, white, cup-shaped, five-leaved; petals ovate, acute, with a few short red hairs on the outside. *Style* deeply trifid; lobes convolute, infundibuliform. *Capsule* three-winged, three-celled, wings equal, obtuse-angled.

BEGONIA PILOSA. *(W. J.)*

Foliis subsessilibus irregulariter serratis acuminatis pilosis subtus rubris, bracteis ad basin pedicellorum subrotundis ciliatis, capsulæ alis subequalibus parallelo-rotundatis.

Interior of Bencoolen.

Caulescent, pilose. *Leaves* alternate, scarcely petiolate, ovate, inequilateral, acuminate, slightly and irregularly serrate, pilose with long red hairs, under surface of a bright red colour; about three inches long. *Stipules* large, lanceolate, pilose externally. *Peduncles* oppositifolious, subdichotomous. *Bracts* at the base of the pedicels, roundish, ciliate. *Flowers* white. *MALE. Corolla* four-petalled, the inner pair smaller. *Stamina* numerous. *FEMALE. Corolla* five petalled; the two outer petals larger. *Capsule* three-winged; wings nearly equal, parallel and rounded.

BEGONIA BRACTEATA. *(W. J.)*

Foliis duplicato-serratis acuminatis pilosis, pedunculo 1—3-floro bracteis numerosis appressis vestito, capsulis basi bibracteatis, alis equalibus rotundatis.

Near the foot of Gunong Bunko in the interior of Bencoolen.

Suberect, strong and branching, very villous, shaggy. *Leaves* alternate, short petioled, ovate, semicordate at the base, acuminate, duplicato-serrate, pilose, 3—4 inches long. *Stipules* large, pilose. *Peduncles* oppositifolious, generally supported by a smaller leaf, invested particularly towards the base with many pair of opposite ovate acute pilose ciliate bracts, which are pressed flat against each other; the uppermost pair is distant from the rest and supports from one to three pedicles. *Flowers* white. *MALE. Corolla* four-petalled; the outer two large subrotund. *Stamina* numerous. *FEMALE. Corolla* five-petalled; petals nearly equal. *Style* three. *Stigmata* lunate, villous with yellow short glandular hairs. *Capsule* embraced by two bracts at the base, three-celled, three-winged; wings equal, rounded.

BEGONIA RACEMOSA. *(W. J.)*

Foliis obovato-oblongis irregulariter dentatis acuminatis glabris, racemis erectis masculis, flore femineo axillari, perianthiis masculis diphyllis, capsulæ alis equalibus parallelo-rotundatis.

Interior of Bencoolen.

Layang-layang Simpai. *Malay.*

Suberect; stem smooth, jointed. *Leaves* alternate, short petioled, obovate-oblong, attenuated towards the base which is unequally cordate, acuminate, irregularly and unequally dentate, smooth; 6—7 inches long. *Stipules* large, oblong. *Racemes* oppositifolious, long, erect, bearing numerous fasciculate male flowers, and having a single female one in the axil. *MALE.* *Corolla* two-petalled, petals very thick. *Stamina* numerous. *FEMALE.* *Capsule* with three equal parallel rounded wings, three-celled.

BEGONIA GENICULATA. (*W. J.*)

Caule geniculato, foliis ovato-oblongis denticulatis acuminatis glabris, pedunculis divaricato-dichotomis, floribus superioribus masculis dipetalis, inferioribus femineis, capsulæ alis equalibus obtusangulis.

Rumput Udang Udang. *Malay.*

Sumatra.

Caulescent; stems smooth, compressed, channeled, jointed, thickened at the articulations. *Leaves* alternate, petiolate, semicordate at the base, ovate oblong, acuminate, denticulate, smooth. *Peduncles* oppositifolious, dichotomous, divaricate, many flowered, lower flowers female, upper male. There is often a female flower from the axil. *MALE.* *Perianth* two-petalled, white. *Stamina* numerous; anthers oblong, broader above. *FEMALE.* *Capsules* long, three-winged, wings obtuse-angled, equal, smooth.

Obs.—The leaves of this plant are used by the natives for cleaning and taking out rust from the blades of creeses. It has considerable resemblance to the preceding species.

XLXIX. LORANTHEÆ.

LORANTHUS COCCINEUS. (*W. J.*)

Floribus spicatis tetrandris, spicis axillaribus erectis, foliis subovatis glabris.

Found at Singapore. *Malacca. W. G.*

Branches long, vimineous. Leaves alternate, petiolate, oblong-ovate, subcordate at the base, attenuated towards the apex which is obtuse, entire, smooth. Petioles short. Spikes axillary, solitary or in pairs, erect, longer than the leaves; flowers sessile, closely pressed to the rachis before expansion. A single small ovate ferruginous bract is situated at the base of each flower. Calyx superior, nearly entire, scarcely toothed. Corolla coccineous, four-petaled, erect, tubular, limb spreading, petals nearly linear, broader at the base. Stamina four, red, erect, inserted into the middle of the petals and equalling them in length; anthers oblong adnate, red. Style red, erect, scarcely longer than the stamina. Stigma obtusely capitate. Berry ovate; elongated above, one seeded. Seed contained in a hard shell, four-sided, its apex immersed in gluten into which the radicle shoots. Embryo inverse, the radicle produced beyond the albumen.

This species is nearly allied to the L. pentapetala of Roxburgh, agreeing with it in habit and inflorescence.

LORANTHUS FERRUGINEUS. *Roxb.*

Ferrugineo-villosa, folliis ellipticis obtusis supra glabris, pedunculis fasciculatis axillaribus 2—6 floris, floribus tetrandris extus ferrugineo-villosis.

Roxb : Hort : Beng : p. 87.*

Sumatra, &c. *Malacca. W. G.*

A parasitic shrub which attaches itself firmly to the branches of trees by means of long runners and numerous circular bands. The branches are long and hanging, and when young densely covered with reddish ferruginous wool. Leaves opposite, short petioled, coriaceous, elliptic, obtuse, entire, smooth and green above, ferruginous and densely villous beneath. Stipules none. Peduncles fascicled, from one to four in each axil, 2-6 flowered. A small scale like

* G. Fl. Ind. 2, p. 207.

bract embraces the base of the ovary. Calyx (if any) an entire margin crowning the ovarium. Corolla covered externally as well as the peduncles and ovary with ferruginous tomentum, green and smooth within, tubular, divisible into four-petals which commonly adhere at their base, but separate at the limb, which is generally more deeply cloven on one side. Stamina 4, inserted into the tube and nearly as long as the limb. Filaments flat, deep purple. Style as long as the corolla. Stigma subrotund. Berry ovate, ferruginous, one-seeded.

LORANTHUS RETUSUS. *(W. J.)**

"*Leaves* opposite, obovate-oblong, retuse or emarginate; *racemes* sub-solitary, limb of the corolla shorter than the clavate tube.

Found at Singapore. *Malacca. W. G.*

Parasitic on trees, and fastening itself by long runners. *Bark* brown.—*Leaves* opposite, short-petioled, obcuneate, or oblong-obovate, retuse or emarginate, entire, smooth, coriaceous; *nerves* indistinct; about three inches long. *Racemes* below the leaves from the former axils, short.—*Flowers* pedicelled with one or two bractes at the base.—*Calyx* consisting of an entire margin. *Tube* of the corolla clavate, gibbous and angled above, rosy, suddenly contracted at the limb, which is five or six-parted, yellowish green; *segments* narrow-lanceolate, reflexed, shorter than the tube. *Stamina* six, sometimes five, erect. *Style* a little longer than the stamina. *Stigma* capitate. *Berry* one-seeded."—*W. Jack's MSS.*

LORANTHUS CYLINDRICUS. *(W. J.)*†

"*Leaves* alternate, petioled, lanceolate, acute at both ends; *racemes* axillary, as long as the leaves, limb of the corolla much longer than the cylindrical tube.

* Roxb. Fl. Ind. ed. Carey. 2. p. 212.

† Roxb. op. cit. 2. p. 213.

Kayo Tiong. *Malay*

Found in Sumatra.

Branches woody, straight, with dark coloured bark.—*Leaves* alternate, rather long-petioled, lanceolate, acute at both ends, entire, smooth, nerved; four or five inches long. *Petioles* about an inch in length. *Racemes* axillary, as long as the leaves, rigid; *flowers* pedicellate-divaricate, rather distant from each other, so that the whole has an open stiff appearance. *Bractes* one embracing the base of the ovary on its outer side.—*Calyx* rather distinct, nearly entire. *Corolla* red, perfectly cylindrical before expansion, five-petalled; *limb* reflexed, three times as long as the tube; *petals* linear, separating almost to the base. *Stamina* five, inserted on the petals, and nearly as long. *Style* filiform, erect. *Stigma* small. *Ovary* cylindrical, one-seeded.

Obs.—This is a well marked species having somewhat the habit of a Rhopala in its inflorescence and cylindrical flowers, which are sometimes tetrandrous."—*W. Jack's MSS.*

LORANTHUS INCARNATUS. *(W. J.)**

" Pentandrous; young leaves and branchlets covered with deciduous, stellate pubescence; *leaves* alternate, broad-ovate, acute; *racemes* below the leaves, hoary; *calyx* five-toothed; *limb* of the *corolla* much shorter than the tube.

Found on the island of Pulo Nias.

Parasitic on trees. All the young parts covered with stellate pubescence which is easily rubbed off. Leaves alternate, petiolate, broad-ovate, attenuated upwards, acute, entire, smooth when adult, nerves strong and distinct; nine inches long. *Petioles* short. *Racemes* from the stem below the leaf-bearing branchlets, generally several together, sometimes solitary. *Flowers* nearly sessile. A small bract at the

* Roxb. Fl. Ind. ed. Carey. 2. p. 213.

base of the ovary. *Peduncles, ovaries* and *calyces* hoary with short dense wool. *Calyx* superior, distinctly five-toothed. *Corolla* above two inches long, slightly tomentose without, pale rosy with a greenish limb; *tube* gibbous below, contracted a little above the base, then widening upwards till it suffers a second contraction before expanding into the limb, which is about a fourth the length of the tube, five-parted, with reflexed segments. *Stamina* five, erect. *Style* longer than the stamina. *Stigma* clavate. *Berry* crowned with the calyx, hoary, and mealy, ovate, one-seeded.

Obs.—This beautiful species comes nearest to *L. farinosa*, Lam. but differs in the pubescence of the young leaves and branches, and the much greater length of the tube of the corolla."

LORANTHUS PATULUS. *(W. J.)**

" *Leaves* opposite, elliptic-ovate, smooth; *flowers* on long pedicels, paniculate-racemose, axillary or below the leaves; *tube* of the corol acutely six-angled, equal in length to the segments of the limb.

Found in the interior of Bencoolen.

Branches smooth.—*Leaves* opposite, petioled, elliptic-ovate, rather obtuse, sometimes sub-acute, entire, smooth, coriaceous; about three inches long.—*Flowers* paniculate-racemose on long divaricate pedicels, axillary or below the leaves. The racemes are shorter than the leaves from which they spring. *Bractes* two or three, embracing the ovary like a calycle. *Calyx* an entire margin. *Corolla* green, tipped with light red and with a purplish tinge towards the base, tube clavate, dilated upwards, acutely six-angled; *limb* six-parted, segments as long as the tube, narrow, revolute. *Stamina* six, erect. *Style* as long as the stamina. *Stigma* capitate. *Berry* sub-globose, one-seeded."

* Roxb. op. cit. 2. p. 214.

L. PROTEACEÆ.

RHOPALA ATTENUATA. *(W. J.)*

Tetrandria Monogynia.

Proteaceæ. Juss. and Br.

Foliis alternis ovatis acuminatis, racemis axillaribus foliis longioribus, pedicellis geminatis calycibusque glabris.

Native of Pulo Pinang.

Arborescent, with round smooth branches. *Leaves* alternate, petiolate, ovate, acuminate, attenuated to the base and decurrent on the petiole, ten or eleven inches long, entire, sometimes with one or two toothlets near the point, very smooth. *Petioles* short, thickened at the base. *Capsule* none. *Spikes* rather longer than the leaves, axillary, cylindrical; flowers geminate, short pedicelled. *Perianth* four-leaved, leaflets linear, dilated and staminiferous at the summit, revolute. *Stamina* four inserted near the apex of the perianth; filaments scarcely any; anthers linear, two-celled. *Style* filiform, as long as the corolla. Stigma clavate. *Ovarium* one-celled, containing two erect ovula.

RHOPALA MOLUCCANA. *(Br.)*

Foliis alternis obovatis obtusiusculis integerrimis, racemis plerumque lateralibus, pedicellis bifidis calycibusque glabris.

Found in a garden at Pulo Pinang.

Arborescent with grey bark. *Leaves* alternate, petiolate, six or seven inches long, obovate (or cuneately ovate) obtuse, very entire, very smooth, yellowish green. *Petioles* an inch long, flattened above, thickened at the base. *Spikes* lateral, generally below the leaves. *Flowers* geminate on a bifid pedicel. *Bracts* very small. *Perianth* four-leaved, leaflets revolute, dilated and stamen bearing at the summit. *Stamina* four, anthers linear, nearly sessile. *Style* filiform. *Stigma* clavate. *Ovarium* one-celled, two-sporous.

Obs.—In the preceding the leaves are acuminate and the flowers in pairs each with its proper pedicel; in this the leaves are rounded and obtuse at the apex, and the flowers are geminate on a common pedicel.

RHOPALA OVATA. *(W. J.)*

Foliis subsessilibus ovatis utrinque acutis integerrimis, pedicellis brevissimis cum calycibus ovariisque levissime tomentosis.

Found at Tappanuly.

A small tree. *Leaves* alternate and opposite, almost sessile, broad ovate, acute, sometimes acuminate, entire, with revolute edges, very smooth, nerves distinct; ten inches long by six broad. *Petiole* none save the thickened base of the middle nerve. *Racemes* below the leaves from former axils. *Pedicels* two-flowered; a bract at the base of each and at the subdivisions. *Perianth* together with the pedicels slightly tomentose or nearly smooth. *Nectarial* scales four.

LI. AQUILARINEÆ.

PHALERIA. *(W. J.)**

Octandria Monogynia.

Perianthium coloratum, tubulosum, inferum, limbo 4-partito. *Stamina* 8, exserta. *Ovarium* biloculare, 2-sporum, ovulis pendulis. *Stigma* capitatum. *Bacca* bilocularis, disperma. *Semina* exalbuminosa, embryone inverso.

Frutex foliis suboppositis, floribus axillaribus.

This genus is related to the Thymeleæ, but differs in having a bilocular ovary and fruit.

* Drimyspermum. Reinwardt. fide Decaisne.

PHALERIA CAPITATA.

Native of Sumatra.

A shrub with smooth branches. *Leaves* opposite, or subopposite, short petioled, ovate-lanceolate, terminated by a long sharp acumen, entire, very smooth : eight inches long. *Petioles* thickened. *Stipules* none. *Peduncles* axillary, sometimes from the axils of fallen leaves, very short, bearing a head or umbel of sessile flowers, which is embraced by an involucre composed of several oblong-ovate leaflets or bracts. *Flowers* large and white, resembling those of the Jasmine. *Perianth* inferior, tube long, faux pervious, smooth, limb four-parted, segments ovate. *Stamina* eight, inserted on the faux, exsert, rather long ; anthers two-lobed. *Ovary* embraced by a thin white nectarial cup, oblong, attenuated into a style, two-celled, cells monosporous, ovula attached to the summit of the cell by a thread, which passing along the back of the ovulum is inserted into its base, so that the ovulum seems as if doubled upon its filament. *Style* a little shorter than the stamina. *Stigma* capitate, papillous. *Berries* crowded, somewhat pear-shaped, rounded above, acute at the base, cortical, two-celled two-seeded. *Seed* exalbuminous ; embryo inverse ; cotyledons plano-convex ; radicle small, superior.

LII. LAURINÆ.

LAURUS PARTHENOXYLON. *(W. J.)**

Enneandria Monogynia.

Foliis venosis ovatis acûtis petiolatis subtus glaucis, paniculis brevibus paucifloris axillaribus et lateralibus, fructu globoso calyci truncato insidente.

* For an account of a nearly allied species, see a paper of Dr. Wallich on the Nipal Camphor and Sapapos tree, *(Laurus glandulifera, Wall.)* in the Transactions of the Medical and Physical Society of Calcutta, vol.

Kayo Gadis. *Malay.*

Abundant in the forests of Sumatra.

This is a lofty timber tree. *Bark* brown and rough. *Leaves* alternate, rather long petioled, ovate, acute, often acuminate, and varying in breadth, about three inches long, entire with somewhat revolute edges, smooth, glaucous beneath, nerves lateral and irregularly alternate. *Petioles* round, an inch long. *Peduncles* from the young shoots at the extremity of the branches, axillary or lateral, terminated by a short, few flowered panicle, and generally longer than the young leaves from whose axils they spring. *Bracts* none. *Perianth* funnel-shaped, six-parted, yellowish. *Stamina* nine, arranged in two rows, the outer six naked, the inner three furnished at the base with two yellow glands ; filaments flat ; anthers adnate, the cells opening with a longitudinal valve or operculum. *Style* as long as the stamina. *Stigma* obtuse, 4-cornered. *Drupe* seated on the enlarged cup-shaped persistent truncated base of the perianth, globose, containing a one-seeded nut. *Embryo* inverse. *Cotyledons* hemispherical. *Radicle* superior, within the edge of the cotyledons.

Obs.—This species has considerable affinity to *L. cupularia.* The fruit has a strong balsamic smell and yields an oil, which is considered useful in Rheumatic affections, and has the same balsamic odour as the fruit itself. An infusion of the root is drank in the same manner as Sassafras, which it appears to resemble in its qualities. The wood is strong and durable when not exposed to wet, and in that case considered equal to Teak. Kayo Gadis siginifies the virgin tree, whence the specific name.

May this be the Oriental Sassafras wood mentioned under the article Laurus in Rees' Cyclopedia ?

LAURUS INCRASSATUS. (*W. J.*)

Foliis ovato-lanceolatis venosis, pedunculis fructûs incrassatis rubris.

Machilus medius. *Rumph : Amb : III. p.* 70. *t.* 41.

Jaring jaring tupai. *Malay.*

Found at Natal in the island of Sumatra.

A tree. *Leaves* alternate, petiolate, ovate-lanceolate or lanceolate, acuminate, entire, very smooth, with lateral nerves proceeding from a middle rib; about five inches long. *Petioles* short. *Peduncles* axillary or lateral near the extremity of the branches, shorter than the leaves, supporting a small panicle of flowers. In the flower these peduncles and pedicels are slender and delicate, but as the fruit advances they become very much thickened, fleshy, and red. *Perianth* six-parted. *Stamina* nine, the three inner ones glandular at the base and somewhat villous; anthers opening by longitudinal valves. *Style* short. *Stigma* capitate, angled. *Berry* seated on the incrassated peduncle, and embraced at the base by the divisions of the perianth a little enlarged, about the size and shape of an olive, purple, one-seeded. *Seed* oval, exalbuminous. *Radicle* superior, far within the edge of the cotyledons.

Obs.—I have met with another species at Bencoolen with larger leaves from 9 to 12 inches in length, in which the pedicels alone are thickened, the peduncles remaining unaltered. In this particular it agrees perhaps still better with Rumphius's figure, than the plant above described.

TETRANTHERA CORDATA. *(W. J.)*

N. O. Laurinæ.

Racemis axillaribus, floribus umbellatis enneandris, filamentis pilosis, perianthii limbo sexpartito, foliis cordati-subrotundo-ovatis uninervibus costatis subtus ramulis pedunculis involucrisque ferrugineo villosis.

West coast of Sumatra.

A moderate sized tree. *Leaves* alternate, petiolate, cordate, sometimes sinuate-cordate, varying from subrotund-ovate to oblong-oval, rather acute, smooth above, tomentose beneath, nerves proceeding from a middle rib, veins transverse, subreticulate. *Peduncles* axillary, shorter than the leaves, bearing a raceme of involucred umbels. *Involucres* five-leaved, leaflets roundish, tomentose without, deciduous. *Umbels* sessile on the involucre, 4—7 flowered; flowers pedicelled. *MALE. Perianth* 6-parted. *Stamina* nine hairy, the inner three filaments furnished with large glands; anthers four-celled. *FEMALE. Perianth* 6-parted, segments narrow. *Sterile stamina* nine, the inner three with large double glands; filaments pilose with long hairs. *Style* one, longer than the stamina. *Stigma* dilated, sublobate. *Berry* oblong, one-seeded.

LIII. MYRISTICEÆ.

KNEMA GLAUCESCENS. *(W. J.)*

N. O. Myristiceæ. Br.

Glomerulis axillaribus 2—6 floris, floribus pedicellatis, baccis oblongo-ovalibus subpulverulentis, foliis oblongis sursum attenuatis subtus glaucis, antheris 12—15.

In the neighbourhood of Bencoolen.

A diœcious tree. The young parts covered with rusty down. *Leaves* alternate, short-petioled, oblong, generally rounded at the base, attenuated upwards, acute, very entire, deep green and shining above, glaucous beneath, the adult leaves nearly smooth, the young ones furnished with short stellate pubescence on the under surface; lateral nerves simple; about seven inches long by two broad. *Petioles* somewhat rusty, a third of an inch in length. *Stipules* none. *Flowers* 2—6, glomerate on a short axillary knob, pedicellate; pedicels as long as the petioles, ferruginously tomentose. A minute bract about the middle of each pedicel. *MALE. Perianth* ferruginously tomentose without, deeply

3-parted, spreading, segments round-ovate, thick; æstivation valvate. *Stamineous column* central, slender, expanding at top into a peltate disk, whose edge is divided into 12 or 15 rays to the lower surfaces of which are attached an equal number of two-celled anthers. *FEMALE. Fruit* axillary, generally solitary, hanging, oblong-oval, considerably smaller than an olive, somewhat pulverulent and rusty, bursting into two valves. *Nut* invested by a thin aril, which is laciniate only at the top. *Seed* with ruminate albumen.

Obs.—The seed has a pungent taste and slightly aromatic smell. Mr. Brown has recognized the propriety of separating Knema from Myristica.

LIV. ASARINÆ

ARISTOLOCHIA HASTATA. *(W. J.)*

Gynandria Hexandria. N. O. Aristolochiæ.

Foliis hastato-trilobis glabris, racemis axillaribus, perianthio basi-inflato, laminâ erectâ ellipticâ marginibus revolutis.

Found at Natal on the west coast af Sumatra.

Suffrutescent. *Branches* long, spreading over the neighbouring shrubs, but not twining, angulate, jointed, smooth. *Leaves* alternate, petiolate, from six to ten inches long, hastately three-lobed, middle lobe elongated and terminating in a blunt acumen, very entire, very smooth, five-nerved and strongly veined. *Petioles* two inches long, thick, round, channeled above. *Racemes* axillary, longer than the petioles. *Flowers* alternate, pedicellate, somewhat distichous; rachis flexuose. *Perianth* superior, purplish red, smooth without, inflated at the base into an ovate six-angled ventricle, from which rises an ascending infundibuliform curved tube with revolute margin; lamina erect, elliptic, revolute at the sides, tomentose on the inner surface, as is also the inside of the tube. *Style* short, thick. *Stigma* orbicular, peltate, divided on the summit into six conical erect lobes. *Anthers* sessile, regularly arranged in a circle below the stigma, six in number each consisting of two lobes which are two-celled and deeply furrowed along the middle. (As these are not arranged by pairs, might they not with equal propriety be considered as twelve distinct two-celled anthers.) *Ovary* oblong, obtusely six-angled, six-celled, many-seeded.

Obs.—This is a large and very beautiful species of Aristolochia, remarkable for the size and form of its flowers. The ventricle at the base is large and the narrow urn-like tube rises upwards with a very graceful curve. In this species the anthers might properly be considered as twelve in number, each two-celled, as they are all arranged at equal distances round the stigma, and it seems questionable whether the genus itself ought not to be referred to Dodecandria in place of Hexandria. The arrangement of the anthers by pairs in the other species does not appear to necessitate the supposition of a deviation from the usual structure in ascribing to them four parallel cells in place of the more usual number of two, nor does the analogy of other cognate genera furnish any thing opposed to the inference so strongly suggested by the present species.

LV. RAFFLESIACEÆ.

RAFFLESIA.* *(W. J.)*

Diœcia Gynandria.

Perianthium monophyllum ventricoso-campanulatum, fauce coarctata nectario annulari incumbente coronata, limbo 5-partito subreflexo, laciniis rotundatis; *Columna* fructifica-

* R. Br. Linn. Trans. 13 p. 201.

tionis maxima, crassa, stigmate truncato coronata, disco processibus pluribus corniculatis echinato.

Mas. *Antheræ* numerosæ, globosæ, sessiles, sub-stigmate in orbem dispositæ, apice poro umbilicatæ, substantia cellulosa.

Fem. *Semina* minuta, nidulantia in substantia rimosa baseos columnæ cui antheræ deficiunt.

Herba parasitica aphylla, flore giganteo.

RAFFLESIA TITAN.*

Sumatran name, *Peliman Sikuddi*, or *Devil's Siri-box.*

Native of the forests in the interior of Sumatra, particularly those of Passummah Ulu Manna, where it was first discovered by Sir T. S. Raffles on his journey into that country in 1818.

This gigantic flower is parasitic on the lower stems and roots of the *Cissus angustifolia*, Roxb. It appears at first in the form of a small round knob, which gradually increases in size. The *flower-bud* is invested by numerous membranaceous sheaths, which surround it in successive layers, and expand as the bud enlarges, until at length they merely form a cup round its base. These *sheaths* or *bracts* are large, round, concave, of a firm membranaceous consistence, and of a brown colour. The bud, before expansion, is depressed, round, with five obscure angles, nearly a foot in diameter, and of a deep dusky red. The *flower*, when fully expanded, is in point of size, the wonder of the vegetable kingdom, its breadth across from the tip of the one petal to the tip of the other, being little short of three feet. The *cup* may be estimated capable of containing twelve pints, and the weight of the whole is from twelve to fifteen pounds. The inside of the cup is of an intense purple, and more or less densely villous, with soft flexible spines of the same colour; towards the mouth it is marked with numerous depressed spots of the purest white, contrasting strongly with the purple of the

* Rafflesia Arnoldi. R. Br.

surrounding substance, which is considerably elevated on their lower side. The *petals* are of a brick red, with numerous pustular spots of a lighter colour. The whole substance of the flower is not less than half an inch thick, and of a firm fleshy consistence. It soon after expansion begins to give out a smell of decaying animal matter. The *perianth* is cyathiform, narrowed at the mouth, which is further contracted by a nectarial ring which surrounds it, leaning inwards. The *limb* is five-parted, somewhat reflexed, but turning upwards again at the point; the lobes subrotund and thick. In the centre of the cup rises a thick *column*, truncate and nearly flat on the top. At its base is a prominent ring or cord, and another a little above, both homogeneous in substance with the column. The summit of the *column* or *stigma* is a flat disk, about six inches in diameter, from which rise from forty to sixty corniculate processes, nearly erect, but diverging a little from the centre; the upper edge is thin, and rises up like the rim of a salver; the lower edge is incumbent and somewhat revolute. The sides of the column are angular.

In the *male,* the *stamina* are arranged in a circle under the lower edge of the *stigma,* by which they are concealed. Each *stamen* is lodged in a proper hollow, separated from the next by a process of the revolute edge. *Filaments* none. *Anthers* sessile, globular, about the size of a pea, dark-coloured, attached to the lower surface of the stigma. They have a white depressed spot on the summit, in the centre of which is a pore or foramen for the emission of the *pollen.* The whole substance is spongy and cellular.

In the *female,* the column is precisely similar, but wants the anthers and their hollows. In the centre its substance is full of irregular fissures, on the surface of which numerous minute *seeds* are observed. The *fruit* never bursts; but the whole plant gradually rots away, and the seeds mix with the putrid mass.

Such are the characters of this very extraordinary vegetable, which appears to have little affinity with any other, and to be as unique in its mode of fructification as in size.

It was, as already mentioned, first discovered by Sir Stamford Raffles, in the forests of Passummah Ulu Manna, and the specimens were forwarded by him to England in 1818. In the following year, numerous additional specimens were procured from various parts of the country, and an opportunity afforded for more minute examination, the particulars of which are contained in the foregoing short account. The greater part of these specimens have been transmitted to England, together with the observations made on the recent plants. Some time after their despatch, a letter was received from Sir Joseph Banks, acknowledging the receipt of the first specimens, which had all proved to be males, and suggesting the probability of the plant being parasitic, a conjecture which had, during the interim, been ascertained to be correct by investigation on the spot.

LVI. NEPENTHEÆ.

NEPENTHES.

Diœcia Monadelphia.

Char. Ess. Mas. *Calyx* 4-partitus. *Corolla* nulla. *Filamentum* columnare. *Antheræ* in globum compactæ.

Fem. *Calyx* et *corolla* maris. *Stigma* sessile, 4-lobum. *Capsula* supera, 4-valvis, 4-locularis, polysperma. *Semina* linearia, paleacea.

Char. Gen. Calyx coriaceus, profunde 4-partitus, patens.

Mas. *Filamentum* columnare, erectum, cylindricum, calyce paullo brevius. *Antheræ* plures, luteæ, biloculares, in globum compactæ.

FEM. *Ovarium* superum oblongum tetragonum. *Stylus* nullus. *Stigma* peltatum, 4-lobum. *Capsula* oblonga, utrinque attenuata, 4-angularis, lateribus sulcatis, 4-locularis, 4-valvis, valvis medio septiferis. *Placentæ* nullæ, præter dessepimenta. *Semina* numerosa, inclusa tunica membranacea rufescente utrinque elongata acuta. *Albumen* oblongum, embryone terete monocotyledone longitudine fere albuminis.

Folia apice in cirrhum urniferum producta. Racemi primo terminales, demum, crescente caule, laterales et oppositifolii.

This remarkable genus offers little affinity with any other, and its place in the natural arrangement is undetermined. Nothing can exceed the sportive variety which nature has displayed in the adornment of these singular plants. Their chief peculiarity is the urn-shaped appendage to the leaf, the use and purpose of which it is not easy to discover. Some Naturalists, who think it necessary in all cases to give an answer to the question of "cui bono," have expatiated, with more imagination than truth, on the benevolent provision of these vegetable fountains for the refreshment of the thirsty traveller in tropical regions. Into this field of speculation it is unnecessary to enter, or to detail the superstitious ideas entertained respecting them, by the ruder inhabitants of the countries in which they grow.

The tendril hangs from the extremity of the leaf, frequently twisting itself round some neighbouring twig, and dilates at its extremity into an urn, which turns upwards in such a manner as always to preserve its perpendicularity. These urns vary in form in the different species, and are frequently tinted with the most beautiful colours. Some are long and tubular, and others are variously dilated or inflated. They are not, however, quite cylindrical, being all more or less flattened anteriorly, and some species being there furnished with two membranaceous wings or fringes. The bottom of the urns is beautifully and finely punctate on the inner surface, apparently by ducts or vessels, from which the water is secreted. The margin is finely and regularly striated, and generally more highly coloured than the rest of the urn; it turns inwards, and forms a peculiar inverted rim, which is denticulate at the edge, in a manner corresponding to the striæ. By this peculiar inversion, it becomes impossible entirely to empty the cup of its water by holding it downwards, and it also forms a kind of trap for whatever enters from without, as ingress proves easier than regress, owing to the row of teeth just mentioned, which oppose themselves to it. The cups, in consequence, are almost always found full of insects that have been lured into the toil, and paid the forfeit of their curiosity. While young, the mouth of the cup is closed by an operculum or lid, attached by a kind of hinge to the posterior angle, which opens at a certain stage, and never closes again. The young cups are about half-full of a pure, limpid, and almost tasteless fluid, but after the opening of the operculum it soon becomes polluted with foreign matter. It has been stated that the lid shuts every night to supply the waste of fluid during the preceding day, but a very little observation shews this to be a mistake. The Malay name of the genus is *Priokra*, or *Kachongbruh*, which signifies the *Monkey-cup*.

NEPENTHES RAFFLESIANA. *(W. J.)*

Foliis petiolatis, ascidiis inferiorum ventricoso-campanulatis antice membranaceo-alatis, superiorum infundibuliformibus nudis, omnium ore pulcherrime striato obliquo postice assurgente.

Native of the forests of the island of Singapore. *Mount Ophir. W. G.*

The *Root* is fibrous. *Stem* ascending at the base, becoming erect, and supporting itself on the neighbouring trees; the young parts covered with a deciduous tomentum or down. The *leaves* are alternate, petiolate, the lower ones crowded and lanceolate, the upper ones more remote and oblong; the adult leaves are smooth; all are entire, have inconspicuous lateral nerves, and the middle one elongated into an urn-bearing tendril. The *Cirrhi* of the lower leaves are not twisted, but hang straight from the apex; they terminate in larger, ventricose, and highly coloured *ascidia* or urns, fringed along the anterior angles with two membranaceous fimbriate wings, somewhat contracted at the mouth, which opens obliquely, rising much higher, and slightly recurved behind, where the operculum is inserted. The *tendrils* of the upper leaves are twisted into one or two spires at the middle, and terminate in long ascending funnel-shaped urns, flattened anteriorly but not winged, and gracefully turned at the mouth like an antique vase or urn. Both have the inverted margin beautifully and delicately striated, and variegated with parallel stripes of purple, crimson, and yellow. The *opercula* are incumbent, membranaceous, ovate, marked with two principal longitudinal nerves and cuspidate behind the hinge. The *racemes* are at first terminal, but the stem begins, after a time, to shoot beyond them, and they become lateral, and are always opposed to a leaf which differs from the others in being sessile, and its cirrhus never having an urn at its extremity. The *pedicels* are one-flowered.

MALE. *Calyx* deeply four-parted, tomentose on the outer surface, smooth, red, and punctate on the inner, segments oblong, obtuse, reflex. *Corolla* none. The *stamineous column* (columna staminea) central, erect, thick, red. *Anthers* numerous, yellow, contorted into a round terminal head.

FEMALE. *Calyx* as in the male. *Ovarium* superior, oblong, four-sided, erect. *Style* none. *Stigma* sessile, peltate, four-lobed. *Capsule* oblong, somewhat curved, four-angled, deeply furrowed at the sides, four-celled, four-valved, the valves septiferous in the middle, many-seeded. *Seeds* long, linear, membranaceous, and acute at both ends, arranged longitudinally, and affixed by the base to the partitions.

Obs.—This is the largest and most magnificent species of the genus, being adorned with two kinds of urns, both elegant in their forms, and brilliant in their colouring. It was first discovered with the following species in the forests of Singapore by Sir T. Stamford Raffles, Lieut.-Governor of Sumatra, when he established a British Colony on that island, in February, 1819. To him, therefore, it is justly dedicated.

NEPENTHES AMPULLARIA. *(W. J.)*

Caule basi repente surculos urniferos promente demum erecto foliifero, cirrhis foliorum muticis, ascidiis petiolatis confertis inflatis antice membranaceo-alatis, ore coarctato subrotundo striato, operculo lanceolato reflexo postice tricuspide.

Found along with the preceding in the forests of Singapore, also at Rhio, on the island of Bintang. *Malacca, W. G.*

Root fibrous. *Stem* repent at the base, becoming erect, and supporting itself on the neighbouring trees, round, covered with a deciduous ferruginous down, urn-bearing at the base, and leaf-bearing above. The urn-bearing shoots or suckers are short and spring from the repent part of the stem; they are entirely sheathed by the crowded petioles of the urns, which are dilated and amplexicaul at the base. The *urns* or *ascidia* are supported on short straight petioles; they are erect, ovate, inflated, green and spotted with purple, furnished anteriorly with two longitudinal, membranaceous, fimbriated wings; mouth somewhat contracted, striated, of a uniform yellowish green colour, and nearly round, the inverted margin being prolonged further into the interior of the cup than in the other species. The *Operculum* is lanceolate-oblong, generally reflexed, tricuspid behind the hinge. It opens at an early stage, and as the urn enlarges, it becomes much too small to reclose it. The *leaves* come on the erect part of the stem, and are alternate, subpetiolate, lanceolate, from eight to twelve inches in length, very entire, somewhat reflex at the margin, smooth above, covered with a ferruginous tomentum beneath, particularly on the nerves, terminating at the apex in a tendril, which is generally thickened and revolute at the extremity; the lower ones have sometimes urns similar to those at the base of the stem. The *Racemes* are at first terminal, and afterwards, as in the other species, lateral and oppositifolious, erect, pyramidal, many-flowered; the lower pedicels three to four-flowered, the upper one-flowered. The *Bracts* are linear, acute, and villous like the raceme.

MALE. *Calyx* four-parted, flat, ferruginously tomentose without, green and smooth within, segments ovate, rather acute, two opposite ones larger. *Corolla* none. *Stamineous column* central, erect, nearly as long as the calyx. *Anthers* about eight, yellow, two-celled, compacted into a globular head.

FEMALE. *Calyx* the same as in the male. *Ovarium* superior, oblong, erect, four-sided. *Style* none. *Stigma* peltate, four-lobed. *Capsule* oblong, narrow at both ends, four-angled, four-celled, four-valved, many-seeded, valves septiferous. *Seeds* linear, paleaceous.

Obs.—This species differs strikingly in habit from the others, in having the urns crowded near the surface of the ground. They are also very different in shape, being somewhat of the form and size of an egg, inflated like a bladder, and the membrane thinner and more delicate than in the others species. The inverted rim is broad, and projects far into the cavity of the cup, forming a trap in which numbers of flies and insects are taken

NEPENTHES PHYLLAMPHORA.

Foliis petiolatis oblongis, ascidiis nudis bàsi subventricosis crassiusculis, superne citius marcescentibus, ore striato depresso, racemis longissimis, pedicellis unifloris.

Cantharifera. *Rumph. Amb. V. t.* 59.

Phyllamphora mirabilis. *Lour. Fl. Coch. p.* 606.

Abundant in moist places and ravines in the neighbourhood of Bencoolen and other parts of the West coast of Sumatra.

It is a larger and stronger plant than the *N. distillatoria*, and has the striated margins of the urns flattened, depressed, and more everted.

NEPENTHES DISTILLATORIA.

Foliis sessilibus amplexicaulibus, ascidiis infundibuliformibus nudis, ore striato.

At Singapore, Malacca, &c.

Poiret seems to have fallen into an error in describing the urns of this species as having smooth margins (*Ency. Méth. II. p.* 459.), I have never met with any that were not striated, though they are less remarkably so than in the other species.

Bencoolen, August, 1820.

LVII. URTICEÆ.

FICUS OVOIDEA. *(W. J.)*

Foliis cuneato-obovatis apice rotundatis, nervo medio dichotomo, fructibus axillaribus solitariis pedunculatis.

Found at Singapore and on several parts of the west coast of Sumatra and its islands.

A small tree, with smooth brownish bark. *Leaves* alternate, petiolate, cuneato-obovate, rounded above, attenuated to the base, very entire, very smooth, the middle nerve dichotomous; from $1\frac{1}{2}$ to 2 inches long. *Petioles* nearly half an inch long, round with a slight furrow above, and covered with grey bark like the branchlets. *Peduncles* solitary, axillary, shorter than the petioles, one-flowered. *Involucres* embraced at the base by three short subrotund bracts, nearly globose, smooth, shut at the mouth by scales, and containing numerous pedicellate florets. *Seeds* naked, hard.

Obs.—The leaves are peculiar in having the middle nerve dichotomous, a character by which this species may be readily distinguished from its congeners.

FICUS DELTOIDEA. (*W. J.*)

Foliis obcuneato-deltoideis apice latis v. retusis, nervo medio dichotomo, fructibus axillaribus binis pedunculatis.

A small tree, native of Sumatra, and very similar to the preceding, but having the leaves proportionally broader, more decidedly deltoid, and retuse or truncate, not rounded at top; the peduncles also are in pairs from the axils of the leaves and longer than the petioles. The breadth of the leaves is generally greater than their length in this species, which is not the case with the preceding; they are however precisely similar in their leathery texture, and in having the nerve dichotomous and not prominent.

FICUS RIGIDA. (*W. J.*)

Foliis ovatis lineari-acuminatis rigidis, fructibus penduculatis axillaribus globosis glabris.

Seribulan. *Malay.*

Sumatra, &c.

A tree, with grey cinereous bark and smooth branchlets. *Leaves* alternate, petiolate, ovate or obovate, with long linear acumina which are obtuse or emarginate at the point, attenuated to the base, 3—4 inches long, entire, firm and rigid, smooth, shining above, rugose with reticulate veins beneath; nerves prominent beneath, the lowermost pair springing from the base and running along the margins until they anastomose with the upper ones. *Petioles* brown, with cracked skin. *Berries* 1—3, axillary, pedicelled, pedicels shorter than the petioles, smooth. *Involucra* globose, orange colored when ripe, smooth with some whitish spots, as large as a currant. *Florets* numerous pedicellate. *Female* ones with a 4—5 parted perianth. *Style* inserted laterally, seed naked.

Obs.—The bark of this species is fibrous, and I am informed, that it is employed in Menangkabau in the fabrication of a coarse kind of paper.

LVIII. CUPULIFERÆ.

QUERCUS RACEMOSA. *(W. J.)*

Foliis lato-lanceolatis integerrimis glaberrimis, spicis masculis paniculatis, fructibus spicatis, nuce umbilicato-depressâ, calice fructûs tuberculato.

Punning-punning bunkus. *Malay.*

Native of Sumatra.

A large tree, with brownish bark. *Branches* smooth. *Leaves* alternate, short petioled, ovate-lanceolate, acuminate, attenuated to the petiole, very entire, very smooth, nerves well marked and reddish beneath; 6—8 inches long. *Stipules* small, linear. *Male spikes* numerous, panicled, terminal and from the axils of the upper leaves which are crowded round the thickened extremity of the branch, slender, hoary; flowers sessile, aggregated. *Female spikes* at first terminal, becoming afterwards lateral by the shooting up of the branch; flowers numerous, dense, sessile. *MALE. Calyx* 6-parted, segments acute. *Stamina* 15—20. The centre of the flower is occupied by a densely villous disk. *FEMALE.* *Calyx* rugose, turbinate, umbilicate. *Ovary* 3—5 celled, each cell containing two ovula attached by a thread to its summit. *Acorns* large, depressed, umbilicate with a short mucro. *Cup* flat, embracing the nut for about half its height, nearly an inch in diameter, rough with angular imbricated tubercles which are large towards the base and become small towards the edge.

Obs.—This is a very splendid species from the great size of the racemes and acorns. Punning-punning is the generic appellation of the Oaks in Malay; in the Rejang dialect they are called Pasang.

QUERCUS URCEOLARIS. *(W. J.)*

Foliis elliptico-oblongis acumine gracili integerrimis glaberrimis, fructibus spicatis, calyce fructûs sub-hemisphærico limbo patente.

Native of Sumatra.

A tree, with rough bark. *Leaves* alternate, petiolate, elliptic-oblong, terminated by a long slender acumen, very entire, smooth, coriaceous, pale beneath; 8—9 inches long. *Fruit* on lateral racemes. *Acorns* rounded and flattened at top, umbilicate in the centre and mucronate with the three short persistent styles, rather perpendicular at the sides, half-embraced by the calyx which is cup-shaped, marked on the outer surface with small acute scaly points concentrically arranged, and whose margin expands into a spreading, nearly entire, waved limb. The *Ovary* is 3-celled, each cell containing two ovula, and is lodged in the bottom of the large funnel-shaped calyx. The acorn contains a single exalbuminous seed placed a little obliquely.

Obs.—The spreading limb of the cups forms a good distinctive character, and renders this a very remarkable and curious species.

EXPLANATION OF THE FIGURES, PLATE XIV. or TAB. I. *Trans. Linn Soc. vol.* XIV.

Fig. 1. *Melastoma Malabathrica.*

a. The calyx.

b: The flower.

c. The same laid open, to show the stamina.

d. A longitudinal section of the unexpanded flower, showing the manner in which the anthers are lodged in cells between the calyx and ovary.

e. A transverse section of the same, showing the septa by which the calyx is connected with the ovary.

f. The fruit.

g. A transverse section of the same.

All of the natural size.

Fig. 2. *Melastoma exigua.*

a. The calyx.

b. The flower.

c. The same cut open, to show the stamina.

d. Two stamina magnified.

e. The fruit.

f. A transverse section of the same.

Fig. 3. *Melastoma alpestris.*

a. The flower.

b. The same cut open, showing the stamina.

c. The fruit.

d. A transverse section of the same.

All of the natural size.

EXPLANATION OF THE FIGURES, PLATE XV. or *Trans. Linn. Soc.* TAB. II. *vol.* XIV.

Fig. 1. *Cyrtandra macrophylla.*

a. The calyx.

b. The flower.

c. The corolla cut open, showing the stamina.

d. A fertile stamen separate.
e. The pistil with its nectarial ring.
f. The fruit.
g. A transverse section of the same.
All these are of the natural size.

Fig. 2. *Didymocarpus crinita*

a. The calyx.
b. The flower.
c. The corolla cut open, showing the stamina.
d. A fertile stamen.
e. The pistil with its nectarial ring.
f. A transverse section of the capsule.
g. The capsule.
All these are of the natural size.
h. A transverse section of the capsule magnified.
i. One of the dissepiments with its revolute lobes, showing the manner in which the seeds are inserted in their margin, magnified.

Fig. 3. *Æschinanthus volubilis.*

a. The calyx.
b. The flower.
c. The corolla laid open.
d. The pistil.
e. The corolla seen sideways.
f. A transverse section of the capsule.
g. One of the revolute lobes of the septum, showing the seeds attached to its inner surface.
h. A seed, aristate at both ends.
i. The capsule.

EXPLANATION OF THE FIGURES, PLATE XVI.
or Tab. IV. *Trans. Linn. vol.* XIV.

Fig. 1. *Lansium domesticum.*

a. The flower.
b. The same in front.

c. The stamineous tube.
d. The same laid open and expanded.
e. The ovary.
f. A section of the same.

Fig. 1. *g.* The fruit.
h. Transverse section of the same.
i. A double seed.
k. The same separated, showing the four cotyledons and two radicles.
l. A single seed.
m. The cotyledons separated.

Fig. 2. *Leuconotis anceps.*
a. The flower.
b. The corolla laid open.
c. The ovary and style.
d. Transverse section of the same.
e. The fruit.
f. Transverse section of a fruit containing three seeds.
g. Ditto ditto, containing a single seed.
h. A seed.
i. The cotyledon externally.
k. The same internally with the radicle.

Fig. 3. *Helospora flavescens.*
a. The flower.
b. The corolla laid open.
c. An anther enlarged.
d. The pistil.
e. The fruit; a transverse section.
f. A seed.

On some Plants, mostly undescribed, in the H. C. Botanic Gardens, Calcutta. By W. Griffith, Esq., *F. L. S., Memb. Acad. Nat. Curios., Royal Ratisb. Bot. Soc., Assist. Surg. Madras Establishment.**

APORUM. *Blume.*

Fam. Nat. Orchideæ.—Sect. Malaxideæ.

A. *micranthum.* (n. sp.) foliis scalpelliformibus acutis, floribus solitariis terminalibus, sepalis lateralibus reflexo-revolutis, petalis anguste-linearibus, labello porrecto trilobo intus processu carnoso truncato aucto, lobo centrali erecto bilobo lobis crenulatis.

Hab.—Insula Penang.

Descr.—Planta rubro tincta. Caules spithamæi, aggregati. Folia subuncialia, fere verticalia. Flores minuti, inconspicui, viridescenti-albidi, postici. Pedicelli solitarii, e paleis erumpentes, longiusculi. Sepala oblonga, subacuta. Petala

* Acting on the law established in Zoology, on the authority of the Committee of the British Association, (herewith quoted,) and which is applicable with equal correctness to the sister science, I have passed over the MS. names the plants, now for the first time described, bear in these Gardens, because they do not appear to have been established on descriptions, much less on definition.

" *Names not clearly defined may be changed.*—Unless a species or group is intelligibly defined when the name is given, it cannot be recognized by others, and the signification of the name is consequently lost. Two things are necessary before a zoological term can acquire any authority; viz. *definition* and *publication.* Definition properly implies a distinct exposition of essential characters, and in all cases we conceive this to be indispensable, although some authors maintain that a mere enumeration of the component species, or even of a single type, is sufficient to authenticate a genus. To constitute *publication,* nothing short of the insertion of the above particulars *in a printed book* can be held sufficient." And with regard to MS. names, it is distinctly stated, that they " are in all cases liable to create confusion, and it is therefore much to be desired that the practice of using them should be avoided in future."—Report, 1842. On Zoological Nomenclature, p. 9.

multoties angustiora. Labellum albidum, cum pede columnæ continuum, sublingulatum, lobo centrali erecto. Appendix (vel processus) carnosa lamelliformis, basin lobi centralis versus præmorsa. Columna semiteres, pede longo curvato. Rostellum truncatum. Clinandrii brevis dens posticus minimus. Pollinia 4, oblonga, per paria collateralia.

This species, was introduced from Penang by Mr. Lewes, Assistant Resident, in May, and flowered in July. It possesses no beauty. It is the smallest flowered species of the genus I am acquainted with, and appears abundantly distinct. It succeeds tolerably well when planted in mould, freely mixed with pieces of broken pots.

Fig. 1. Two stems, natural size.
2. Flower, in front.
3. Ditto, lateral view.
4. View of flower, lateral sepals removed.
5. Column in front, anthers removed.
6. Column and anthers, lateral view.
7. Lateral and inner view of the labellum, divided along its middle.
8. Pollen masses.

AGROSTOPHYLLUM. *Blume.*

Fam. Nat. Orchideæ.—Sect. Vandeæ.

A. *khasiyanum.* (n. sp.) petalis lineari-lanceolatis, labelli lamina obreniformi, sinu dentigero, margine integro.

Eria planicaulis, Wall. (sine charactere!) Lindl. Bot. Reg. Vol. 26, Misc. Notices, p. 8, No. 4.

Hab.—Montes Khasiyani.

Caules aggregati, plani, basi attenuati, vaginis distichis ½ amplectentibus, semitecti. Fol. 2-3, apices versus caulis, lineari-lanceolata, basi attenuata, apice æqualiter bifida, mucrone interjecto. Spicæ 2-3 floræ in capitulum terminalem subnutantem paleaceum congestæ, bracteis paleaceis vaginantibus sursum majorifactis vestitæ. Flores minuti, viridescenti-albidi, in paleis subimmersi, superiores præcociores; interdum solitarii. Perianthium ringens, posticum. Sepala oblonga, acuta, lateralia obliqua, et ob labellum basi saccata. Petala lanceolata, paullo breviora, margine recurva fere conduplicata, vel semi-reflexa, alba. Labellum horizontale, saccatum, cum columna continuum, medio constrictum et transverse septatum, septo lutescente, late emarginato; lamina reniformis, emarginata, dente interjecto, aucta crista obsoleta longitudinali margine crenulata subrecurva. Columna sepalis paullo brevior, medium versus gibbere valido subbilobo instructa, gradatim attenuata in pedem brevem, cum quo labellum continuum. Clinandrium 3-dentatum. Stigmatis labium superius (rostellum,) bipartitum, parvum; inferius carnosum, magnum, revolutum; tela stigmatosa tantum subtus labium superius. Anthera terminalis, 8-locellata. Pollinia 8, oblongo-obovata, in glandulam rotundam rubescentem sessilia. Ovarium rectum, costis inconspicuis.

This plant was introduced by Mr. Gibson, during his residence on the Khasiya Hills. It succeeds well in mould mixed with broken pots. I know it to be the Eria planicaulis of Dr. Wallich, on the authority of a drawing in the Library. The name would have been passed over entirely, had it not made its appearance under the sanction of Dr. Lindley.* And so grave are the mistakes that may be imposed by the authority of MSS. names, which should very generally be viewed with suspicion, that this plant which differs toto *cœlo* from Eria, and which belongs to the Section Vandeæ of Dr. Lindley, has been characterised by that authority on the species of this difficult family as an Eria; and has also been fully described by Mr. Booth as an Eria.†

The gland is sufficiently well represented by the native artist in the drawing alluded to, as well as also in another

* Bot. Reg. loc. cit. † Bot. Reg. loc. cit.

species procured from Mr. Gibson, similarly referred to Eria, the name of which I suppress.

1. A stem of the plant, rather reduced.
2. Flower and peduncle.
3. Flower, upper face.
4. Column, etc. in front.
5. Apex of columna in front, anther case removed.
6. Column laterally, anther and pollinia removed.

APPENDICULA. *Blume.*

Fam. Nat. Orchideæ.—Sect. Vandeæ.

A *Lewisii* (n. sp.) caulibus ancipitibus simplicibus, foliis anguste lanceolatis bifidis cum mucrone interjecto, racemis oppositifoliis foliis brevioribus, labelli erecti lamina oblongo-cordata, processu sacci semi-cyathiformi antice deficiente, sacco laminam longitudine æquante.

Hab.—Insula Penang.

Descr.—Caulis spithamæus vel subpedalis, anceps. Folia bifaria, anguste lanceolata, inæqualiter bifida, mucrone interjecto, univenia, pallide viridia. Racemi oppositifolii, subcernui, pauciflori, foliis breviores. Flores minuti, resupinati, albidi. Bracteæ membranaceæ, angustæ, ovarii longitudine. Perianthium connivens, membranaceo-cellulosum. Sepala oblonga, subacuta, lateralia basi valde obliqua et cum pede columnæ connata. Petala conformia, paullo minora. Labellum suberectum, cum columnæ pede continuum ; lamina integra ovato-cordata, acuta; saccus magnus rotundatus, auctus processu semi-cyathiformi medium versus affixo, postice libero. Columna nana, basi longe producta, sursum pupureo-fusca. Clinandrium profunde excavatum, dente postico, antheram affingente, magno, introflexo. Anthera ovato-cordata, membranacea, sub-immersa, in stigmate postico, (rostello) incumbens, bilocularis, antice 3-dentata. Pollinia 8, clavata, cerea, in glandula oblonga carnosa sessilia. Stigma posticum (rostellum) obliquum, sublinguiforme, bifidum; stigmatis apertura cæterum verticalis. Capsula oblonga, tricostata, pallide brunnea.

Flos habitusque Sarcanthorum, columna et stamen Neottiarum.

This species may perhaps be Blume's Appendicula anceps, but his characters are too short, and have too little reference to the flower to admit of his species being determined with any satisfaction. I have therefore dedicated it to Mr. Lewes, Assistant Resident, Penang, who introduced it, with many other plants, into this garden, where it flowered in March last. It appears to thrive well in pots with leaf soil, mixed with broken pots.

1. Plant, natural size.
2. Flower, one lateral sepal removed.
3. Column and labellum, laterally.
4. Upper part of column viewed dorsally.
5. The same, laterally.
6. Front view of anther.
7. Pollen masses and gland.
8. Column, lateral view. Anther and Pollen masses removed, gland remaining.

HABENARIA. *Willd.*

Fam. Nat. Orchideæ.—Sect. Ophrydeæ.

H. *tenuis*, (n. sp.) foliis in parte caulis inferiori confertis lineari-lanceolatis canaliculatis, racemo elongato tenui, bracteis lanceolato-acuminatis ovario dimidio brevioribus, sepalis lateralibus reflexis, labelli tripartiti lobis obtusis sublinearibus longitudine subæqualibus, centrali paullo latiore pendulo, calcare curvato filiformi-clavato ovario ⅓ longiore, stigmatibus lateralibus longe projicientibus.

Hab.—In graminosis Serampore. Floret Augusto, Septembre.

Descr.—Pedalis, succedente statura omnino gracilior. Folia infima patentissima, superiora ascendentia, conduplicata, folia Plantaginis lanceolatæ sub-æmulantia. Spica mediocris, tenuis. Bracteæ ovario semi-breviores, acutæ. Flores parvi, viridi-lutescentes. Sepalum posticum subcordatum cum petalis galeam efformantibus: lateralia oblonga, oblique reflexa, marginibus demum revoluta. Petala obliquiuscula, sepalo postico paullo longiora, margine inferiore ad basin subauriculata. Labellum trilobum, lobis lateralibus obtusis patentissimis sursum arcuatis, paullo angustioribus, centrali pendulo, paullo longiore vel subæquali. Calcar arcuatum, subulatum, vel filiformi-clavatum, ovario ⅓ longius. Stamina sterilia dentiformia. Antheræ loculi basi vix producti. Stigmatis postici crura breviuscula sub-plana; st. lateralia sublinguiformia, longe projicientia et calcaris faucem obclaudentia, cum basi labelli cohærentia. Ovarium breviter rostratum.

This species was first brought to me in 1841 by the gardeners of the late Dr. Carey's garden, then under the care of Dr. Voigt. It has very lately been introduced into this garden, though it appears to be abundant about Serampore. In technical characters it appears to approach to H. viridiflora,* and H. promensis.† It is I believe one of the novelties‡ to be found in the MSS. Hortus Suburbanus Calcuttensis, but I do not know under what name.

Fig. 1. Plant, natural size.
2. A flower, front view.
3. Column and anther, sterile stamens and base of labellum.

H. *hamigera*, (n. sp.) foliis amplexicaulibus 5-7 in parte inferiore caulis oblongo-lanceolatis sub-canaliculatis margine parce repandis, sepalis lateralibus patentibus, labelli tripar-

* Lindl. Gen. et Sp. Orchid. p. 319.

† Op. cit. p. 320.

‡ Among these I may mention Eriocaulon setaceum, and five or six other species of the same genus, one or two species of Stylidium, two or three species of Naias, etc.

titi lobis lateralibus plano-subulatis, centrali sub-linguiformi paullo breviore, calcare filiformi-clavato hamato ovario multo longiore, staminibus sterilibus rotundatis brevibus, stigmatibus lateralibus brevibus.

Hab.—Goruckpore, Capt. Vicary?

Descr.—Sesquipedalis. Radices testiculatæ. Folia subcarnosa, subtus carinata, glabra, summa in folia floralia acuminatissima mutata. Spica elongata, densiflora. Bracteæ acuminatæ, ascendentes, ovariis breviores, vel interdum subæquantes. Flores parvi, inconspicui, viridescentes. Sepala oblonga; posticum cum petalis galeam efformantia; lateralia patentia. Labelli lobi laterales centrali obtuso fere triplo angustiores, oblique penduli. Calcar ovario $1\frac{1}{2}$ longius, pendulum. Stamina sterilia anthera breviora. Antheræ loculi basi parum producti. Stigma posticum abbreviatum; lateralia dua in fauce calcaris recondita, ratione præcedentis obsoleta.

This species, which belongs to the section Rostratæ of Dr. Lindley's genera and species of Orchidaceous Plants, appears to approach H. *commelinifolia*. It differs, however, abundantly by its smaller greenish flowers, the shorter rostrum of the ovarium, the spreading (not reflexed) almost equilateral sepals, the three-lobed labellum, and generally in the small comparative development of the stigmatic processes, and shortness of the bases of the anther cells.

It was introduced by Capt. Vicary, I am told, from Goruckpore. It flowers here in August and September. It seems to vary somewhat in the divisions of the labellum and length of the spur.*

* To these Habenariæ I subjoin an account of H. marginata, another Bengal species, and of a Bengal species of Bonatea.

H. *marginata* Coleb, foliis humifusis approximatis oblongis basi cordatis albomarginatis, racemo oblongo brevi paucifloro, labelli profunde tripartiti laciniis lateralibus plano-subulatis curvatis centrali porrecta sublanceolata longioribus, sepalis lateralibus basi angustata cum labello connatis, calcare pendulo clavato apice ventricoso ovarii longitudine.

Fig. 1. Plant, reduced from a coloured drawing in the H. C. Library.
2. Flower, side view.
3. Column, labellum and upper part of ovarium in front.
4. Column, divided down the centre.

H. marginata, Coleb MSS. Hooker. Ex. Flora, t. 136. Lindl. Gen. et Sp. Orchid. p. 320.

Hab.—In graminosis Serampore, rara. Floret Augusto.

Descr.—Spithamæa. Folia plana, obtusiuscula, 3-5 venia. Bracteæ acuminatæ ovarii longitudine. Flores mediocres. Sepala viridia; posticum cordato-ovatum 5-venium, 3-5 carinatum; lateralia lanceolata, oblique patentia, acuminata. Petala (cum labello) lutea, obliqua, cum sepalo postico galeantia. Labellum subporrectum; lobi laterales centrali conduplicato fere duplo longiores. Stamina sterilia antheram excedentia, oblongo-lanceolata. Antheræ loculi distantes, connectivo fere hippocrepiformi. Stigmatis postici crura longa, cuneata; st. lateralia dimidio breviora. Ovarium erostratum.

According to Mr. Colebrooke, this plant was introduced accidentally into the Botanic Garden; it was found in Kumaon by Mr. Blinkworth; in Mysore by Dr. Heyne, so that its range seems wide. Roxburgh appears to have been unacquainted with it.

BONATEA. *Willd.*

B. *benghalensis*, (n. sp.) caule folioso, foliis amplexicaulibus lanceolatis acutis inferioribus ad vaginas reductis, spica oblonga, bracteis lanceolatis convolutis ovarii longitudine, petalorum lobo postico lineari-falcato sepalo postico paullo longiore, anticis longioribus lineari-acuminatis falcatissimis, labelli tripartiti lobis lateralibus linearibus falcatis, centrali longiore spathulato, calcare clavato oblique pendulo ovarium subæquante, stigmatibus lateralibus mediocribus.

Hab.—In graminosis, Serampore.

Descr.—Subpedalis, erecta, Folia inferiora ad vaginas fere reducta, superiora lanceolata, acuta, amplexicaulia, conferta, trivenia. Bracteæ anguste lanceolatæ, acuminatæ, glabræ, ovaria subæquantes. Sepalum posticum cordatum, rotundatum; lateralia oblonga, obliqua, duplo longiora, deflexo-pendula. Petala biloba ad basin fere, lobo postico falcato, lineari, cum sepalo postico paullo longiore galeam efformante, antico

DIDYMOPLEXIS. *(Gen. Nov.)*

Fam. Nat. Orchideæ.—Sect. Arethuseæ.

Perianthium ima basi monophyllum, ringens ; labium superius fornicatum, trilobum, inferius bilobum, (medio reflexum.) *Labellum* inclusum, cucullatum, cum pede columnæ articulatum, fundo cristatum, lobo centrali obsoleto. *Columna* basi producta, apice dilatata et utrinque auriculata. *Rostellum* prominens, triangulare, truncatum.

Herba *pallida, aphylla, spithamæa, squamis loco foliorum instructa. Flores albi, inconspicui.*

Hab.—Prope cæspites Bambusarum, Calcutta, Serampore.

Descr.—Pallida, aphylla. Tuberes irregulares, sæpe nodosæ, circa basin caulium radiculas proferentes. Caules spethamæi, succulenti, squamis paucis patentibus loco foliorum. Racemus terminalis. Bracteæ foliis similia sed minora ; inferiora, ut videtur, vacua. Flores majusculi, albi, inodori, fugaces,resupinati. Perianthium ima basi gamophyllum, ringens ; labium superius fornicatum, trilobum (e sepalo postico petalisque marginibus connatis efformatum) ; inferius ultra medium

basi lineari labello adnato, acuminato, falcatissimo. Labellum trilobum ; lobi laterales paullo breviores, petalorum lobis anticis subsimiles, falcato-ascendentes ; centralis longior, ovario paullo brevior, spathulatus, in siccis conduplicatus in clavum calcariformem. Calcar clavatum, oblique pendulum, ovarium subæquans. Staminodia membranacea, oblonga, apice glanduloso uncinulata. Stigmata lateralia (inferiora) spathulata, paullo ultra sinus loborum labelli projicientia, cruraque stigmatis postici paullo minora longitudine æquantia. Antherarum loculi distantes.

Of this plant I have only seen two dried specimens, collected near Serampore by Haloodar, the very intelligent gardener of the late Dr. Carey's garden. It appears to be represented by a drawing in the Library, bearing the name of Habenaria Vicaryi, but of which I have obtained no other information than that it was procured from Capt. Vicary, probably from Goruckpore. It seems to be allied to Habenaria digitata.*

* Lindl. Gen. Sp. Orch. p. 307.

bilobum, ad medium abrupte deflexum, (e sepalis 2 lateralibus compositum.) Sepala lateralia etiam cum pede columnæ connata. Labellum inclusum, cucullatum, (explanatum oblunulatum) breviter unguiculatum, cum pede columnæ articulatum; lobi laterales oblongi, columnam fere includentes; centralis obsoletus truncatus; fundus instructus processubus luteis carnosis subglandulosis in seriebus transversis dispositis, quorum basilares majores. Columna arcuata, apice dilatata et utrinque auricula carnosa antice truncata aucta, basi in pedem mediocrem producta. Clinandrium breve. Anthera terminalis, carnosa, bilocularis. Pollinia 4, per paria collateralia, pulverea. Stigma infra clinandrium immediate situm; pars superior (rostellum) prominens, triangularis, truncata. Capsula oblongo-fusiformis, fuscescens.

This plant was first brought to me in 1841, by one of my collectors, who found it about Serampore. It also occurs about clumps of bamboos around the villages here, whence it has been introduced into the Botanic Gardens. I can say nothing precise of its mode of vegetation; but although its appearance is entirely that of plants parasitic on roots, the specimens that have been brought to me, though dug up with care, have presented no appearances of such of the ordinary parasitic adhesions as might have been expected. No other Indian botanist appears to have met with it.

The structure of the stigma appears to me remarkable. The third stigma (uppermost from the resupination of the flower) is prominent, and its front surface is truncate and triangular in outline. But after maceration in spirits this separates into two parts, an interior cellular, which might be mistaken for a gland; and a posterior, resembling the ordinary undivided rostellum of Dendrobeæ and Epidendreæ. I have described it, however, as it appeared to me in the fresh specimens.

I am not sufficiently acquainted with the genera of the tribe to which this belongs to be able to state its more immediate affinities. From the Indian Arethuseous, genera Corysanthes, Cephalanthera, and Pogonia,* it is easily distinguishable by the want of perfect leaves, the peculiar arrangement of sepals and petals from which the bilabiate perianth results, (in which respect it approaches Pterostyles,) and the form of the labellum.

MYRIOPTERON. *(Gen. Nov.)*

Fam. Nat. Asclepiadeæ.—Sect. Periploceæ.

Corolla rotata, laciniis torsivis. *Corona staminea* 5-phylla, foliolis aristatis, sinubus dente (incluso truncato) auctis. *Antheræ* membrana terminatæ, apice cohærentes, a stigmate subliberæ, imberbes. *Pollen* granulosum, in massis solitariis corpusculorum stigmatis parti dilatatæ affixum. *Folliculi* oblongo ovati, alis pluribus longitudinalibus aucti, divaricatissimi. Semina basi comosa.

Planta *volubilis, puberula, lactea.* Folia *opposita, reticulation esubtus prominula.* Processus *interpetiolares carnosi, dentati.* Cymæ *irregulares, in paniculis axillaribus dispositæ.* Flores *albidi, parvi.* Folliculi *oblongo-ovati.*

Myriopteron paniculatum.

Descr.—Caulis glaber, tactu asperulus. Folia subovalia, basi cordata, mediocriter cuspidata, molliter puberula; venæ secondariæ arcuatim nexæ, interveniis reticulatis, venis subtus prominentibus venulisque prominulis; superficies supera rugosa. Petioli subsemunciales. Processus interpetiolares (stipuliformes) carnosi, pluridentati, subreflexi. Paniculæ laxæ, pendulæ, folia sæpius superantes, e cymis multis irregularibus conflatæ. Flores albidi, parvi, subodorati. Pedicelli apice incrassati, papillosuli. Sepala 5 minuta. Corolla rotata, æstivatione contorta; laciniæ oblongæ, tortæ

* Anthogonium referred with some doubt to this same section by Dr. Lindley, will, if characters derived from the pollen masses are to be absolutely relied on, be found, I suspect, to belong to Epidendreæ.

æquilaterales. Corona staminea exserta; foliola subulato-aristata, erecta, antheras subduplo superantia, alba. Sinus unusquisque dente carnoso, truncato, emarginato, incluso auctus. Filamenta (libera) brevissima. Antheræ ovatæ, in conum stigma insuper incumbentem conniventes, apicibus membranaceis cohærentes; connectivum pallide fuscescens; loculus exterior interiore dimissius productus in auriculum rotundatum. Pollen granulosum, ternarium quaternariumve. Stigma obtusum, emarginatum, centrum versus ambitu obsolete pentagonum. Glandula magna, alba, concava, ambitu suborbicularis. Appendicula obovata, brunnea, bipartita. Stylus brevissimus. Ovarium biloculare; ovula oo (familiæ) placentis carnosis affixa. Folliculi (panicularum sæpius solitarii) oblongo-ovati, divaricatissimi, longitudine 3-unciales, latitudine semunciales, cum alis virides. Semina brunnea.

Hab.—Assamia, et prope oppidum Tenasserim Provinciæ Merguensis.

I first met with this plant in 1834, subsequently in Assam in 1835-6. It appears to have been introduced into these gardens, where it flowers in August and September, by Major Jenkins.

I am not aware of the immediate affinities of the genus; the foliation is that of Gymnema and Marsdenia, the corolla in some measure that of Cryptolepis. It is singular, in the family, in the wings of the fruit: the axillary panicles also appear to be a very unusual character. In the form of the processes of the corona it resembles Streptocaulon, and Finlaysonia *(jure Gurua* Hamilton,*)* but in those genera the part called corona is so little developed, that the processes are referred in characters to the faux of the corolla.

EXCÆCARIA.—*Linn.*

E. *oppositifolia*, fruticosa, foliis oppositis, floribus dioicis, fæmineis terminalibus solitariis.

Habt.—Bengala orientalis.

Frutex arbusculoideus succo lacteo caustico scatens; ramuli virides, compressiusculi. Folia opposita, breve petiolata, pendula, oblongo-lanceolata, acuminata, serrata, læte viridia, venis secondariis distinctis. Stipulæ parvæ, subfoliaceæ, conduplicato-carinatæ, mucronibus 1 vel 2 sphacelatis. Gemmæ axillares et terminales, squamis stipuliformibus paucis imbricatæ. Flores dioici; masculi in spicis solitariis ascendentibus, terminalibus, foliis ½ brevioribus dipositi, solitarii, utrinque glandula stipati, bractea rotundata basi carnosa suffulti.* Rachis (spicarum) exsculpta. Perianthium 3-sepalum, sepalis denticulatis. Stamina 3; 2 lateralia sepalis sub-opposita, tertium anticæ bracteæ oppositum. Filamenta robusta, sepalis paullo longiora. Antheræ magnæ, cordato-reniformes, didymæ, longitudinaliter dehiscentes, connectivo mucronulato. Pollen oblongum, plicis tribus instructum. Flos fœmineus solitarius, terminalis, pedicellatus, basi utrinque glandula magna stipatus, unibracteatus. Perianthium 3-sepalum, sepalis bracteæ subsimilibus, tertio postico. Rudimenta staminum o. Ovarium 3-loculare, ovatum, attenuatum in stylum brevem robustum tripartitum, ramis recurvis subulatis intus stigmatosis; ovula solitaria pendula. Fructus baccatus, pedicellatus, subrotundus, pendulus, basi perianthio glandulisque suffultus, apice subumbilicatus, 6-sulcatus, trilocularis, tricoccus, coccis bipartibilibus, pomi minoris magnitudine. Semen pendulum, sub-globosum; tegumentum exterius carnosum, tenue, raphe ½ completa; interius atrum, osseum. Albumen carnosum. Cotyledones foliaceæ. Radicula ovata supera.

Introduced from Sillet in 1826. It exhibits occasionally a tendency to become monoicous, in which case the female is found at the base of the spike; it also sometimes presents 4 stamina, as well as occasional cohesions between anthers

* Vel potius spiculæ 3-floræ, interdum 4-floræ. Flos quisque e stamine solitario in axilla bracteæ, bractea postica (vel quarta) sæpius vacua.

and bracteæ. Although it presents differences, especially in habit, from *Excæcaria*, I have considered it best to refer it to that genus than to endeavour to define it as a distinct one.

The situation of the stamina with regard to the parts of the perianth is not satisfactorily determinable. The flower may be considered as solitary, 1-bracteate, 3-sepalous, with 3 stamina alternating, or as monandrous, each with a bracte. And this appears to me the more correct opinion from the want of isochronism in the development of the stamina, the anticous one being most præcocious, as well as from the situation of the 4th stamen, which when developed has always appeared to me opposite the posticous sepal or 4th bracte. In *Excæcaria Agallocha*, the male flowers would appear as monandrous as in this, an assumption founded on the want of isochronism in their development.

It presents no beauty. It does not often ripen seed, the males and females having been planted apart from each other.

GIVOTIA. *(Gen. Nov.)*

Fam. Nat. Euphorbiaceæ.

Fl: fœm.—*Calyx* 5-sepalus, imbricatus. *Petala* 5, convoluta, partibus superpositis in corollam gamopetalam suburceolatam cohærentia. *Stamina* O. *Annulus* hypogynus 5-lobus. *Ovarium* bi-tri-loculare, loculis uniovulatis. *Styli* 2-3, profunde bi-partiti, intus stigmatosi. *Fructus* drupaceus, monospermus.

Arbor *mediocris facie Rottleræ.* Folia *alterna, sublobata, subtus pube stellata alba, petiolis biglandulosis.* Flores *fœminei terminales, cymoso-paniculati.* Fructus *albido-tomentosi, cerasi magnitudine.*

Descr.—Arbor mediocris, partes novellæ et calyx extus dense ferruginei pilis stellatis. Folia alterna, bistipulata, stipulis parvis subulatis, interdum obsoletis. Petioli longi, laminam subæquantes, medium versus glandulis turbinatis distantibus vel approximatis stipati, pilis stellatis ferrugineo-albis vestiti. Lamina deltoidea, cordata, inæqualiter dentata sæpe sublobata, acuminata, basi 5-venia et sæpe 1-glandulosa, subtus ferrugineo-alba pilis stellatis. Inflorescentia fæminea terminalis, cymoso-paniculata. Cymæ irregulares. Flores articulati in pedicellum brevisimum sæpius bractea filiformi suffultum, inconspicui, parvi. Masc: nondum visi. Fæm: Calyx imbricatus 5-sepalus, sepalis oblongis inæqualibus. Petala 5, breve unguiculata, rotundata, convoluta, mediantibus partibus superpositis cohærentia in corollam urceolatam sepalis paullo longiorem. Stamina O. Annulus hypogynus carnosus, 5-lobus, circa basin ovarii. Ovarium ovato-oblongum, corolla brevius, pube solita dense vestitum, bi-triloculare. Styli 2-3, profunde bipartiti, secus latera et faciem internam stigmatosi. Ovula solitaria, pendula. Fructus subrotundus, breve et dense pubescens, pedicello turbinato insidens, styli cicatrice apicem versus notatus, drupaceus, abortu unilocularis, monospermus. Caro crassus, succosus, viridis. Putamen tenue, lignosum. Semen pendulum subrotundum; tegumentum exterius tenue, cellulosum, venosum, raphe ad chalazam in ramis sæpe dichotomis divisa; interius crassum, atrum, osseum. Albumen copiosum carnosum. Cotyledones foliaceæ. Radicula brevis supera. Habitus Rottleræ, succus aqueus.

By this plant it is my wish to commemorate the late Mr. J. Voigt, Surgeon to the Danish Settlement of Serampore, and author of the MSS. Hortus Suburbanus Calcuttensis. When I mention that, under the superintendence of Mr. Voigt, the Botanic Garden of Dr. Carey continued to be as rich in species as the H. C. Botanic Gardens, and that its contents were made available with exceeding liberality; that the Hortus Suburbanus is a complete and digested catalogue of all the plants found about Calcutta, arranged according to their Natural Families, and that it thus forms the ground work of a Flora of Lower Bengal, to which it exhibits many interesting additions, I trust to have shewn very sufficient reasons in justification of the name. For, though precedents would not be wanting in favour of the sufficiency of mere friendship to the establishment of a name in science, I wish to shew that Mr. Voigt has real claims to the grateful remembrance of all students of the amabilis scientia. For the anagram the confused synonymy of Voigtia, and its extreme similarity to Voitia must be my apology.

It is I am told the Rottlera nivea of Dr. Roxburgh, which name however I do not find in his arranged MSS. or in the Hortus Bengalensis, although it appears to have been introduced by the Rev. F. Carey from Ava in 1808.

There are two or three trees in the Gardens, which flower and appear to ripen seeds in July and August, although I have not yet seen male flowers.

It appears to approach in some respects to Anda and Aleurites. It may be readily recognised among the section with corollas and uni-ovulate cells of the ovarium by its drupaceous 1-celled, 1-seeded fruit.

Description of a collection of Fishes made at Chusan and Ningpo in China, by Dr. G. R. Playfair, *Surgeon of the Phlegethon, War Steamer, during the late Military operations in that country. By* J. M'Clelland, *Bengal Medical Service*, vid. plates xxi, xxii, xxiii, xxiv, and xxv.

It would be impossible to comprise in so small space, a greater amount of interest, than the little collection forming the subject of this paper affords. Of about thirty species, half of them are new; of the species which are not new, some are highly interesting; of these I may mention *Cyprinus putitora*, Buch., *Silurus bimaculatus*, Bl., and S.

duda, Buch. The first of these is the only species of the extensive family to which it belongs described by Buchanan in his work on the Gangetic fishes, which I had not before met with; it was consequently suspected from its rarity in Bengal, that it might prove to be a variety only of *Barbus hexagonolepis.** Having identified the Chinese specimen in this collection with Buchanan's description, and compared it with a specimen of *Barbus hexagonolepis*, we were enabled to draw at least one definite distinction between the two; namely, *Barbus hexagonolepis* has 27 or 28 scales on the lateral line, while *Barbus putitora* has only 24 or 25. When fresh specimens of both are compared together, other more striking differences may appear. Of *Silurus bimaculatus*, Bloch, some slight variations are apparent in the Chinese example here noticed, from those pointed out by others in the same species as it occurs at Java. It is also to be remarked, that the dark spot on either side above the pectorals to which it owes its name, is common to most, if not to all the species of this genus. *Silurus mysoricus*, Cuv. et Val. would seem to be *Silurus duda*, Buch.; and, as it thus seems to belong to China, as well as to Mysore and other parts of India, the former name becomes improper, even if the latter had not the priority. A new species is added to this genus differing only from *Silurus pabda*, Buch., in possessing three additional branchial rays, beyond the number ascribed to Buchanan's species.

With regard to the species of *Trigla*, which I have named *Spinosa*, it is worthy of remark, that the fin rays correspond with those of *Trigla alata*, Gmelin, said to belong to the Japanese seas, and which, instead of the three detached rays under the pectorals which are characteristic of the genus, is described by Houttuyn as presenting the very anomalous character of twenty rays in this situation, united

* Indian Cyprinidæ, As. Res. vol. xix, p. 336.

by a membrane so as to form a kind of wing, not large enough, however, to enable it to fly. Cuvier with prophetic caution rejected this species, because he could not comprehend clearly the text of the author, published in the Memoirs of the Society of Harlem, t. xx, part 2, p. 336, quoted dans l' Histoire Nat. des Poissons, vol. 4, p. 15, in order to shew with what facility an error is propagated when once admitted into works of authority.*

The way in which all this confusion arose in the first instance may, perhaps, be explained by supposing the original describer to have confounded the ventral, with the pectoral fins of *Trigla spinosa*, which together with the three intermediate rays, would exactly make up the number (twenty) of the rays ascribed to the supposed wings.

I have noticed under the proper head, the probability of the species of *Sebastes* here described being the *Sebastes albofasciatus*, Cuv. the history of which is so singular, as partly derived from a Japanese work, that I may be excused for adverting to it in this place. Cuvier having first identified a species of his genus *Sebastes* in certain Japanese drawings, with the aid of M. Abel Remuset, found the accompanying Japanese description to correspond with that of the *Sebastes* of the North sea. The fish is described by the Japanese as common on their coasts, where it attains three feet in length; they inform us that its flesh is white and rich, and that it is much sought after by their fishermen in the winter season, &c.. Subsequently, the actual fish itself, as described in the Japanese writings, having been forwarded from

* Here are a few of the names bestowed on this supposed species, which, from the facts now brought forward in regard to *Trigla spinosa*, we have additional reason to believe does not exist. The Red wing (rouget ailé) of Houttuyn. *Trigla rubicunda*, Hornsdetedt in his Dutch translation of Syst. Naturæ, *Trigla Japonica*, Shaw Gen. Zool. *Dactylopterus*, Lacep. 111. p. 335, Trigla alata, Gm. Syst. Linn. and subsequently repeated in the different Dictionaries of Natural History.

China to the Berlin Museum, it was submitted to the examination of M. Cuvier, and found to be the Holocentrum albofasciatus of Lacep. It may be remarked in this place, that one of my reasons for regarding the specimen here figured, t. xxi. f. 3. and described from Dr. Playfair's collection to be distinct, is, the great size of the second dorsal and anal spines.

The collection affords a beautiful species of *Clupeidæ*, or the Herring family, which seems to have escaped the observation of naturalists. It is nearly allied to the genus *Thryssa*, Cuv.; but is distinguished from that group by long setaceous free rays, situated above the pectoral fins. This is described as a new genus, Chœtomus, of which I am also acquainted with a second species.

The Chinese species is here named in honor of Dr. G. R. Playfair, its discoverer, a compliment richly merited for the valuable collection which we owe to his zeal and intelligence. *Macrognathus undulatus* is another new species due to Dr. Playfair. It differs but little from the species described in Buch. as *M. armatus*, still it is distinct in its markings, as well as in having three spines in front of the anal fin, while Buchanan's species has but two. Buchanan was wrong in supposing the species he named *armatus*, to be identical with Lacepede's species of that name; it is distinguished from it by having four additional spines in the back, and must therefore be distinguished from it also, in name, for which I propose that of *Hamiltonii*.

Two species of *Cobitis*, or Loach, are comprised in this collection; both of which are quite distinct from any species of that genus hitherto described. They are also quite distinct from each other; the one being remarkable for the depth of the head, and small size of the pectorals, while the other has the pectorals large, and the head more elongated than compressed.

The most important accessions which we owe to Dr. Playfair's collection are, First. A very striking form of the genus *Hetrobranchus* of Geoffroy. Indeed this new form must constitute a distinct genus of itself. The new genus *(Cossyphus)*, in addition to the arborescent appendages to the third and fourth branchial arches, presents them also on the second arch: and instead of the caudal being a distinct fin from the anal and dorsal, as in M. Geoffroy's genus, there may be some question as to the existence of a caudal at all; but if there be one, it must be in union with the anal and dorsal.

Second. Two undescribed species of the genus *Anguilla*, both from Chusan; both distinguished from the eels of Europe, by the number of their fin rays.

The other accessions to this order in the proposed genus *Murænesox*, are less exclusively due to this collection, for I have been long acquainted with several Bengal species, although it is probable I should have postponed their description to some future period, had it not become necessary to say something of the species contained in Dr. Playfair's collection. The Bengal species of the proposed genus *Pneumabranchus*, of which there are several, I could not consistently introduce in this place, but hope to describe them in the next number.

The following is a list of species contained in Dr. G. R. Playfair's valuable collection made at Chusan and Ningpo, including the following four new genera; namely, CHŒTOMUS, COSSYPHUS, MURŒNESOX, and PNEUMABRANCHUS.

1.—Salt or Sea-water fishes, before undescribed.

HOLOCENTRUM MACULATUM,
SEBASTES SINENSIS,
TRIGLA SPINOSA,
TETRADON FASCIATUS,
CHŒTOMUS PLAYFAIRII.

2.—Estuary species, before undescribed.

PIMELODUS ASPERUS,
SILURUS SINENSIS,

Cossyphus ater,
Macrognathus undulata,
Murœnesox tricuspidata,
Pneumabranchus cinereus,

3.—Estuary species of Bengal, found at Chusan by Dr. Playfair.

Chaca Hamiltonii, Gray.
Saccobranchus singio, Cuv. et Val.
Bagrus cavasius, Cuv. et Val.
Silurus bimaculatus, Bloch.
Silurus duda, Buch.

4.—Fresh-water species before undescribed.

Anguilla macroptera,
Anguilla sinensis,
Cobitis bifurcata,
Cobitis pectoralis.

5.—Fresh-water species of Bengal, found at Chusan by Dr. Playfair.

Cyprinus (Barbus) putitora, Buch.

Holocentrum maculatum, *t.* xxi. *fig.* 1.

This is a very well marked species of an extensive genus. The general colour of specimens in spirits is silvery white on the lower parts of the body and sides, below the lateral line; with light brownish grey on the back, softening down into silvery white on the sides. There is one, two, or three rows of black spots on each side; one of these rows extends along the base of the dorsal fins, and another along the upper edge of the lateral line, together with an incomplete row between these on the higher part of the body, and another incomplete row below the lateral line, particularly in the larger specimens.

There is an arched row of dark spots on each side along the middle of the anterior dorsal fin, with an imperfect row at the base of the longer spines, and a black mark on the lunate margin of the fin membrane, behind the point of each spine.

The operculum terminates in a narrow scaly point, close over which, there is rather a large-sized sharp spine. The pre-operculum is serrated behind, presenting at the corner and lower margin, five small spines.

The lower jaw is longer than the upper, the teeth in both jaws are minute and numerous like the pile of velvet. The nostrils have two apertures on each side, close in front of the eyes. The eyes are large, and the orbits smooth-edged, irides dark above.

The first dorsal has twelve spinous rays, of which the fifth is the longest; the posterior dorsal has thirteen soft, and one spinous ray. The pectoral is composed of sixteen soft rays. The ventrals which are situated under the pectorals contain each, six soft branching rays, and one smooth sharp spine. The anal contains three spinous, and eight soft rays; the first spinous ray (not distinctly represented in the drawing,) is very short, and situated close to the base of the second, which is strong and large; the third anal spine is as long, but more slender than the second. The caudal is slightly forked, and contains seventeen rays, so that the number of the fin rays will stand thus:

$$\text{D. } 12 : -\tfrac{1}{13} : \text{P. } 16 : \text{V. } \tfrac{1}{6} : \text{A. } \tfrac{3}{8} : \text{C. } 17.$$

The fins on the lower parts of the body are white, the caudal and posterior dorsal tinged with grey.

There are five rays in the branchial membrane.

This species would seem to be very common in the China seas. Dr. Playfair found it both at Ningpo and Chusan.

It is one of the most beautiful, and no doubt one of the most useful of the perch-like fishes, as it would seem to attain a large size, and to afford the fishermen much employment at certain seasons.

Trigla spinosa, *t.* xxii. *fig.* 2.

Trigla alata, Gm.

This species, which is allied to T. Lyra, is distinguished by a spine on either side of the occiput or nape, a single large spine on the humeral bone over the situation of the pectorals, a single small spine on the operculum, and two spines on lower corner of the pre-operculum, with a row of spines on either side of the dorsals. The pectorals are large and of blue colour, reaching on either side to the middle of the second dorsal fin.

There is a raised ridge over and in front of the eyes, with a single short point behind, and two before and above the eyes. The lateral line is raised and smooth, the caudal is bifid; a dark spot on the anterior dorsal, and another on the posterior dorsal, as well as on the caudal fin, and on the upper edge of the irides.

The fin rays, are,

D. 7—15. P. 11 : V. 6 : A. 14 : C. 11—B. 7.

This species is about four inches in length, and has the number of rays in its fins corresponding exactly with the number ascribed by Houttuyn to Trigla alata; there is reason to think that the mistake relative to the existence of the latter may be explained, by supposing that author to have confounded the pectoral and ventral fins of the species here described, and that he mistook them, together with the three intermediate free rays, for a single fin, or wing as he called it. Having been preserved in spirits, the specimen has lost the vivid colours of the species, but there is still the remains of blue on the pectorals.

Sebastes sinensis, *t.* xxi. *fig.* 3.

The genus is characterised by scaly opercula and spinous incrustations about the head, and is distinguished from Scorpæna, from which it was first separated, by the absence of cutaneous appendages to the head.

The species here noticed is probably the *S. Albofasciatus* of Cuvier, but having been preserved in spirits, it has lost its characteristic colours. It seems also to present some slight variation in the number of its fin rays.

There are two spines on the posterior angle of the operculum, five on the inferior angle of the pre-operculum, and two between the nostrils. The interval between the eyes is hollow, and only equal in breadth to about half the diameter of the orbit; there are no scales in the hollow between the eyes, which is marked by two ridges. The salient ridge which forms the upper boundary of each orbit, presents three spines, one before and two behind. There is also a small spine on the humeral bone above the pectoral fin. The ten lower rays of the pectorals are jointed, but not branched. The following are the fin rays:

D. $\frac{12}{13}$: A. $\frac{3}{5}$: C. 14 : P. 18, of which 10 are simple V. $\frac{1}{5}$.

The stomach is a short *cul-de-sac;* a narrow pyloric process, furnished with a bundle of soft appendages, joins it to a capacious intestine. The liver is large, consisting of two lobes, of which the right is the largest. The air-vessel consists of a flat pyriform bag.

The Sebastes are not numerous. One species is peculiar to the North Seas; another to the sea between America and Kamschatka; a third to the Mediterranean; two to the Cape; another to the Indian seas, and three are noticed as from Japan. Of these, one is without spines on the head. What is known of the only Japan species (with which it is probable the present one may be allied,) has been chiefly derived, as already observed, from the Japanese Encyclopedia. M. Cuvier found it to be *Holocentrus albofasciatus.*

MACROGNATHUS UNDULATUS. *t.* xxii. *fig.* 1.

This species is nearly allied to, if not the same as one that has been mistaken by Buchanan for Macrognathus armatus of Lacepede, but which is however, quite distinct.

The pectoral fins of the Chinese fish are round, and each contains 20 divided rays; on the back there are 37 short spines in front of the dorsal. The dorsal contains about 72, the anal about 75 rays, and these fins are united with the caudal. The caudal is distinguished by longer rays than the adjoining parts of the anal and dorsal. In front of the anal, there are three prickles. The fin rays and spines are thus:

D $\frac{37}{72}$. P. 24 : A. $\frac{3}{75}$: C. 20.

Colour.—The sides are marked along the whole length above the lateral line by a series of irregular half circles, occasioned by a broad undulating dark line, which extends along each side, sending off at every undulation a branch to the back, which meets a corresponding branch from the opposite side; similarly formed, but smaller semicircles are observed below the lateral line on the tail.

Habitat.—Chusan.

Distinguished from *M. Armatus*, Buch. which has also 37 prickles in front of the dorsal, by short bands, instead of small circular dots or spots, connecting the undulations on the sides with the back, and by 3 spines in front of the anal instead of 2; and from *M. Armatus*, Lacep. by 37 spines in the back instead of 33.

BARBUS PUTITORA, *t.* xxiii. *fig.* 2.

Cyprinus putitora, Buch.

This species, which has been described by Buchanan in his account of the fishes of the Ganges, I have never before met with; and it is singular, that it should be found in a collection from China. Buchanan's description is very accurate, and leaves little additional to be said on the subject, except as to the number of scales.

It may be described in a few words, as a short Barbel, with a short blunt smooth snout, with 4 short cirri. The back forms a high narrow ridge in front of the dorsal, abruptly arched from the snout to behind the nape. The mouth is small, the length of the head is less than a third of the body, (exclusive of the head and caudal fin,) and considerably less than the depth of the body. There are 25 scales along the lateral line, and $6\frac{1}{2}$ scales in an oblique row, from the base of the ventrals to the front of the dorsal: the third scale from the ventral fin forming the lateral line, and the seventh the ridge of the back. The fin rays are,

D. $\frac{3}{8}$: P. 16: V. 9: A. 7: C. 19.

The Chinese specimen, which we owe to Dr. G. R. Playfair, is about ten inches in length. In the higher parts of the rivers of India, Buchanan states, that it attains nine feet in length.

It was found by Buchanan in the vicinity of the mountains on the northern frontier of Bengal, and by Dr. G. R. Playfair at Ningpo, in China.

COBITIS BIFURCATA, *t.* xxiii. *fig.* 1.

A Loach with eight cirri, four on the upper jaw, two at the corners of the mouth, and two bifurcated cirri on the lower jaw; the head short, compressed; the body compressed so that the breadth is only equal to about half the depth of the body. The depth is about equal from the nape to the tail; both margins being nearly straight and parallel. The lower margin extends in a straight line to the mouth; the head is arched in front, the eyes small, and situated high and about midway between the nape and the snout. The nostrils are situated a short distance in front of the eyes, and consist on either side of a single external opening, with a tubular valve in front.

The branchial aperture is situated above the pectoral fins, and some way behind the operculum, consisting of a small oblique slit; the pectoral fins are small, are situated low, and the dorsal and ventrals about midway between the pectorals and base of the caudal. The ventral fins reach to the vent; the anal is situated midway between the extremity of the ventrals and the base of the caudal. The fin rays are,

D. 9 : P. 10 : V. 6. A. 7. C. 16, together with an indefinite number of gradually diminishing short rays as usual at the base of the caudal.

The colour seems to have been a mottled brown above, and below yellowish white.

Habitat.—Chusan.

Fig. 1. A is a magnified drawing of the lower view of the mouth and cirri.

COBITIS PECTORALIS, *t.* xxiii. *fig.* 3.

A Loach with ten cirri, four on the upper jaw, two at the corners of the mouth, and four small cirri on the lower jaw, two of which are very minute, and might be considered appendages rather than cirri.

The pectoral fins are large, the body arched uniformly from the eyes to the dorsal, and chiefly compressed at the tail, the head rather long and low. The dorsal is situated behind the middle of the back, the ventrals do not reach to the vent. The branchial aperture which is small, extends downwards as low as the pectorals. The fin rays are,

D. 8 : P. 12 : V. 9 : A. 7 : C. 16—with an indefinite number of short bristle-points, a little more developed than usual, and gradually diminishing at the base of the caudal.

The colour seems to have been greyish or olive brown above, mottled about the head and fins, and with a dark transverse spot at the upper base of the caudal; the lower parts of the body white.

Habitat.—Chusan.

Fig. 3. A magnified representation of the mouth and cirri.

SILURIDÆ.

Of the genus Silurus as defined by Cuvier, without sensible spines in the dorsal, and with teeth like those of a card in both jaws, furnished with a second band on the vomer, parallel to the first; the collection contains three species.

The first of these is *Bimaculatus*, Bl. originally found at Tranquebar, of which MM. Kuhl and Vanhasselt have described a variety found at Java, in which some of the fin rays differ slightly from the Tranquebar fish. It will be seen, on comparing the following characters of the specimen found at Chusan, that it differs slightly in the number of fin and branchial rays from both the former varieties; yet the species is, in my opinion, unquestionably the same.

Silurus bimaculatus,* Bl. variety from Chusan; four cirri shorter than the head, a fine sharp smooth spine, having a soft articulated extremity.

D. 5 : P. $\frac{1}{13}$: V. 9 : A. 65 : C. 17—Branch. 13.

The second species differs from *Silurus pabda*, Buch. in which the number of branchial rays are nine, while the Chinese fish has twelve, and in the pectoral spines of the latter being serrated behind, while in the Bengal fish they are smooth-edged according to Buchanan.

* With regard to this name, it may be remarked, that the three species here noticed have each two black marks, as in Bloch's species, near the commencement of the lateral line; and this seems to be a general character of most of the Asiatic species.

The following are the characters of the species in question :—

SILURUS SINENSIS.

Four cirri, the two on the upper jaw are as long as the head, the two lower cirri are very small. The pectorals preceded by a slender spine on either side, about half the length of the fin. The spine has a few distant prickles on the hinder margin towards the point. The following are the fin rays :

D. 4 : P. $\frac{1}{13}$: V. 8 : A. 54 : C. 18.—Branchial rays 12.

The third species in Dr. Playfair's collection from Chusan, I consider to be the same with that found by M. Dussumier in Mysore; though the latter is said to have thirteen, while in the former I found only twelve branchial rays.

Having no doubt as to the Mysore and Chinese specimens being one species, it can no longer be proper to retain the local name bestowed on the former in the *Hist. Nat. des Poissons.** Indeed I conceive the *Silurus mysoricus* of MM. Cuvier and Valenciennes, to be the *Silurus duda* of Buchanan. The following are the characters of this species as exhibited by the specimen in Dr. Playfair's collection from China.

SILURUS DUDA, Buch.

Silurus mysoricus, Cuv. et Val.

Four cirri, the two upper cirri reaching to the end of the pectorals, the lower very small. Pectoral spine smooth and slender.

D. 4 : P. $\frac{1}{15}$: V. 8 : A. 76 : c. 17.—Branchial rays 12.

Habitat.—Bengal, Mysore, and China.

* Par MM. Cuvier et Valenciennes, vol. xiv. p. 364.

With species corresponding in their general form and size as the Siluri of Cuvier do, mistakes may occasionally arise from the difficulty of distinguishing one from another.*

Cossyphus,† Nov. Gen.

Gen. Char.—The head broad and covered with a flat helmet, the *dorsal and anal long, and continuous with the caudal*‡ an arboraceous appendage to the *second* and *third* branchial arches; eight cirri; two transverse rows of minute crowded teeth in the upper, and a single row in the lower jaw.

Cossyphus ater. t. xxii. *fig.* 3.

The length from the hinder process of the helmet to the snout, equal to one-third part of the length of the body. The helmet terminates behind by a round short process in front of the dorsal, and has an oval depression between the eyes; the eyes are small and lateral. The pectoral spine is not so long as the fin; but it is strong, and has the front edge thin and finely serrated; the operculum is small; eight rays in the branchial membrane; the openings to the branchiæ are situated low; the branchial combs are four, the

* *Calcutta Journ. Nat. Hist.* vol. II. p. 583. It is remarked that *Silurus duda*, *Canio*, and *Chechra*, Buch. are but one species. The *Chechra* may however be conceived to be a variety of S. bimaculatus, Bl., and is distinguishable from *S. duda* by its dorsal spine being serrated on the hinder margin. There is also a typographical error in the characters of the species noted, the pectoral rays being given as 3, instead of $\frac{1}{13}$.

† From κοσσυφος, the Greek name of an unknown kind of dark-coloured fish.

‡ In *Cossyphus ater*, the specimen from which the genus is described, and the only one that is known, the caudal was removed from the end of the tail, and its place left vacant by an open fissure.

first and third ascend above into a capacious cell formed by the helmet, in which the arborescent processes rise above from the branchial arches; in addition to which there is a folliaceous appendage to the top of each branchial arch. See fig 3, *a*.

The fin rays are,

$$D. 59 : P. \frac{1}{8} : V. 6 : A. 45.$$

A remarkable peculiarity is the absence of a caudal fin, or of rays representing that fin in the species here described. A single specimen only being contained in the collection, it would be difficult to say whether the caudal rays were displaced, leaving an accidental fissure in the situation of the caudal fin, or whether the fissure is natural.

The stomach is reflected forward, and terminates without cecal appendages in a narrow and slightly convoluted intestine, the entire length of which together with the stomach, does not exceed half the length of the body. The liver is small, consisting of two very distinct equal lobes.

The cirri are placed two on the upper, and four on the lower jaw, and two at the corners of the mouth, which are the longest, although they scarcely exceed the length of the head.

Habitat.—Chusan.

PIMELODUS ASPERUS. *t.* XXIV. *fig.* 2.

Head depressed and narrow, but not elongated at the mouth. The helmet prolonged towards the dorsal fin, and forming arches over the eyes, which are very small. A separate buckler at the base of the dorsal, and two narrow processes of the helmet directed backward on either side, one of them situated immediately over the lateral line, the other extending backwards from the posterior jamb of the operculum; opercula almost immovable, seven branchial rays, and one broad band of minute conical teeth like those of a card in both jaws.

A spinous process of the buckler is extended obliquely along each side above the pectoral fin; there is a large flat spine in each pectoral with long hooked barbs on the hinder margin, and five prickles on the anterior margin: second ray of the dorsal striated, strong, and very sharply serrated behind, six variegated short cirri, two at the corners of the mouth, and two at the base of the lower jaw: body and fins variegated transversely with brown and white. The following are the fin rays:—

D. $\frac{2}{6}$: 0: P. $\frac{1}{6}$: V. 6: A. 8: C. $\frac{10}{\frac{16}{10}}$—Branch. 7: Cirri 6.

Habitat.—Chusan.

Fam. Clupeidæ.

Chœtomus.* Nov. Gen.

Gen. Char.—Snout prolonged in front of the jaws, maxillaries extended behind the corners of the mouth, and finely dentated. The lower jaw, which is shorter than the snout, terminates in a narrow point. The palatines form a slender arch, provided on either side with minute teeth. The tongue and branchial arches present several rows of pectiniform digitations; *a tuft of setaceous bristles is situated over the pectorals on either side;* there are ten rays in the branchial membrane. The body is much compressed, the anal fin long, and joined to the caudal which is small, and placed obliquely on a narrow elongated tail; a short isolated spine is situated in front of the dorsal: scales large, thin, and easily detached.

Chœtomus Playfairii.† *t.* xxiv. *fig.* 3.

The caudal is small and bifid, with the upper lobe much

* Etym. from χαιτε, a lock of hair, and, ωμος the shoulder.

† This very beautiful species is dedicated to Dr. G. R. Playfair, to whom we are indebted for this collection. Dr. Playfair served with much credit and zeal throughout the late war in China, from its commencement in 1839 to its termination in 1843.

longer than the lower; the maxillary bones reach backward beyond the base of the pectorals. The dorsal is placed on a somewhat oblique elevated base, situated on the anterior third of the back; the maxillaries throughout their length are finely dentated, as well as the lower jaw, which presents a sharp knob at the apex, for which there is a corresponding indentation in the upper jaw. The following are the fin and branchial rays.

B. 10—D. $\frac{1}{12}$: V. 7: A. 80: C. 19.—P. 10—with 6 bristles.

The pectoral fins are as long as the head, and the bristles extend to the commencement of the anal fin; the ventral fins are placed beneath the commencement of the dorsal.

The opercula are silvery white, as well as the irides, which last are tinged on the upper edge with dark colour; the rest of the body is golden yellow, with a darkish tinge at the extremity of the tail.

Habitat.—China.*

ANGUILLA SINENSIS. *t.* XXV. *fig.* 2.

An Eel with about 206 rays from the middle of the caudal to the anterior extremity of the anal fin, snout broad

* To this genus must be added a Bengal species,

CHŒTOMUS HAMILTONII.

Mystus Ramcarati, Buch.

This species, which is fully described by Buchanan Hamilton in the Gangetic fishes, though referred to a wrong family, may be characterised as follows: maxillaries not extending beyond the pre-operculum; caudal entire, the pectoral fins are shorter than the head, the bristles extend beyond the commencement of the anal.

D. 14: P. 12: V. $\frac{1}{10}$: Anal and Caudal 111.

This, like the Chinese species, is of a bright golden yellow colour.

and flat, the lower jaw longer than the upper. The breadth of the snout almost equal to the distance from the latter to the eyes; 17 rays in the pectoral. The body is somewhat compressed, the tail more so, but nearly as deep or broad as the body. The head is short; the distance from the apex of the upper jaw to the base of the pectorals, being one-eighth of the distance from the base of the pectorals to the extremity of the tail.

The interval from the branchial aperture to the anus, is equal to half the distance from the anus to the base of the caudal, and the same measurement is also equal to the distance from the snout to the commencement of the dorsal.

There is a broad band of crowded conical teeth on the vomer and at the apex of the jaws, with a narrow band of similar teeth on the sides of the jaws.

The eyes are placed over the angle of the mouth, at a distance from each other equal nearly to their distance from the snout.

The body seems to have been olive green or brown above, minutely dotted, and yellowish white beneath; the extremity of the dorsal and anal fins being variegated with a narrow dark border at the tail.

Habitat.—Chusan.

Anguilla macroptera. *t.* xxv. *fig.* 1.

An Eel with about 221 rays from the middle of the caudal to the anterior extremity of the anal fin, with the snout narrow and depressed, and the lower jaw narrower and considerably longer than the upper, and about 17 rays in the pectoral fin. The body is cylindric, the tail compressed and rather narrow: the head is long, the distance from the apex of the upper jaw to the base of the pectorals being equal to one-seventh of the distance from the base of the pectorals to the extremity of the caudal.

The interval from the branchial aperture to the anus, is equal to half the distance from the anus to the end of the caudal, and to the whole distance from the extremity of the snout to the commencement of the dorsal.

Both of the jaws, the palate, and the vomer are densely, and uniformly covered with small, but strong conical teeth. The eyes are placed over the corners of the mouth, and their distance from the extremity of the snout is equal to twice the breadth of the latter; the nostrils open at each corner of the upper lip, by two short tubes. The colour above seems to have been olive green, minutely dotted; the whole of the lower surface of the body from the jaws to the tail is whitish. The fins at the extremity of the tail are variegated with black.

Habitat.—Chusan.

Fam. Anguilliformes, Cuv.

MURŒNESOX.* Nov. Gen.

GEN. CHAR.—Jaws very long, narrow, and dilated at the apex for the insertion of prominent teeth in that situation. A row of very prominent compressed teeth on the vomer, branchial apertures small, situated low in front of the pectorals, and lead to four large branchial combs on either side.

The rays in the branchial membrane are numerous, long, and slender.

Obs.—The stomach and intestine, together form a capacious but short straight tube without cecæ; the air-vessel is long and spindle-shaped. Several species of this genus are met with in the East. The dorsal commences in front of the pectorals, and there is a diffuse dark spot on the upper part of the gill covers; their colour above is bluish grey, silvery white below, with a black edging to the dorsal and anal fins. Their resemblance to the sand eels of Europe, has procured for them the common name of silver eel.

* Etym. From *Murœna*, and *Esox*, the generic names of the Eels and Pikes, of both which the proposed genus partakes in form.

There is a great sameness also in general appearance of these species, the chief difference being merely in the teeth. One species *(M. tricuspidata)* with tricuspid vomerial teeth, is common to Chusan and Ningpo in China, where it was found by Dr. G. R. Playfair, as well as to Bengal, where I have met with numerous specimens about Calcutta. A second large species with long narrow lanceolate vomerial teeth, *(M. lanceolata)* is also common about Calcutta: and thirdly, *M. exodon*, a species which attains nearly four feet in length, with a row of large lateral teeth on either side of the lower jaw, is found at Arrakan; and lastly, the *Talabon* of Dr. Russell's Coromandel fishes, (the only species hitherto described) whose vomerial teeth are serrated on the edges.* I name this last, *M. serradentata.*

MURÆNESOX TRICUSPIDATA. *t.* xxiv. *fig.* 1.

The colour is silvery grey above, and silvery white below, the edge of the dorsal and anal is variegated with a black line. The eyes are situated at a distance from the snout, equal to the greatest diameter or height of the body, and the mouth extends more than a third beyond the eyes; both jaws are dilated at the extremity, where there are two very large hooked teeth in the lower jaw, and four in a corresponding situation at the apex of the upper jaw, in which there is an irregular notch near the apex, for the reception of the two long teeth of the lower jaw. The lower jaw, which is shorter than the upper, also presents a double row of teeth on each side, the outer of which is composed of very

* *Ophidium talabon.*—Russell, No. 38, Indian Fishes. I am aware that Russell's species is referred in the *Règne Animal* to the genus *Muræna*, Lacèp., but while we are always bound to respect such references, we are not to be implicitly guided by them; particularly in such cases as this, where we must presume that great modern ichthyologist never had an opportunity of examining the species.

short conical teeth, the inner row is composed of much larger teeth, which are also compressed and hooked.

The upper jaw presents three rows of minute teeth on either side, together with a single row of large tricuspid teeth on the vomer, which are compressed, and present sharp cutting edges before and behind, with a high sharp lanceolate point in the middle, and two small low points, one before and one behind on each tooth. See fig. 1. *a.*

The distance from the snout to the hinder part of the iris, is equal to a third of the distance from the snout to the branchial aperture, and to one-fourth of the interval between the base of the pectorals and the vent. The distance from the snout to the commencement of the dorsal fin, is equal nearly to one-seventh of the entire length. The dorsal commences immediately over the branchial apertures, and contains above 230 rays; the anal contains about 200. The pectoral fins contain about 16 or 17 rays each, and the branchial membrane on either side about 21 long and slender rays. The head is slightly compressed, the middle of the body is cylindrical, and the tail is compressed, and terminates in a very thin ensiform point.

The other species of this genus above indicated, necessarily belong to a paper on the apodal fishes of Bengal, which will, I hope, appear in the next number of this Journal.

Family Synbranchidæ, Swainson.

PNEUMABRANCHUS.* Nov. Gen.

GEN. CHAR.—The head is broad, the jaws of equal length, a single row of strong conical hooked teeth on the lower jaw, another on the palate, together with a row of fine teeth of the same kind on the intermaxillary, terminating in front in a crescent. The body is covered with minute scales, and has no fins except a mere compression of the tail, which resembles the point of a two-edged sword.

* Etym. from Πνευμα, breathing, and Βραγχια, the gills of a Fish.

Obs.—There are three small branchiæ furnished with a sack which opens over the situation of the first arch. The intervals between the first and third arches are closed by a membrane, in which there is merely a small hole in each space. The middle arch alone has a small tuft, or gill, out side, the others are smooth.* The branchiæ open into a semi-lunar transverse slit under the throat. Each nostril has two apertures, one at the end of the snout, and the other between the eyes.

PNEUMABRANCHUS CINEREUS. *t.* XXV. *fig.* 3.

The jaws of equal length, somewhat thin and pointed, with the intermaxillary teeth rather crowded at the apex, general colour dark brown, somewhat bluish brown, with minute spots above, and below dark bluish grey. The anus is situated at the posterior third of the length. The body is cylindric, the tail compressed, ending in a thin narrow point with membranous margins. The membranous margin of the upper edge of the tail extends two-thirds of the distance to the anus, and below about one-third of that distance. The posterior aperture of the nostrils opens near the eyes, and the anterior aperture by means of a short tube on either side at the extremity of the snout.

Habitat.—Chusan.

* I have been indebted to Mr. H. Walker, Surgeon to the Body Guard, for mentioning to me the existence of *lungs* in the *Cuchia*, before I had made the observation myself. The peculiarities of the branchiæ to which the term *lungs* may be applied, were however described by J. Taylor, Esq. of Dacca (as both Mr. Walker and myself were aware) in his observations on the respiratory organs, and air-vessels of fishes in the Gleanings in Science, vol. II. page 176, Calcutta, 1830. The species to which this peculiarity belongs has been supposed to be a *Synbranchus*, but after a careful enquiry I find, that if the *Cuchia* of Bengal, and the so-called *Synbranchi* of India can be referred to any known genus, it should be to that of *Monopterus*, of Commerson and Lacèpede. Mr. Swainson, with juster views of the importance of this group than

TETRODON FASCIATUS. *t.* xxi. *fig.* 2.

This species is nearly allied to T. oscellatus of Bloch, which was long since found by Osbeck* in the river of Canton, and by Kæmpfer in the waters of Japan. It is distinguished from that species by the presence of several transverse bands crossing the back; as well as by the dark spot and yellow ring which surround the base of the dorsal fin; while T. oscellatus has but a single band on the shoulder. Moreover the entire body as far back as the dorsal and anal fin of this species is covered with minute spines; while the species figured in Bloch and originally described by Kæmpfer, is stated to have the back free from spines, which are confined only to the dilatable portion of the body. That this species may have been taken for T. oscellatus is however highly probable.

The following are the characters of the species in Dr. Playfair's collection. The anterior parts of the body as far back as the dorsal fin, are covered with very minute spines. Five narrow light-coloured bands cross the head and back; the first of these is situated between the nostrils, the second between the eyes, the third between the eyes and the pectoral, the fourth is extended between the pectorals, and

any other writer, here proposed to found his genus *Ophichthys*, but upon mistaken characters. The genus Monopterus was founded by Lacèpede, on the MS. description by Commerson, of a species of supposed Conger Eel, found in the straits of Sunda. The description is minute, but vague as to the most essential and peculiar characters; so much so, that Cuvier conjectures the supposed Conger to be the *Unibranchpertura lisse*, Lacèp. The inefficiency of the characters assigned to the genus *Monopterus*, can require no better proof than the fact, that Cuvier himself, Buchanan, Mr. Taylor, and all subsequent writers refer the species that might have been supposed to belong to it, to *Synbranchus*, Bl., and *Unibranchapertura*, Lacèp. In going over this ground a-new, I have found several species of this singular genus in the East, which will be described in our notice of the Bengal species of this order. Even since the above observations were written, I received another remarkable undescribed genus of this family from Arrakan, which I had not met with before.

* Voyage à la Chine.

the fifth between the pectorals and dorsal; together with an oscillated spot round the base of the dorsal.

The nostrils are large and situated near the eyes, each having two apertures. The dorsal is situated far back, and contains fifteen divided rays, and two soft undivided rays at the commencement of the fin, shorter than the rest. The pectorals contain each about eighteen soft branching rays; the anal contains fourteen rays, the caudal contains about nine large rays, thus:

D. 17: P. 18: A. 14: C. 9.

Habitat.—Chusan and Ningpo.

The bite of *Tetrodon oscellatus* is said by some authors to be poisonous, the same thing is remarked of other species of this genus; but we conceive the idea to have no foundation.

Reduction of Meteorological Observations made at Kulsea on the Doab Canal, during the years 1837-38-39-40-41. *By Lieut.* R. Baird Smith, *Bengal Engineers.*

These observations which consist of Registers of the Thermometer at sun-rise, of the Pluviometer, of the direction of the wind, and the state of the weather, were commenced by Mr. Sub-Conductor John Pigott, under instructions from Capt. P. T. Cautley, on the 1st of May 1837. They were carried on at Kulsea, one of the stations on the Doab Canal, about fourteen miles to the northward of Saharanpore, and having an elevation above the level of the sea of probably 1,100 feet.

The value of the Thermometric observations has, I regret to find, been seriously deteriorated by certain circumstances to which more specific allusion will immediately be made, and as means do not now exist of ascertaining the exact influence of these, I have felt considerable hesitation in placing the observations on record at all. It is farther to be regretted, that they were discontinued in February 1839; for although they exhibit the Temperature but at one period of the day, their continuance for a space of time that would now have exceeded five years, would have made them of considerable interest and use.

Imperfect, however, as the observations are, I am unwilling that Mr. Pigott's labour should be wholly lost, and as they include an almost complete double cycle of the annual changes of season in India, I have availed myself of Captain Cautley's kind permission, and have reduced them into Tables of General Results, in the hope that they may not prove altogether useless.

The Registers of the Pluviometer, of the wind and weather, are still in progress, having been continued without interruption from their original institution.

The Thermometer employed by Mr. Pigott was suspended inside a room, and closely against the wall, both circumstances somewhat unfortunate, since in consequence of the instrument having been accidentally broken, it is now impossible to ascertain the exact amount of correction necessary on their account. I am accordingly forced to give the observations simply as they appear in the daily Register.

TABLE I.

Shewing Thermometric Results for the year 1837.

No.	Month.	Min.	Mean.	Max.	Epochs. Of Min.	Of Mean Appox. to Mean.	Of Max.	Remarks.
		°	°	°				
1	January, ..	0	0	0	0	0	0	
2	February,..	0	0	0	0	0	0	
3	March, ..	0	0	0	0	0	0	
4	April, ...	0	0	0	0	0	0	
5	May, ...	77.	80.27	86.	M. 11th	9th	23d	
6	June, ...	76.	81.50	86.	J. 3d	9th	28th	
7	July, ...	80.	85.51	94.	J. 9th	8th	17th	
8	August ..	76.	81.45	84.	A. 28th	4th	9th	
9	September,..	72.	76.50	84.	S. 19th	14th	1st	
10	October, ..	62.	70.80	79.	O. 31st	8th	13th	
11	November,..	59.	62.03	64.	N. 6th	7th	18th	
12	December,..	58.	60.13	61.	D. 26th	20th	1st	
	Sums.	560.	598.19	638.				
	Means.	70.	74.789	79.75				

The Minimum of the month of September approaches most nearly to that of the whole year, differing, however, from it by +2°, and the Mean of the same month is also the nearest approximation to the Mean of the year, exhibiting a difference of +1.702. The month of October shews a Maximum that differs only 0.75° from the Annual Maximum. The Mean of the Columns of Maxima and Minima is 74.875°, thus exceeding the Annual Mean by 0.077°. The highest range of the Thermometer shewn in 1837 was 94°, the lowest 58°, giving a difference of 36° for the extreme Annual range of the instruments.

TABLE II.

Shewing Thermometric Results for the year 1838.

No.	Months.	Min.	Mean.	Max.	Epochs. Of Min.	Of Mean Appox. to Mean.	Of Max.	Remarks.
		°	°	°				
1	January, ..	56.	58.26	60.	25th	5th	1st	
2	February, ..	58.	61.03	64.	1st	15th	20th	
3	March, ..	58.	62.61	76.	3d	20th	31st	
4	April, ..	74.	77.73	82.	4th	14th	29th	
5	May, ..	72.	82.19	86.	6th	9th	19th	
6	June, ..	87.	90.47	92.	28th	1st	6th	
7	July, ..	77.	81.80	89.	14th	4th	2d	
8	August, ..	77.	79.25	82.	10th	8th	2d	
9	September, .	76.	77.86	80.	27th	1st	3d	
10	October, ..	68.	71.16	76.	28th	14th	4th	
11	November, .	61.	64.33	68.	22d	9th	1st	
12	December, .	57.	59.22	62.	10th	9th	1st	
	Sums.	821.	865 91	917.				
	Means.	68.41	72.16	76.41				

Whence it appears that the Mean Annual Temperature at Kulsea during the year 1838, approximated very closely to that of the month of October, since

Min. of Oct.	68.00	Mean of Oct.	71.16	Max. of Oct.	76.00
Min. of 1838,	68.41	Mean of 1838,	72.16	Max. of 1838,	76.41
Difference,	—0.41		1.00		0. 41

The Mean of the columns of Maxima and Minima is 72.41°, thus shewing a difference from the Mean Annual Temperature of +0.25°, or only a quarter of a degree. The highest indication of the Thermometer was 92°, the lowest 56°, thus giving an extreme range of 36°, precisely the same as in 1837, although the Annual Maximum and Minimum of that year were 2° higher respectively than those of 1838. This difference is due no doubt to the Registers of four months, (two of which are the coldest in the year,) being deficient in 1837. It is probable that had these been furnished, there would have been a very close approximation to the same results in both Tables.

For the year 1839, the Registers were carried on only for the months of January and February, the Thermometer having been unfortunately broken at the close of the latter month. The following are the results for these two months :—

	Min.	*Mean.*	*Max.*
January,........	50°	54.80°	58°
February, ...	56°	58.53°	63°

TABLE III.

Shewing Monthly Deviations of the Thermometer from its Mean Annual Height at Kulsea.

Months.	Kulsea.	Kulsea.	Months.	Kulsea.	Kulsea.
	1837.	1838.		1837.	1838.
	°	°		°	°
January, ..	0	—13.90	July, ...	+10.71	+ 9.64
February, ..	0	—11.13	August, ..	+ 6.65	+ 7.09
March, ...	0	— 9.55	September, .	+ 1.71	+ 5.70
April, ...	0	+ 5.57	October, ..	— 3.99	— 1.00
May, ...	+5.47	+10.03	November,..	—12.77	— 7.83
June, ...	+6.70	+18.31	December,, .	—14.67	—12.94
An. Mean.	74.798	72.16		0	0
Mean Range.	25.38	31.25		0	0

The Pluviometer employed in the Kulsea observations consisted of an upper Receiver terminating in a long tube. The aperture of the Receiver was exactly ten times that of the tube into which the Rain passed and was measured. The rod employed for ascertaining the quantity was graduated so as to allow for the slight correction due to the displacement caused by its insertion, and the measurements are given to hundredths of an inch. The instrument was fixed in a masonry pillar standing about five feet from the surface of the ground.

The succeeding Tables exhibit the reductions of the Rain Guage Registers, and those for the winds and weather during the year specified.

TABLE IV.

Shewing Pluviometric Results and Variations of Wind and Weather during the year 1837.

Month.	Pluviometer.	Weather.				Direction of Winds.							
		Cloudy with Rain Days.	Cloudy without Rain Days.	Fine Days.	Partially fine Days.	N.	S.	E.	W.	N. E.	N. W.	S. E.	Calm.
January, ...	0	0	0	0	0	0	0	0	0	0	0	0	0
February, ..	0	0	0	0	0	0	0	0	0	0	0	0	0
March, ...	0	0	0	0	0	0	0	0	0	0	0	0	0
April, ...	0	0	0	0	0	0	0	0	0	0	0	0	0
May, ...	not registered.	4	3	22	2	0	0	14	13	1	1	1	1
June, ...	.60	2	0	27	1	1	0	15	14	0	0	0	0
July, ...	8.43	10	12	9	0	0	0	24	7	0	0	0	0
August, ...	3.90	7	6	9	9	0	0	19	12	0	0	0	0
September, ..	7.30	4	5	13	8	0	0	19	11	0	0	0	0
October, ...	1.00	3	6	20	2	0	0	25½	4	0	1½	0	0
November, ..	0.00	0	3	26	1	0	0	13	17	0	0	0	0
December, ..	0.00	0	7	24	0	0	0	16	15	0	0	0	0
Sums. ..	21.23	30	42	150	23	1	0	145½	93	1	2½	1	1
Means...	3.033	3.75	.525	18.75	2.875	0	0	0	0	0	0	0	0

From this Table it appears that during the eight months of 1837, when observations were made, the number of fine clear days was just five times that of cloudy ones accompanied by rain. The proportions of the varieties of weather to each other may be shewn as follows :—

No. of days of fine weather

	to that of cloudy days, with rain,	as	5	to	1
,, ,,	to that of cloudy without rain,	as	$3\frac{1}{2}$	to	1
,, ,,	to that of partially fine,	as	$6\frac{1}{2}$	to	1

The winds that chiefly prevail throughout the whole year are the Easterly and Westerly, the former being in the proportion to the latter of nearly 3 to 2. In the more immediate vicinity of the Siwalik Hills, about 10 or 12 miles to the North of Kulsea, the winds appear to be curiously affected by local causes. At Badshah Mahal, an old hunting palace of the Emperor Shah Jehan, situated close to the bank of the river Jumna, the wind, as I am informed by Mr. Pigott, sets in regularly every night all the year round from the North, and appears to flow down the valley of the river. This current is quite local, and may very possibly be caused by the colder air from the hills flowing down to restore the atmospheric equilibrium, disturbed by the greater heat of the adjoining sandy plains during the day. The building is now in ruins, but in those portions where the green sandstone of the Siwaliks has been employed, it is to be observed much more weathered when it has a Northerly exposure than when otherwise.

I may here remark, how much it would facilitate the reduction of observations on winds, were the method of reading off their direction as from a graduated circle to be adopted, in preference to employing simply the points of the compass. Not only would greater accuracy of Registry be thus introduced, but a great deal of labour would be saved in putting the observations in form to deduce general inferences from them. This plan is now adopted by many observers, and in practice, has several strong recommendations.

I cannot observe, from the detailed Register, that either of the prevailing winds had a greater tendency than the other, to bring rain or any other change of weather, since variations of the latter seemed to take place without any kind of perceptible connection with those of the former. Rain, however, appears always to have accompanied a North-west wind.

TABLE V.

Shewing Pluviometric Results and Variations of Wind and Weather during the year 1838.

Months.	Pluviometer.	Weather. Cloudy with rain days.	Cloudy without rain days.	Fine days.	Partially fine days.	Direction of Winds. E. Days.	W. Days.	N. W. Days.	Remarks.
January,..	0.0	0	4	27	0	12	19	0	
February,	0.45	3	3	21	1	15	13	0	
March, ..	2.75	3	8	16	4	17	14	0	
April, ..	1.40	3	4	19	4	14	14	2	
May, ..	1.00	1	1	28	1	16	15	0	20th of May an Earthquake felt.
June, ..	1.10	3	1	26	0	28	2	0	
July, ..	15.85	15	5	8	3	27	4	0	
August ..	17.80	17	4	8	2	30	1	0	
September,	6.10	4	0	24	2	18	12	0	
October,..	0.00	0	1	28	2	18	13	0	
November,	1.20	3	2	24	1	21	9	0	
December,	0.00	0	8	22	1	24	7	0	
Sums. ..	47.65	52.	41.	251.	21.	240.	123.	2	
Means. ..	3.970	4.3	3.4	20.9	1.75	20.	10.25	0	

I find from the Register that on Saturday the 26th of May 1838, the shock of an Earthquake was experienced at Kulsea, at 8 A. M.; no farther particulars relative to this occurrence are mentioned, and as I have sought in another place to attract more particular attention to events of so much interest, and have specified the points on which information is desirable, it is unnecessary to dwell upon the point here.

During the two days when North-west Winds prevailed; namely, the 11th and 12th of April, heavy gales accompanied by rain and hail were experienced.

The proportions of the varieties of weather during the year 1838 are as follow :—

No. of days of fine weather to that of cloudy with rain, as .. .. 5 to 1 }
,, ,, to that of cloudy without rain, as .. 6 to 1 }
,, ,, to that of partially fine weather, as .. 12 to 1 } Nearly.
No. of days of cloudy weather with rain to that of cloudy weather without rain, as 1 to ½ }
No. of days of Easterly winds to that of Westerly, as .. .. 2 to 1 }

TABLE VI.

Shewing Pluviometric Results and Variations of Wind and Weather during the year 1839.

Months.	Pluviometer.	Weather.				Direction of Winds.			
		Cloudy with rain.	Cloudy without rain.	Fine.	Partially fine.	E.	W.	N. W.	S. E.
January, ..	6.45	8	3	16	4	28	3	0	0
February,	4.65	8	8	9	3	18	10	0	0
March, ..	2.50	3	6	20	2	15	16	0	0
April, ..	0.00	0	0	29	1	14	16	0	0
May, ..	0.95	2	2	27	0	25	6	0	0
June, ..	4.70	8	0	16	6	25	4	0	1
July, ..	7.85	8	8	14	1	25	6	0	0
August, ..	19.65	14	0	16	1	20	11	0	0
September,	4.80	6	3	21	0	16	13	1	0
October, ..	0.00	0	0	31	0	15	16	0	0
November,	0.20	1	1	28	0	19	11	0	0
December,	0.10	1	1	29	0	17	14	0	0
Sums. ..	51.85	59.	32.	256.	18	237.	126	1	1
Means. ..	4.32	4.9	2.6	21.3	1.5	19.75	10.5	0	0

The following are the relative proportions of the varieties of wind and weather during the year 1839 :—

No. of days of fine weather to those of cloudy with rain, as 4.34 to 1
,, ,, to those of cloudy without rain, as .. .. 8 to 1
,, ,, to those of partially fine, as .. .. .. 14 to 1

No. of days of cloudy with rain to those of cloudy without rain, as .. .. 1 to 5

" " of Easterly wind to those of Westerly, as .. 2 to 1

TABLE VII.

Shewing Pluviometric Results, and Variations of Wind and Weather during the year 1840.

Months.	Pluviometer.	Weather.				Direction of Winds.			
		Cloudy with rain.	Cloudy without rain.	Fine.	Partially fine.	E.	W.	N. W.	S. E.
January, ..	2.4	3	1	26	1	24	7	0	0
February, ..	0	0	3	26	0	19	10	0	0
March, ..	0	0	0	31	0	23	8	0	0
April, ..	0	0	0	29	1	19	11	0	0
May, ...	0	0	0	30	1	24	6	½	½
June, ...	4.75	6	4	20	0	23	7	0	0
July, ...	13.2	14	4	12	1	21	10	0	0
August, ..	3.425	4	7	17	3	23	9	0	0
September, ..	1.60	5	2	23	0	21	9	0	0
October, ..	0	0	1	30	0	7	24	0	0
November, ..	0	0	4	26	0	15	15	0	0
December, ..	0	0	4	27	0	17	14	0	0
Sums. ..	25.375	32	30	297	7	235	130	½	½
Means. ..	2.114	2.6	2.5	24.75	0	19.5	10.8	0	0

On the night of the 4th of May, a very severe storm occurred, by which much serious injury was done, and on the afternoon of the 5th of the same month, a similar gale from the South-east was experienced. The rains of 1840 appear to have been much less abundant than those of 1838 and 1839; the latter shewing respectively 47.65 and 51.85 inches, while the former shews only 25.375, being nearly one-half.

The proportions of the varieties of wind and weather during 1840, are as follow :—

No. of fine days to those of cloudy with rain nearly, as .. 9 to 1
„ „ to those of cloudy without rain, as .. 10 to 1
„ „ to those of partially fine, as .. .. 42 to 1
No. of days of cloudy with rain to those of cloudy without rain, as .. .. 1 to 1
No. of days of Easterly winds to those of Westerly, as .. 1.8 to 1

TABLE VIII.

Shewing Pluviometric Results and Variations of Wind and Weather for the year 1841.

Months.	Pluviometer.	Weather.				Direction of Winds.	
		Cloudy with rain.	Cloudy without rain.	Fine.	Partially fine.	E.	W.
January, ...	0.9	1	3	23	4	9	22
February, ...	2.5	6	1	21	0	0	28
March, ...	2.0	3	17	11	0	17	14
April, ...	0	0	3	27	0	16	14
May, ...	1.97	2	4	25	0	2	29
June, ...	4.15	6	6	18	0	26	4
July, ...	12.1	11	18	2	0	23	8
August, ...	14.6	12	15	4	0	25	6
September.	11.3	3	4	23	0	7	23
October, ...	0.1	1	0	30	0	9	22
November, ...	1.7	4	5	21	0	8	22
December,..	0.5	1	10	20	0	8	23
Sums.	51.82	50	86	225	4	150	215
Means.	4.318	4.1	7.1	18.7	0	12.5	17.9

From the above the following proportions are obtained :—
No. of days of fine weather to those of cloudy with rain, as .. .. 4.5 to 1
„ „ to those of cloudy without rain, as .. .. .. 2.6 to 1
„ „ to those of partially fine, as .. 56. to 1

No. of days of cloudy with rain to those of cloudy without rain, as .. .. 1 to 1.72

No. of days of Easterly winds to those of Westerly, as 2 to 3.

Considering the rainy season to commence in June and to terminate in September, we have the following points determined:—

		No. of Rainy Days.	*Total of Rain.*	*Daily Average of Rain.*
At Kulsea.	Rainy Season of 1837, ..	21	19.63.. ..	.934
	" of 1838, ..	36	39.75.. ..	1.104
	" of 1839, ..	28	32.30.. ..	1.15
	" of 1840, ..	24	21.375 ..	.89
	" of 1841, ..	26	38.00 ..	1.46

Thermometric observations are again in progress at Kulsea, and will probably be of more interest and value than those reduced in the present paper, in the two first Tables of which, I place very little confidence for reasons before indicated; but I would venture to hope, that the remaining Tables of the present series may be considered a contribution of some interest, to the Meteorology of Upper India.

Camp Kulsea, Doab Canal, 8th March, 1842.

Reduction of Meteorological Observations, made at Surrowli on the Doab Canal, during the years 1837-38-39-40-41. *By Lieut.* R. Baird Smith, *Bengal Engineers.*

The observations at Surrowli, conducted by Mr. Sub-conductor Brew, overseer of the Southern Division of the Doab Canal, were instituted simultaneously with those at Kulsea, discussed in a former paper. They have been continued with perfect regularity from May 1837 up to the present time, and from Mr. Brew's well-known exactitude in observation, I am disposed to place much confidence in his results.

The series to be discussed consist of daily Thermometric Observations at sunrise, with registers of the Pluviometer and the variations of wind and weather, extending over a period of five years. Surrowli is situated about ten miles to the northward of the city of Delhi, and may probably be about 600 feet above the level of the sea. The

Thermometer displayed is suspended against the cross wall of the northern verandah of the Canal bungalow, and except in so far as an easily permeable chick door may interfere, is freely exposed to the atmosphere.

As in the case of the Kulsea observations, I propose discussing the Thermometric observations first, and afterwards the Pluviometric series, with the state of the weather, &c. I regret it is not in my power to apply some necessary corrections to the first mentioned class; but as I may probably yet have an opportunity of ascertaining the precise amount of these, I will now cônfine myself solely to the registered results.

TABLE I.

Shewing Thermometric Results for the year 1837.

No.	Months.	Min.	Mean.	Max.	Monthly Differential.	Epochs. Of Min.	Of Mean.	Of Max.
		°	°	°				
1	January, ..	0	0	0	0	0	0	0
2	February, ..	0	0	0	0	0	0	0
3	March, ..	0	0	0	0	0	0	0
4	April,.. ..	0	0	0	0	0	0	0
5	May,.. ..	69.	77.99	85.	+ 3.68	4th	2d	29th
6	June,.. ..	74.	83.10	88.	+ 8.79	2d	14th	27th
7	July,.. ..	78.	85.30	90.	+15.69	31st	27th	6th
8	August, ..	78.	83.64	89.	+ 9.33	30th	8th	15th
9	September, ..	78.	79.66	84.	+ 5.35	3d	4th	2d
10	October, ..	66.	74.38	80.	+ 0.07	31st	10th	2d
11	November, ..	50.	58.33	64.	—15.98	28th	14th	3d
12	December, ..	43.	52.09	55.	—22.22	23d	1st	4th
	Sums. ..	536.	594.49	635	0	0	0	0
	Means, ..	67	74.31	79.375	0	0	0	0

The minimum, mean and maximum of the month of October in 1837, approximate with considerable closeness to those of the whole year, as may be shewn below :—

Min. of October 66°	Mean. of Oct. 74.38	Max. of Oct. 80.
Min. of 1837, 67	Mean. of 1837, 74.31	Max. of 1837, 79.375
—1	+ 0.07	+ 0.625

In the Kulsea observations for the same year, the Temperature of the month of September, approached most closely to that of the year.

The expression, monthly differential, has been introduced to mark the difference between the mean Temperature of each month and that of the whole year, from which it appears that while the month of July rises highest above the annual mean, December falls lowest, the combined differences shewing a mean range of 37.91°.

The influence of a fall of rain in decreasing the Temperature is occasionally remarkably distinct. Thus on the 22nd of June 1837, the Thermometer at sunrise was 85°; a fall of rain of 2.1 inches, but so strictly local, that it was confined to within a few miles from Surrowli took place on that day, and next morning the Thermometer had sunk to 81°, shewing a difference of 4°, due undoubtedly to the influence of the rain. Again on the 21st of July, the Thermometer was 88°, showers fell on the same and two succeeding days, and on the 24th the Temperature had fallen 6°. The cooling influence of rain may be shewn more in detail as follows, the instances being selected for the year 1837 :—

	Temp. before rain.	*Temp. after rain.*	*Diff.*	*Fall of rain.*
1	85°	81°	4°	2.15 Inches.
2	84°	82°	2	.525 ,,
3	88°	82°	6	.21 ,,
4	82°	78°	4	.11 ,,
5	87°	78°	9	1.12 ,,
6	84°	80°	4	.22 ,,
			29	9.1 95

From the above it appears, that the cooling influence of a fall of rain of 3.17 inches, reduces the Temperature 1° of Fahrenheit. Of course so many local circumstances must necessarily affect this result, that in the present instance it is no doubt more curious than correct.

TABLE II.

Shewing Thermometric Results for the year 1838.

No.	Months.	Min.	Mean.	Max.	Monthly Differential.	Epochs. Of Min.	Of Mean.	Of Max.
1	January, ..	45.°	49.12°	53.°	—19.79	16th	11th	29th
2	February, ..	51.	57.35	62.	—11.66	3d	17th	28th
3	March, ..	61.	66.03	72.	— 2.88	5th	6th	27th
4	April, ...	69.	76.53	83.	+ 7.61	1st	11th	30th
5	May, ...	70.	79.84	87.	+10.92	7th	12th	2d
6	June, ...	80.	83.76	92.	+14.84	5th	11th	17th
7	July, ...	78.	82.33	90.	+13.41	16th	5th	1st
8	August, ..	76.	80.42	86.	+11.50	24th	4th	1st
9	September, ..	71.	75.43	81.	+ 7.51	29th	12th	17th
10	October, ..	62.	70.97	74.	+ 4.05	23d	7th	11th
11	November, ..	46.	56.36	70.	—12.55	23d	0	7th
12	December, ..	41.	48.84	56.	—20.07	25th	1st	10th
	Sums, ..	750.	826.98	906.	0	0	0	0
	Means, ..	62.5	68.915	75.5.	0	0	0	0

During the year 1838, as during 1837, the Temperature of the month of October approaches nearest to that of the year, the Minimum differing only 0.5° or half a degree, the mean ×2.06° and the Maximum, 1.5°. The mean of the two Annual extremes being 69° exhibits a difference from the annual Mean of only +0.085, so that when the Maxima and Minima for the year are given, the mean Annual Temperature may be ascertained within a very limited error. The warmest day of the year was the 17th of June, the coldest the 25th of December, the extreme Annual range of the instrument being 51°, the Mean range 34.91°. The extreme range at Surrowli is 15 degrees greater than at Kulsea, a difference due no doubt to the Thermometer in the latter case being within, in the former without, doors.

TABLE III.

Shewing Thermometric Results for the year 1839.

No.	Months.	Min.	Mean.	Max.	Monthly Differential.	Epochs. Of Min.	Of Mean.	Of Max.
1	January, ..	40.°	48.93°	54.°	—20.26	24th	1st	14th
2	February,..	45.	53.96	60.	—15.23	8th	4th	20th
3	March, ..	53.	63.22	69.	— 5.97	1st	17th	9th
4	April ..	66.	73.46	78.	+ 4.27	2d	13th	27th
5	May, ..	77.	83.55	88.	+14.36	1st	8th	10th
6	June, ..	80.	88.10	94.	+18.91	12th	5th	29th
7	July, ..	82.	84.29	90.	+15.10	16th	8th	4th
8	August. ..	77.	81.00	86.	+11.81	16th	3d	1st
9	September,	72.	77.03	84.	+ 7.84	24th	2d	6th
10	October, ..	62.	65.13	72.	— 4.06	19th	11th	1st
11	November..	52.	56.66	65.	—12.53	26th	12th	4th
12	December,	48.	54.87	57.	—14.32	13th	5th	24th
	Sums, ..	754.	830.20	897.	0	0	0	0
	Means, ..	62.83	69.19	74.75	0	0	0	0

Although the month of October again exhibits the Temperature most closely approximating to the Mean of the year, the approximation is not quite so close as on the former instances. The Minimum of October differs only —0.83° from the yearly Minimum, but the mean differs, —4.06°, and the Maximum —2.75°.

The highest indication of the Thermometer during 1839 was 94° on the 29th of June, the lowest 40° on the 24th of January, thus giving an extreme range throughout the year of 54°, which is 3° greater than that of 1838. The Mean range is 39.17°. being 4.26° greater than in the preceding year. The Mean of the two Annual extremes is 68.79°, being thus only 0.40° different from the Mean Temperature of the year.

TABLE IV.

Shewing Thermometric Results for the year 1840.

No.	Months.	Min.	Mean.	Max.	Monthly Differential.	Epochs. Of Min.	Of Mean.	Of Max.
1	January, ..	48.°	53.16°	58.°	—17.60	3d	11th	22d
2	February...	52.	57.24	66.	—13.52	2d	18th	28th
3	March, ..	62.	69.26	76.	— 1.50	3d	12th	25th
4	April, ..	71.	77.46	84.	+ 6.70	1st	17th	21st
5	May, ..	73.	81.13	90.	+10.37	3d	14th	25th
6	June, ..	83.	85.83	88.	+15.07	2d	4th	5th
7	July, ..	81.	85.00	90.	+14.24	21st	18th	10th
8	August, ..	78.	82.48	87.	+11.72	3d	21st	11th
9	September,	66.	79.70	86.	+ 8.94	28th	19th	4th
10	October, ..	64.	70.79	73.	+ 0·03	31st	5th	12th
11	November,	51.	59.83	64.	—10.93	31st	2d	12th
12	December,	42.	47.26	56.	—23.50	21st	14th	6th
	Sums, ..	771.	849.14	918.	0	0	0	0
	Means, ..	64.25	70.76	76.5	0	0	0	0

The month of May in 1840 exhibits a Maximum rather higher than usual, while that of June is lower. This difference appears to have arisen from the earlier setting in of the rain in this year, a very large quantity having fallen in June. October, as usual, approaches most nearly to the Mean Annual Temperature, and the approximation between the Minimum and Means of each is very close, being —0.05° in the first case, and only ×0.03° in the other. The difference of the Maxima is greater than usual, being —3.5°. The coldest day in the year was the 21st of December, when the Thermometer stood at 42°, and the hottest the 10th of July, when the Temperature was 90°: hence the extreme Annual range was 48°, while the Mean range was 38.57°.

The Mean of the columns of Annual Maxima and Minima is 70.37°, exhibiting a difference of —0.39° from the Mean Annual Temperature.

TABLE V.

Shewing Thermometric Results for the year 1841.

No.	Months.	Min.	Mean.	Max.	Monthly Differential.	Epochs. Of Min.	Of Mean.	Of Max.
		°	°	°				
1	January, ..	47.	51.43	56.	—20.27	30th	2d	6th
2	February,..	52.	59.29	68.	—12.41	1st	6th	27th
3	March, ..	62.	67.22	72.	— 4.48	2d	16th	27th
4	April, ..	68.	75.03	85.	+ 3.33	6th	12th	27th
5	May, ..	79.	82.53	86.	+10.83	10th	1st	31st
6	June, ..	83.	87.73	92.	+16.03	30th	9th	2d
7	July, ..	83.	88.61	94.	+16.91	1st	22d	14th
8	August, ..	82.	88.90	92.	+17.20	26th	17th	15th
9	September,	72.	77.83	85.	+ 6.13	16th	0	8th
10	October, ..	71.	72.32	75.	+ 0.62	12th	3d	6th
11	November,	51.	60.26	69.	—11.44	29th	14th	1st
12	December,	42.	49.35	58.	—22.35	25th	30th	1st
	Sums.	792.	860.5	932.	0	0	0	0
	Means.	66.00	71.70	77.76	0	0	0	0

The Maximum Temperature of 1841 is 4° higher than that of 1840, while the Minima of both are the same. Altogether the year 1841 appears to have been hotter by nearly 2° than the year 1840. The extreme Annual range is 52°, or 4° higher than during the preceding year, and the Mean range is 39.55°, or 0.98° during the same time. The Mean of the columns of Maxima and Minima is 71.88°, shewing a difference of +0.18° from the Annual Mean.

The following Table exhibits at one view the Monthly Differentials at Surrowli for five years :—

TABLE VI.

Shewing Monthly Deviations of the Thermometer from its Mean Annual Height, from 1837 *to* 1841.

Months.	Diff. 1837.	Diff. 1838.	Diff. 1839.	Diff. 1840.	Diff. 1841.	Months.	1837.	1838.	1839.	1840.	1841.
January, ...	0	—19.79	—20.20	—17.60	—20.27	July, ...	+15.69	+13.41	+15.10	+14.24	+16.91
February, ...	0	—11.66	—15.23	—13.52	—12.41	August, ...	+ 9.33	+11.50	+11.81	+11.72	+17.20
March, ...	0	— 2.88	— 5.97	— 1.50	— 4.48	September,	+ 5.35	+ 7.51	+ 7.84	+ 8.94	+ 6.15
April,...	0	+ 7.61	+ 4.27	+ 6.70	+ 3.32	October, ...	+ 0.07	+ 4.05	— 4.06	+ 0.03	+ 0.62
May, ...	+ 3.36	+10.92	+14.36	+10.57	+10.83	November,	—15.93	—12.55	—12.53	—10.93	—11.44
June, ...	+ 8.79	+14.84	+13.91	+15.07	+16.08	December,...	—22.22	—20.07	—14.32	—23.50	—22.35
Annual Mean,	74.31	68.91	69.19	70.76	71.70		0	0	0	0	0
Range, ...	37.91	34.91	39.17	38.57	39.55		0	0	0	0	0

Neglecting the year 1837, of which the Annual Mean is considerably higher than it ought to be, from the absence of the observations for the four first months, there appears to have been, during the remaining four years, a gradual increase of Temperature, that of 1841 being 2.85° higher than that of 1838. The amount of depression below the Annual Mean exceeds that of elevation above it, by about an average of 6°, and it will be observed, that generally the Mean Temperature of the month of October represents most closely that of the whole year.

In passing now to the discussion of the Pluviometric results, and the observations on the directions of wind and variations of weather, I may remark that in respect to the latter, Mr. Brew's Registers do not admit of the same detail as was given from the Kulsea observations by Mr. Pigott, since he has scarcely, if at all, attended to the state of the weather, and hence no data are furnished by which the proportions of its varieties can be estimated.

The rain guage employed at Surrowli was of precisely similar form and dimensions to that used at Kulsea. It likewise stood at a height of about 5 feet from the surface of the ground. The correction is applied for the effect of the displacement and consequent elevation of the water in the tube, caused by the insertion of the measuring rod; but as it is very thin, the error caused would be small, and when an opportunity occurs, I will endeavour to ascertain its exact amount. Rain guages fixed permanently in a vertical position, are liable to another source of error, namely, the effect of winds in altering the direction of falling rain, so that the receiver of the guage no longer continues perpendicular to the line of direction in which the rain is falling. Hence, when the wind drives the rain in an oblique direction, the quantity received in the guage cannot be considered strictly proportional to the entire quantity falling, since a considerable portion of the shower, which, had there been no wind, would have fallen into the receiver, would, under the circumstances supposed, be carried past it. Some experiments have I believe been made, to indicate the precise oblique effect of winds on the quantity of rain as shewn by guages, but I have not yet been able to see them. The point is one meriting attention, and any numerical determination would be highly interesting.

TABLE VII.

Shewing Pluviometric Results and variations of Wind and Weather for the year 1837.

No.	Months.	Pluviometer.	Weather.		Direction of Wind.							
			No. of Rainy Days.	No. of Not Rainy Days.	N.	S.	E.	W.	N. E.	N. W.	S. E.	S. W.
1	January, ..	0	0	0	0	0	0	0	0	0	0	0
2	February, ..	0	0	0	0	0	0	0	0	0	0	0
3	March, ..	0	0	0	0	0	0	0	0	0	0	0
4	April,.. ..	0	0	0	0	0	0	0	0	0	0	0
5	May,.. ..	0	0	31	1	0	0	16	1	10	1	2
6	June,.. ..	2.35	2	28	0	1	3	16	0	6	0	4
7	July,.. ..	3.825	7	24	2	4	4	4	2	6	6	3
8	August, ..	1.62	5	26	1	0	8	11	4	3	4	0
9	September,..	2.96	4	26	1	1	8	9	5	3	2	1
10	October, ..	0	0	31	0	0	6	18	5	1	1	0
11	November,..	0	0	30	0	0	5	24	1	0	0	0
12	December, ..	0	0	31	0	0	0	29	2	0	0	0
	Sums. ..	10.755	18	227	5	6	34	127	20	29	14	10
	Means. ..	1.344	2.25	28.375	0	0	0	0	0	0	0	0

It is remarked in the Register, that the heavy fall of rain at Surrowli on the 22nd of June, amounting to 2.1 inches, was confined to within a few miles of that place, and that spots at this distance to the North or South of it experienced no rain whatever. From the 9th to the 16th of August, very strong parching winds prevailed from the West and North-west, and during the first week in September the distribution of the rain was of the most irregular character, some parts of the country receiving great quantities, others none at all.

The most prevalent winds at Surrowli are the Westerly, the number of days during which these prevailed, having been nearly one-half of the whole period embraced by the observations. The proportions between the different winds are as follow, small fractions being neglected :—

1 Northerly winds are to Westerly, as 1 to 25.
2 Southerly, ... ditto, as 1 to 21.
3 Easterly, ... ditto, as 1 to 3.
4 North Easterly, ... ditto, as 1 to 6.
5 North Westerly, ... ditto, as 1 to 4.
6 South Easterly, ... ditto, as 1 to 9.
7 South Westerly, ... ditto, as 1 to 12.

The number of rainy days is to that of days without rain nearly as 1 to 14, but no Means are furnished by the Register for ascertaining how many of the days without rain were fair, and how many partially so.

TABLE VIII.

Shewing Pluviometric Results and Variations of Wind and Weather during the year 1838.

No.	Months.	Pluviometer.	Weather, No. of Rainy Days.	Weather, No. of Not Rainy Days.	Direction of Winds. N.	S.	E.	W.	N. E.	N. W.	S. E.	S. W.
1	January, ..	0	0	31.	0	0	2	28	1	0	0	0
2	February, ..	0	0	28.	1	0	7	18	1	1	0	0
3	March, ..	.7	2	29.	2	0	8	17	2	1	1	0
4	April, ..	1.0	3	27.	0	0	5	23	2	0	0	0
5	May, ..	.8	2	29.	0	0	2	24	2	2	0	1
6	June, ..	1.1	1	29.	0	1	8	9	2	0	8	2
7	July, ..	1.14	16	15.	0	2	7	8	2	1	7	4
8	August, ..	1.285	15	16.	0	10	4	2	1	0	12	2
9	September, ..	4.225	3	27.	1	3	1	20	1	0	2	1
10	October, ..	5	1	30.	4	0	1	14	5	5	2	0
11	November, ..	0	0	30.	0	1	6	16	5	0	0	2
12	December, ..	0	0	31.	0	0	10	17	2	0	2	0
	Sums.	32.575	43	322	8	17	61	196	26	10	34	12
	Means.	2.714	3.58	26.83	0	0	0	0	0	0	0	0

From the 8th to the 14th of February, it is stated, cloudy weather accompanied by thunder and lightning without rain prevailed, but it is to be regretted, that the same kind of observation has not been again repeated. The electrical condition of the atmosphere, in so far as that is indicated by the duration and intensity of thunder-storms, is a point of much interest, and one that has occupied the attention of Meteorological observers, far less than its importance merits. The curious relations and analogies subsisting between heat and electricity, lead us to anticipate that we may yet trace some marked connections between the indications of the Thermometer and those of the Electrometer, and it would be well worth the while of observers to pay special attention to this subject, to enter in their Registers the epochs and duration of thunder-storms during the year, and to record all such particulars relative to them as in their opinion would prove of interest and use. Theories on the distribution of electricity throughout the atmosphere in Polar and Equatorial regions have been broached, which cannot possibly be either established or refuted, save by observations made throughout extensive areas, and continued for considerable periods. These, India affords peculiar facilities for making, and I yet trust to see them generally and extensively in active progress.

The following are the proportions of the different winds to each other during the year 1838 :—

1. Northerly winds are to Westerly,	as	1	to	24
2. Southerly ditto, ...	as	1	to	11
3. Easterly ditto, ...	as	1	to	3
4. North Easterly ditto, ...	as	1	to	7
5. North Westerly ditto, ...	as	1	to	19
6. South Easterly ditto, ...	as	1	to	6
7. South Westerly ditto, ...	as	1	to	16

The Southerly winds, including under this expression South Easterly and Westerly, prevailed during the present year to a much greater extent than during the preceding one, especially during the rainy months of August and July, when out of 62 days, 37 had winds of the above description. The proportion of rainy days to those without rain increased also from 1.14 to 1.7, or double, and the quantities of rain that fell were nearly as 1 to 3, that of 1838 being three times greater than that of 1837. The latter year was one I believe of fearful famine, the crops having failed for want of the usual supply of rain, which, as appears above, was very deficient indeed.

TABLE IX.

Shewing Pluviometric Results and Variations of Wind and Weather during the year 1839.

No.	Months.	Pluviometer.	Weather. Rainy Days.	Weather. Not Rainy Days.	N.	S.	E.	W.	N. E.	N. W.	S. E.	S. W.
1	January, ..	3.85	5	26	1	3	0	18	0	1	2	6
2	February, ..	2.00	6	22	1	0	9	9	5	3	0	1
3	March,.. ..	.40	1	30	0	0	5	20	6	0	0	0
4	April, ...	0.0	0	30	0	0	0	27	0	3	0	0
5	May, ...	.25	1	30	0	1	7	15	1	0	3	4
6	June, ...	1.15	2	28	2	2	7	8	5	0	4	2
7	July, ...	5.14	9	22	1	2	13	1	4	0	8	2
8	August ..	8.425	11	20	1	0	14	7	4	0	5	0
9	September, ..	1.875	4	26	0	1	6	14	1	2	6	0
10	October, ..	0.0	0	31	0	0	0	9	0	22	0	0
11	November, ..	0.0	0	30	0	0	0	0	0	30	0	0
12	December, ..	0.0	0	31	0	0	4	24	0	1	2	0
	Sums.	23.09	39	326	6	9	65	152	26	62	30	15
	Means... ..	1.924	3.25	27.16	0	0	0	0	0	0	0	0

The quantity of rain falling in 1839, appears to have been distributed more generally than usual throughout the year, instead of being concentrated in the rainy months.

The proportions of the Winds are as follow :—

1. Northerly winds are to Westerly, as 1 to 25
2. Southerly ditto, ... as 1 to 17
3. Easterly ditto, ... as 1 to $2\frac{1}{4}$
4. North Easterly ditto, ... as 1 to 6
5. North Westerly ditto,....... as 1 to $2\frac{2}{5}$
6. South Easterly ditto, ... as 1 to 5
7. South Westerly ditto, ... as 1 to 10

The proportion of days with rain to those without rain, is as 1 to 9, and the North Westerly winds appear to have prevailed to an unusually large extent.

TABLE X.

Shewing Pluviometric Results and Variations of Wind and Weather during the year 1840.

No.	Months.	Pluviometer.	Weather.		Direction of Winds.							
			Rainy Days.	Not Rainy Days.	N.	S.	E.	W.	N. E.	N. W.	S. E.	S. W.
1	January, ..	3.20	4	27	0	1	9	6	0	8	4	3
2	February, ..	0.0	0	29	0	0	0	20	0	3	3	3
3	March,.. ..	.15	1	30	0	0	2	9	0	18	0	2
4	April, ...	0.0	0	30	0	0	2	20	0	6	2	0
5	May, ...	.35	1	30	0	4	0	4	0	7	16	0
6	June, ...	6.045	6	24	0	8	2	3	0	0	15	2
7	July, ...	15.225	11	20	0	1	7	9	0	1	10	3
8	August, ..	4.42	9	22	0	0	7	16	2	1	1	4
9	September, ..	2.55	3	27	0	2	7	6	0	8	6	1
10	October, ..	0.0	0	31	0	0	2	24	2	3	0	0
11	November, ..	0.0	0	30	0	0	2	14	0	10	4	0
12	December, ..	0.0	0	31	0	0	0	7	0	24	0	0
	Sums.	31.94	35	331	0	16	40	138	4	89	61	18
	Means... ..	2.661	2.91	27.58	0	0	0	0	0	0	0	0

The following are the proportions of the prevailing winds during the year 1840, and from the Table it will be observed, that there is no instance of Northerly wind throughout the twelve months.

1. Southerly winds are to Westerly as 1 to 8
2. Easterly ditto, ... as 1 to 3
3. North Easterly ditto, ... as 1 to 34
4. North Westerly ditto, ... as 1 to $1\frac{1}{2}$
5. South Easterly ditto, ... as 1 to 2
6. South Westerly ditto, ... as 1 to 7

The number of days with rain is to those without rain as 1 to 6, and the quantities of rain falling in this and the preceding year are nearly as 3 to 4.

TABLE XI.

Shewing Pluviometric Results and Variations of Wind and Weather during the year 1841.

No.	Months.	Pluviometer.	Weather.		Direction of Winds.							
			Rainy Days.	Not Rainy Days.	N.	S.	E.	W.	N. E.	N. W.	S. E.	S. W.
1	January, ..	.05	1	30	0	0	5	14	0	0	12	0
2	February, ..	.65	2	26	0	3	0	11	0	11	3	0
3	March, ..	.90	3	28	0	4	4	15	0	2	6	0
4	April, ..	.00	0	30	0	0	0	0	0	0	0	0
5	May, ..	1.80	3	28	0	0	0	0	0	0	0	0
6	June, ..	3.45	5	25	0	0	0	0	0	0	0	0
7	July, ..	6.45	7	24	0	0	0	0	0	0	0	0
8	August, ..	6.40	5	26	0	0	0	0	0	0	0	0
9	September, ..	4.175	5	25	0	0	2	13	1	9	4	1
10	October, ..	0.0	0	31	0	0	0	0	0	0	0	0
11	November, ..	0.0	0	30	0	0	0	0	0	0	0	0
12	December, ..	1.45	2	29	0	0	0	0	0	0	0	0
	Sums.	25.325	33	332	0	0	0	0	0	0	0	0
	Means... ..	21.08	2.75	27.66	0	0	0	0	0	0	0	0

The irregularity of the registry of the directions of the winds at Surrowli during the year 1841, renders this section of the observations of no use, and as only four out of the twelve months are complete, no general inferences can be made.

Considering, as, in the case of the Kulsea observations, the rainy season to commence in July and to terminate in September, we have the following comparative results :—

Rainy Season.	No. of Rainy Days.		Total of Rain.		Average daily of Rain.	
	Surrowli	Kulsea.	Surrowli	Kulsea.	Surrowli	Kulsea.
Of 1837,	16	21	—7.905	19.63	—.494	.9347
Of 1838,	34	36	—28.475	39.75	—.837	1.1041
Of 1839,	24	28	— 15.44	32.30	—.643	1.1535
Of 1840,	23	24	—22.195	21.375	—.965	.8906
Of 1841,	17	26	—17.025	38.00	—1.000	1.4615

By comparing these numbers it will be observed, that both the rainy days are more numerous, and the quantity of rain falling is considerably greater at Kulsea than at Surrowli; their respective positions may serve in a measure to explain this, the first being situated in the jungle adjoining the base of the Sub-Himalayan range of hills, and consequently subjected to its influence, while the other is the low land of the plains around Delhi.

The observations at Surrowli are still in daily progress, under Mr. Brew's superintendence, and when accumulated to a sufficient extent, will again be subjected to examination and discussion.

7th May, 1842.

Meteorological Observations in Upper Assam, made during the years 1839, 40, 41, *and* 42. *By* J. W. Masters, Esq.*

June 1839.—On the 15th of June I started from Guhatti, N. Lat. 26° 35′ E. Long., in a small boat, proceeding up the Kullung River to Bisenath, N. Lat. 26° 40′ E. Long 93° 12′. I made regular observations at sunrise, 2 P. M. and sunset, the Thermometer being the only instrument I had with me.

The mean temperature of the latter 15 days was 80·56° at

Sunrise.	2 P. M.	Sunset.
78.02°	82.86°	80.81°.

Highest temperature observed 90.5°, lowest ditto 75°.

Greatest variation 15.5°.

There were 10 rainy days; the 17th was fair in the morning, with a storm at sunset.

July.—During the month of July, I travelled from Bisenath to Luckimpoor, in N. Lat. 27° 15′ E. Long. 94° 7′; thence crossing the Brahmapootra, proceeded up the Booree Dihing to Jeypoor, N. Lat. 27°15′ E. Long. 95° 21′.

Mean temperature of the month, 79.67°.

Sunrise	2 P. M.	Sunset.
7611°	82.26°	80.66°.

Highest temperature observed 88°, lowest ditto 74°.

Greatest variation 14°.

Rainy days 13, with frequent very heavy rain at night.

* Presented for publication in the Calcutta Journal of Natural History by the Assam Company.—Eds.

August.—Remained at Jeypoor till the 29th, then proceeded down the river towards Seebsagur, N. Lat. — E. Long. —

Mean temperature 78.79°.

At Sunrise.	2 P. M.	Sunset.
75.72°	80.87°	79.77°.

Highest temperature observed 86°, lowest ditto 74°.

Greatest variation 12°.

Rainy days 25, besides frequent heavy falls of rain at night.

September.—The observations in September were made on the Booree Dihing the Brahmapootra at Jorehaut, N. Latitude 26° 46′ E. Longitude 94° 13′ 15″.

The mean temperature of the month, 80.89.

At Sunrise.	2 P. M.	Sunset.
78.18°	84.15°	80.75°.

Highest temperature observed 91.5°, lowest ditto 76°.

Greatest variation 15.5°.

Rainy days 11, a storm at 5 P. M. on the 3rd, and at night on the 5th very heavy rain and thunder; at 8 P. M. on the 21st, also on the 25th at noon.

October.—In October the observations were made principally at Nazera; the rains broke up on the night of the 14th with a storm, accompanied by heavy rain and thunder; the remainder of the month was beautifully fair. In the former months when in a small boat, and also during this month on shore, I have observed the Thermometer frequently to stand higher between 4 and 5 P. M. than at 2 P. M., and the heat is to me more oppressive in the after part of the day than at noon.

Mean temperature of the month 79.98°.

At Sunrise.	2 P. M.	Sunset.
73.35°	83.53°	83.08.

Highest temperature observed 88°, lowest ditto 64°.

Greatest variation 24°.

The weather was generally fair throughout. Rainy days 2, foggy mornings 6.

November.—The month of November was generally fair. Heavy rain on the 21st, 23rd and 29th.

Mean temperature 72.86°.

At Sunrise.	2 P. M.	Sunset.
65.42°	76.73°	76.45°.

Highest temperature observed 82°, lowest ditto 62°.

Greatest variation 20°.

December.—Weather generally fair throughout, thick fogs in the morning; gathering about sunrise; rain on the 29th.

Mean temperature 61.45°.

At Sunrise.	2 P. M.	Sunset.
51.54°	67.5°	65.31°.

Highest temperature observed 76°, lowest ditto 45°.

Greatest variation 31°.

I have had no opportunity of making any satisfactory observations relative to the wind, being generally surrounded by a dense jungle: the direction has for the most part been between the North-East and South-East, although the upper strata of clouds may frequently be seen flying in a contrary direction to the lower strata.

From the 15th June to the 31st December, there were 65 rainy days; besides heavy periodical showers at night.

Mean temperature of the 6 months 76.74°.

At Sunrise.	2 P. M.	Sunset.
71.62°	79.7°	78.12°.

Highest temperature observed 91.5°, lowest ditto 45°.

Greatest variation 46.5°.

On the 5th December I received a Barometer, but the observations have hitherto been too imperfectly registered to be depended upon.

Nazera, 31st December, 1839.

January 1840.—Nazera N. Lat. 26° 52′ E. Long 94° 44′ 42″(*—)above the sea. Weather generally fair throughout. Rain on 6 days, and dense fogs in the mornings. On the 14th, at 6 A. M. two shocks of an Earthquake.

Mean height of Bar. 29.47 inch. Of the Ther. 58.87°

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.4694 inch	29.4767 inch	29.4690 inch.
Ther.	48.47°	64.48°	63.68°.

Greatest pressure observed 29.515 inch, least ditto 29.310 inch.

Highest temperature 74.5°, lowest ditto 46°.

Greatest variation, Barometer 0.205 inch. Ther. 25.5°.

February.—Weather generally fair, with foggy mornings; shock of an Earthquake on the 3rd at 2 A. M. Rain and thunder at night on the 16th, 17th and 26th.

Mean height of Bar. 29.3898 inch, of Ther. 64.4°.

* Something wanting here, which we regret we cannot supply, not being acquainted with the locality.—EDS.

At Sunrise.	2 P. M.	Sunset.
Bar. 29.3872 inch	29.3958 inch	29.3865 inch.
Ther. 55.1°	69.95°	68.17°.

Greatest pressure observed 29.50 inch, least do. 29.30 inch.

Highest temperature, 75.5° lowest do. 50°.

Greatest variation, Bar. 0.20 inch. Ther. 25.5°.

March.—A stormy, rainy month; rain on 10 days, and very heavy periodical thunder showers on 13 nights.

Mean height of Bar. 29.3259 inch. Ther. 71.23°.

At Sunrise.	2 P. M.	Sunset.
Bar. 29.3316 inch	29.3232 inch	29.3229 inch.
Ther. 64.64°	74.56°	74.51°.

Greatest pressure observed 29.41 inch, least do. 29.18. inch.

Highest temperature, 83°, lowest do. 61°.

Greatest variation, Bar. 0.23 inch. Ther. 22°.

April.—Several days of fine weather, with the usual periodical showers at night; 5 very rainy days, and 8 very rainy nights.

Mean height, Bar. 29.264 inch. Ther. 74.24°.

At Sunrise.	2 P. M.	Sunset.
Bar. 29.263 inch	29.2693	29.2603 inch.
Ther. 68.69	78.45°	75.79°.

Greatest pressure observed 29.40 inch, least do. 29.20 inch.

Highest temperature, 91° lowest do. 62°.

Greatest variation, Bar. 0.20 inch. Ther. 29°.

May.—Weather much the same as in April; 13 rainy days, frequent heavy showers at night, and a tremendous thunder storm at 9 P. M. on the 13th.

Mean height of Bar. 29.2123 inch. Ther 79.23°.

At Sunrise.	2 P. M.	Sunset.
Bar. 29.2125 inch	29.2132 inch	29.2113 inch.
Ther. 74.53°	83.15°	80.01°.

Greatest pressure observed 2930 inch, least do. 29.16 inch.

Highest temperature, 92° lowest do. 71.5°.

Greatest variation, Bar. 0.14 inch. Ther. 20.5°.

September.—A very unpleasant rainy month, 17 rainy mornings, and frequent heavy showers at night.

Mean height of Bar. 29.185 inch. Ther. 84.53°.

At Sunrise.	2 P. M.	Sunset.
Bar. 29.0935 inch	29.092	29.0955 inch.
Ther. 76.71°	84.8°	81.5°.

Greatest pressure observed 29.20 inch, least do. 28.90 inch.

Highest temperature, 90° lowest do. 74°.

Greatest variation, Bar. 0.30 inch. Ther. 16°.

July.—Owing to my illness during the whole of this month, the register is very imperfect.

Mean height of Bar. 29.185 inch. Ther. 84.53°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.19 inch	29.184 inch	29.181 inch.
Ther.	81.04°	86.27°	86.3°.

Greatest pressure observed 29.22 inch, least do. 29.10 inch.

Highest temperature, 92° lowest 78°.

Greatest variation, Bar. 0.12 inch. Ther. 14°.

August.—Cloudy and overcast nearly the whole of the month, 12 rainy days, with frequent thunder showers at night.

Mean height of Bar. 29.1413 inch. Ther. 83.09°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.1287 inch	29.1651 inch	29.1303 inch.
Ther.	78.81°	85.39°	85.10°.

Greatest pressure observed 29.25 inch, least do. 28.80 inch.

Highest temperature, 90° lowest 76°.

Greatest variation, Bar. 0.45 inch. Ther. 14°.

September.—A very unpleasant rainy month, 17 rainy mornings and frequent heavy showers at night.

Mean height of Bar. 29.1241. inch. Ther. 80.92°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.1294 inch.	29.1284 inch.	29.1145 inch.
Ther.	76.25°	84.16°	82.35°.

Greatest pressure observed 29.23 inch, least ditto 29.00 inch.

Highest temperature 90°, lowest ditto 74°.

Greatest variation, Bar. 0.23 inch. Ther. 16°.

October.—On the first 4 nights heavy rain, also on the 19th, 20th, and 21st; otherwise the weather was generally fair throughout.

Mean height of Bar. 29.3152 inch. Ther. 79.08°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.3305 inch	29.3165 inch	29.2985 inch.
Ther.	72.80°	84.41°	80.05°.

Greatest pressure observed 29.47 inch, least ditto 29.115 inch.

Highest temperature 87°, lowest ditto 63°.

Greatest variation, Bar. 0.355 inch Ther. 24°.

November.—Weather for the most part fair, mornings foggy, thunder and rain on the 18th, 19th, and 26th.

Mean height of Bar. 29.4035 inch. Ther. 67.48°.

At Sunrise.	2 P. M.	Sunset.
Bar. 29.4123 inch	29.4016 inch	29.3966 inch.
Ther. 59.28°	72.45°	70.73°.

Greatest pressure observed 29.55 inch, least ditto 29.21 inch.

Highest temperature 79°, lowest ditto 53°.

Greatest variation, Bar. 0.34 inch. Ther. 26°.

December.—Rain on the 1st, after which fair, with foggy mornings.

Mean height of Barometer 29.449 inch. Ther. 60.46°.

At Sunrise.	2. P. M.	Sunset.
Bar. 29.4493 inch	29.4519 inch	29.4459 inch.
Ther. 51.69°	65.66°	64.03°.

Greatest pressure observed, 29.53 inch, least ditto 29.36 inch.

Highest temperature 72°, lowest ditto 47°.

Greatest variation, Bar. 0.17 inch. Ther. 25°.

Mean pressure of the year, 29.2812 inch.

Mean temperature, 73.71°.

Greatest pressure observed 29.55 inch, least ditto 28.80 inch.

Highest temperature 92°, lowest ditto 46°.

Greatest variation, Bar. 0.75 inch. Ther. 46°.

Nazera, 31st December, 1840.

January 1841.—Dull, foggy, misty weather, rain on night of the 1st, 14th, and 21st. Evenings generally clear, but mornings foggy, and the sky during the greater part of the day either overcast with clouds, or covered with thick haze.

Mean height of Bar. 29.4882 inch. Ther. 61.36°.

At Sunrise.	2 P. M.	Sunset.
Bar. 29.4938 inch	29.4851 inch	29.4858 inch.
Ther. 55.11°	65.06°	63.93°.

Greatest pressure observed 29.68 inch, least ditto 29.37 inch.

Highest temperature 70°, lowest 50°.

Greatest variation, Bar. 0.31 inch. Ther. 20°.

February.—A dull foggy, cloudy, hazy, unpleasant, feverish month; not a single fine clear day; rain on the 28th, and heavy rain and thunder at night on the 5th, 7th, 12th, 24th, 25th, 27th, and 28th.

Mean height of the Bar. 29.4830 inch. Ther. 63.73°.

At Sunrise.	2 P. M.	Sunset.
Bar. 29.4928 inch	29.4917 inch	29.4677 inch.
Ther. 56.67°	67.75°	66.77°.

Greatest pressure observed 29.61 inch, least ditto 29.30 inch.

Highest temperature 71°, lowest ditto, 50°.

Greatest variation, Bar. 0.31 inch. Ther. 21°.

March.—A very stormy, rainy month, comparatively little during the day, but periodic returns of thunder and very heavy rain at night; viz. on the 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 24th, 26th, 27th, 28th, and 29th.

Mean height of Bar. 29.2427 inch. Ther. 66.27°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.3474 inch	29.3474 inch	29.3335 inch.
Ther.	60.51°	69.66°	68.64°.

Greatest pressure observed 29.43 inch, least ditto 29.22 inch.

Highest temperature 78°, lowest ditto 56°.

Greatest variation, Bar. 0.21 inch. Ther. 22°.

April.—Frequent showers in the day, with intervals of fair weather; rain throughout the whole day and night on the 10th and 28th, with the periodic returns of thunder and rain on 18 different nights as in March.

Mean height of Bar. 29.3157 inch; Ther. 70.73°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.3080 inch	29.3143 inch	29.3248 inch.
Ther.	66.10°	74.40°	71.80°.

Greatest pressure observed 29.45 inch, least ditto 29.14 inch.

Highest temperature 85°, lowest ditto 60°.

Greatest variation, Bar. 0.31 inch. Ther. 25°.

May.—A very wet month, rain on 24 days, and throughout day and night on the 19th; the periodic returns of thunder storms were not so regular as in March and April, though very frequent between 4 P. M. and 9 P. M.

Mean height of Bar. 29.2497 inch. Ther. 75.97°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.2564 inch	29.2603 inch	29.2326 inch.
Ther.	72.19°	78.38°	77.34°.

Greatest pressure observed 29.40 inch, least ditto 29.09 inch.

Highest temperature 86°, lowest 66°.

Greatest variation, Bar. 0.31 inch. Ther. 20°.

June.—Fair at the beginning, after the 5th very rainy. Rain at Sunrise on 16 days; at 2 P. M. on 6 days; and at Sunset on 5 days; with frequent thunder storms at night, these returning regularly towards the end.

Mean height of Bar. 29.1098 inch. Ther. 81.66°

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.1178 inch	29.1140 inch.	29.0976 inch.
Ther.	77.64°	84.68°	82.66°.

Greatest pressure observed 29.22 inch, least ditto 29.00 inch.

Highest temperature 89°, lowest ditto 72°.

Greatest variation, Bar. 0.22 inch. Ther. 17°.

July.—As in June so in July it was more frequently rainy at Sunrise than at any other part of the day. On 16 days there was rain at Sunrise, and frequent thunder. Showers at night.

Mean height of Bar. 29.0936 inch. Ther. 83.03°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.1061 inch	29.0939 inch	29.0808 inch.
Ther.	79.17°	85.53°	84 51°.

Greatest pressure observed 29.20 inch, least ditto 29.00 inch.

Highest temperature 91.5°, lowest ditto 76.5°.

Greatest variation, Bar. 0.20 inch. Ther. 15°.

August.—On the 1st, the weather was fair till 8 P. M. when there was a heavy thunder shower, after which it continued overcast and cloudy nearly the whole of the month, with rain at Sunrise on 18 days, but less frequent thunder showers at night.

Mean height of Bar. 29.1752 inch. Ther. 81.02°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.1787 inch	29.1868 inch	29.1603 inch.
Ther.	78.07°	82.85°	82.16°.

Greatest pressure observed 29.30 inch, least ditto 29.04 inch.

Highest temperature 85°, lowest ditto 75°

Greatest variation, Bar. 0.26 inch. Ther. 10°.

September.—Mornings cloudy or rainy, the after part of the day fair, frequent thunder showers at night. The 12th and 30th were very rainy days. On the 2nd, a fair day, the Thermometer stood at 2 P. M. in the shade 88°, in the River 78°, in the Sun 116°. On the 24th at 2 P. M. in shade 86°, in the full sun 124°.

Mean height of Bar. 29.2155 inch. Ther. 81.67°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.2326 inch	29.2143 inch	29.1996 inch.
Ther.	77.39°	83.98°	83.66°.

Greatest pressure observed 29.32, least ditto 29.05 inch.

Highest temperature 89°, lowest 74°.

Greatest variation, Bar. 0.27 inch. Ther. 15°.

October.—The first 3 days very rainy day and night, after which the mornings foggy, cloudy or rainy; the after part of the day generally fair. Shock of an Earthquake on the 12th at 6 A. M. Storm on the 16th at 5 A. M.

Mean height of Bar. 29.3893 inch. Ther. 76.10°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.3918 inch	29.3880 inch	29.3881 inch.
Ther.	70.97°	78.68°	78.67°.

Greatest pressure observed 29.46 inch, least ditto 29.30 inch.

Highest temperature observed 84°, lowest ditto 66°.

Greatest variation, Bar. 0.16 inch. Ther. 18°.

November.—Rain at 4 A. M. on the 1st, 4th, 7th, 15th, and 16th; very heavy rain from 7 to 9 A. M. on the 20th, after which fair, with fogs in the morning.

Mean height of Bar. 29.4175 inch. Ther. 67.54°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.4130 inch	29.4350 inch	29.4046 inch.
Ther.	60.78°	71.20°	70.66°.

Greatest pressure observed 29.60 inch, least ditto 29.26 inch.

Highest temperature observed 76°, lowest 54°.

Greatest variation, Bar. 0.34 inch. Ther. 22°.

December.—Generally fair, with foggy mornings; a shower at Sunrise on the 6th, a storm on the night of the 16th. Rain at 9 A. M. on the 17th, ditto at night on the 22nd and 23rd.

Mean height of Bar. 29.4191 inch. Ther. 60.87°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.4216 inch	29.4232 inch	29.4126 inch.
Ther.	52.77°	65.53°	64.32°.

Greatest pressure observed 29.56 inch, least ditto 29.33 inch.

Highest temperature observed 72°, lowest ditto 49°.

Greatest variation, Bar. 0.23 inch. Ther. 23°.

Mean pressure for the year 29.2798 inch, temperature 72.5°.

Greatest pressure observed 29.68 inch, least ditto 29.00 inch.

Highest temperature observed 91.5°, lowest ditto 49°.

Greatest variation, Bar. 0.68 inch. Ther. 42.5°.

Nazera, 31st December, 1841.

January 1842.—This month commenced with fair weather and continued fair throughout, with frequent fogs in the morning, and light clouds or partial haze in the day. Rain at Sunrise on the 4th, and shock of an Earthquake at 8 A. M.

Mean height of Bar. 29.4656 inch. Ther. 61.09°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.4735 inch	29.4694 inch	29.4539 inch.
Ther.	52.58°	66.20°	64.50°.

Greatest pressure observed 29.58 inch, least ditto 29.30 inch.

Highest temperature observed 70°, lowest ditto 47.5°.

Greatest variation, Bar. 0.28 inch. Ther 22.5°.

February.—Generally fair, mornings foggy and an overcast sky towards the end. A storm on the 6th at 10 A. M., also on the 8th at 9 P. M.

On the 17th at 9 P. M. very heavy rain and thunder, which continued the whole night, during which 3.2 inches of rain fell.

Mean height of Bar. 29.4258 inch. Ther. 64.57°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.4374 inch	29.4310	29.4090 inch.
Ther.	56.58°	69.15°	68.00°.

Greatest pressure observed 29.57 inch, least ditto 29.32 inch.

Highest temperature observed 76°, lowest ditto 48°.

Greatest variation, Bar. 0.25 inch. Ther. 28°.

March.—This month was ushered in with heavy rain. Weather throughout unsettled, sky alternately clear and overcast, with periodic returns of heavy rain and thunder at night; to this few exceptions.

Rain during the month 10.3 inches.

Mean height of Bar. 29.3628 inch. Ther. 66.57°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.3670 inch	29.3683 inch	29.3532 inch.
Ther.	59.93°	69.90°	69.90°

Greatest pressure observed 29.50 inch, least ditto 29.20 inch.

Highest temperature observed 77°, lowest ditto 55°.

Greatest variation, Bar. 0.30 inch. Ther. 22°.

April.—A very rainy stormy month, with the usual periodic thunder showers at night; these often occur for 10 or 12 nights successively, commencing later and later till they fall in the morning.

Rain during the month 17 inches.

Mean height of Bar. 29.2791 inch. Ther. 71.20°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.2836 inch	29.2803 inch	29.2736 inch.
Ther.	67.70°	72.86°	72.86°

Greatest pressure observed 29.39 inch, least ditto 29.12 inch.

Highest temperature observed 84°, lowest ditto 64°.

Greatest variation Bar. 0.27 inch. Ther. 20°.

May.—Cloudy, showery, or overcast, with frequent intervals of fair weather. Little rain in the forepart of the day; the heavy periodic showers fall in the afternoon, and most frequently about 4 P. M.

Rain during the month 8.65 inches.

Mean height of Bar. 29.2031 inch. Ther. 80.03°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.2135 inch	29.2048 inch	29.1910 inch.
Ther.	75.21°	83.19°	81.69°

Greatest pressure observed 29.35 inch, least ditto 29.10 inch.

Highest temperature observed 90°, lowest ditto 70°.

Greatest variation, Bar. 0.25 inch. Ther. 20°.

June.—The weather and aspect of the sky much the same as in May. Frequent light showers, the periodic showers occurred in the night; these happened every day from the 22nd to the end.

Rain during the month 6.75 inches.

Mean height of Bar. 29.1365 inch. Ther. 81.85°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.1796 inch	29.1210 inch	29.1090 inch.
Ther.	78.08°	85.05°	82.30°.

Greatest pressure observed 29.25 inch, least ditto 29.00 inch.

Highest temperature observed 92, lowest ditto 74°.

Greatest variation, Bar. 0.25 inch. Ther. 18°.

July.—A rainy month, heavy showers falling almost every night, often continuing till Sunrise, comparatively little rain in the middle of the day: on the 17th. at 2½ P. M. Ther. in the shade 86°, in the sun 116°.

Rain during the month 15.5 inches.

Mean height of Bar. 29.0581 inch. Ther. 80.71°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.0745 inch	29.0618 inch	29.0011 inch.
Ther.	79.05°	81.92°	81.41°.

Greatest pressure observed 29.16 inch, least ditto 28.98 inch.

Highest temperature observed 96°, lowest ditto 76°.

Greatest variation, Bar. 0.18 inch. Ther. 20°.

August.—Cloudy and showery throughout, night showers till 17th. On the 27th at noon, Ther. in the shade 86°, in the sun 122°.

Rain during the month 11.3 inches.

Mean height of Bar. 29.1388 inch. Ther. 81.83°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.1506 inch	29.1369 inch.	29.1221 inch.
Ther.	78.80°.	83.68°	83.03°.

Greatest pressure observed 29.26 inch, least ditto 29.03 inch.

Highest temperature observed 88°, lowest ditto 76°.

Greatest variation, Bar. 0.23 inch. Ther. 12°.

September.—Sky overcast or cloudy in the forepart of the day, evenings frequently fair, frequent heavy showers of rain about 10 A. M.: on the 5th, Ther. at 4½ P. M. in the shade 90°, in the sun 118°.

Rain during the month 13 inches.

Mean height of Bar. 29.2248 inch. Ther. 82.62°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.2439 inch	29.2235 inch	29.2073 inch.
Ther.	79.46°	84.65°	83.25°.

Greatest pressure observed 29.35 inch, least ditto 29.10 inch.

Highest temperature observed 90°, lowest ditto 74°.

Greatest variation Bar. 0.25 inch. Ther. 16°.

October.—Mornings for the most part foggy, evenings generally fair; a storm at 4 P. M. on the 9th, also at 10 P. M. on the 31st. Two smart shocks of an Earthquake 6 minutes before 8 P. M. on the 29th.

Rain during the month 5.4 inches.

Mean height of Bar. 29.3712 inch. Ther. 76.2°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.3848 inch	29.3677 inch	29.3612 inch.
Ther.	70.91°	80.35°	77.35°.

Greatest pressure observed 29.50 inch, least ditto 29.18 inch.

Highest temperature observed 87°, lowest ditto 66°.

Greatest variation, Bar. 0.32 inch. Ther. 21°

November.—Rain on the evening of the 1st, at Sunrise on the 2nd, and distant rain on the 3rd at 10 P. M., after which fine clear weather till the 28th, when there was rain at Sunrise. On the 30th overcast throughout the day, a few foggy mornings, and rain on the 15th.

Rain during the month 0.55 inches.

Mean height of Bar. 29.4699 inch. Ther. 67.25°.

	At Sunrise.	2. P. M.	Sunset.
Bar.	29.46	29.445 inch	29.445 inch.
Ther.	60.75°	73.75°	71.75°.

Greatest pressure observed 29.57 inch, least ditto 29.38 inch.

Highest temperature observed 74°, lowest ditto 56°.

Greatest variation, Bar. 0.19 inch. Ther. 18°.

December.—Generally fair throughout, with frequent dense fogs in the morning, a little sprinkling of rain on the 21st, 23d, 24th, and 26th.

Rain during the month 0.4 inch.

Mean height of Bar. 29.475 inch. Ther. 60°.

	At Sunrise.	2 P. M.	Sunset.
Bar.	29.5022 inch	29.5006 inch	29.4938 inch.
Ther.	54°	67°	65°.

Greatest pressure observed 29.55 inch, least ditto 29.40 inch.

Highest temperature observed 72°, lowest ditto 48 inch.

Greatest variation, Bar. 0.15 inch. Ther. 24°.

Mean pressure for the year 29.3009.

Mean temperature ——— 72.62.

Greatest pressure observed 29.58 inch, least ditto 28.98 inch.

Highest temperature observed 96°, lowest ditto 47.5°.

Greatest variation, Bar. 0.60 inch. Ther. 48.5°.
Rain during the year 92.1 inch.
Nazera, 31st December, 1842.

Exhibiting the Mean Pressure and Temperature in a Tabular form, we have

	Mean Pressure				Mean Temperature.			
	1840.	1841.	1842.	Mean of 3 years.	1840.	1841.	1842.	Mean of 3 years.
	Inches.	In.	In.	In.	°	°	°	°
January,......	29·471	29·488	29·465	29·475	58·87	61·36	61·09	61·44
February, ...	·389	·483	·425	·432	64·40	63·73	64·57	64·23
March, ...	·325	·342	·362	·343	71·23	66·27	66·57	68·02
April, ...	·264	·315	·279	·286	74·24	70·73	71·20	72·05
May, ...	·212	·249	·203	·221	79·23	75·97	80·03	78·41
June, ...	·093	·109	·136	·113	81·00	81·66	81·85	81·50
July, ...	·185	·093	·058	·112	84·53	83·03	80·71	82·75
August, ...	·141	·175	·138	·151	83·09	81·02	81·83	81·98
September, ..	·124	·215	·224	·188	80·92	81·67	82·62	81·73
October, ...	·315	·309	·371	·358	79·08	76·10	76·20	77·12
November, ..	·403	·417	·469	·430	67·48	67·54	67·25	67·42
December, ..	·449	·419	·475	·447	60·46	60·87	60·00	60·44

From this is deduced annual mean pressure 29.2968 inches, annual mean temperature 73.09°. The observations from which the foregoing means have been obtained were made at sunrise, 2 P. M., and sunset, and not at the time of the maximum and minimum pressure, but of the mean pressure merely. Where the terms *Greatest pressure observed, least do.,* are used, the maxima and minima are not thereby intended, but the greatest or least pressure at the usual time of observations. It may also be remarked, that from observations made at the time above stated, the diurnal tide of the Barometer is scarcely perceptible. The following horary observations shew that the mercury in the Barometrical tube is subject to the same diurnal and nocturnal ebb and flow in Assam, as has been observed in other parts of the world. The first series commenced on the 10th July, 1842, at 6 A. M. amidst heavy rain.

BAROMETER.

Time.	A. M. 1	2	3	4	5	6	7	8	9	10	11	12	P. M. 1	2	3	4	5	6	7	8	9	10	11	12
10th July, ...	In. 29					·11	.12	·12	.14	.15	.14	.13	.14	.14	.10	.08	.08	.07	.10	.10	.11	.12		
14th August,......	.134		.125	.120		.110	.115	.145	.175	.180	.185	.185	.175	.145	.140	.135	.135	.106	.113	.135	.150	.175		
28th August,......					.150	.150		.215	.25	.27	.275	.200	.215	.210	.210	.197	.190	.195	.20	.22	.235	.272	27 5	.275
29th August,......	.275		.125	.120		.110	.115	·145	.175	.180	.185	.185	.175	.145	.140	.135	.135	.105	.113	.135	.150	.175		
12th November, ..							.45			.50	.50	.49			.42	.40	.40	.42	.41	.41	.42	.41	.41	.41
13th November, ..	.41	.41	.41	.41	.41	.41	.41	.43	.47	.48	.48	.48	.46	.44	.41	.41	.41	.41	.41	.42	.43			
25th December, ..							.50	.50	.50	.51	.53	.52	.51	.50	.50	.50	.51	.51	.52					

Horary Observations on the Thermometer, 1842.

Time.	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
10th July, ...	..	..	..	..	..	78.2	79	77	76.5	77.5	78	80	80	80.7	82	82.2	83.1	83	83	82	82	82	81.5	81
28th August,........	82	81.5	81	80.4	80	80	80	80	81	82	82	83	84	85	85	86	86	85	84	83.5	82	82	82	82
29th August,........	82	..	..	..	..	80	..	..	82	83	84	85	86	86.5	87	87.5	87.5	86.5	86	85	84	84	..	..
13th November, ...	63.5	62	62	61	60	60	59	60	61	62	66	70	72	72	72	73	74	72	70	68	67	..	..	..
25th December, ...	..	..	..	..	..	..	57	57	58	60	60	60	60	61	62	62	62	62	61	..	..	..	..	..

THERMOMETER.

	Mean Diurnal Oscillations.	Monthly Oscillations.
January, ...	13.2°	22.66°
February	12.8	21·88
March, ...	9.71	22
April, ...	7.52	24.66
May, ...	7·6	20.16
June, ...	7.38	17
July, ...	4.85	16.33
August, ...	5.42	12
September, ...	6.56	15.66
October, ...	9.85	21
November, ...	11.8	22
December, ...	13.4	24
Mean, ...	9.17	20

During the months of June, July, August and September, the variation in the temperature is very trifling, as will be seen by the following observations made at Sunrise and 2 P. M. on the 15th of each month, during three successive years:—

	June.		July.		August.		September.	
	Sunrise,	2 P. M.	Sunrise,	2 P. M.	Sunrise,	2 P. M.	Sunrise,	2 P. M.
1840	77°	85°	78°	86°	78°	82°	75°	83°
1841	78	85	78	86	79	82	80	88
1842	77	85	78	85	78	80	78.3	86

Table shewing the Mean Maxima and Minima, from 3 successive Years' Observations.

	Barometer.			Thermometer.		
	Max.	Min.	Mean.	Max.	Min.	Mean.
	Inches.	In.	In.	°	°	°
January, ...	29.591	29.326	29.458	70.88	52.	61.44
February, ...	56	306	433	76.5	51.96	66.23
March, ...	416	20	323	73.35	62.69	68.02
April, ...	41	153	281	74.71	67.39	72.05
May, ...	35	116	233	82.85	73.97	78.41
June, ...	223	28.967	09.48	85.63	77.37	81.50
July, ...	193	29.026	109	85.75	79.75	82.75
August, ...	27	28.957	113	85.64	78.32	81.98
September, ...	30	29.05	175	85.76	77.7	81.73
October, ...	476	198	337	82.68	71.56	77.12
November, ...	573	283	425	78.51	56.33	67.42
December, ...	5466	3633	45.49	72.88	48.00	64.04

	Barometer at 32° Fahrenheit.			
	Max.	Min.	Mean.	Range.
	Inches.	In.	In.	In.
January,	29.5027	29.2379	29.2702	.265
February,	4572	2032	3302	.254
March,	3380	0920	2150	.246
April,	2860	0350	1625	.251
May,	2106	28.9766	1872	.234
June,	0745	8185	28.9465	.256
July,	0407	8737	9572	.167
August,	1200	8070	9635	.213
September,	1508	9008	29.0258	.250
October,	3406	29.0626	2016	.278
November,	4660	1770	3210	289
December,	4600	2780	3690	.182

Mean pressure for the year, Inches. 29.1624

J. W. MASTERS,

27th March, 1843. *Superintendent South Division.*

Correspondence.

Extract of a Letter from Charles Lyell, Esq. *F. R. S. dated London, May* 10, 1843.*

"Even such comparatively small territories as Newfoundland and Canada, as well as 18 of the states of North America, have either accomplished, or have actually in progress, such surveys, directed as you suggest by scientific geologists, with powers, in most cases, to employ as assistants men of practical knowledge in the respective regions. These different Governments are all well convinced of the economical advantage which they have derived from the surveys, in checking absurd and costly enterprises, and giving a good direction to mining speculations; pointing out the nearest localities of lime-

* This extract from Mr. Lyell's letter is here given, to redeem the promise made in the concluding paragraph p. 617, vol. 3, of this Journal. We reserve our further remarks on the subject to a future occasion.—Eds. *Calcutta Journal Natural History.*

stone, materials for roads, and the probable or positive position of metalliferous or coal bearing rocks."

Extract of a Letter from Dr. H. FALCONER, *dated London, August 5th* 1843.

" One of the Missionaries in New Zealand sent home a bone which was stated to have been dug out of recent mud, and considered by the natives as belonging to a bird of huge size, which their fathers are reported to have hunted, and the place is shewn where the last one known was killed. It was sent to Mr. Owen, by whom it has been lately examined; it proves to be the *tibia* of a *Struthæus* bird with three toes, and most nearly allied to the *Apteryx* or Casuary of Australasia. I have seen the bone which is nearly perfect, and measured it. It is 28½ inches long, and the lower articulation is 5 inches across!! The same bone of the Ostrich seen alongside of it looks wonderfully small; and well it may, for this bird must have stood 16 feet high. Owen has called it the *Dinoryx*, and supposes it possible, that the bird is still alive in some of the remote parts of New Zealand."

Dr. Falconer also refers to a collection of Fossils from New Zealand, in which they have discovered the bones of gigantic Kangaroos, some of those which he saw approached to the Mastodon in size. They probably, he thinks, belonged to marsupial animals, with fanged teeth like the *Tapir*. Dr. Falconer states, that from conversations he has had with Mr. Owen and Mr. Lyell, it appears there is nothing certain known of the extreme limit of growth attained by the Crocodiles of the Ganges and other animals; Dr. Falconer suggests, that parties in India, who have opportunities of ascertaining points of this nature exactly, would confer a great benefit on science by contributing well authenticated dimensions of large Crocodiles, &c. which they may have measured, to our Journal. It is supposed by some that there is an intermediate species of large Crocodile in the rivers of India, between the long-nosed and short-nosed kinds. Further testimony on this point would also be deeply interesting. We need not add how happy we should be to give any such communications insertion. We would recommend the subject particularly to correspondents in Assam, where we know the number of Crocodiles to be very great.

Appearance of a New Volcanic Island on the Arrakan Coast.

Reports of an island having suddenly appeared on the Coast of Arrakan, we took an opportunity when writing a short time since to Captain Boyle, the Commissioner of the Province, to enquire incidentally, as to whether he had heard of such an occurrence, when we were favoured with the following obliging reply :—

"I should also be most happy to be able to give you a full and true account of the island lately thrown up ; but all that is at present known is, that on 26th of July last, a volcanic eruption took place, about a quarter of a mile off the South end of False Island, (South-east of Chedooba,) and that after fuming away for the next three days, it was observed that a new island had been formed on the spot. The place is so exposed, that no one can approach it in the South W. Monsoon; but now that the boisterous season is over, I hope to see it myself, if not, to obtain some further particulars regarding it. No one lives on False Island, and all the information we possess, is derived from the people of Flat Island, who have been so frightened by the affair, and annoyed by a witch who has for sometime been residing on their Island, and who they have been strictly prohibited either ducking or burning as they would desire, that they are quitting their homes and seeking peace and quiet on Chedooba, leaving the old witch Queen of the Isles ! !"

Extract of a Letter from Captain A. Jack, *30th Regiment, N. I. Lucknow, 5th September,* 1843.

I have read with great pleasure Captain T. Hutton's exposition of the error into which the scientific world had been led, with regard to the snow lying longer and deeper on the southern aspect, than on the northern of the Hymalaya, which error he has exposed most lucidly, and the fact of its being exactly the reverse, is strongly corroborated by Captain Cunningham ; if it wants any further confirmation, I find abundance in my diary. I crossed the Borendo Ghat on the 25th September 1842, and there was no snow at all on the southern aspect, or on the very summit of the Pass ; but descending a few yards on the northern aspect, to the base of a rock which was nearly perpendicular, we had the pleasure of seeing our baggage, coolies, ducks, geese, and fowls in their baskets, descending most rapidly by their own gravity, upon an unbroken bed of snow, extending 250 to 300 yards, in one slope, forming an angle of about 45°; which was interrupted by a huge wall of rocks, which had evidently been swept down from the neighbouring heights, in snow slips. Such accumulations are still going on, forming this and other similar ridges of stones lower down, wherever there is space more level than the general slope. I send you a sketch done on the spot, taken from the second wall or ridge of stones, looking nearly south. I also send you two sketches taken at Setee, one looking S. E., the other N. W.; also one on north side of the Borendo Pass, looking North, at 2,000 feet higher than Setee, which is on the southern side, and southern aspect, which will elucidate my observations more clearly. Though Captain Hutton has, I think, clearly proved the error into which the scientific world in general has been led, yet I fear that Captain Hutton, sometimes supports his facts by theories which are not always correct.

In my opinion the greater length of time during which the southern aspects are exposed to the direct rays of the sun is sufficient to account for the absence of snow. Captain H. has stated as another cause, that which I fear no mountains will bear witness to; viz. page 280, of your Journal, No. 14.—"Another argument also in "favor of the snow on the northern side, appears to be furnished "in the occurrence of dense forests and vegetation along the southern slopes, while they are nearly altogether wanting on the "northern face."

Now I look at all my sketches taken from nature, (some hundreds,) in Kumaon, Simla, and Kunawur, and in deed wherever I have travelled in the northern hemisphere, and I find the northern aspects much more wooded than the southern.* I have not travelled in Norway or Russia; but I have been informed that the same is the case there. In Wales, Ireland, and Scotland plantations on southern

* Our own observations perfectly coincide with those of Capt. Jack as to the wooded character of northern, and the generally dry, arid, and naked condition of southern declivities of the Himalaya.—Eds.

aspects are raised with much more difficulty than on northern. In the Mauritius, the forest is nearly all on northern aspects; the oak decidedly prefers it; the pine also seems to prefer it; and the birch which grows at a higher elevation on the Borendo than the oak or pine, grows also much larger at an elevation on the northern side at least 2000 feet higher than where it grows, weakly and stunted on the southern side at Setee. If I am right, I hope Captain Hutton will correct the above error into which he may have been led inadvertently. I recollect in 1839, I was surprised to see the mountains above Algiers covered with snow on the northern aspect, when there was none visible on the southern aspect of the mountains of Arragon in Spain, though much higher. The sketch I send you of the Borendo, represents a snow cloud which commenced falling while I was making the sketch about half an hour after we had crossed the ridge. The forest on Mount Jacho is greatest on the northern aspect, principally oak and pine. The magnificent forest of Muhassoo, which is quickly disappearing to make way for potatoes, is principally on the northern aspect; there I measured one pine which had been blown down, whose base from its position had never seen the sun; it measured as it lay, straight trunk 160 feet, the top of it had disappeared, but it might have been 10 or 20 feet more.

The two mountains near Simla called great and little Lhally, are wooded to their crests on the northern aspects, and bare and rocky on the southern; these are familiar instances of the naked appearance of the southern aspects; few may have seen the northern, but all must recollect the appearance of the crests fringed with tall pine trees, giving an idea that they only grow on the top of the mountains. Suppose that forests grow most luxuriantly where moisture is most abundant, as in the swamps of Surinam: it is proved by chemical analysis, that in the formation of woody fibre water is decomposed; that trees decompose water, and assimilate hydrogen and carbonic acid; that thereby 72.35 parts of oxygen by weight must be separated as a gas, for every 27.65 parts of carbon which are assimilated by the plant; or what is much more probable, plants under the same circumstances may decompose water, the hydrogen of which is assimilated along with the carbonic acid, while oxygen is separated; if the latter change takes place, 8.04 parts oxygen must unite with

100 of carbonic acid, in order to form woody fibre, and 72.35 parts by weight of oxygen which was in combination with the hydrogen of the water, and which exactly corresponds in quantity with the oxygen contained in the carbonic acid, must be separated in a gaseous form.*

Again, the best soil for forest trees possesses a strong affinity for water or its elements, and the shade afforded by the forest protects the moisture from evaporation in a great degree—even in the decay of woody fibre there is every reason to believe, that decomposition of water again takes place—whereas I am unaware of any proof that forest has any power of attractions for the clouds, beyond what its height may give it on extensive plains, and that could not cause more rain to fall on northern aspects than on southern, in the region we are talking of, as there are numerous points above the region of forests that would, from their superior height, exert a superior attraction. All my observations lead to the following conclusions; 1st, that the snow lies longer and deeper on northern aspects, in consequence of not being exposed for so long a time to the rays of the sun; 2nd, that forest grows more profusely on northern aspects, owing to the fact, that the moisture on northern aspects is protected from evaporation in a greater degree than on the southern. I am glad to see that Captain Hutton also contradicts what I find to be a very prevailing mistake, viz. that Chin-i, in Kunawur, is beyond the influence of the monsoon, which is interpreted erroneously as being above the region of clouds, and that no rain falls there. I got as complete a *ducking* from rain as a man could wish, while I was there, which demonstrated the error sufficiently to me.

* Vide Liebig's Organic Chemistry of Agriculture and Physiology.

Meteorological Register kept at the Surveyor General's Office, Calcutta, for the Month of May 1843.

Observations after Sunset are made at the Honorable Company's Dispensary.

May. Days of the Month.	Moon's Changes.	Observed at 9 H. 50 M.					Observed at 4 P. M.					Rain Gauges.		Observations made at 8 P. M.				Observations made at 10 P. M.			
			Temperature.			Wind.		Temperature.			Wind.				Temperature.				Temperature.		
		Barometer.	Of the Mercury.	Of the Air.	Of an Evapg. Surface.	Direction.	Barometer.	Of the Mercury.	Of the Air.	Of an Evapg. Surface.	Direction.	Upper.	Lower.	Barometer.	Of the Mercury.	Of the Air.	Of an Evapg. Surface.	Barometer.	Of the Mercury.	Of the Air.	Of an Evapg. Surface.
		Inches	°	°	°		Inches	°	°	°		Inches	Inches	Inches	°	°	°	Inches	°	°	°
1		29,746	87,0	90,7	85,0	S. (high)	29,646	91,6	96,5	88,1	S. W. ..			29,800	89,75	89,5	87,25	29,850	88,75	88,25	87,0
2		,700	87,0	92,0	86,0	S.	,569	91,2	97,0	88,4	S.			,975	89,0	89,5	87,0	,950	90,0	89,25	86,75
3		,670	86,5	92,5	86,0	S.	,550	93,3	98,0	88,0	S. (high)			,700	9,00	89,25	87,0	,700	90,0	89,25	86,75
4		,642	87,5	92,0	85,8	S. (high)	,590	92,9	97,0	88,1	S. W. ..			,750	90,25	90,0	89,5	,750	90,0	89,5	89,25
5		,650	87,8	92,9	84,5	S. (high)	,573	92,9	96,4	88,0	S.	0,39	0,47	,750	85,0	85,25	83,5	,750	85,0	85,0	83,25
6		,710	86,0	88,0	84,0	S.	,641	[illegible]	91,0	84,0	S. W...	0,07	0,09	,850	82,5	82,0	81,75	,850	82,5	82,0	81,5
7	☽	,749	84,2	86,6	82,0	S.	,670	87,5	90,0	82,0	S. (high)	0,58	0,65	,900	82,0	81,75	81,0	,900	81,75	81,25	80,75
8		,741	84,8	87,0	81,4	S. (high)	,674	87,0	89,0	83,1	S. (high)	0,58	0,72	,850	85,0	85,15	83,75	,850	85,0	85,0	83,25
9		,803	81,9	85,2	81,0	N. E. ..	,733	83,8	88,0	81,9	S.	0,23	0,32	,850	83,0	83,5	81,75	,850	83,0	83,25	81,5
10		,778	80,2	80,9	75,8	W.	,717	81,5	85,3	78,0	Calm. ..			,900	82,25	82,0	81,25	,900	82,0	81,5	81,0
11		,765	80,8	86,5	79,0	E.	,705	85,3	93,2	82,5	S.	0,13	0,17	,850	83,0	83,5	82,75	,850	83,0	83,25	82,75
12		,746	82,0	87,5	82,5	S.	,686	82,5	82,6	78,0	E.			,850	84,0	83,5	81,0	,850	83,5	83,25	80,75
13		,757	83,1	87,0	82,0	S. W. ..	,678	85,0	94,8	86,0	S. W...			,850	86,75	86,5	86,0	,850	86,0	85,75	85,25
14	○	,761	84,5	90,0	83,8	S.	,649	87,1	90,2	84,5	S.	0,64	0,72	,900	82,0	82,5	80,0	,900	82,25	82,75	80,5
15		,781	83,0	89,4	83,0	S.	,698	87,1	96,0	86,1	S.			,900	84,75	84,25	83,75	,900	84,0	84,25	8,35
16		,825	85,0	90,4	83,5	S.	,733	88,5	95,0	85,0	S.			,900	88,0	87,75	87,25	,900	87,5	87,25	86,75
17		,805	84,0	90,2	84,0	W. S. W.	,694	87,2	97,0	87,2	W. S. W.			,850	89,25	88,5	87,27	,850	89,0	88,5	87,25
18		,725	86,0	93,0	84,6	S. W. ..	,642	88,5	99,0	90,0	S. E. ..			,800	90,5	89,5	88,5	,800	90,25	89,25	88,5
19		,722	87,1	92,2	83,5	S.	,653	92,0	98,6	88,5	S. W. ..			,850	90,5	90,0	84,75	,850	90,25	88,75	88,2
20		,725	86,0	91,4	84,0	S. W. ..	,662	[illegible]	98,2	89,0	S.			,800	90,0	89,0	86,0	,800	90,0	89,25	86,0
21	☾	,733	87,0	94,0	86,5	S.	,646	93,0	96,5	85,0	S. W. ..	0,07	0,09	,775	89,0	88,75	88,0	,775	89,0	88,5	88,0
22		,681	87,8	92,0	85,2	S. W. ..	,618	85,5	81,0	80,5	E.	0,68	0,78	,750	88,5	88,0	87,5	,750	88,5	87,75	87,25
23		,605	84,1	8 ,0	84,0	E.	,550	80,1	79,0	77,0	S. E. ..	0,52	0,60	,725	89,0	88,5	86,0	,725	89,0	88,0	86,0
24		,634	83,0	85,8	82,2	E.	,582	82,1	83,0	80,1	S.	0,10	0,16	,775	84,5	81,0	83,5	,775	84,5	84,0	83,0
25		,662	84,8	91,3	86,0	S. E. ..	,647	83,0	84,8	82,2	N. E. ..	0,21	0,27	,700	86,0	86,5	85,0	,700	86,0	86,0	85,0
26		,630	84,7	90,2	84,5	S. W. ..	,554	87,6	90,0	86,1	S. W. ..			,700	86,75	86,0	85,25	,700	86,5	86,0	85,0
27		,598	85,6	89,0	86,0	S.	,538	89,0	91,0	83,0	S.			,700	87,0	86,25	85,5	,700	86,75	86,25	86,0
28	●	,557	85,9	89,2	83,8	S. W. ..	,457	89,8	93,7	87,0	S.			,675	87,25	87,0	86,75	,675	87,0	86,75	86,0
29		,521	85,2	86,7	82,6	S.	,417	90,0	92,6	86,2	S.			,600	87,0	87,5	86,25	,600	87,0	87,75	86,25
30		,473	87,0	92,0	86,0	S.	,360	81,0	94,8	87,4	S.	0,23	0,29	,625	87,0	86,75	85,5	,625	67,0	86,75	85,25
31		,386	85,2	88,4	85,0	S.	,365	88,2	90,4	86,0	S.			,600	87,75	87,0	87,0	,600	87,5	87,25	87,0
Mean.		29,686	85,4	89,4	83.7		29,610	87,8	93,1	84,8		4,43	5,33								

N. B. From a comparison of the two Barometers, the Mercury in that at the Dispensary stands 1-10th of an inch higher than that in use at the Surveyor General's Office.

Meteorological Register kept at the Surveyor General's Office, Calcutta, for the Month of June 1843.

The Observations after Sunset are made at the Honorable Company's Dispensary.

June. Days of the Month.	Moon's Changes.	Observed at 9 H. 50 M. Barometer.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of an Evapg. Surface.	Wind. Direction.	Observed at 4 P. M. Barometer.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of an Evapg. Surface.	Wind. Direction.	Rain Gauges. Upper.	Rain Gauges. Lower.	Observations made at 8 P. M. Barometer.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of an Evapg. Surface.	Observations made at 10 P. M. Barometer.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of an Evapg. Surface.
		Inches	o	o	o		Inches	o	o	o		Inches	Inches	Inches	o	o	o	Inches	o	o	o
1		29,453	88,0	92,6	86,5	S.	29,402	92,0	97,9	91,0	S.	0,32	0,37	29,550	89,0	89,0	87,75	29,550	89,0	88,5	87,5
2		,497	87,4	91,3	87,0	S.	,433	93,0	98,0	89,0	S.	0,13	0,18	,700	89,0	88,25	87,0	,700	89,0	88,25	87,0
3		,573	86,0	88,5	84,0	E.	,494	88,4	93,0	87,0	S. E.			,700	88,0	87,75	86,0	,700	87,75	87,0	85,5
4 S.		,577	83,9	86,0	81,0	W. S. W. ..	,506	85,1	88,0	82,5	S. (high)	3,72	3,96	,750	82,75	82,75	80,75	,750	82,5	82,5	80,5
5	☽	,537	81,8	81,7	79,2	S.	,473	82,5	81,5	80,9	S.	0,43	0,55	,625	82,5	82,5	80,0	,625	82,25	82,0	79,75
6		,490	83,9	89,0	83,9	W. S. W. ..	,440	87,0	94,0	86,2	S. W.....			,600	87,5	87,25	87,0	,600	87,5	87,0	86,75
7		,433	85,8	92,5	85,0	W. S. W. ..	,417	90,0	98,0	85,8	W. S. W.			,625	89,0	88,5	87,0	,625	89,0	88,25	86,75
8		,510	86,4	93,0	87,0	S.	,490	90,5	98,0	89,0	S.			,585	90,0	89,0	89,0	,585	89,5	88,8	88,25
9		,625	86,8	92,5	88,0	S.	,585	90,4	97,5	90,0	S.			,595	90,5	89,25	89,0	,595	90,0	89,5	88,75
10	○	,661	85,8	92,5	86,4	S.	,582	91,2	96,5	87,0	S. W.....			,700	91,0	89,75	89,0	,700	90,0	89,5	89,0
11 S		,590	87,5	92,2	84,0	S.	,509	93,0	95,5	86,0	S.			,700	91,5	91,0	90,75	,700	91,25	91,0	90,25
12		,617	87,8	91,4	85,0	S.	,561	92,0	95,0	86,0	S.			,775	90,0	90,0	89,0	,775	89,5	89,25	88,5
13		,721	87,0	91,0	85,5	S. W.......	,669	86,5	88,3	84,0	S. E.			,850	90,0	88,75	86,5	,850	90,0	88,75	86,5
14		,758	86,0	91,0	85,0	E.	,697	87,2	90,2	84,2	S.	0,14	0,17	,850	94,5	94,0	93,75	,850	93,75	93,25	93,1
15		,737	82,0	81,9	78,5	W. S. W. ..	,662	83,1	84,0	81,5	S. W.....	0,07	0,08	,850	87,0	86,25	84,5	,850	87,0	86,0	84,25
16		,653	84,0	84,6	81,0	S.	,546	86,4	92,0	85,8	S.			,750	87,0	87,0	85,5	,750	87,0	86,75	85,5
17		,570	87,0	91,0	86,0	S. (high) ..	,454	88,0	92,0	85,0	S. W.....			,700	87,5	89,0	86,5	,700	87,0	86,5	86,0
18 S.		,500	88,0	93,0	87,0	S.	,434	93,0	97,0	89,0	S. E.			,650	91,0	90,75	88,0	,650	90,75	90,5	90,0
19	☾	,494	88,0	92,0	85,4	S.	,421	90,5	95,4	87,2	S.			,600	91,0	90,5	90,25	,600	90,75	90,5	90,0
20		,522	88,1	90,2	85,0	E.	,425	88,0	92,0	85,4	E.			,600	91,0	90,0	89,75	,600	90,25	90,0	89,5
21		,478	83,9	84,0	80,6	W. S. W. ..	,414	84,0	83,5	81,0	W. S. W.	04,1	0,55	,575	90,0	89,5	89,0	,575	90,0	89,0	88,5
22		,433	80,0	80,4	78,0	S. W.	,397	84,6	85,0	80,0	S. W.....			,550	85,0	84,75	83,75	,550	85,0	84,25	83,5
23		,458	83,5	87,0	81,6	S. W.	,421	87,1	92,5	86,0	S. W.....			,625	88,0	89,0	84,5	,625	88,0	86,5	84,25
24		,537	85,2	87,0	83,0	S. W.	,493	86,4	88,0	83,0	S.			,675	86,5	85.5	84,5	,675	86,0	85,5	84,5
25 S.		,549	84,6	91,0	84,0	S. W.	,505	88,4	91,0	84,8	S.	0,19	0,29	,650	87,0	86,75	85,0	,650	87,0	86,5	84,75
26	●	,597	81,0	80,5	78,8	S.	,530	82,9	88,2	80,0	S.	0,20	0,30	,675	85,5	85,0	84,75	,675	85,0	86,0	84,25
27		,562	84,0	86,8	82,0	S. W. (high)	,465	85,5	88,0	83,5	S. W.....	0,40	0,48	,650	85,0	85,0	84,0	,650	84,75	84,5	83,5
28		,522	84,0	84,0	81,5	S. W.	,441	86,2	89,0	85,0	S.			,600	87,0	85,5	84,5	,600	87,0	85,25	84,25
29		,502	84,4	88,0	82,8	S. W.	,441	88,4	91,0	86,4	S. W.....	0,11	0,14	,600	86,25	85,75	84,0	,600	86,25	85,25	83,5
30		,478	82,4	81,3	79,9	Calm, ...	,446	84,0	86,0	84,0	S. E.	1,50	0,57	,650	86,5	85,0	84,1	,650	86,25	84,75	84,0
Mean.		29,554	85,1	88,3	8[illegible],4		29,492	87,8	91,5	85,2		7,62	8,64								

N. B. From a comparison of the two Barometers, the Mercury in that at the Dispensary stands 1-10th of an inch higher than that in use at the Surveyor General's Office.

Meteorologic[illegible]ter kept at the Surveyor General's Office, Calcutta, for the Month of July 1843.

The Observations after Su[illegible]the Honorable Company's Dispensary.

July. Days of the Month.	Moon's Changes.	Observed at 9 H. 50 M. Barometer.	9 H. 50 M. Temperature. Of the Mercury.	9 H. 50 M. Temperature. Of the Air.	9 H. 50 M. Temperature. Of an Evapg. Surface.	9 H. 50 M. Wind. Direction.	Observed at 4 P. M. Barometer.	4 P. M. Temperature. Of the Mercury.	4 P. M. Temperature. Of the Air.	4 P. M. Temperature. Of an Evapg. Surface.	4 P. M. Wind. Direction.	Rain Gauges. Upper.	Rain Gauges. Lower.	Observations made at 8 P. M. Barometer.	8 P. M. Temperature. Of the Mercury.	8 P. M. Temperature. Of the Air.	8 P. M. Temperature. Of an Evapg. Surface.	Observations made at 10 P. M. Barometer.	10 P. M. Temperature. Of the Mercury.	10 P. M. Temperature. Of the Air.	10 P. M. Temperature. Of an Evapg. Surface.
		Inches	o	o	o		Inches	o	o	o		Inches	Inches	Inches	o	o	o	Inches	o	o	o
1		29,578	84,8	88,0	84,4	S. ..	29,550	78,5	77,4	76,0	S. E.	0,33	0,44	29,625	86,0	85,5	85,0	29,625	86,0	85,5	84,75
2 S.		,593	83,0	89,0	85,0	S. ..	,505	82,0	83,0	80,3	S. E.			,600	87,25	85,75	85,0	,600	87,0	85,25	84,5
3		,549	84,0	89,0	85,5	S. ..	,505	81,5	81,4	79,2	E. ..	0,42	0,62	,700	85,0	84,25	83,25	,700	86,0	85,25	84,5
4		,553	83,0	89,0	84,5	E. ..	,506	82,9	84,4	81,0	S. E.			,700	85,0	84,5	84,0	,700	85,0	84,25	84,0
5	☽	,550	83,8	89,2	84,2	E. ..	,493	83,1	84,5	82,0	S. ..	0,27	0,34	,750	85,75	85,0	84,5	,750	85,25	84,75	84,0
6		,562	83,1	85,8	83,0	S. ..	,510	83,9	86,4	82,2	S. ..	0,79	0,89	,700	85,25	84,75	83,75	,700	85,0	84,25	83,0
7		,569	82,0	85,8	82,0	S. ..	,514	82,9	85,0	82,0	S. E.	0,16	9,22	,650	85,0	84,25	83,25	,650	85,0	84,0	83,0
8		,590	83,8	87,4	83,0	S. E.	,530	83,5	86,5	84,0	Calm.			,625	84,5	84,0	83,25	,600	84,0	83,5	83,0
9 S		,562	83,0	88,6	84,0	S. E.	,477	86,8	91,5	86,0	S. E.	0,63	0,72	,625	84,75	84,25	84,0	,625	84,75	84,25	84,0
10	○	,538	83,1	86,0	82,1	S. W.	,482	83,0	84,7	82,0	S. ..	1,02	1,15	,600	84,25	84,0	83,0	,600	84,0	83,75	82,5
11		,538	83,0	86,0	82,0	S. W.	,485	83,2	87,8	84,0	S. ..	0,15	0,18	,700	84,5	83,75	83,0	,700	84,25	83,25	82,5
12		,590	83,0	86,7	83,0	E. ..	,537	85,5	89,8	84,5	S. E.			,700	85,0	85,0	83,75	,700	84,5	84,0	83,5
13		,589	83,1	88,0	84,0	S. E.	,510	85,8	90,0	83,8	S. E.	0,22	0,26	,650	86,0	85,5	84,75	,650	86,0	84,75	83,0
14		,554	84,0	90,0	85,0	E. ..	,490	84,2	88,0	83,0	E. ..	0,82	0,91	,700	87,0	86,25	85,5	,700	87,25	86,75	85,5
15		,553	86,0	88,6	84,0	E. ..	,509	84,0	86,8	83,5	E. ..	0,09	0,10	,650	86,25	86,0	85,75	,650	86,25	86,0	85,5
16 S.		,581	83,0	86,0	83,0	E. ..	,538	84,6	86,4	83,0	E. ..	0,06	0,08	,625	86,0	85,0	84,0	,625	86,0	84,75	83,5
17		,597	85,5	87,9	84,0	E. ..	,533	82,6	82,5	80,5	Calm.	1,07	1,18	,650	85,75	85,5	85,25	,650	85,25	85,0	84,5
18		,546	83,5	88,0	84,0	N. E.	,442	85,5	92,6	86,8	E. ..			,600	85,5	85,0	84,75	,657	85,25	84,5	84,25
19	☾	,537	84,0	88,0	84,0	E. ..	,454	87,0	91,6	85,0	E. ..			,650	88,0	87,25	83,25	,650	88,0	87,0	85,0
20		,550	84,8	88,4	84,0	E. ..	,497	85,0	87,5	84,0	E. ..	0,56	0,60	,675	87,5	87,25	86,0	,675	86,5	86,25	85,5
21		,562	83,5	87,0	82,2	E. ..	,510	84,0	86,0	82,2	E. :	0,07	0,09	,650	86,75	86,5	86,0	,650	86,5	86,25	85,0
22		,549	83,8	87,4	83,3	S. E.	,493	84,0	87,0	83,5	S. E.	0,12	0,17	,650	86,0	85,0	84,0	,650	86,0	85,25	84,0
23 S.		,525	84,0	90,2	85,0	E. ..	,478	82,2	82,5	80,2	S. ..	0,40	0,46	,650	86,5	86,0	84,5	,650	86,5	85,75	84,5
24		,510	84,0	88,0	83,0	N. E.	,470	84,5	86,6	82,4	S. ..	0,27	0,34	,600	86,75	86 0	85,25	,600	86,5	86,0	85,25
25		,594	81,4	81,0	79,0	S. E.	,538	82,2	83,0	80,0	S. W.	0,19	0,07	,650	84,0	83,5	82,75	,650	85,5	85,0	84,0
26	●	,569	83,5	87,8	81,8	S. W.	,4[illegible]8	85,4	88,0	82,0	S. ..			,700	86,0	85,75	85,0	,700	85,75	85,5	85,0
27		,525	83,9	89,0	83,2	Wsw.	,454	84,5	89,1	83,8	S. ..			,675	85,5	85,0	84,7	,675	85,5	85,0	84,5
28		,521	84,2	89,8	84,8	E. ..	,454	85,9	90,8	84,5	S. E.	0,20	0,22	,600	87,0	86,5	85,0	,600	86,5	85,75	85,5
29		,489	83,0	85,1	81,8	E. ..	,418	85,4	89,0	84,0	S. E.	0,54	0,63	,600	85,5	85,0	84,0	,600	85,5	84,75	84,0
30 S.		,509	82,4	86,1	82,8	E. ..	,462	84,0	85,1	81,0	S. E.	0,18	0,21	,650	86,0	86,0	85,5	,650	86,5	85,7	85,25
31		,530	83,2	87,0	82,0	E. ..	,500	84,4	87,1	84,0	E. ..	0,24	0,30	,700	87,25	87,0	86,5	,700	87,0	86,7	86,0
Mean.		29,554	83,6	87,5	83,3		29,495	84,0	86,5	82,6		8,67	10,18								

N. B. From a comparison of the two Barometers, the Mercury in that at the Dispensary stands 1-10th of an inch higher than that in use at the Surveyor General's Office.

Meteorological Register kept at the Surveyor General's Office, Calcutta, for the Month of August 1843.

The Observations after Sunset are made at the Honorable Company's Dispensary.

August. Days of the Month.	Moon's Changes.	Observed at 9 H. 50 M. Barometer.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of an Evapg. Surface.	Wind. Direction.	Observed at 4 P. M. Barometer.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of an Evapg. Surface.	Wind. Direction.	Rain Gauges. Upper.	Rain Gauges. Lower.	Observations made at 8 P. M. Barometer.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of an Evapg. Surface.	Observations made at 10 P. M. Barometer.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of an Evapg. Surface.
		Inches	°	°	°		Inches	°	°	°		Inches	Inches	Inches	°	°	°	Inches	°	°	°
1		29,596	83,5	86,5	83,0	S. E.	29,553	82,4	83,0	80,8	S. ...	0,10	0,16	29,750	86,25	85,50	84,	29,757	86,	85,25	83,75
2		,689	83,9	87,5	83,0	S. E.	,622	86,9	91,2	85,0	E. ..			,750	86,50	85,75	83,50	,757	85,75	85,25	83,
3		,674	84,8	90,8	85,0	E. ..	,586	87,6	91,0	84,7	S. E.			,750	86,25	85,	84,	,757	86,	85,	83,50
4		,591	85,0	88,5	84,6	E. ..	,486	87,0	93,2	87,0	Ws.w.			,675	87,50	89,	85,	,675	87,25	87,	84,75
5		,505	84,1	90,7	85,2	Ws.w.	,434	86,5	88,0	83,0	N. ..	0,87	0,97	,675	86,	85,50	83,	,675	85,50	85,	82,25
6S.		,553	83,4	86,5	83,0	N. W.	,477	85,4	87,2	83,9	Calm.	0,24	0,27	,650	85,	84,50	84,	,650	85,	84,25	83,
7	☽	,562	84,5	90,0	85,0	N. ..	,502	82,2	82,6	80,0	S. W.	0,20	0,25	,650	85,	84,25	83,50	,650	84,75	83,75	82,50
8		,545	83,0	84,6	82,0	Ws.w.	,490	83,5	84,4	82,2	S. W.	0,33	0,39	,650	84,50	83,75	83,	,650	84,50	83,75	83,
9		,525	82,0	83,0	80,0	N. W.	,460	83,8	87,0	82,5	N. W.	3,05	3,27	,650	84,50	84,	83,	,625	84,50	84,	82,50
10		,485	81,2	81,3	79,0	N. W.	,418	84,0	86,2	82,4	W. ..	0,89	1,02	,625	85,	84,25	83,	,625	85,	84,	82,75
11		,485	81,5	82,5	80,0	W. ..	,438	83,5	85,9	83,0	N. W.	3,60	3,92	,650	84,50	83,75	83,	,650	84,	83,50	82,75
12		,550	82,8	84,5	82,0	S. W.	,506	84,5	86,0	82,8	S. ..	0,10	0,16	,650	84,	83,75	82,50	,650	84,	83,25	83,
13S.		,577	82,5	84,8	81,9	S. W.	,518	85,0	88,0	84,0	S. ..	0,73	0,90	,675	84,50	84,25	85,	,675	84,25	84,	82,
14	◐	,570	82,8	84,0	82,0	S. ..	,534	85,5	88,6	84,0	S. W.			,750	86,25	85,50	83,	,750	86,25	85,50	85,
15		,694	85,0	88,0	84,0	S. W.	,658	85,0	90,0	84,0	Ws.w.	1,24	1,31	,775	85,	84,50	83,	,775	85,	84,25	83,
16		,737	84,0	88,0	84,0	S. W.	,657	86,8	92,4	85,8	S. W.	2,91	3,12	,825	85,	84,50	82,	,825	85,	84,25	82,50
17		,689	78,0	77,8	86,0	S. ..	,629	78,2	80,0	78,0	S. W.	0,22	0,31	,775	84,50	83,50	83,	,775	84,50	83,50	82,
18		,666	80,8	82,4	80,0	E. ..	,617	80,7	81,5	79,8	Calm.	0,24	0,27	,775	84,50	83,25	82,50	,775	84,	83,25	83,
19		,721	82,5	88,0	83,4	E. ..	,650	86,5	92,2	85,0	N. E			,825	85,	84,	82,50	,825	84,75	84,	82,25
20S.		,674	83,0	92,0	84,0	E. ..	,581	86,9	92,8	86,8	E. ..	0,77	0,84	,825	85,	84,	83,50	,825	84,50	83,75	82,
21	☾	,617	83,0	88,0	83,0	E. ..	,526	84,9	88,6	84,8	E. ..			,750	84,50	84,25	82,	,750	84,25	84,	83,50
22		,553	83,4	86,5	83,2	E. ..	,490	81,9	80,2	78,2	S. E.	0,50	0,57	,650	84,25	83,57	84,	,650	84,	83,25	82,
23		,525	82,5	85,7	81,2	E. ..	,461	84,9	89,0	84,0	E ..	0,19	0,25	,650	84,50	84,25	82,25	,650	84,50	84,25	84,
24		,585	83,0	85,0	81,4	E. ..	,554	81,5	82,0	79,0	S. E.	0,07	0,09	,650	84,	83,25	82,	,650	84,25	83,	82,25
25		,742	82,2	84,0	82,2	S. E.	,686	83,0	85,5	82,0	S. E.	0,05	0,06	,850	84,25	83,50	84,	,850	84,	83,	81,95
26		,710	81,9	85,1	82,0	S. E.	,609	82,9	85,0	82,0	S. ..			,800	85,	84,75	84,75	,800	85,	84,75	84,
27S.		,637	82,6	86,1	82,6	N. E.	,578	85,6	90,0	85,0	S. E.			,850	86,	85,25	85,	,750	86,	85,25	84,
28	●	,637	84,0	88,0	84,0	S. E.	,570	85,5	88,2	82,4	S. ..	0,25	0,34	,775	89,	86,	85,25	,775	86,50	84,50	84,
29		,614	83,8	87,2	82,1	E. ..	,541	83,2	85,0	82,0	E. ..	0,12	0,15	,750	84,75	84,50	83,25	,750	84,55	84,75	83,23
30		,553	82,5	86,5	82,0	E. ..	,481	83,5	85,0	82,4	E. ..	0,16	0,18	,750	84,50	84,25	83,	,750	84,50	84,	83,
31		,518	83,2	88,0	83,0	E. ..	,474	82,6	85,1	81,0	E. ..	0,16	0,25	,650	84,50	81,75	83,	,650	84,25	83,25	82,
Mean.		29,606	[illegible]	[illegible]	82.4		29,541	84,2	86,9	82,8		17,99	20,35								

N. B. From a comparison of the two Barometers, the Mercury in that at the Dispensary stands 1-16th of an inch higher than that in use at the Surveyor General's Office.

THE

CALCUTTA JOURNAL

OF

NATURAL HISTORY.

The Cryptogamous Plants of Dr. ROXBURGH, *forming the fourth and last part of the Flora Indica.*

[Published by permission of Government from Dr. Roxburgh's MSS. in the Library of the H. C. Botanic Gardens.]

The MSS. now printed may be taken as completing* the Flora Indica of Dr. Roxburgh, of which three volumes have already appeared. The matter has been taken from a large folio, arranged, epitome of the Flora Indica, and, so far as was compatible with their imperfect state, from a set of MSS. descriptions of Roxburgh to which the epitome alluded to has numerical references. The foot notes are my own, otherwise the matter is verbatim Roxburgh's, as also is the arrangement. The sketches have been copied in a reduced form from Roxburgh's invaluable series of Botanical Drawings deposited in this Institution, and probably the most authentic and extensive† ever completed by one individual.

* There does not appear to be any MSS. extant of the other divisions of Cryptogamia. Drs. Wight and Arnott in the preface to their Prodromus† state, that of the Flora Indica not only the Ferns are wanting, but also the few species referred by Roxburgh in his Hortus Benghalensis to Polygamia. But this class does not exist in the original MSS. of the Hortus Benghalensis, nor in my copy of that work; the matter proceeding directly from Diœcia to Cryptogamia.

† They contain 2360 folio sheets, and representations of 2542 species. All which were executed between 1793 and 1814.

† Prod. Fl. Penins. Ind. Orient. p. 14.

I have not yet become acquainted with the circumstances, owing to which the Flora Indica has not been heretofore completed, or with the reason of its being so disfigured by obscurities and typographical errors.* But considering it to be a positive duty of all Superintendents of Public Institutions to make known to the fullest extent the meritorious labours of their predecessors, I have availed myself of the permission of Government to place on record the labours of Dr. Roxburgh in this department of Botany. The neglect under which these MSS. have been buried since 1817, and the absolute want of his authentic Herbarium, under which these Botanic Gardens labour, prevent me effectually from doing justice to the memory of Roxburgh, beyond shewing the extent to which he had observed the higher Cryptogamic Plants.† His names probably in very many instances have been passed over, and the law of priority of publication and definition may hinder many from being adopted. But I am sure that Botanists‡ will exert themselves and determine that his MSS. names shall not be passed over in favour of any other MSS. names, given in neglect of Roxburgh's characters, descriptions or drawings; any more than Zoologists will shew countenance to similar names in the most marked case of the zoological labours of Buchanan.§

* All I have been able to ascertain is, that the work was printed from MSS. in the possession of Dr. Carey, and that it was carried through the press when he was labouring under the debility of great age. Dr. Wallich was in England when the printing was contemplated in 1830; six years had elapsed without the appearance of the third volume of the 1st edition, *promised* by Dr. Wallich in 1825, and the advanced age of Dr. Carey did not permit any longer delay.

† The number of species viz. 149, exclusive of Musci, Lichens, Algæ and Fungi, is I think considerable. The proportion that the Cryptogamic Plants here published bear to the flowering plants of the Flora Indica, may be estimated as 1 to 22.

The proportion of the Cryptogamous Plants *of the same kinds* in the E. I. Herbarium taking 9500 as the whole number, (which ought not to be too much, considering the Catalogue contains very few Gramineæ, few Rubiaceæ, no Euphorbiaceæ or Sapindaceæ, and scarcely any Asclepiadeæ or Terebinthaceæ,*) may be taken as 1 to 19.

‡ I beg to address myself here in particular to Sir Wm. Hooker, who is said to be engaged in a work on the species of Ferns.

§ I wish here to call the attention of the scientific world to the fact, that no explanation has been yet given by Mr. John Edward Gray of the appearance of copies of Buchanan's Zoological drawings, without the slightest acknowledgment, in the Illustrations of Indian Zoology of General Hardwicke.

* Prod. Fl. Penins. Ind. Orient. preface p. 17.

In explanation of this it is necessary to observe that the Ferns forming part of the collections known as the E. I. Herbarium* appear to have been distributed at two different, though not very distant periods. The first set which reaches to No. 396, including many Lycopodia, almost entirely bears the name of Dr. Wallich. It contains only four or five names of Roxburgh, although the Hortus Benghalensis, which appeared in 1814, contains 44 other Crytogamous plants, some of which *at least* might have been identified by the drawings which had been in Dr. Wallich's charge from 1827.

After the Catalogue of the above had reached No. 2159, (it would be difficult to state any thing more definite from the peculiar want of arrangement of the matter,) some additions took place to the materials for distribution, among which were Dr. Roxburgh's "small Herbarium," containing "no duplicates," and Dr. Buchanan's "very extensive Herbarium," containing "some duplicates;" this latter I reserve for a future opportunity. The Catalogue then recommences, first with corrections and additions to the list of Ferns; among these occur many of Roxburgh, in most cases, though long prior, though defined and characterised, drawn, and illustrated by authentic specimens, quoted as synonyms to Dr. Wallich's own names, long posterior, and in no instance that I know of defined or described. But what is more to the point, the Catalogue recommences at No. 2151, and between this number and No. 2241, where it breaks off to Nepenthes! the following names of Roxburgh occur as primary names.†

So that the conclusion is evident, and not to be gainsayed, that had these additions come into notice earlier (they were known to be at the India House) all those names of Roxburgh quoted as synonyms to Dr. Wallich's names must have superseded them. And as in this part of the Catalogue Dr. Wallich has not only given primarily several of the names of Roxburgh, but has properly enough given Roxburgh as the authority for the name, when Roxburgh had referred the species to a genus to which they are not considered to belong

* The Catalogue of this is herein referred to as Wall. Cat.

† Dicksonia moluccana, R.
Lycopodium rotundifolium, R.
——— lævigatum, R.
Vittaria divergens, R.
Lindsæa interrupta, R.
Asplenium trapeziforme, R.
Asplenium cultratum, R.
Davallia moluccana, R.
Polypodium scabrum, R.
——— arboreum, R.
Cyathea bipinnatifida, R.

now,* so omni jure, all his names quoted as synonyms to Dr. Wallich's own names ought to supersede them.†

Still there are a great number, the majority indeed, of the Roxburgh names unaccounted for; I do not think there are 40, besides those in the lists here given, which amount to 28, accounted for, so that about 80 remain, of which we have no accounts at all. Now in this case Botanists will do well always to give the preference to the names of Roxburgh, when the characters shew any agreement with the plant in question, in preference to those of Dr. Wallich, which are names, and no more; and to remember that Roxburgh's Herbarium exists in England, (although not a fragment of one of his dried plants remains here, the scene of all his labours, and the repository of his drawings and MSS.) and that though Roxburgh's definitions herein given may now-a-days be insufficient, they *must* be more sufficient than mere MSS. names, which appear fully entitled to the appellation—trivial.

Observing that the MSS. names of Flowering plants of the Herbarium Indicum have been adopted by Dr. Steudel in the new edition of the Nomenclator Botanicus, I am induced to remark, that benefit would accrue to science if those names only were adopted to which

* Vittaria parasitica, R. appears as Lindsæa parasitica, R.
Trichomanes campanulatum, R. —— as Hymenophyllum campanulatum, R.
Polypodium flagelliferum, R. —— as Aspidium flagelliferum, R.

† Adiantum proliferum, R. must supersede Adiantum flagelliferum, Wall.
Pteris amplexicaulis, R. —————— Pteris amplectens, Wall.
Lycopodium furcatum, R. —————— Lycopodium atroviride, Wall.
—————— mimosoides, R. —————— —————— elegans, Wall.
Cyathea pinnata, R. —————— Cyathea Brunonis, Wall.
Davallia angustifolia, R. —————— Davallia angustata, Wall.
—————— multiflora, R. —————— —————— parallela, Wall.
Polypodium cuspidatum, R. —————— Polypodium urophyllum, Wall.
—————— coriaceum, R. —————— —————— sphærocephalum, Wall.
Aspidium scariosum, R. —————— Aspidium affine, Wall.
Asplenium coriaceum, R. —————— Asplenium Finlaysonianum, Wall.

Also by the same *usual* courtesy shewn in adopting the specific names of Roxburgh when he had referred the plants to a genus to which they are not considered now to belong.

Grammitis macrophylla, Wall. should be Grammitis reticulata, R.
Cheilanthes dealbata, Wall. —————— Cheilanthes discolor, R.
Aspidium Singaporianum, Wall. —————— Aspidium Phyllitidis, R.

Consequent on the above.

Lomaria acrostichoides, Hamilton, should supersede Lomaria aurea, Wall.
Cheilanthes tenuifolia, Hamilton, —————— Cheilanthes micrantha, Wall.
Polypodium spissum, Hamilton, —————— Polypodium vittariodies, Wall.

there is some clue traceable by all Botanists; that is, to which a distinct reference either of a plate, printed character, or description can be given. Such references as Wall., Wall. Cat., Wall. in Herb., are altogether insufficient: they are moreover superfluous, for copies of the Catalogue of the Herbarium Indicum were given to those who received specimens, who could be the only ones benefited by names without characters.

The system (for such it is) of adopting names of any sorts, whenever there is no evidence of their having been examined and defined, appears to me decidedly mischievous. Its constant tendency has been to overburden Synonymy; to make useless references, whereas Synonymy should comprehend those references only that are useful in a positive sense; to weaken the great claim of priority, dates in Herbaria and MSS. being capable of much greater inexactness than dates in a printed book: it may make Botanists lazy, confident and hasty in giving names; now naming ought to be the last step of investigation.

Lastly, all the advantages said to be inherent in MSS. names can be gained by the use of numbers, and respect be shewn to science at the same time.

The disadvantages to science attendant on these MSS. names are known by experience to be sufficient to recommend their being disused;* but if it can be shewn that they have been given or brought forward when the same plants, previously named, have been in the same Institution with the writer of the MSS. names, with descriptions or definitions, or both, or with drawings methodically referred to, or references to a methodised Catalogue, then the supercession of the MSS. names becomes a matter of justice. These remarks, will apply, I believe, to some extent to the Plants of Dr. Buchanan Hamilton, as for instance Sioja, Jilia,† Gurua; and there are a good many other genera in his Catalogue of dried plants presented to the Museum of the Hon'ble E. I. Company, (which only contains 2599 species,) of which up to this time I have not been able to find any account.

The only instances in which any notice should be taken of MSS. names, are those of the exactness of which the name of the Botanist is a guarantee. But somehow or other, among such authors, MSS. names are comparatively unknown; a name to be exact, presumes

* "MSS. names are in all cases liable to create confusion, and it is therefore much to be desired, that the practice of using them should be avoided in future." —Report, 1842, on Zoological Nomenclature, British Association.

† Jilia begonioides Ham. MSS. not Begonioides Jila as represented in the Flora Indica, ed. Carey. 2. 324.

proper examination of the object named, and its diligent comparison with all others allied to it; definition is the abridged summing up of the examination, and is so essential, that its systematic omission should not be tolerated.

CRYPTOGAMIA MISCELLANEA.

1. EQUISETUM.

Fructifications terminal, peltate, of many valves, bursting on the inside, verticillate on ovate-oblong spikes. (Stem and branches composed of tubes inserted into each other at the joints.)

E. debile. R. Icon. Roxb. Suppt. 5. t. 3. Wall. Cat. 13, No. 397.

Stems smoothly fluted, weak. Branches opposite, simple. Spikes terminal; of the stems often tern; of the branches single.

Nat. of swampy thickets in *Bengal.* Flowers during the rains.

Root perennial, creeping under the surface of the ground.

Stems numerous, about as thick as a stout crow-quill, length from 3 to 4, or even more feet, and then so weak as to require support, slightly marked with from ten to fifteen smooth grooves and elevations. *Joints* from 2 to 3 inches long, their mouths ending in as many ensiform scariose teeth as there are flutings on the outside. *Branches* simple, generally two at each joint, though sometimes one or three, slender: from 6 to 18 inches long, and with about half the number of flutings there are in the stems.

Spikes terminal, subcylindric, the largest which terminate the stems, about an inch long; from its base two smaller diverge in opposite directions. Those of the branches smaller, and always single.

Fructifications pedicelled, peltate, 5-6 celled, from 6 to 10 in a verticil; and about as many verticils compose the spike. *Pollen* or *seed* pale blue, composed of spiral threads, which are in constant motion when observed at a proper age; when examined earlier, they appear to be simple, minute, round, green grains, without motion.

2. MARSILEA. *Lemma, Jussieu.*

Involucre, or *receptacle* oval, shut, (transversely) many-celled; cells with anthers and pistils, which ripen into single seeds.

1. *M. quadrifolia. Linn. Spec.* 1563. Icon. Roxb. 14, t. 80.

Creeping. Leaves quatern; leaflets of the barren shoots very long-petioled, broad-obovate, large and entire, of the fertile small, and truncate-dentate. Capsules short-pedicelled, subreniform, one or two-toothed at the base.

Teling. Chick-linta-kura.

Beng. Shooshnie-shak, who eat the leaves in their curries, &c.

Common on the borders of fresh water lakes, &c. over *India,* where it fructifies during the cold season. The long-pedicelled, oval capsules of Burman's *M. coromandeliana, Flor. Ind.* t. 62. f. 3, indicate a different plant, yet I never could find any other, though long and diligently looked for.

3. SALVINIA.

MALE.

FEMALE.—*Capsules* among the roots, 1-celled, many-seeded.

1. *S. verticillata. R.*

Floating. Leaves opposite at the joints, petioled, oval, flat, verrucose. *Capsule* from the under-side between the insertion of the leaves, pedicelled, surrounded with a verticil of long, hairy roots. Seeds numerous on a free central receptacle.

Beng. Ulki-pana.

2. *S. cucullata. R.* Wall. Cat. 13, No. 399.

Ramous. Floating. Leaves opposite, subsessile, cowl-shaped, erect with an opening on the inside.

Beng. Indurni-pana.

3. *S. imbricata. R.**

Floating, ramous, winding. Leaves sessile, alternate, bifarious, imbricated, trapeziform, fleshy. Capsules covered by imbricated scales, between the roots, on the under-side of the plant.

All three are found floating on lakes, or pools of sweet water, throughout *Bengal*, during the rainy season.

4. ISOETES.

Anthers of the male flower within the base of the inner leaves. *Capsules* of the female flower 1 or 2-celled, within the base of the exterior leaves.

1. *I. capsularis. R.* Icon. Roxb. 14, t. 81.

Capsules peduncled, 1-celled. Leaves linear, flat.

This plant grows in deep standing sweet water, with *Valisneria spiralis*, &c.

Stoles creeping, jointed, tufts of filiform roots descend from each joint, and from 4 to 12 leaves ascend; they are like those of *Valisneria spiralis*, very delicate, 2-3 feet long, a quarter of an inch broad, and slightly serrated near the apex. From the alæ of the leaves arise several diaphanous, cordate capsules standing on short peduncles; they consist of 1-cell, formed of two valves, opening from the apex, the seeds are numerous connected to a conical receptaculum in the centre.

I have not seen the male flowers.

2. *I. coromandeliana. Linn. Suppl.* 447. Icon. Roxb. 14, t. 82.

Capsules sessile within the enlarged base of the leaves, 1-celled. Leaves filiform, erect, semi-columnar.

* Azolla?—W. G.

A native of wet marshy places up amongst the Circar mountains, where it appears during the rainy season.

Root consists of a numerous tuft of small capillary filaments issuing from the base of the head, which is composed of the enlarged bases of the leaves forming an imbricated bulb. *Leaves* radical, erect, filiform, half columnar, about 6-8 inches long, smooth, inwardly interrupted every $\frac{1}{4}$ or $\frac{1}{6}$ of an inch, yet the leaf is not visibly contracted, nor does it appear jointed.

Capsules oval, concave on the inner side and convex on the outer, conforming to the enlarged base of the leaves which cover them, 1-celled.

Seeds numerous, like very fine sand.

I have not seen the male flowers.*

5. LYCOPODIUM.

Capsules in the axils of the scales, digested into oblong imbricate spikes, or of the leaves themselves; kidney-shaped, 2-valved, many-seeded.

1. *L. Phlegmaria. Dill. musc. t. 6s. f.* 5. Icon. Roxb. 14, t. 84.

Perennial, parasitic, pendulous. Leaves numerous, ovate-lanceolate. Spikes terminal, dichotomous, or simple.

Beng. Shitahar.

Tama ponel patsia maravara. *Rheed. Mal.* 12, *t.* 14.

Equisetum amboinicum. *Rumph. Amb.* 6, *t.* 41, *f.* 1.

Found in the *Sunderbunds*, on old trunks of trees, in flower during the rains.

Root perennial, fibrous.

* A third supposed species represented in his Drawings, vol. 14, t. 83, under the name *I. tuberosa*, Roxburgh afterwards considered, I believe correctly, to be probably a *Scirpus*, its description is therefore omitted.—W. G.

Stems numerous, succulent, pendulous, 2-3-forked, round, from 6 to 10 furrowed, the leaves being inserted on their corresponding ridges; about 18 inches long, and towards the base as thick as a common rattan.

Leaves very numerous, horizontal, subsessile, not verticilled but in from 6 to 10 rows; their short petioles have a half twist, which brings their edges in the situation of the upper and under surface of the leaves of most plants, so that in looking down from the top, they resemble so many radii; their shape is ovate-lanceolate, very acute, smooth, entire, veinless, of a firm rigid texture.

Spikes terminal, numerous, about 2 inches long, cylindric, simple, or 2-forked, imbricated with numerous, oval, sessile, appressed bractes, or floral leaves.

Fructification, a reniform, apparently sessile, (I say apparently, because there is a pedicel corresponding in length to the depth of the concavity of the capsule,) 2-valved, capsule in the axil of each bracte, they open spontaneously round the convex margins, and discharge much very fine cream-coloured dust, like seed or pollen. I could see no other kind of flowers.

Rheede's figure Tana-ponel-poatsia Maravara, vol. 12. *p.* 27, *t.* 14, differs from my plant, in the number of the rows of leaves, and in the spikes being much longer, yet I have no doubt of their being the same.

2. *L. cernuum. Dill. musc. t.* 63. *f.* 10.

Shrubby, very ramous. Leaves numerous, subulate, incurved. Spikes short, cylindric.

Bellan-patsja. *Rheed. Mal.* 12 *t.* 39.

Cingulum-terræ. *Rumph. Amb.* 6, *t.* 40, *f.* 1.

Nat. of various parts of *India*. Is terrestrial.

3. *L. pendulum. R.*

Parasitic, shrubby (1-2 feet long,) pendulous, dichotomous. Leaves generally tern, imbricated, appressed, channelled, lanceolate, rigid, entire, smooth. Spikes terminal, very long, and scarce distinguishable from the barren parts.

Nat. of *Amboyna.*

4. *L. filiforme. R.* L. Phlegmaria Linn. Wall. Cat. p. 62, No. 133.

Parasitic, drooping, (1-2 feet long.) Leaves tending to be tern, triangulari-cordate, acute, smooth, and entire. Spikes filiform, numerous, dichotomous, and often as long as the rest of the plant, scales thereof opposite, ovate, scarcely longer than the capsules.

Nat. of *Sumatra.*

Dillenius has no figure any thing like it.

5. *L. rotundifolium. R.* Wall. Cat. 65, No. 2183.

Parasitic, drooping, (2-3 feet long.) Leaves approximate, opposite, sessile, round-oval, entire, smooth. Spikes filiform, dichotomous, scales thereof approximate, opposite, ovate, length of the capsules.

Nat. of *Sumatra,* and a most beautiful species it is.

6. *Lycopodium aristatum. R.*

Patent, (1-3 inches long,) dichotomous. Leaves as well as the superficial scales alternate, bifarious, ovate-falcate; membrane margined, apex ending in a bristle or arista.

From *China* this pretty little species was brought to the Botanic Garden at *Calcutta* in 1812, where it grows freely in a rich, shaded, moist soil. It resembles most *Dillenius's figure, t.* 66, *f.* 7.

7. *L. mimosoides. R.* L. elegans. Wall. Cat. No. 62, 128. (quod nomen delendum.)

Suffruticose, oblique; branches alternate, bifarious with alternate bifarious branchlets, (exactly like the pinnæ of a fine-leaved *mimosa.*) Leaves alternate, bifarious, sessile, expanding, falcate, somewhat acute, smooth, entire ; superficial scales (stipules,) semiovate mucronate. Spikes short, imbricated 4-ways ; scales long, cordate, acute.

Nat. of the *Moluccas.*

8. *L. lævigatum, Lamarck. Encyclop.* 3, 652. Wall. Cat. 65, No. 2185.

Somewhat suffruticose, leaning, and emitting roots, (12 inches high,) branches and branchlets alternate, bifarious. Leaves alternate, sessile, bifarious, expanding, falcate, smooth, superficial scales (stipules) obliquely-oblong, smooth, cuspidate. Spikes short, imbricated four ways : scales cordate, cuspidate, margined, twice the length of the round-reniform capsules.

Muscus fruticescens. *Rumph. Amb.* 6, *t.* 39, *f.* 2.

Nat. of the *Malay Islands.*

9. *L. pectinatum. Lamarck. Encyclop.* 3, 651. L. semicordatum, Wall. Cat. 62, No. 126 ?

By far the greatest part of the plant erect. Branches bifarious, alternate, dichotomous. Leaves alternate, bifarious, expanded, falcate, obtuse, smooth ; posterior lobes protruded ; superficial scales subelliptic, mucronate. Spikes short, imbricated four ways ; scales thereof reniform-cordate, acute, and longer than the reniform-capsules.

Nat. of the *Malay Islands.*

10. *L. plumosum. Dill. musc. t.* 66, *f.* 10. L. atroviride. Wall. Cat. 62, No. 120 ?

Creeping, branches oblique, dichotomous. Leaves alternate, bifarious, expanded, oblong, obtuse ; posterior lobes stem-clasping and ciliate ; superficial scales subovate, ciliate, and awned. Spikes imbricated four ways, with taper-cordate, ciliate, acute scales, twice longer than the cordate capsules.

Nat. of various parts of *India.* In *Bengal* it is found on rotten wood.

11. *L. furcatum. R.* L. atroviride. Wall. Cat. 62, No. 120, (quòd nomen delendum.)

Perennial, scandent, dichotomous; with long, simple roots from the forks. Leaves bifarious, spreading, oblong, falcate; anterior lobe large, and stem-clasping; superficial scales oval, and mucronate. Spikes solitary, or in pairs, imbricated with four rows of cordate scales, which are greatly longer than the round cordate capsules.

Nat. of *Pullo-Pinang.*

12. *L. imbricatum, R.*

Creeping, (2-3 inches long,) dichotomous, very ramous. Leaves alternate, imbricated, bifarious, falcate-cordate, smooth; superficial scales of the same shape, but small and cuspidate.

Hatha-joori of the Hindu M. M.

Found by H. Colebrooke Esq. amongst stones, in moist, cool shaded places, over *Behar.*

CRYPTOGAMIA FILICES.

6. OPHIOGLOSSUM.*

Spikes distichous. *Capsules* (or cells) opening transversely, without an elastic ring. *Seeds* numerous.

1. *O. cordifolium. R.* Icon. Roxb. 14, t. 85.

Fronds simple, ovate, and ovate-cordate, veinless, bearing the spike, surmounted on a scape greatly longer than the leaf.

Beng. Danga-ghechu, or Ekteera.

Ophioglossum simplex. *Rumph. Amb.* 6, *t.* 68, *f.* 2.

* All the species but the first will now be referred to Lygodium, Swartz.—W. G.

Nat. of *Bengal, Moluccas,* &c. in cool shaded places, where it appears, and fructifies during the rainy season.

Root fibrous.

Stems or rather stipes few, compressed, erect, smooth, 2 or 3 inches long.

Fronds cordate, entire, waved, a little rugose, nerveless, but with many small, not very conspicuous, reticulated veins; smooth on both sides; about two inches long, and one and a half broad.

Scape erect, issuing from the upper part of the stipe, (petiole,) on the foreside; simple, a little compressed, smooth, from 3 to 6 inches long.

Spikes simple, distichous, not jointed, except the openings of the cells can be so called; tapering a little, fine pointed.

Cells numerous, arranged along the margins of the spikes, opening transversely near the base.

Seeds most numerous, globular, white.

I have, in luxuriant plants, found the stem divided into two towards the top, with a leaf and spike to each division.

Ophioglossum simplex. *Rumph. Herb. Amb. tab.* 68, *f.* 2, appears more like *O. vulgatum*, than the above described plant.

2. *O. filiforme. R.* Icon. Roxb. 14, t. 86. Lygodium microphyllum, Br.

Perennial, scandent, filiform, smooth. Fronds conjugate-pinnate: leaflets subcordate, with the spikelets of the fructifications on their anterior margins.

Tsjeria valli-panna. *Rheed. Mal.* 12, *t.* 34.

Adiantum volubile minus. *Rumph. Amb.* 6, *t.* 32, *f.* 3. Hydroglossum scandens, Willd. 5, 77.

Nat. of various parts of India, time of fructifying the rainy season.

Root running under the surface of the ground, towards the apex olive, while the older parts are of dark rust colour, and villous, about as thick as a goose-quill, from these descend many ramous, dark çoloured fibres.

Stems issue from the large creeping roots, alternate, scandent, filiform, flexuous, smooth; their general length from 2 to 3 feet, and very slender.

Fronds alternate, conjugate on a very short common petiole.

Pinnæ 2-3 inches long, composed of about four pair of alternate, petiolated, subcordate, smooth leaflets. The fertile ones are deeply cut into linear segments or spikelets; on the under side of which the fructifications are lodged, in the same manner as in *O. scandens.*

3. *O. scandens.* *Linn. spec. pl.* 1518. Lygodium semibipinnatum, Br. Wall. Cat. 63, No. 175.

Perennial, scandent. Fronds conjugate-pinnate: leaflets linear, bearing the spikelets on the whole of the margin.

Tsjura-valli-panna. *Rheed. Mal.* 12, *t.* 33. Hydroglossum pinnatifidum, Willd. 5. 80.

Nat. of the *Malay Islands, Chittagong, Malabar,* &c. Is common in most parts of *India.* Flowering time the rainy and cold season.

Root perennial.

Stipes scandent, or twining, and of considerable extent, several yards often; about as thick as a pack thread, and smooth.

Fronds paired on common, alternate petioles; compound and decompound; *leaflets* or lobes thereof tapering from the base.

Spikelets on the margins of the leaflets, resembling deep serratures; they are imbricated with two rows of scales, each enclosing a single, ovate, sessile, 1-celled capsule, containing innumerable, minute, yellow seeds.

4. *O. flexuosum.* *Linn. spec. pl.* 1519.

Perennial, scandent. Fronds conjugate-pinnate, rarely bipinnate, the barren generally palmate; leaflets subensiform, (long and narrow,) bearing spikes on both sides.

Beng. Bhootraj.

Valli-panna. *Rheed. Mal.* 12, *t.* 32. *bad.*

5. *O. furcatum. R.*

Scandent. Fronds dichotomous, ultimate divisions linear, very long, finely pinnatifid, with numerous minute spikelets.

Nat. of *Pullo Pinang.*

7. OSMUNDA.

Capsules subglobose, disposed on a spike, or back of the fronds, 2-valved, 1-celled, opening transversely, without an elastic ring.

1. *O. zeylanica. Linn. sp. pl.* 1519. Icon. Roxb. 14, *t.* 88.*

Fructifications disposed on a single, subcylindrial, cauline spike, composed of several spherical, 2-valved folliculi, lodged under the lacerated segments of peltate receptacles; opening on the outside, near the base, and emitting numerous minute grains. Fronds pinnate-pedate; divisions lanceolate, waved.

Beng. Ekbeera.

Ophioglossum laciniatum. *Rumph. Amb.* 6, *t.* 68, *f.* 3.

Root, a creeping larger shoot, with thick fibres, which every year pushes forth one new frond from the apex, while a portion decays at the other end.

Stipe 6-8 inches long, erect, nearly round, and smooth.

Frond solitary, pedate. *Leaflets* thereof lanceolate, with their margins much waved, and irregularly scalloped; smooth on both sides; veins numerous, very fine, expanding; length from 4 to 6 inches.

Spike from the apex of the stipe where the three first divisions of the frond are inserted. *Scape* rather shorter than the stipe, *(spike)* subcylindric, about one-third the length of the scape, closely covered with the fructifications.

Fructifications generally from 4 to 6; minute, spherical bodies, closely surround a small, short, sessile raggedly

* Helminthostachys dulcis.—W. G.

peltate receptacle, which unites them to the common axis, or rachis.

Nat. of *Amboyna* and *Bengal.* Fructifies during the rains in the Botanic Garden at *Calcutta.*

2. *O. lanceolata. R.* Icon. Roxb. 14, t. 89.*

Scapes radical, naked, cylindric. Fronds simple, lanceolate, waved, and scalloped.

8. ACROSTICHUM.

Fructifications occupying almost the whole of the under surface of the fronds, without any other involucre than little scales, or hairs interspersed amongst the capsules, which are girt with an elastic ring.

1. *Acrostichum ramentaceum. R.*

Petioles of the barren leaves short, (2-3 inches,) and shaggy; of the fertile long, (10-15 inches,) and smooth; barren leaves linear-cordate; fertile cordate-sagittate; all have entire margins.

Nat. of *Chittagong*, and grows in the earth. Intermixed amongst the numerous crowded capsules, are many pretty long brown filaments.

2. *A. heterophyllum. Linn. spec.* 1523.

Parasitic, creeping. Fronds entire, both sides clothed with minute stellate pubescence; the barren oblong, the fertile cylindric. Fructifications of single, pedicelled capsules, mixed amongst much, soft, short, downy pubescence.

Maretta-mala-maravara. *Rheed. Mal.* 12, *t.* 39.

Nat. of the *Malay Islands, Sunderbunds,* &c.

3. *A. radiatum. Kœn. MSS.* Roxb. Icon. 14, t. 90. Asplenium radiatum. Sw. Wall. Cat. p. 63. No. 197.

Fronds long-stiped, pinnatifid in a semicircle, (fan-shaped,) rays more or less divided, with truncate, ragged extremities. Petioles 3-sided and grooved.

A. australe. Vahls. symbolæ. 1, *t.* 25.

* Appears to be a species of Acrostichum.—W. G.

Nat. of the mountains of *Coromandel*, growing in clefts of rocks. The whole height rarely exceeds 6 inches.

4. *A. semipinnatum. R.*

Fronds (2 feet high,) with about two distinct, subopposite pairs of pinnæ, and a deeply, 2 or 3-lobed terminal one; they are broad-lanceolate, with uneven margins, and smooth on the upper surface.

Nat. of the *Malay Islands*.

5. *A. emarginatum. Buch.* Icon. Roxb. 14, t. 91.*

Stipes smooth, green, with a few remote thorny points. Fronds pinnate; leaflets alternate, linear, smooth, entire, emarginate, fertile and barren alike.

Nat. of the *Delta of the Ganges*. Fructifies in the rainy season.

Roots fibrous, issuing from a firm, subrotund head, even with the earth, round which the stipes are attached.

Stipes in bundles, straight, smooth, polished, green, with remote thorny points on the margins of the furrow, which runs up the forepart; length about one, or one and a half foot.

Fronds pinnate, from 2 to 4 feet long, *leaflets* generally alternate, about 12 or 14 on each side, short-petioled, linear, entire, smooth, emarginate, *fertile* leaflets like the abortive, and are the most exterior; general length about 6 inches, and about 1 broad.

6. *A. alatum. R.*

Fronds pinnate, (12 inches high,) the barren pinnæ alternate, linear, crenate, smooth, truncated at the base, and there enlarged at the upper angle; fertile pinnæ very minute, linear-oblong, on distinct stipes which are rather longer than those of the barren fronds.

Nat. of the *Malay Islands*.

7. *A. seetacoonense. R.*

Fronds (18 inches high,) suboppositely pinnate; barren leaflets linear-oblong, base truncate, margins crenate-

* Very like Acrostichum aureum.—W. G.

serrate, smooth; fertile alternate, slender, cylindric. Spikes on longer and more delicate stipes.

Nat. of *Chittagong*, near the burning wells at *Seetacoond.*

9. POLYPODIUM.

Fructifications in roundish, scattered, not marginal spots, (generally) with a peltate *involucre*, separating round the edges. *Capsules* girt with an elastic ring.

Section I.—*With simple leaves.*

1. *P. coriaceum. R.* Icon. Roxb. 14, t. 92. P. sphæroce-phalum. Wall. Cat. p. 64, No. 272, (quod nomen delendum.)

Parasitic, creeping to a great extent. Fronds undivided, linear-lanceolate, thick and very firm; above polished, underneath hoary, with stellate down. Fructifications solitary, (that is in one longitudinal row of large, rather remote, naked spots, on each side, equally distant from the nerve and margin.)

Nat. of the *Malay Islands* and *Pullo Pinang*, whence introduced into this Garden by Mr. W. Roxburgh, Jun.

Parasitic, *stems* creeping amongst moss on trees, and putrid wood; round, winding, as thick as a crow-quill, imbricated with numerous, oblong, brownish black, smooth scales; while young and tender, these end in long, slender, tapering, soft, membranous tails.

Stipes triangular, channelled on the upper side, polished; from three to six inches long.

Fronds linear-lanceolate, most entire, from six to eighteen inches long, of a remarkable firm thick texture, polished on the upper surface; underneath hoary with soft stellate down.

Fructifications in a single row, of large, rather remote spots on each side, and about equally distant from the nerve and margin; though when the fronds grow old their margins become revolute, and appear almost to touch the spots.

Involucre none. While the fronds are young, the spots are clothed with the same stellate down which clothes the frond underneath.

2. *P. attenuatum. R.*

Parasitic, creeping, stipes alternate, smooth. Fronds linear lanceolate, rather obtuse, much attenuated at the base, both sides smooth. Fructifications solitary, very large.

Nat. of *Pullo Pinang.*

3. *P. glabrum. R.* Icon. Roxb. 14, t. 93. Wall. Cat. p. 10, No. 281.

Parasitical, rooting. Fronds subsessile, linear-lanceolar, from premorse to acute, smooth, and fleshy. Fructifications scattered in numerous dots, below the apex of the frond. Involucres obscure.

Beng. Chitteea-borah.

Nat. of *Bengal.* Found near *Calcutta* on the trunks of large old trees, &c. where there is much shade and humidity.

Root perennial, creeping, with many ramous dark coloured fibres, generally covered with moss, bending in various directions, rough with umbilicated tuberosities, (the remaining sites of the fallen leaves,) otherwise the surface, when cleaned of earth, &c. is smooth, and of an olive colour.

Fronds numerous, erect, sub-sessile, simple, lanceolate, entire, veinless, fleshy, very smooth on both sides; from 12 to 24 inches long, and from 2 to 3 broad, fertile and barren fronds alike.

Fructifications in minute dots, irregularly scattered over the upper third or half of the frond.

Capsules numerous, kidney-shaped, with an elevated, crenulated, brown band round the convex side of the transparent integument; each contains some minute grains, of a most beautiful bright shining gold colour.

4. *P. phyllitidis.* Aspidiun Singaporianm, Wall. Cat. P. 64, No. 374?

Stipes scaly near the base. Fronds (6-12 inches,) lanceolate; entire, smooth. Fructifications in numerous scattered spots. Involucres obscure.

Nat. of *Chittagong.*

5. *P. pertusum. R.* Icon. Roxb. 14, t. 94.* Wall. Cat. p. 10, No. 267.

Parasitic, creeping. Fronds lanceolar, fleshy, entire, acuminate; above smooth; underneath covered with minute scales. Fructifications lodged in deep pits, and so numerous over the upper half of the fronds, as often to render that part subcylindric. Involucre none.

A native of the *Delta of the Ganges,* where it surrounds the trunks of trees with its brown woolly roots, interwoven with various kinds of moss, &c.

Stems about as thick as a pack-thread, covered with dark, rust coloured scales.

Stipes round, channelled, covered with minute stellate scales.

Fronds lanceolate, fleshy, veinless; above smooth; underneath covered with minute stellate scales like the stipes. The fertile are in general narrower towards the point, with their margins involute, so as to appear like subcylindric spikes.

Fructifications in deep pits over the exterior portions of the fronds.

6. *P. tomentosum, R.* Icon. Roxb. 14, t. 95.† P. mysurense Heyne.? Wall. Cat. p. 64, No. 269.

Parasitic. Fronds lanceolate, entire, acuminate; downy underneath. Fructifications over the centre, and nearly hid by the thick, soft, stellate down.

Nat. of *Hindoostan,* on trunks of trees.

* Niphobolus.—W. G. † Niphobolus.—W. G.

Root ramous, creeping amongst moss, &c.

Stipes from 2 to 3 inches long, clothed with soft, stellate, white down.

Fronds all lanceolate, entire, long fine-pointed, upper surface pretty smooth, but like the stipe the underside is clothed with soft, stellate down; length about 6 inches.

Fructification in numerous, large dots, over the centre of the back of the fronds and nearly hid by the thick, soft, stellate down, already mentioned.

7. *P. phymatodes. Linn. Mant.* 306.

Stipes smooth; fronds from simple to being divided into as far as five, or more, linear-lanceolate lobes. Fructifications scattered, large, and very conspicuous on the upper surface. Involucre none found.

P. scolopendria. Burm. Flor. Ind. 232.

Polypodium, &c. *Burm. Zeyl.* 196, *t.* 86.

Nat. of various parts of *India.*

8. *P. quercifolium.* Icon. Roxb. 14, t. 96.

Parasitic; barren fronds sessile, ovate-cordate, slightly pinnatifid; fertile ones long-stiped, and deeply divided into long sublinear segments. Fructifications scattered in numerous minute spots over the whole of the back of the leaves.

Pannæ-kelengo-maravara. *Rheed. Mal.* 12. *t.* 11.

Polypodium Indicum majus. *Rumph. Amb.* 6. *t.* 36.

Beng. Goroor.

Nat. of various parts of *India.* Is a large species, grows on trees, with slowly creeping, broad, thick, fleshy, scaly-tomentose shoots.

Root creeping, short, fleshy, covered with a thick coat of long, filiform, downy, scales.

Fronds of two sorts; viz. barren and fertile. *Barren* sessile, cordate sinuate, smooth, except for numerous beautifully reticulated veins. *Fertile* stand upon pretty long, half-round, smooth somewhat winged petioles, they are deeply pinnatifid; *pinnæ* alternate, tapering, smooth, entire.

Fructification in numerous dots over the back of the pinnæ.

Capsules most numerous, each supported on a long slender pedicel, subglobular, 4-5ths girt with a necklace-like elastic ring, 1-celled, 1-valved.

Seeds most numerous, of a bright shining gold colour.

9. *P. excavatum. R.* Icon. Roxb. 14, t. 97.

Fronds all long-stiped, from simple to deeply pinnatifid; laciniæ lanceolate, acute. Fructifications solitary, in two rows of very large, naked spots, lodged in deep concavities.

Polypodium Indicum glabrum. *Rumph. Amb.* 6. *t.* 35. *f.* 2.

Nat. of the *Moluccas.* Introduced into the Botanic Garden in 1798, where it fructifies during the rains.*

Root creeping horizontally under the surface of the earth, about as thick as a stout rattan, with numerous, filiform, ramous, hard fibres issuing from them, and penetrating deep into the ground.

Stipes straight, smooth, round, from 6 to 12 inches long.

Fronds barren and fertile alike, oblong, pinnatifid; very smooth on both sides; from 12 to 18 inches long. *Laciniæ* ensiform or tongue-shaped, sometimes obtuse, sometimes pointed; sinuses rounded, margins most entire.

Fructifications in only two rows of naked, equally distant between the nerve and margin, distinct, rather remote, very large, round spots, lodged in deep hollows; which are equally conspicuous on the upper surface of the frond as on the under.

Involucre none.

Capsules pedicelled, 2-valved, girt, with a jointed elastic ring.

It has much the appearance of *Polypodium quercifolium*, but differs from it in many respects. The most obvious are,

* Common on Walls, Malacca.—W. G.

1st. Here the root runs under ground, whereas *P. quercifolium* is parasitical, thick, fleshy, densely clothed with brown fibres.

2nd. Here the fronds are all stiped, and deeply pinnatifid, with only two rows of large naked fructifications on each pinnule. In the other, the barren fronds are sessile, and the fructification consists of numerous small dots scattered over the segments of the fertile fronds.

10. *P. semipinnatum. R.*

Stipes smooth; fronds smooth, composed of one or two distinct, remote pair of broad, variously-shaped segments below; and a large terminal, 3-lobed one. Fructifications in numerous, approximate, distinct spots, over the whole disk. Involucre obscure.

Nat. of the *Malay Islands.* Is very like my *Acrostichum semipinnatum.*

Section II.—*With compound leaves.*

Polypodium lucidum. R. Icon. Roxb. Suppl. 5, t. 2.

Fronds pinnate: stipes smooth, leaflets subalternate, sessile, linear-lanceolate, entire, smooth. Fructifications in a single line, of large, remote spots, on each side, half-way between the margin and nerve.

A native of *Nepaul,* from thence introduced into the Botanic Garden at *Calcutta,* by Dr. Buchanan in 1802; general height of the whole plant from 18 inches to 2 feet. Fructifies during the rains.*

Shoots creeping, thick, and fleshy, pretty smooth, colour a deep green.

Fronds few, alternate, nearly erect, oval, from 1 to 2 feet long, stipe included; pinnate. *Leaflets* opposite, and alternate, sessile, narrow-lanceolate, with oblique tapering base, entire, smooth, and shining; of a thin but firm tex-

* Khassia Hills, common.—W. G.

ture: the terminal one often bifid, or trifid, and those next to it more or less decurrent; general length from 4 to 6 inches.

Stipes from 6 to 12 inches long, round, and smooth.

Fructification in a single line, of remote, large, round spots, half-way between the margin and rib.

Involucre not discovered.

11. *P. flagelliferum. R.* Icon. Roxb. 14, t. 99. Aspidium flagelliferum. R. Wall. Cat. p. 67, No. 2234.

Shoots creeping under ground, stipes hairy; fronds subalternately pinnate, proliferous at top; leaflets broad, ensiform, crenate, and crenulate, smooth. Fructifications in one row, on each side, half-way between the nerve and margin. Involucre reniform.

Nat. of *Bengal.* Fructifying time the rainy season.

Root fibrous, and from the base of the stipes, where they unite, spring many, very long, slender runners.

Stipes a little woolly, particularly while young, and near the base, dark chesnut colour, furrowed on the anterior side; whole length, frond included, from 2 to 3 feet.

Fronds pinnate, terminating in an incurved, somewhat gemma-like knob, which strikes root, and produces other plants where it rests on the ground.

Pinnæ alternate, sessile, ensiform, with enlarged bases, the lower pairs, (and they extend down to near the base of the stipe,) broader, shorter, and sterile, with their margins slightly serrate. The superior pairs fertile, longer, narrower, and crenulate; all are smooth on both sides.

Fructifications in a single row of distinct dots on each side of the nerve.

Involucrum reniform.

12. *P. ferrugineum. R.*

Stipes and nerves clothed with much brown, scaly pubescence; fronds (3-5 feet high,) alternately pinnate; leaflets ensiform, base truncate, with the upper angle thereof rather enlarged, the fertile crenulate. Fructifications large, in a line near the margin. Involucre round.

Nat. of *Amboyna.*

13. *P. rupestre. R.*

Petioles smooth; fronds pinnate, (3-4 feet high,) smooth; leaflets subalternate, narrow-lanceolar, scarcely crenate. Fructifications solitary, (forming a line on each side the nerve, of rather remote dots.) Involucre obscure.

Nat. of *Pinang*, on mossy shaded rocks of granite.

14. *P. radicans. Burm.* Aspidium auriculatum Sw. Wall. Cat. p. 67, No. 2233.

Scandent, and supported by tendrils or roots, from short, remote, scaly, frond-bearing shoots. Fronds pinnate; sterile leaflets oblong; fertile ensiform, with base truncate, and there enlarged on the upper angle; all are obtuse. Fructifications in a line near the margin. Involucre round-reniform.

P. radicans. Burm. Fl. Ind. 233. *t.* 66. *f.* 3. is not unlike the sterile frond, and was most likely intended for the same plant.

Nat. of the *Malay Islands*, &c.

15. *P. unitum. Burm.* Icon. Roxb. 14, t. 100.

Stipes smooth; fronds (2-3 feet high,) pinnate; leaflets barren and fertile alike, ensiform, serrate, villous underneath. Fructifications generally scattered, and nearer the margin than the nerve. Involucre ciliate.

Filix Zeylanica. *Burm. Zeyl.* 1. 44, *f.* 1.

I doubt if this is Desfontaine's *Barbary* plant. His description does not well accord with our *East Indian* species. Here our leaflets are not pinnatifid, but serrate, with a single line of distinct spots, a little removed from the margin. It is probably a *Davallia* or *Dicksonia.* Unfortunately I neglected examining the involucre when I had it in my power.

16. *P. sophoroides. Thunb. in Linn. Trans.* 2. 341.*

Fronds pinnate, a little hairy; leaflets ensiform, gashed-serrate, the lower pair of serratures longer; terminal one tapering to a fine serrated point. Fructifications sometimes in a single line of spots on each side of the nerve; sometimes they form a nearly continued line near the margins of the incisures.

Nat. of the *Moluccas*, &c. Fructifies during the rainy season.

17. *P. proliferum. R.* Icon. Roxb. 14, t. 101.

Fronds pinnate, drooping, and often ending in long creeping flagelli; leaflets opposite, and alternate, tapering from a truncated base, obtusely crenulate, smooth. Fructifications in lines parallel with the veins.

Beng. Depu.

Hind. Kull-ke-jaup.

Nat. of *Bengal*, and the more interior parts of *India*. Grows among brushwood, long grass, &c. in moist shady places about Calcutta; fructifies during the latter part of the rainy season.

Root creeping, flexuose, dark blackish rust colour, with many fibres of the same hue.

Stipe smooth, channelled, as thick as a quill; of various lengths according to soil, &c. the whole length of it and the fronds, including the tail, is often as much as 10-12 feet.

Fronds drooping, pinnate. Leaflets sessile, opposite, and alternate, sword-shaped, with an oblique cordate base; margins notched; notches lanceolate; both sides smooth, with numerous, beautiful, parallel, diverging veins, each ending in the apex of a notch; the largest are from 4 to 6 inches long, those of the tail small, often hastate or 3-lobed. *Tail* long, sarmentous.

Note.—In luxuriant plants the fronds are frequently ramous, that is here and there a similar frond growing from the axils of the leaflets.

* Aspidium Sophoroides, Hb. Roxb. Wall. Cat. p. 67 No. 2238?

Fructifications numerous, minute approximate in parallel lines, one on each side of the diverging veins; each dot composed of a number of minute, pedicelled globules, girt with their brown crenulated, elastic rings; there is a constant succession of them for a length of time.

Note.—It may be *P. unitum*, as it agrees better with the Linnean definition of that plant, and with the figures in *Burman's Thesaurus Zylanicus*, and *Sloane's History of Jamaica*, than with the definition of *P. parasiticum*, though the figure of that species in *Rheede's Hortus Malabaricus* agrees with this plant tolerably well, the tail of the fronds excepted.

18. *P. acuminatum. R.*

Fronds alternately pinnate, smooth, (3-6 feet high;) leaflets ensiform, cuspidate, with base truncate, serrate, serratures very small, but distinct towards the top. Fructifications in lines parallel with the veins. Involucre minute, and soon disappears.

19. *P. mucronatum. R.*

Fronds alternately pinnate; stipes somewhat hairy; pinnæ ensiform, acutely serrate, finely acuminate. Fructifications in numerous minute spots, arranged in lines between the veins; no involucre.

A native of *Silhet*. In the Botanic Garden, at *Calcutta*, it grows obliquely to the height of about 2 feet, and fructifies during the cold season. The texture of the leaves is hard, and glossy: the apex quite ensiform, the serratures of a middling size, and very acute.

20. *P. tenerum. R.*

Fronds alternately-pinnate; pinnæ linear-lanceolate, gash-serrate, acuminate. Fructification in a few spots on each side of the veins: involucre reniform.

A native of *Silhet*. In the Botanic Garden at *Calcutta*, it grows to the height of from 12 to 18 inches, is of a delicate soft texture, and somewhat villous.

21. *P. cuspidatum. R.* P. urophyllum. Wall. Cat. 64, No. 299, (quod nomen delendum.)

Fronds alternately pinnate, (3-6 feet high;) leaflets alternate (6-12 inches long,) linear-lanceolate, cuspidate, bluntly serrate, smooth; the whole nearly equal in size. Fructifications in lines parallel with the veins, and running their whole length. Involucres none visible.

Nat. of *Pinang*, under the shade of lofty trees.

22. *P. semisagittatum. R.*

Base of the stipes scaly; fronds (6-18 inches high,) sub-oppositely-pinnate; leaflets serrate, smooth, the superior ensiform; the lower small, and triangular. Fructifications in numerous dots, parallel with the nerve of the segments. Involucres round, with a fissure on one side.

Nat. of the *Delta of the Ganges, Chittagong*, &c.

23. *P. involucratum. R.*

Stipes smooth; fronds alternately pinnate; leaflets remote, petiolate, lanceolar, cuspidate, margins waved. Fructifications in numerous spots, over the whole disk. Involucres very large, round, entire, permanent.

Nat. of *Amboyna.*

24. *P. nudatum. R.*

Fronds alternately pinnate; leaflets rather remote, sessile, smooth, incurve-ensiform, fine taper-pointed, rounded at the base, margins very equally serrate, the terminal one larger, but not more deeply serrate than the rest. Fructifications in numerous minute dots, in lines parallel with the veins. Involucres none.

Nat. of *Amboyna.*

25. *P. scabrum. R.* Wall. Cat. 66, No. 2225.

Stipes scabrous, and hirsute; fronds (6-12-feet high,) alternately pinnate; leaflets linear, most long, smooth on both sides, gash-serrate, fine-entire-pointed. Fructifications in 2 lines, of numerous, round spots, close to the nerves of the serrature of the pinnæ. Involucre uncertain.

Nat. of the tops of the highest mountains of *Amboyna.*

It differs from all I have yet found, in having the fructifications close to the veins, (nerves of the serratures or segments.)

26. *P. parasiticum.* Aspidium parasiticum, Hb. Madras, Wall. Cat. 67, No. 2239?

Stipes sometimes pubescent; fronds lanceolate, (3-4-feet high,) pinnate; leaflets subalternate, ensiform, pinnatifid (to the middle,) apices fine, and entire; barren segments obtuse, entire, the lower pair larger. Fructifications in two rows, parallel with the nerves of the segments. Involucres round-reniform.

Nat. of various parts of *India.* The above definition is taken from *Molucca* plants.

27. *P. longifolium R.*

Fronds linear, (3-4 feet high,) pinnate leaflets; alternate, and opposite, ensiform, pinnatifid, apices rather obtuse; entire, and fertile throughout; segments entire, incurved, obtuse. Fructifications in two lines, of numerous spots, parallel with the nerves of the segments. Involucre round-reniform, uncommonly permanent.

Nat. of *Amboyna.*

28. *P. acutum. R.*

Stipes smooth, channelled; fronds (3-4 feet high,) lanceolate, a little hairy, sub-bipinnate; leaflets subalternate, linear-lanceolate, and ensiform, pinnatifid to near the base; most acute, segments linear, incurved, entire, rather obtuse. Fructifications in two lines, parallel with the nerves of the segments. Involucre round, 2-lobed.

Nat. of *Amboyna.*

Differs from *P. longifolium*, in the leaflets having exceeding acute, sterile apices; and in being more deeply pinnatifid.

29. *P. pilosum. R.*

Fronds (12-18 inches high,) hairy bipinnate at the base, middle pinnate, top pinnatifid, leaflets acute, their lobes obtuse, and from entire to serrate, or even gashed. Fructifications scattered, or in two lines, parallel with the nerves of the segment. Involucre round.

Nat. of *Chittagong*, near the *Burning Wells.*

30. *P. dichotomum.* *Thunb. Fl. Jap.* 338. *t.* 37. good.

Fronds dichotomous, about half the divisions of the rachis naked, smooth; leaflets pectinato-pinnatifid; segments separated to very near the base, linear, diverging, obtuse. Fructifications in two lines, of minute spots, on the segments of the pinnæ.

Acrostichum furcatum. *Linn. sp.* 1529.

Nat. of the *Molucca Islands.*

31. *P. furcatum. R.*

Scandent. Fronds dichotomous, all the divisions (of the rachis) furnished with diverging, linear, pectinato-pinnatifid segments.

Found in the forests of *Pullo Pinang*, running over fallen trees, &c. &c. to a great extent.

32. *P. multiflorum. R.*

Stipes smooth. Fronds (6-8 feet high,) suboppositely, and alternately bipinnate below, and bipinnatifid, and finally pinnatifid towards the top; leaflets remote, fertile fine pointed; segments thereof subensiform; the larger gashed, the smaller crenate. Fructifications numerous, scattered, (almost confluent.) Involucre uncertain.

Nat. of *Amboyna.*

33. *P. confertum. R.*

Stipes smooth, erect, (3-4 feet high,) fronds from bipinnate below, to bipinnatifid, and finally pinnatifid towards the top; leaflets rather remote, sublinear, fine-fertile-pointed; segments broad-ensiform, somewhat incurved, from gashed to obscurely crenate. Fructifications in numerous, large, crowded spots, covering the whole of the back of the frond.

Found by Mr. Roxburgh in *Chittagong*, under the shade of trees.

34. *P. confluens. R.*

Stipes scaly: fronds (1-2 feet high,) smooth, bipinnate at the base, becoming less compound to the obtuse pinnatifid apex; pinnæ tapering; segments thereof obtuse, linear, confluent, from entire to serrate, or even pinnatifid. Fructifications in two lines parallel with the nerves of the segments.

Nat. of *Chittagong.*

35. *P. squarrosum. R.*

Stipes to the top of the frond clothed with long, brown, ragged scales and hairs; fronds linear, alternately-bippinate, (2-3 feet high:) pinnæ linear; leaflets subtriangular, mucronate, and acutely jagged, particularly on the anterior margin. Fructifications few, and large, in two rows. Involucre peltate.

Found by Captain Hardwicke on the tops of the mountains between *Hurdwar* and *Sirinagur.*

36. *P. scariosum. R.*

Stipes clothed with scariose, scaly hairs to the top of the fronds (which are 3-5 feet high,) subalternately bipinnate: pinnæ sublanceolate; leaflets trapeziform, crenate-serrate, smooth. Fructifications scattered, numerous, large. Involucre obscure.

Nat. of *Amboyna.*

37. *P. impuber. R.*

Stipes smooth; fronds (5-6 feet high,) alternately bipinnate; pinnæ linear, ending in fine, serrated, barren points; leaflets oblong, obtuse, entire, smooth; on the lower half of the pinnæ distinct; on the exterior confluent. Fructifications in two lines, parallel with the nerve of the leaflets. Involucre obscure.

Nat. of *Amboyna;* an elegant, firm, polished species.

38. *P. affine. Forst. Flor. Austr. p.* 83.

Stipes with large scariose scales at the base; fronds (3-4 feet high,) alternately bipinnate; pinnæ tapering; leaflets linear-oblong, obtuse, smooth, to the middle pinnatifid.

Fructifications somewhat scattered, inserted amongst hairs, on elevated receptacles. Involucre obscure.

Nat. of *Amboyna.*

39. *P. elatum. R.*

Stipes smooth; fronds (many feet high,) alternately tri-pinnatifid; pinnæ linear, fine serrate; barren pointed, leaflets ensiform; fertile pointed, pinnatifid; segments thereof incurved, scarce serrulate, obtuse. Fructifications large, in a crowded line, near the margin of the segments. Involucre obscure.

Nat. of *Amboyna.*

40. *P. tridentatum. R.*

Stipes smooth. Fronds (of a delicate texture, 2-4 feet high,) alternately tri-pinnatifid; pinnæ linear, tapering to most fine, long, serrate points; leaflets of nearly the same form, and deeply pinnatifid; segments thereof linear, serrate, with dentate apices. Fructifications remote and small, in two rows of solitary spots near the base of each of the segments of the leaflets. Involucre obscure.

Nat. of the *Island of Banda;* an elegant, finely-divided plant, of a soft, delicate texture.

41. *P. arborescens. R.* P. arboreum. Hb. Roxb. Wall. Cat. 66, No. 2226. ?

Arborescent. Stipes smooth; fronds alternately tri-pinnatifid; pinnæ linear, ending in long, fine, crenate, fertile points; leaflets ensiform, fertile-pointed, to the base pinnatifid, segments thereof linear-oblong, incurved. Fructifications in a line of dots, on each side of the nerve of the segments of the leaflets. Involucre obscure.

Nat. of the *Island of Honimoa,* one of the *Moluccas;* yet I cannot think *Rumphius's Palmifilix,* Hb. Amb. vol. 6, t. 27, is the same.

42. *P. felinum. R.*

Scandent. Stipes rough with minute prickles, (like the tongue of a cat;) fronds alternately tri-pinnatifid; pinnæ, linear, (2-3 feet long;) leaflets broad-ensiform, with serrate, barren points; near the base often pinnate, the rest deeply pinnatifid; segments thereof linear, crenulate, obtuse, incurved. Fructifications in two crowded lines, parallel with and close to the nerve of the segments. Involucre obscure.

Nat. of *Amboyna* and *Pullo Pinang*, climbing, in open situations, over fallen trees, &c.

43. *P. dubium. R.* Davallia Roxburghii. Wall. Cat. 66, No. 2218.

Fronds alternately quadri-pinnatifid, smooth, (several feet high;) its ultimate divisions obtuse, tending to be trapeziform, and more or less deeply gashed. Fructifications in solitary spots at the bottom of the fissures of the leaflets. Involucre opens on the anterior margin, forming a pouch.

Nat. of the *Moluccas.* Is probably a *Davallia.*

44. *P. æmulum. Ait. Kew.* 3. 466.

Fronds quadri-pinnatifid, smooth, and delicate; ultimate divisions narrow-trapeziform-oblong, sides pinnatifid, or gashed and denticulate at tip. Fructifications solitary on the segments. Involucre reniform, peltate and ciliate.

Nat. of the mountains north of *Rohilcund.*

10. ASPLENIUM.

Fructifications disposed in straight, subparallel lines. *Involucre* originating laterally from a vein, and separating inwards.

1. *A. Nidus. Linn.* Wall. Cat. 63, No. 198.

Fronds simple (1-3 feet,) subsessile, linear-lanceolate, entire, glossy; veins numerous and parallel. Fructifications in approximated lines, with a very conspicuous involucre, separating upwards and inwards, (that is, towards the apex of the leaf.)

Nat. of *Chittagong, Malay Islands*, &c. It grows in large compact bowl-shaped tufts, not unlike a bird's nest; the specific name is therefore particularly appropriate.

2. *A. reticulatum. R.* Grammitis macrophylla. Wall. Cat. 61, No. 10.

Fronds simple, (1-2 feet,) subsessile, lanceolate, entire, smooth, with reticulated veins. Fructifications in rather remote parallel lines. Involucre not visible.

Nat. of the *Malay Islands.*

3. *A. linguæforme. R.*

Stipes long, and polished; fronds tongue-shaped, entire, smooth. Fructifications in numerous, approximated lines, over the whole disk, and extending almost to the margin. (Involucre not visible in the dry specimens.)

Nat. of the *Moluccas.*

4. *A. monanthemoides. R.*

Stipes polished, round, with a groove; fronds (6-12 inches high,) alternately-pinnate; leaflets delicate, smooth, trapeziform, very obtuse, anterior and exterior margins dentate-serrate; posterior entire. Fructifications in short lines, on both sides of the nerve; when the involucre expands they become round, (as in *Polypodium.)*

Nat. of *Chittagong.*

5. *A. trapeziforme. R.* Wall. Cat. 66, No. 2213.

Stipes polished; fronds (12-18 inches,) alternately pinnate; leaflets trapeziform, very obtuse, serrate, except a small portion of the posterior margin near the base, smooth. Fructifications in many lines, on both sides of the nerve. Involucre separating inwards.

Nat. of the *Malay Islands.*

6. *A. coriaceum. R.* Asplenium Finlaysonianum. Wall. 63, No. 191, (qoud nomen delendum.)

Stipes smooth; fronds (1-2 feet high,) alternately pinnate; leaflets obliquely-ovate ensiform-falcate, remotely serrate, smooth, coriaceous. Fructifications in numerous parallel lines, over the whole of the disk. Involucre very conspicuous.

Nat. of the *Malay Islands.*

7. *A. serrulatum. R.*

Stipes smooth; fronds (2-3 feet high,) alternately pinnate; leaflets (about 15) smooth; broad-ensiform, margins remotely serrulate; inner upper angle enlarged; terminal lobe larger, and pinnatifid. Fructifications in lines, on the (secondary) veins, of which the lower are often double. Involucre single or double, according with the lines.

Nat. of *Amboyna* and other *Malay Islands.*

8. *A. crenatum. R.*

Stipes smooth; fronds smooth; (several feet high,) alternately pinnate; leaflets linear-ensiform, elegantly crenate, (6-9 inches long.) Fructifications in numerous double and single lines, on the (secondary) veins. Involucre double or single.

Nat. of the *Malay Islands.*

9. *A. cultrifolium. Linn.*

Stipes smooth, grooved; fronds (2-4 feet high,) suboppositely pinnate; leaflets lanceolate-falcate, taper-pointed, gash-serrate, firm and smooth. Fructifications in rather remote, longish, parallel lines. Involucre separating inwards.

Nat. of *Amboyna.*

10. *A. varium. R.*

Fronds alternately-pinnate; leaflets from ensiform to linear, and obtuse, smooth, largely-crenate, inner crenature on the upperside very large. Fructifications in various sized single and double lines. Involucre single and double, each separating outwards.

Nat. of *Amboyna.*

11. *A. hemionitoides. R.*

Stipes pretty smooth; fronds lanceolate, alternately pinnate; leaflets falcate, obtuse, the lower pinnatifid; the upper more or less crenate-serrate, inner crenature on the upper side larger. Fructifications generally in double lines, with a vein between them. Involucres double.

Nat. of the *Malay Islands.*

In the double lines and *involucres*, it approaches to Smith's character of *Hemionitis*.

12. *A. mixtum. R.*

Stipes smooth; fronds lanceolate, alternately pinnate; leaflets ensiform, with tapering, serrate, fertile points, the rest more or less pinnatifid, with the segments thereof rounded. Fructifications in short lines, on the veins of the segments; the lower one, at least, always double. Involucre in the single lines, separating inwards; in the double, both ways.

Nat. of *Amboyna.*

13. *A. multiflorum. R.*

Fronds pinnate, (3-6 feet high,) with angular, hairy petioles; leaflets numerous, alternate, ensiform, pinnatifid. Fructifications in two rows, of short, parallel, single lines on the veins of the segments of the pinnæ. Involucre separating on the side next the nerve of the segment.

Nat. of the *Malay Islands*, under the shade of trees.

14. *A. bipinnatum. R.* Icon. Roxb. Suppl. 5, t. 1.

Fronds alternately-bipinnate, (3-4 feet high;) pinnæ remote, recurved; leaflets broad-ensiform, smooth, remotely crenate, truncate at the base. Fructifications in minute, single, parallel lines, on the veins of the segments of the leaflets. Involucre separating inwards.

Nat. of *Amboyna*, but introduced into the Botanic Garden at *Calcutta*, where it *fructifies* during the rains.

Root, the united bases of the stipes form something like a very short, oblique, ragged, blackish one, or a *trunk*, which sends forth numerous radical fibres into the ground.

Stipes 18 inches long, nearly 4-sided; upper side grooved, toward the base somewhat scaly, otherwise they are smooth.

Fronds alternately bipinnate, ovate-oblong, 2-3 feet long. *Pinnæ* alternate, 8-12 inches long. *Pinnules* sub-opposite, and alternate, sessile, ensiform, crenate, base truncate, smooth, 2-3 inches long.

Fructifications in parallel lines.

Involucre originating from a vein, separating inwards or both ways.

15. *A. cicutarium. Linn.*

Shoots creeping, scaly. Stipes alternate, polished ; fronds alternately subtripinnate, as broad as long, (6-8 inches high ;) ultimate divisions subovate, with the anterior margins crenate-dentate, firm, and smooth on both sides.

Nat. of the mountains north of *Rohilcund.*

16. *A. tripinnatum. R.*

Stipes polished, grooved ; fronds (2 feet high,) alternately tripinnate ; ultimate divisions thereof wedge-shaped with their apices præmorse, deeply notched, and generally two or three-flowered.

Nat. of the *Molucca Islands.*

17. *A. woodwardioides. R.*

Stipes smooth ; fronds (2 feet high,) subovate, smooth, alternately-bipinnate ; leaflets broad-ensiform ; those of the inferior pinnæ pinnatifid ; of the upper more or less serrate. Fructifications in oblong spots along the nerve, but forming a sharp angle with it. Involucre separating towards the nerve.

Found at *Chittagong* by Dr. Buchanan.

11. HEMIONITIS.

Fructifications digested in scattered or branched lines, each of them double, with a vein running between. *Involucre* originating from a vein, and each separating outwards.

1. *H. cordifolia. R.* Icon. Roxb. 14, t. 103.

Fronds cordate, obtuse, entire. Lines of the fructifications decussated, forming rhomboidal interstices.

Beng. Chacooly.

Nat. of *Bengal.* Grows in a rich wet soil about Calcutta.

Root fibrous, perennial.

Fronds oblong-cordate, obtuse, entire ; smooth on the upper surface, a little hairy underneath ; from 3 to 6 inches long ; the fructiferous fronds smallest, and on much longer stipes.

Stipes slender, channelled, woolly, dark purple; from 2 to 12 inches long.

Lines of the fructification decussating, numerous over the whole underside of the fronds, leaving but small oblong interstices.

Capsules most numerous, short pedicelled, girt with an elastic ring.

Seeds very numerous.

2. *H. reticulata. R.* Antrophyum reticulatum. Kaulf. Wall. Cat. 61, No. 40.

Fronds in tufts, sessile, cuneate-lanceolate, entire. Nerve vanishing towards the middle of the frond; veins and lines of the fructification reticulated, forming sublanceolate interstices.

Nat. of the *Moluccas.*

12. SCOLOPENDRIUM.

Fructifications in scattered double lines, placed between two veins. *Involucre* originating from the surface, (or rather from the veins,) lying over one another longitudinally, and separating by a longitudinal suture. *Smith.*

S. lanceolatum. R.

Parasitical, creeping. Stipes polished. Fronds lanceolate, entire, acute, the barren greatly larger, and with shorter stipes.

Nat. of *Chittagong.*

13. BLECHNUM.

Fructifications disposed in two-parallel lines, approaching the nerve. *Involucre* originating from the surface, continued; separating towards the nerve.

1. *B. angustifolium. R.*

Stipes polished, as long as the simple, linear-lanceolate, entire, smooth fronds. Fructifications in an uninterrupted line, half-way between the nerve and margin. Involucre obscure.

Nat. of the *Moluccas*, grows about 12 or 18 inches high.

2. *B. glabrum. R.* Tænitis blechnoides. Sw. Wall. Cat. 62, No. 141.

Stipes smooth. Fronds (3-4 feet high,) suboppositely pinnate; leaflets short-petioled, linear-lanceolate, entire, rather obtuse, firm and smooth. Fructifications in an uninterrupted line, half-way between the nerve and margin. Involucre obscure.

Nat. of *Prince of Wales' Island,* where it is found growing under the shade of lofty trees.

3. *B. decurrens. R.*

Stipes smooth; fronds alternately pinnate; leaflets (above a foot long,) linear, sessile, attenuated at the base, and decurrent. Lines of the fructification close to the nerve.

Found by Dr. Hunter. on *Prince of Wales' Island.*

4. *B. moluccanum. R.* Blechnum orientale, Linn. Wall. Cat. 61, No. 57.

Stipes smooth. Fronds (6-9 feet high,) alternately pinnate; leaflets ensiform, firm, smooth, and entire. Fructifications close to the nerve of the leaflets. Involucre of a very firm texture, and separating from the nerve.

Nat. of *Prince of Wales' Islands, Moluccas, &c.*

14. PTERIS.

Fructifications in an uninterrupted marginal line. *Involucre* from the margin of the frond, turned in uninterrupted, separating on the inner side.

P. graminifolia. R. Icon. Roxb. 14, t. 104, f. 3.*

Parasitic. Fronds linear, very long (2-3 feet) entire pendulous.

* Vittaria.—W. G.

Nat. of the close dark forests of *Silhet*, where it is found suspended on trees, resembling long tufts of long, narrow-leaved grass.

P. angustifolia. Swartz. Icon. Roxb. 14, t. 104, f. 2.

Parasitic, creeping. Fronds (4-6 inches,) subsessile, simple, linear-lanceolar, acute, smooth. Fructification occupying the whole margin.

Nat. of the *Delta of the Ganges*, where it is found growing on the trunks of trees, intermixed with mosses, &c. parasitic plants, of various kinds.

Stems creeping, but short, and covered with much dark brown long hair.

Stipes short, roundish.

Fronds linear-lanceolate, smooth on both sides; from 4 to 12 inches long.

Fructifications in a continued marginal line.

Involucre, a continuation of the epidermis of the upper surface of the frond, reflected over the capsules, and until they are ripe adhering to the under surfaces.

2. *P. piloselloides. Linn. Sp. Pl. Banks. ic. Kæmpf. t.* 31. Icon. Roxb. 14, t. 104, f. 1.*

Parasitic, creeping, filiform. Fronds subsessile, succulent, veinless, obtuse, entire; barren from oval to oblong; fertile linear.

Nat. of *Chittagong*, creeping upon the trunks of trees.

Stems and *branches* filiform, equally thick throughout, climbing on trees, and rooting like *Ivy*, many feet in length.

Leaves subsessile, succulent, veinless, obtuse; the barren from round to oblong, and perfectly entire; length about an inch, *fertile* linear, and linear-lanceolate; length from 2 to 4 inches.

Fructification in an entire marginal line, even round the obtuse apices, and down to near the base. Involucre fleshy.

* Nothochlæna.—W. G.

3. *P. lobata. R.*

Petioles smooth, nearly as long as the thin, polished, 2 or 3-lobed fronds.

Nat. of the *Moluccas.*

4. *P. vittata. Osb. It. t.* 4. Icon. Roxb. 14, t. 105. Pteris longifolia. Linn. Wall. Cat. 62, No. 111.

Stipes alternate, from a creeping root, polished. Fronds alternately pinnate, (2-5 feet high); leaflets sessile, ensiform, all the sterile part have their margins waved and spinulose. Fructifications occupy the lower two-thirds, or more.

Nat. of the *Delta of the Ganges, &c.* Fructifies in the Botanic Garden most part of the year.

Root (or rather *stem*) creeping under ground.

Stipes springing alternate from the creeping root or stem, polished, channelled, dark brown; whole length, frond included, from 2 to 4 feet.

Fronds pinnate with an odd one, 2-3 feet long, smooth. *Pinnæ* sub-opposite, sessile, ensiform, tapering to a very long fine point; margins of the fertile (pinnæ as far as they are so) straight and entire, of the sterile waved and serrulate, the serratures often end in sharp cartilaginous points; all are smooth, and shining on both sides.

Fructifications in an uninterrupted marginal line, extending from the base for about two-thirds or more of the (fertile) pinnæ.

Involucrum from the margin of the pinnæ turned in, uninterrupted, separating on the inner side.

To *Pteris amplexicaulis* (now before me): this comes the nearest of any other I have hitherto met with, yet differs essentially.

1st. Here (in *P. vittata*) the stipes rise single from the creeping stem, and are long and polished. There (in P. *amplexicaulis)* they grow in tufts and are short, and when old, scabrous; when young, woolly.

2nd. Here the pinnæ are not enlarged into a stipe-clasping base; taper to a very long fine point, and are (in general) fertile for only about two-thirds their length. There they have enlarged stipe clasping bases, are rather obtuse pointed, and are fertile almost to the very points.

5. *P. amplexicaulis. R.* Icon. Roxb. 14, t. 106. P. amplectens. Wall. Cat. 62, No. 112, (quod nomen delendum.)

Stipes in tufts, short, somewhat rough. Fronds oblong, (about 2 feet high,) alternately pinnate, smooth; leaflets sessile, ensiform, rather obtuse, with two enlarged, stipe-clasping, rounded lobes at the base; the barren most finely serrulate; the terminal one greatly longer than the rest. Fructifications occupy the whole margin, except the very apices.

Nat. of *Bengal*, in shady, moist places. Also among ruins of brick buildings. Is sometimes parasitical.

Stipes short, on the forepart channelled, woolly, from 1 to 2 feet long.

Frond linear-oblong, pinnate with an odd one, leaflets below opposite; above frequently alternate; all are sessile, linear, entire, smooth; at the base broadest, and there obliquely cordate, from 2 to 3 inches long, and from ¼ to ½ an inch broad; in small plants the terminal one is often as long, or even longer, than the rest of the frond.

Note.—In a good soil, amongst brushwood, or long grass I have found them 3-4 feet high, the terminal leaflet is then as short, or shorter than the rest.

6. *P. linearis. R.*

Stipes rough. Fronds alternately-pinnate, (4-5 feet high;) leaflets linear, entire, very long, smooth, both sides rounded, and greatly protruded at the base. Fructifications occupy the whole margins, and when most expanded, leave very little of the naked pinnæ to be seen.

Nat. of *Amboyna.*

7. *P. scandens. R.* Icon. Roxb. 14, t. 107. Lomaria scandens. Willd. Wall. Cat. 6, No. 36.

Stem creeping up, and over large trees. Stipes somewhat armed. Fronds alternately-pinnate; sterile leaflets linear-lanceolate, acutely-serrate, cuspidate; fertile filiform.

Filix non ramosa, &c. *Burm. Zeylan. p.* 100, *t.* 46, good for part of a barren leaf only.

Panna valli. *Rheed. Mal.* 12, *t.* 35, the barren leaves.

Nat. of various parts of *India;* very old plants only fructify during the rains; and when the *involucre* is fairly open, it may be taken for an *Acrostichum.*

Stems about as thick as a ratan, creeping up, and over trees of the first magnitude, flexuose, angular, tolerably smooth, except for little, rather sharp, warty prickles scattered over every part.

Stipes alternate, grooved on the upper sides, smooth, except for a few very minute prickles; length to the pinnæ from 6 to 12 inches.

Fronds pinnate, about 3 feet long, drooping a little.

Leaflets (pinnæ,) from ten to twenty pair, alternate, subsessile. The *barren* lanceolate, long, taper, acute pointed, and most acutely serrate, smooth on both sides, veins numerous, very fine, and nearly diverging; general length from 6 to 9 inches, and about 1 inch broad.

Fertile leaflets before the involucre opens filiform, after the capsules begin to burst, they become considerably broader; if found in this state only, it may be taken for an *Acrostichum,* and when still more advanced, the edges of the leaflets and involucre become involute, exposing the numerous minute capsules as if it were in a spike.

Involucre uncertain.

8. *P. lunulata. Retz. Obs.* 2, *No.* 99, *t.* 4. Adiantum lunulatum. Burm. Wall. Cat. 61, No. 77.

Stipes in tufts, polished, black. Fronds (6-18 inches,) longer than the petioles, recurved, alternately pinnate; leaflets petioled, somewhat crescent-shaped, smooth.

Avenka. *Rheed. Mal.* 12, *t.* 40.

Hind. Kull-k'ha.

Common in most parts of *India,* sometimes the margin is broken, when it resembles an *Adiantum,* and is very like *A. lunulatum,* but at all times sufficiently distinct.

9. *P. multifida. R.*

Stipes polished, black-purple; barren fronds cordate-lobate; fertile very long-petioled, pedato-bipinnatifid, with long, ensiform, acute segments.

A terrestrial, elegant species. The barren fronds about a foot high; the fertile from 2 to 3 feet. It is a native of the province of *Chittagong.*

10. *P. dimidiata. R.* Pteris semipinnata. Linn. Wall. Cat. 62, No. 97.

Stipes polished, brown, fronds alternately-semi-bipinnate, smooth, (about 3 feet high;) leaflets halved, linear, and entire on the upper side of the nerve; broad and pinnate, or deeply pinnatifid on the under; segments thereof entire, linear-oblong. Fructifications round the whole margins.

Nat. of *Chittagong.* Is one of the most beautiful Ferns I have ever seen.

11. *P. bicolor R.* Cheilanthes dealbata. Wall. Cat. 61, No. 71.

Stipes polished, dark brown, filiform; fronds (3-12 inches high,) bipinnatifid; pinnæ opposite, pinnatifid; segments obtuse, crenate, green above, perfectly white underneath. Involucre brown, with lacerated margin.

Nat. of the mountains north of *Rohilcund.*

12. *P. pectinata. R.*

Stipes smooth; fronds subbipinnate, smooth; pinnæ few, opposite; segments thereof entire, linear, falcate, obtuse, confluent. Fructifications occupy the whole of the margins, except the very apex.

Nat. of the *Moluccas.*

13. *P. quadriaurita. Retz. Obs.* 6, *N.* 86.

Stipes somewhat scabrous; fronds opposite, and alternately-bipinnatifid, (3 or 4 feet high, and the petioles about as much more,) smooth; pinnæ linear; the lower pair sometimes doubled, deeply (almost quite to the nerve,) pinnatifid; segments thereof falcate, obtuse, entire, the terminal one ensiform, and when barren crenate.

Nat. of the *Moluccas.*

14. *P. gracilis. R.*

Stipes smooth; fronds decursively, suboppositely bipinnate; pinnæ few and remote; barren leaflets elliptically-lanceolar, and acutely serrate; fertile linear, and many times longer than the barren.

A terrestrial species, a native of *Chittagong.* The fertile fronds are very slender, and about 20 inches high; the barren little more than half of that.

15. *P. tripinnatifida. R.*

Stipes polished; fronds (3-4 feet high,) smooth, oppositely tripinnatifid; pinnæ broad-ensiform, with more or less deep, rounded triangular breaks and lobes. Fructifications in a very completely continued line, round every part of the margin.

Nat. of the *Moluccas.*

16. *P. pedatifida. R.*

Stipes trifid, with the lateral branches again bifid; or trifid, all the divisions thereof bipinnatifid; pinnules linear, deeply pinnatifid; segments thereof linear-oblong, obtuse. Fructifications in a continued line, on the sides of the segments.

Nat. of *Amboyna*, and the *Malay Islands*, where it grows to be several feet high.

17. *P. daucifolia. R.*

Stipes smooth; fronds ovate, (about 12 inches high,) alternately superdecompound; its ultimate divisions minute and linear, almost entirely occupied with the fructifications.

Nat. of the Eastern parts of *Bengal.*

18. *P. succulenta. R.* Icon. Roxb. 14, t. 108. Acrostichum thalictroides et siliquosum. Roxb. Ceratopteris thalictroides. Brongn. Wall. Cat. 61, No. 81.

Annual, succulent. Fronds (from 2 inches to 5 feet high;) the barren decompound, with ultimate divisions broad, and variously lobate; the fertile super-decompound, with ultimate divisions linear.

Junglee Jhow of the Bengalis.

Nat. of various parts of *India*, in wet places.

Root fibrous, dark brown annual.

Stipes between quadrangular and half round, sulcated.

Fronds, barren pinnate, with pinnatifid leaflets. Fertile generally super-decompound; *divisions* alternate; *leaflets* subulate, furrowed on the back, smooth; whole length (stipe included,) from 4 inches to 4 feet.

Fructifications in a line of numerous, distinct capsules, until ripe, completely hid under the entirely reflected margins of the leaflets.

Capsules sessile, globular, girt with the usual elastic ring.

Seeds (or globules,) about 20 in each capsule.

15. VITTARIA.

Fructifications in an uninterrupted marginal line. *Involucre* double, uninterrupted; one from the surface separating outwards; the other from the margin of the frond turned in, separating inwards.

1. *V. lineata. Smith.* Icon. Roxb. 14, t. 109.

Parasitic, stipes very short, compressed; fronds both fertile and sterile linear, entire, smooth, (from 4 to 8 inches long.)

Pteris lineata. Linn.

Nat. of *Prince of Wales' Island:* thence introduced into the Botanic Garden by Mr. W. Roxburgh, Jun.

Parasitic with numerous fibrous roots, adhering to the bark of trees or putrid wood.

Stem scarce any.

Stipes very short, compressed, smooth.

Fronds linear-lanceolate, entire, acute, smooth, and slender, like a blade of grass; about 6 inches long, and less than half an inch broad; the barren and fertile are alike in shape and size.

Fructification in an uninterrupted line, on the anterior margins; that is, from the middle of the frond to within half an inch, or an inch of the apex, with a double involucre.

2. *V. divergens. R.* Wall. Cat. 65, No. 2191.

Stipes polished, black. Fronds linear, (12-15 inches high,) alternately-pinnate; leaflets subensiform, obtuse, approximate, diverging, enlarged at the base on the upper angle. (Fructifications as in *Pteris*, but with double involucre.)

Nat. of *Prince of Wales' Island*, where Mr. W. Roxburgh, Jun. found it growing in cool shady places.

3. *V. resecta. R.*

Stipes smooth; fronds oblique, (6-12 inches high,) alternately pinnate; leaflets sessile, subtrapeziform, obtuse, smooth. (Fructifications in a continued line on the anterior margin and round the apex. Involucre double.)

Nat. of *Chittagong*.

4. *V. lunulata. R.*

Fronds subsessile, linear, (6-12 inches high,) straight, alternately pinnate; leaflets sessile, approximate, (touching,) crescent-shaped, with inner edge straight. (Fructifications in a continued line, on the anterior and exterior margins. Involucre double.)

Nat. of *Prince of Wales' Island*.

5. *V. parasitica. R.* Lindsæa parasitica. R. Wall. Cat. 65, No. 2196.

Parasitical. Stipes short, smooth, alternate on the creeping stem. Fronds oblong, alternately bipinnate, (about 2 feet high;) pinnæ linear; leaflets small, sessile, approximate, subtriangular, with the anterior side or margin, where the line of fructifications is found, circular. (Involucre double.)

Nat. of *Prince of Wales' Island*, where it was found by Mr. W. Roxburgh, Jun. growing on the trunks of trees.

6. *V. interrupta. R.* Lindsæa interrupta. R. Wall. Cat. 65, No. 2195.

Stipes polished, as long, or longer than the smooth, alternately bipinnate frond; pinnæ linear; leaflets triangularly-wedge-shaped, with anterior margin, chiefly of the barren fronds, gash-dentate. Line of fructifications on the anterior margin, and interrupted by the breaks therein. (Involucre double.)

Found by Mr. W. Roxburgh, growing on the ground, in shady cool places on *Prince of Wales' Island.*

16. LINDSÆA.

Fructifications in an uninterrupted line, a little removed from the margin. *Involucre* originating from the surface, continued; separating outwards.

1. *L. odorata. R.* Icon. Roxb. 14, 109.

Stipes alternate from a creeping root, smooth; fronds alternately-pinnate; leaflets petioled, trapeziform-falcate, anterior margin gashed.

An elegant, small, erect species, of from 6 to 12 inches in height; a native of the *Garrow Hills;* when dry and drying, sweetly fragrant. The line of fructification is completely marginal, and interrupted by the fissures on the anterior margin of the leaflets, and I would rather be inclined to consider it a *Hymenophyllum*, if any thing like a column could be found within the involucre.

2. *L. bipinnata. R.*

Fronds alternately bipinnate, smooth; pinnæ linear; leaflets sub-sessile, somewhat crescent-shaped, with an uninterrupted line of fructifications, a very little removed from the anterior-exterior margin. (Involucre originating from the surface, continued, separating outwards.)

Found by Mr. W. Roxburgh on *Prince of Wales' Island.* I am not certain if ever the thin edge of the leaf is turned in (over the inner) involucre. I am rather inclined to think not; at least I have not been able to discover that it is.

It is exceeding like *Vittaria parasitica*, and only a little larger, and more robust.

17. ADIANTUM.

Fructifications in roundish, separate, marginal spots; under, (and inserted into,) the reflected involucre-like tips of the margin of the fronds which separate inwards.

1. *A. proliferum. R.* A. flagelliferum. Wall. Cat. 61, No. 76, (quod nomen delendum.)

Stipes filiform, hairy; fronds (6-12 inches long,) alternately-pinnate, tailed at top, and there proliferous; leaflets triangular, anterior margin præmorse, and more or less divided.

Nat. of the *Moluccas.*

2. *A. caudatum. Mant.* 308. Icon. Roxb. 14. t. 110.

Stipes purple and hairy; fronds (6-12 inches long,) alternately-pinnate, tailed at top, and there proliferous; pinnæ subtrapeziform gashed. Fructifications under the reflected apices of the divisions of the pinnæ.

Adiantum caule reflexo. *Burm. Zeyl. t.* 5. *f.* 1. has the leaflets longer and narrower than I have met with.

Nat. of *Hindoostan* as well as *Ceylon.*

Root perennial.

Stem none.

Fronds simply pinnate, slender, reclined, about a foot long; apex often leafless, and striking root.

Stipes a little villous, round.

Leaflets alternate, subsessile, subtrapeziform, the anterior-exterior margin from three to six cleft, (with the fructifications on the exterior margins of these divisions,) posterior and inner margins entire, striated, somewhat villous, length generally under an inch, and about half as much in breadth.

Fructifications, a large oblong cluster of minute capsules, on the under edge of the margin of the divisions of the leaflets.

Involucre simple, separating on the inner side, being a continuation of the segments of the leaflets.

3. *A. tenerum. R.* A. Capillus. Linn. Wall. Cat. 61, No. 73.

Stipes polished black; fronds (6-12 inches high,) alternately bi-tripinnate; its ultimate divisions fine-petioled, triangularly wedge-shaped, and often deeply cut on the anterior, irregularly rounded margin.

Found on the northern boundary of *Oude*, by Mr. A. Gott. It is very like Dryander's *Lindsæa tenera. Trans. Linn. Soc.* 3, p. 42, t. 10.

4. *A. microphyllum. R.* A. venustum. Don. Wall. Cat. 61, No. 81.

Stipes highly polished, deep brown. Fronds (12-18 in-
s high,) super-decompound; its ultimate divisions round-
e-shaped; anterior margin minutely dentate. Fructifi-
s from 1 to 3, though generally solitary, on the an-
edge.

of the mountains north of *Rohilcund*.

ny generic character of this genus, I have observed
he little annulated capsules, are inserted on the involu-
itself, such being the case in all the above four species.

18. DAVALLIA. *(Smith.)*

Fructifications in roundish, separate spots, near the margin. *Involucres* like scales, from the surface, distinct, separating outwards.

1. *D. angustifolia. R.* D. angustata, Wall. Cat. 63, No. 242, (quod nomen delendum.)

Parasitic, creeping. Fronds sessile; both barren and fertile linear-lanceolate, serrulate, firm and polished. Involucres like scales.

Nat. of *Prince of Wales' Island*, and found by Mr. W. Roxburgh, running to a great extent up the trunks of trees.

2. *D. longifolia. R.*

Fronds linear, pectinato-pinnatifid, firm, though a little villous on the upper surface; segments linear, obtuse, with about three fructifications just under their apices. Involucre like a pouch.

Found, by Mr. W. Roxburgh, growing on well-shaded rocks on *Prince of Wales' Island.*

3. *D. pectinata. Smith.*

Creeping; petioles scaly. Fronds (about 6 inches high,) ovate-oblong, firm, and smooth, to the nerve pectinato-pinnatifid; segments linear, obtuse, almost entire. Fructifications in a row of numerous approximated dots, between the nerve of the segment and their margin. Involucres like scales.

Found on the northern boundary of *Oude*, by A. Gott.

Filix polypodium, &c. *Pluk. t.* 289, *f.* 1 and 2, are ceeding like my plant.

4. *D. cordifolia. R.*

Creeping, petioles smooth, fronds about 6 inches long-cordate, polished, and very firm, oppositely pi leaflets confluent falcate, obtuse, deeply crenate; the pair semicordate. Fructifications marginal, with very tinct, roundish, hard scaly involucres.

Nat. of the mountains north of *Rohilcund.* The habit of this species is remarkably hard and smooth.

5. *D. serrata. R.*

Rachis 3-sided. Fronds alternately pinnate; leaflets linear, firm and smooth, serrate. Fructifications solitary at each serrature. Involucre forming a small pouch, after the capsules expand.

Found on *Prince of Wales' Island*, under the shade of trees, by Mr. W. Roxburgh.

6. *D. multiflora, R.* Icon. Roxb. 14, t. 98, (sub nomine Polypodii Davallioidis.) D. parallela, Wall. Cat. 63, No. 251, (quod nomen delendum.)

Fronds linear and linear-lanceolate, pinnate; leaflets alternate, crowded, sessile, linguiform, minute toward the top and base; margins crenulate; anterior angle of the truncated base enlarged. Fructifications in a single line of separate spots near the margin. Involucre reniform, separating outwards.

Nat. of the interior parts of *Bengal, Nepaul,* &c. The leaves are always erect, but when forced to rest on the ground, their tips take root and produce other plants.

Root fibrous, perennial.

Stem scaly, creeping under the surface of the earth.

Stipes short, channelled, covered with brown woolly scales.

Fronds linear, or linear-lanceolate, nearly a foot long. Fertile and barren nearly alike.

Pinnæ alternate, sessile, tongue-shaped, rather obtuse, serrulate, smooth on both sides, truncated at the base, and there the anterior angle is enlarged into an obtuse process; general length about an inch and a half, and less than half an inch broad towards the base, and apex; of the young greatly smaller.

Fructifications in numerous, (almost one for each serrature,) distinct spots, near the margin.

Involucre reniform, separating on the anterior and exterior edges.

Capsules very numerous, chesnut-coloured.

7. *D. pilosa. R.* Icon. Roxb. 14, 102, (sub nomine Polypodii ciliati.)

Fronds alternately bi-and-tripinnate, hairy; leaflets deeply crenate, or pinnatifid; ultimate segment thereof semicircular, somewhat crenulate, and generally three-flowered. Involucre ciliate and separating outwards.

Nat. of the eastern parts of the *Delta of the Ganges.* Thence introduced into the Botanic Garden, by Dr. Buchanan.

Root perennial, as thick as a rattan, hairy, creeping under the surface of the earth, from it descend many radical fibres.

Stipes suberect, of a pale green colour, and tender substance, hairy; general length, frond included, from 2 to 3 feet.

Fronds alternately bipinnate, hairy.

Pinnæ 8-10 pair, alternate.

Pinnulæ alternate, numerous, smaller towards the apex, gashed, or pinnatifid, with the segments rounded and crenate.

Fructifications from 1 to 5 distinct spots, near the margin of each segments of the (fertile) pinnulæ.

Involucrum, a single, ciliate, reniform scale, separating outwards.

Capsules numerous, and in succession.

Note.—The habit of this Plant is very different from the firm, polished, compact texture of this genus, as mentioned by Dr. Smith.

8. *D. trapeziformis. R.*

Stipes smooth, nearly as long as the ovate-oblong, alternately bipinnate and tripinnatifid fronds (1-2 feet high;) leaflets subtrapeziform, obtuse, and more or less divided into rounded segments. Fructifications in, generally, a single spot, near the bottom of the fissures of the ultimate segments. Involucre opening on the anterior margin, forming a pouch.

Nat of the *Moluccas.* Is of a soft texture, tending to be villous.

9. *D. moluccana. R.* Wall. Cat. 66, No. 2219.

Stipes as long as the leaves, 4-sided, smooth. Fronds (1-2 feet high,) ovate, alternately bi-tripinnate; leaflets lanceolate, deeply gashed, smooth, and rather firm. Fructifications generally solitary, on the segments of the pinnules. Involucre a pouch.

Nat. of the *Moluccas.*

10. *D. chinensis. Smith.* Icon. Roxb. 14, t. 119. (unfinished pencil sketch.) D. tenuifolia. Sw. Wall. Cat. 63, No. 245.

Erect. Fronds lanceolate, alternately-tripinnate, polished; ultimate divisions decurrent, wedge-shaped; apices truncate and generally 2-flowered. Involucre dentate.

Trichomanes chinensis, Linn.

An elegant, erect, slender, polished species, from 1 to 2 feet high, and of a thin texture; a native of the eastern parts of *Bengal,* where it fructifies during the rains. The whole of the annulated capsulæ are inserted by means of very slender pedicels into the very bottom of the 2-valved pouch.

19. DICKSONIA.

Fructifications in roundish, marginal, distinct, prominent spots. *Involucre* double; one (the inner,) from the (under) surface, separating outward; the other from the margin of the frond turned in over the former, and separating inwards.

1. *D. moluccana. R.* Wall. Cat. 65, No. 2173.

Stipes, divisions a little hairy. Fronds (3-4 feet high,) alternately bipinnate; leaflets ensiform, the fertile more deeply serrate, with the fructifications on the points of the serratures.

Nat. of the *Molucca Islands.*

20. CYATHEA.

Fructifications scattered, roundish, standing in an hemispherical calyx, which bursts at the top, without an operculum.

1. *C. pinnata. R.* C. Brunonis. Wall. Cat. 63, No. 179, (quod nomen delendum.)

Fronds (5-8 feet high,) smooth, alternately pinnate, leaflets linear, acute, and slightly waved; above shining. Fructifications in numerous, globose spots, near the nerve of the leaflets.

Nat. of *Prince of Wales' Island*, where Mr. W. Roxburgh found it under the shade of lofty trees.

2. *C. tripinnatifida. R.* C. excelsa. Sw. Wall. Cat. 63, No. 181, (sub nomine C. bipinnatifidæ.)?

Fronds many, (some 10 feet high,) alternately-tripinnatifid, smooth and firm; leaflets broad-ensiform, toward the base deeply pinnatifid; segments thereof falcate, entire, or serrulate, with a single row of 5-6 spherical spots of the fructifications on each side of their rib.

Nat. of the *Molucca* Islands.

These are the only two species of this very well-marked genus which I have yet met with in *India*. In both, the capsules while young, are enveloped in a thin, spherical, entire, membrane, affixe'd round their insertions on the frond, forming a resemblance to a pounce bag. When the capsules are advanced to maturity, they burst (generally) at the top.

21. TRICHOMANES.

Fructifications inserted into the margin of the leaf separate. *Involucre* urn-shaped, opening outwards. *Columns* extending beyond the involucre, like styles.

1. *T. campanulatum. R.* Hymenophyllum campanulatum. R. Wall. Cat. 66, No. 2199.

Creeping, villous; petioles erect, hairy, shorter than the 2-3-inches high, bipinnatifid leaves. Rachis winged. Fructifications at and near the apex of the fronds, campanulate.

Found by Dr. Buchanan at *Chittagong.*

2. *T. laciniatum. R.*

Fronds alternately pinnate, with the rachis fibrous; leaflets oblong, and cuneate-oblong, finely laciniate, firm and smooth, with a few long urn-shaped fructifications at their apices.

Nat. of the *Molucca Islands.*

3. *T. caruifolium. R.*

Stipes smooth, greatly longer than the tri-quadripinnatifid fronds, ultimate segments thereof sublinear and decurrent. Fructifications lateral, subpedicelled, with most long filiform columns.

Nat. of *Prince of Wales' Island,* where it grows in small tufts, about 4 or 6 inches high.

4. *T. lucidum. R.* Davallia elegans. Willd. Wall. Cat. 64. No. 253.

Scandent, stem scaly; stipes smooth, fronds polished and firm; subalternately quadripinnate; ultimate segments sub-lanceolate, serrate, gashed, or pinnatifid. Fructifications solitary, and sunk in the sinuses round the margins of the leaflets, compressed.

Nat. of *Prince of Wales' Island,* where it was found by W. Hunter, Esq.

I could discover no column in this plant; is it therefore to be referred to *Hymenophyllum?* The habit is rather firm and polished.

5. *T. malayanum. R.*

Stipes and rachis polished, fronds (4-5 feet high,) quadri-pinnate; ultimate divisions small and cuneate, with the flat-tened fructifications, (1 or 2,) in their truncated apices, and composed of two valves, without column.

Nat. of the *Malay Islands.*

22. MARATTIA.

Capsules oval, bursting longitudinally on their upper side; disclosing several cells in each division.

1. *M. pinnata. R.* Angiopteris crassipes. Wall. Cat. 63, No. 187.

Fronds (4-5 feet high,) smooth, generally oppositely pin-nate, leaflets linear-lanceolate, entire, polished. Capsules numerous, crowded (cross-ways) into a broad, uninterrupted line, a little within the margin.

Nat. of the *Molucca Islands.*

As I have found in the H. C. Botanic Gardens ample evidence that Dr. Roxburgh was a methodical Botanist, and that he did not name and describe a plant, and then make away with it, but very generally illustrated his species by drawings and dried specimens, I consider it advisable to append a list of those species, which appear somehow or other to have attracted no notice, and most of which will very probably be found under other and much later names, without characters, in the Catalogue of the E. I. Herbarium by Dr. Wallich.

Salvinia verticillata.
——— imbricata.
Isoetes capsularis.
Lycopodium pendulum.
——— aristatum.
——— imbricatum.
Ophioglossum furcatum.
Osmunda lanceolata.
Acrostichum ramentaceum.
10 ——— semipinnatum.
——— alatum.
——— seetacoonense.
Polypodium attenuatum.
——— excavatum.
——— lucidum.
——— ferrugineum.
——— rupestre.
——— proliferum.
——— acuminatum.
20 ——— mucronatum.
——— tenerum.
——— semisagittatum.
——— involucratum.
——— nudatum.
——— longifolium.
——— acutum.
——— pilosum.
——— furcatum.
——— multiflorum.
30 ——— confertum.
——— confluens.
——— squarrosum.
——— scariosum.
——— impuber.
——— elatum.
——— tridentatum.
——— felinum.
Asplenium linguæforme.
——— monanthemoides.
40 ——— serrulatum.
——— crenatum.
——— cultrifolium.
——— varium.
——— hemionitoides.
——— mixtum.
——— multiflorum.
——— bipinnatum.
——— tripinnatum.
——— woodwardioides.
50 Scolopendrium lanceolatum.
Blechnum angustifolium.
——— decurrens.
Pteris graminifolia.
——— lobata.
——— linearis.
——— multifida.
——— pectinata.
——— gracilis.
——— tripinnatifida.
60 ——— pedatifida.
——— daucifolia.
Vittaria resecta.
——— lunulata.
Lindsæa odorata.
——— bipinnata.
Davallia longifolia.
——— cordifolia.
——— serrata.
——— pilosa.
70 ——— trapeziformis.
Trichomanes laciniatum.
——— carnifolium.
——— malayanum.

In conclusion, I have to request that for 1827, at the end of the first paragraph, p. 465, 1817 may be substituted, otherwise Dr. Wallich might be considered as having been in charge of Roxburgh's MSS. and Drawings only 15 years, whereas 25 years is the correct period of his guardianship of the MSS. and Drawings of Roxburgh and Buchanan Hamilton.—W. G.

Some Memoranda on the Geology of Sikkim. Communicated by D. Liston, Esq.

[With a Sketch Map of the Country, Plate XXXV.]

The portion of Sikkim visited by me in company with Capt. B. is bounded on the east by the river Teesta; on the north by the Kullait; on the east and north by the great Rungeet; and on the south by the Morung or Terai. Darjeeling I first approached from the plains by the new road along Sinchul, and had occasion to travel that course several times; once also we proceeded from Punkabaree to Darjeeling by the valleys of the Bellassun and smaller Rungeet, and returned by the same path to Kursiong. From Kursiong we on one occasion proceeded to Punkabaree by the left side of the Bellassun. We travelled down the great Rungeet, Teesta and Jubbon rivers to the plains. We likewise sought the sources of the Mahannudee under Mahaldaram from Kursiong, and returned to Darjeeling round the shoulder of Sinchul, crossing the Rungoong at Sengenboom, and ascending by Ging to Darjeeling. We also ascended the valley of the great Rungeet, crossing the Rumam, Rutto and Reshee rivers to the Kullait, and proceeded up the Kullait three or four marches. I left Capt. B. at Hee, a Limboo settlement on that river; he persevered in making an attempt to reach the snow, though prevented from attaining his object by the jealousy of the people; while I returned to Darjeeling by a little frequented path, which skirts the sources of the Reshee and Ruttoo, and crosses the valleys of the Rumam and small Rungeet. Thus I had good opportunities of seeing the country, and if I make but an imperfect report of its geological appearance, the cause lies rather in my want of qualification to make proper use of my advantages, than from my not having possessed occasions which I might have availed myself of with profit.

The general result of my observations is, that the higher ridges are composed of gneiss rock, but round their sides is to be found a fold of slate overlying that, and lower down the mountains, sandstone is to be met with, super-imposed on the slate.

The ridge by which Darjeeling is approached from the plains, and along which the new road runs is gneiss, as above stated, from about half-way between Punkabaree Dak Bungalow and the Kursiong Hotel pretty uniformly, and to near Ging on one spur and to near Tukvar on another spur. The upper portion of Goongla is gneiss, and on these parts of the mountains, oak trees abound. The higher portion of Singreeong is gneiss, and the ridge from Hee on the Kullait stretching southward, and from which the Reshee and Ruttoo take their origin, is of the same primitive rock, and they are also covered with oak forest. The upper portion of Chinchul likewise exhibits the same natural characters, geological and botanical.

The cultivated lands may be said to mark the limit of the aluminous deposit; for it is only on the black soils that the people of the country think it worth while to sow grain, as they say, the red soil gives but a very scanty out-turn in comparison with what the dark coloured lands afford. On the upper lands, the alumina is only met with in a disintegrated state; towards the banks of the rivers it occurs in the stratified form of slate.

Captain Herbert in his account of the Geology of the Himalayas, so far as examined by him, states, it is difficult to draw any distinctions between the mica slate and clay slate formations in those regions, and the observation seems to hold good for the section of those mountains now spoken of.

From Tukvar to the Rungeet, and up the Rungeet valley by the road to old Sikkim over Chakoong, Sungreeong and Rinchinpoore, and along the Kullait, we passed through land in cultivation, or that bore traces of having been one time sown or culturable, except where too steep and rocky to admit of being so used. But from an elevation, a little higher than Hee on the Kullait, and south of it by the sources of the

Ruttoo and Reshee till the tributaries of the Rumam are reached, gneiss mountains are only met with, and the country is there left in a state of nature.

In the Bellassur valley, the cultivation may also be considered to mark the elevation to which the aluminous soils rise. On the east side of the Sonada range, the mountain under Mahaldarem is too steep to admit of cultivation being attempted on it high up, and we had made a march and a half down the hill before we came on slate *in situ:* as we approached the Munna or Mahanuddee we met with sandstone, slate and sandstone are also found on the Rektee, and on the small streams about Punkabaree, and on the low hills in its neighbourhood; and at that place and above it till half-way to the level on which Kursiong Hotel stands, mica slate abounds, and forms the outer covering rock of the mountain.

From the junctions of the small Rungeet and great Rungeet to the junction of the latter with the Teesta, slate occurs, and down the valley of the Teesta, by Sideongbleoo, Dimma and Britgong, the country presents a slate formation. On the Subbok, clay stones and sandstones occur.

From the Munna over Sutong, across the Rieng over Mungpo, across the Rungzo up Rienghien-yon-lot, and till well up Sinchul, we meet slate. At Rienghien-yon-lot the country bears marks of having been extensively under cultivation not many years ago.

The minerals met with by me in the Sikkim hills are gneiss rock in the highest positions, and it is also found protruding through slate at the elevations where that rock occurs in many places, as on Rinchonpoom, where abrupt masses of it with a weathered look remind one of the storm-beaten rock seen on sea coasts in other regions. To me the dip of the gneiss seemed generally, if not uniformly, to be back from the valley from 15° to 20° by the eye. This is seen in many places, but no where more clearly than at Boodam, Seguar, a precipice in the valley of the Boodam, a tributary to the

Rumam, where the rock rises very high, and bears the appearance of some fort of the giants, with bastions of enormous proportions, and other phenomena in keeping.

In the quartz of the gneiss I have met lime, as on the Pucheem road; and near the top of Goongla following the old road up the Bellassun valley to the Rungeet valley, there is a piece of gneiss rock through which small amethysts, or seed amethysts are profusely scattered, of the size of half a barley-corn.

It may be worth while to mention, that the gneiss rock about Darjeeling contains nodules of a flinty appearance, or more probably they are fused quartz, which some have supposed to be fossil remains. There is a specimen to be seen on Mr. Turton's grounds, which has an appearance resembling the back of a huge lizard, with divisions answering to the scales; but the divisions seemed to me to pass down through the mass of the specimen, and not to have taken their shapes from the covering of any animal's body, or from having been filtered into a mould shaped from any animal which had originated the form for its reception. The circumstance of no fossil remains having been heretofore found on primitive rocks, may be thought to cause an unwillingness to admit these appearances to be what some have thought them to be; but for my own part I have no theory to maintain in geological matters, and would readily agree to their being fossil relics, if I saw reason for their being so considered. In the menilites of Menilmoutant, we have something of the kind now spoken of (and they by the bye are allowed to be of animal origin) only on a smaller scale, for the quartzy nodules here alluded to, are of a much greater size than any menilites I ever saw, and may weigh some of them many pounds.

Lower on the hills as above remarked than the gneiss, slate occurs in the forms both of mica slate and of clay slate, and in the former chiefly graphite is met with, as at Punkabaree on the new road; also in the land slip to the east of the Dak Bungalow where the road was originally laid out, and on the Roklee or Rektee, three or four miles to the SE. across the hills, and where there is a lick frequented by the animals of the forest. Graphite is also met with near the Joom lime deposit in slate, but whether in clay slate or mica slate I do not know. We likewise met with it on the Munna in mica slate, and a small trace of it was found at Mungpo, between the Rieng and Rungzo, in clay slate.

It is superimposed on the slate that we find lime deposits on Chakoong and Sungreeong. These deposits are tufaceous, and so far as I can conjecture or observe, if not original in their character, they must be exudations from stores of the material contained within the hill, and contiguous to the localities where these deposits are observed to occur. There are of these deposits with which I am acquainted four, and they are in each instance connected with streams of water which pass through them; and in regard to three of them I have made some search for co-existent, compact and primitive limestone with which they might have a connection or relation, but without success. In each instance, the stream leaves on the stones it passes over, a covering of lime. At Chakoong we followed the brook beyond the first deposit met with, and finding it still leaving marks of its character, we proceeded onward to a second deposit, above which the indications of lime became feeble, though they still occurred; but the conclusion we came to from the appearance of the channel of the brook, compared with what we had passed on our way upwards was, that we had got beyond the principal store of the mineral.

At Joom I followed the stream beyond any trace of lime, and till I came to a debris of slate, and subsequently I passed repeatedly above and behind the deposit, though by the same route, and could detect no apparent trace of lime in any of the streams leading from the Joom face of the Chakoong mountain to the great Rungeet river.

At the first deposit on Singreeong or at Singonong, as that portion of the mountain is called, on the road to old Sikkim and Paymiontsu, we made no investigation; but at the second deposit, which is higher up the mountain, I went round the deposit and could discover no lime, but only at the place where the calc tuffa is met with; so unless the lime is brought out of the bowels of the mountain by the water that percolates through a store of it, it is difficult to conjecture where it comes from. In all the instances the streams on which the lime is met with, drain but a small portion of the mountains on which they are found, as is evident by paying regard to the divisions into which they are respectively broken.

I believe active search would lead to the discovery of a small lime deposit at Punkabaree on the stream that crosses the road about half a mile below the Dak Bungalow; up that brook and under a waterfall some way from the road, Capt. B. picked up a piece of tufaceous lime, but impure, as on burning it ran together, and would not slake. We afterward endeavoured to penetrate beyond the fall in search of lime, but a storm coming on, prevented our succeeding at that time, and we never found an opportunity of renewing the attempt.

In addition to these lime deposits, there is also found a small supply of marl, I am told, on Goke hill, by the small Rungeet, and in a straight line from Darjeeling to Chakoong lime deposit: by the analysis of Mr. Piddington it is partly magnesia and partly lime, and would it is likely form a good enough mortar, if prepared for this purpose, but it is only used for white-washing edifices by the Booteeas and Lepchas, and is not burnt for cement.

A flinty slate is met with on Chakoong in masses on the road to old Sikkim and Paymiontsu before mentioned; we also found flinty slate at the junction of the Munnaand Selim.

On the great Rungeet river, at the end of Goke spur, clay slate is met with, nearly perpendicular and in the direction of the river's course, and the same rock is found at different declinations in every valley. Quartz stratified is also found in a nearly perpendicular position on the small Rungeet, as is mica slate on the great Rungeet at the north end of the Tukvar spur, and I believe also on the small Rungeet, at the spot called the Bhoot Bungalow by the Lepchas, not far above the junction of the two rivers of that name.

On Chakoong, sandstone occurs with other amorphous secondary stones, and the same, according to my recollection, is true of Sungreeong and Rinchanpoom. We met with sandstone on the Subbok river and on the Rektee, with different other clay rocks. Some of the sandstones we saw on the Subbok and Munna contain pebbles imbedded in them, or disseminated through them. On the Teesta and great Rungeet we found basalt and porphyry, and also actinolite in rolled masses. Traces of iron are to be met with in every valley, and this mineral impregnates numerous springs in many of the hills, as for instance at the old cane-bridge on the Bellassun, at the end of Goke on the great Rungeet, where there is also a chalybeate spring reckoned medicinal by the Lepchas and Booteeas, and employed, heated, by them in the cure of sores; generally indeed the springs by the rivers bear marks of being chalybeate. A hot spring is mentioned in Mr. Smith's Darjeeling Guide, as occurring higher up the Rungeet in the direction of Paymiontsu, which is used for baths by the natives in cutaneous and other disorders.

On the great Rungeet, where a second spur from the Tukver ridge in travelling eastward abuts on the river, I picked up a fossil bone about the size of a deer's leg bone, (it is now in Dr. Campbell's possession); it seemed quite silicified, and was a drift bone, so that it could not be guessed from whence it had come, and though I searched diligently for an hour or two in the same place, I could find no fellow to the specimen; but the spot ought to be looked over anew, after the annual floods have taken off, and would perhaps yield some reward for the labour of examination.

Such are a few of the minerals noticed by me in the Sikkim hills. I have no doubt many other, and more curious specimens came under my eye, but that I failed to notice or recognize them, my sight being imperfect, both in observing objects any way remote, and in distinguishing colours; some of those mentioned I should not have known of, unless my attention had been directed to them by Capt. B.'s kindness.

A remark has been made by Captain Herbert in his Report on the Geology of the Himalayas to this effect, that a first view of any portion of these hills suggests the idea of a chaotic mass of mountains without any perceptible principle of arrangement, and that it is by tracing the river courses that the best notion of the position of the mountain ridges relatively to each other is to be obtained. This remark is emphatically applicable in every point to the portion of the Himalaya which form the country of Sikkim.

A close examination of this region is apt to suggest the opinion, that it is now very much in the state assumed by it at the commencement of the present constitution of things on the surface of our globe. The rivers run through valleys which seem at first to have been hollowed out for their reception, and bear little mark of change, whether caused by violent convulsions of nature or the slower action of the attrition of waters upon barriers which may at one time have caused them obstruction in their free course towards the plains. The smaller torrents join the greater streams unopposed in the direction given them by their vallies, which, to borrow an anatomical term, anastomose into each other; and the great rivers are poured into the plains direct through their channels, and have no cross ridges to struggle through before debouching on the low lands, as is the case with many other streams in various countries; as for instance with the great Gunduk, which is discharged into the plains through a ridge of sandstone hills.

Perhaps exceptions to the above observations occur in the routes taken by us in some parts of the valley of the Bellassun.

Under Kursiong, the portions of the valley in the neighbourhood of the old cane-bridge is flat and reedy, and looks as if it had not improbably been the bottom of a lake. The same remark applies to another circular portion of the valley bounded by steep rocks, half a mile or three-quarters of a mile higher up the river than the old bridge; here the rocks approach the river on each side at the south end of the portion of the valley in question, and may at one time have been united, and have yielded to the influence of running water, or been otherwise broken down. Again further down the river than the old bridge and on the right bank of the river, there are two or three circular basins with narrow and steep rocky sides, extending from half a mile to a mile to the west of the present course of the river, which if examined, might be found perhaps to have held collections of water now drained off by the river flowing freely through them; a thorough investigation of the appearances of the localities, however, owing to the heavy jungle, could not be undertaken without occasioning much trouble and fatigue.

The rocks forming the edge of the basins above-mentioned have in them curious openings, which serve as passes from one to another, of a size large enough to permit elephants to come and go, and perhaps they have been formed by these sagacious animals having selected soft places in the rock and worn it down by frequent transit. It may be remarked by the way, that they are extremely ingenious in making roads, shewing themselves no mean adepts in selecting gentle ascents by means of well-devised zig-zags: an elephant road when come upon far surpasses a Lepcha path for easy travelling; these last generally go as straight up the mountain as a man can manage to walk. Unfortunately, the elephant tracks are only met with on the lowest range of hills, the animals do not penetrate deep into the country, and only it is supposed, seek the elevated lands during the rains; at least this was the inference we drew from the appearance of the traces of them we met with in our rambles.

Further, a small piece of alluvial land on the banks of the small Rungeet, elevated some feet above the present level of the highest floods as met by me under Goke spur, and a similar appearance on the Rumam at the Boodam valley to the west of Chakoong and Nissjee or Goke, give indications as if these rivers had at one time been partially obstructed in their courses, and had remained stagnant for a considerable period, from some unknown cause, in former times; and Capt. B. who went down the valley and bed of the Rumam on one occasion from Chakoong, found traces of a broken barrier on it, and met with very rugged ground in the course of the river; still there is little appearance of extensive or general change having occurred in the course of the rivers of these hills, so far as we examined them, for many ages.

Yet though there be no striking indications of convulsions, or even of gradual and great change in the river beds or valleys of the country, there are appearances occasionally met with, which shew the condition of these regions not to have always been what it is in the present day. Thus there is in the neighbourhood of Subbokgola, down towards the Teesta, a high broken bank of a hundred feet and more in elevation, the upper portion of which, or as much as is exposed, is made up of boulders of from two to three feet in diameter. A like phenomenon is seen on the banks of the Selim Nuddee, a mile or two above its junction with the Munna, and a similar bank is also found on the Munna about a couple of miles above its junction with the Selim, and of great height; nor is it easy to account for the arrangement of materials, nothing that is now taking place in those quarters having any tendency to occasion such results.

Again, the large rounded boulders found high up the mountain torrents, and which the present streams at their highest never have moved, far less rolled; shew us, that a force far greater than is now exhibited, or at least a power of a different kind or differently directed, brought them to their present places, and gave them their existing forms.

On the Teesta, I observed an arrangement of boulders which it is difficult to account for. The stones near the river, and within reach of its highest floods, bear the usual rounded shape of water-worn stones, while those above the reach of the highest floods that now ever occur as I conceive, are of an angular shape, and lie piled as a wall of say six or eight feet high, in which position they seem to have settled for a lengthened period.

The Sikkim hills being characterized by a scarcity of lime, it may be worth while noticing, that the country is at the same time remarkable for the limited nature of its conchology. The species not only are few in number, but the individuals belonging to any given species are at the same time very scanty. Now it may be asked, is the reason of this deficiency in this class of animals owing to the want of material necessary for the formation of shells, or, is it an accident to be accounted for on some other unknown principle? Certain it is, there is no want of birds in the country, and of course they must have the means of finding material for forming the shells of their eggs, yet this too may be effected by the greater power of locomotion in birds than in mollusca, and in their capacity to go to more remote distances in search of substances that may afford the means of producing a requisite covering for their eggs. Quadrupeds too thrive in the country, and are not stunted in growth, nor to appearance inconvenienced in any way by want of a supply of matter to form the bones of their structure.

One other observation which it occurs to me to make here, is, that the valleys about Darjeeling are generally not insalubrious at any season. The natives say, they are never affected by fever by going any where in them, except in the rains to a small extent. The hills are steep, and the rain which falls on them, though very abundant, runs quickly off them;

nor are there flat places of large expanse in the bottom of the valley, any where in which the water can stagnate. There may be a spot or two which deserve to be excepted from the character of healthiness, and these are marked as the habitations of demons, who in the hills, as well as in the plains, have the character of causing disease in waste and jungle tracts. By my own experience I should pronounce the valleys healthy from November to May, for I travelled through them during that period of the year, and had no ague or illness, yet so predisposed was my constitution from former sickness to disease of this character, that passing through the Terai, and remaining a few days at Titaleea in June, brought on an attack of jungle fever.

Description of a new species of venomous Snake, Elaps Macclellandi. By J. T. Reinhardt, *Junior, Professor of Zoology, Copenhagen.*

This new species is of rather slender form; the short head, the broad, rounded and obtuse muzzle, as well as small eyes, resemble *Elaps lemniscatus.* The nostrils are large and situated between the 2 nasal plates, or perhaps rather behind the first. In the upper jaw, as far as I could discover after a strict examination, no solid teeth are to be found behind the venomous fangs. Among the plates of the head, the occipital plates are distinguished by their size and oblong form; two temporal plates, lying one behind the other, separate them from the labial plates, which are 7 at each side, of these the third and fourth border the eye. There are two back plates and one occular. The inferior labial plates are 6 in number at each side; they increase to the fourth, which is the largest of them all.

The body is of the normal form of the genus; it is covered with simple rhomboidal scales. The number of the rows of scales amount to 13, and in that respect our new serpent differs from the generality of the species of the genus, (in which the number of the rows of scales amount to fifteen, and agrees with a few species, forming with them a separate little group) to which it bears no further resemblance either in colour or physionomy. The abdominal plates are rather broad and in number 216. The tail is thick, moderately pointed and short, or about one-tenth of the entire length, underneath it is covered with 27 pairs of subcaudal plates. At the root of the tail, the number of the rows of scales amount to 9.

With respect to the system of coloration, it deviates from the rest of the Asiatic species of the Elaps by an annulated body. The colour of the specimen preserved in spirits, is brownish red at the upper parts of the body, being somewhat paler in the midst of the scales, than at the edges; down the sides of the body this colour becomes more and more light, and passes at the under-parts into a yellowish white. The whole body from the neck to the end of the tail is surrounded by black rings about a line in breadth, which are generally placed at the distance of an inch, but sometimes nearer to each other. In a few places there are slight* irregularities in the colouring the rings not reaching to the abdomen, and thus being only half rings. The row of scales, situated at the median line of the back, are here and there marked with a black point or streak.

In the midst of the abdomen we find a row of irregular black spots, placed betwixt every two rings.

The head has the colour of the under-parts, but its back is marked with two very broad cross bars, so that only the band of the muzzle, and a transversal band behind,

* *Elaps furcatus Schn: Elaps bivirgatus* and a new species, which the royal Museum in Copenhagen has got from the island of Pulo-Pinang.

the eyes are yellow. However, it is probable, that the colours of the living animal are very different. Total length 25 inches, 6 lines: length of the tail 2 inches, 3 lines: Scuta abdominalia 216: Scutella subcaudalia 27.

This new species, which is a native of *Assam*, I take the liberty of dedicating to the eminent naturalist, Mr. M'Clelland, Bengal Medical Service, to whom the Royal Museum in Copenhagen is indebted for the only example I have seen.

Copenhagen, March 10, 1843.

Correspondence.

Jerdon's Illustrations of Indian Ornithology.

We have been favoured with the sight of the first number of this work, published at Madras, by J. B. Pharoah, containing twelve coloured plates, with a full description of the species figured; the whole to be completed in four numbers, price 6 rupees each. The execution of the plates and the colouring which has been done under the superintendence of the author, T. C. Jerdon, Esq. Madras Medical Service, together with the general appearance and character of the work, surpasses any thing of the kind that has yet been attempted in the way of Zoological publications in India. We merely refer to the work upon this occasion, as highly creditable not only to the author, but to the Presidency at which it is got up, and sincerely hope it may meet with that support which it deserves from the admirers of the interesting subject of which it treats. Mr. Blyth has requested us to insert the following valuable notes by himself on the contents of the present number, which we do with much pleasure:—

"The *Nisaëtus grandis*, Hodgson, figured in Plate I. is, I have now reason to suspect, identical with the European *Aquila Bovelli*, which species is included in Mr. Vigne's list of birds procured in Tibet, Kashmir, &c. published *Proc. Zool. Soc.* for 1841, p. 6. It certainly differs in several respects from the type of *Nisaëtus*, Hodgson, so exemplified by *N. pulcher cristatellus* (apud Elliot, which is identical with *pallidus* of Hodgson,) *niveus* and *Kienierii*, all of which are in the Asiatic Society's Museum, approaching the restricted *Aquilæ* in all except its lengthened tarsi. The four species of true *Nisaëtus* here mentioned, I must further add in reference to Mr. Jerdon's suggestions on the subject, are quite distinct from each other; but I am not satisfied of the identity of *N. cristatellus* apud Elliot, with the bird so named in Jardine and Selby's 'Illustrations of Ornithology'.

Rhipidura hypocantha, Blyth, noticed in the description attached to Plate II, has been justly separated by Mr. Hodgson by the generic appellation *Chelidorynx*.

Plate III.—Respecting the species here figured (which I still prefer to class in *Phœnicophœus*, as this group is recognised in my monograph of eastern *Cuculidæ*), Mr. Jerdon has mistaken my meaning in the passage which he quotes. What I intended by the expression—"No doubt the present species is *alluded to* in both cases," was, that the Indian bird referred to by Levaillant and the Ceylon bird of Daniell, were identical with Mr. Jerdon's species, but certainly not with the African *Serisomus cristatus*. I may add, that the *Ph. tristis*, Cuv. *Melias tristis* of Lesson, and my *Ph. longicaudatus* has just been obtained in the vicinity of Calcutta; and that a third species, the *Ph. Sumatranus* (*Cuculus Sumatranus*, Raffles, and apparently *Melias Diardi* of Lesson,) is common on the hill ranges of Assam. The *Zanclostomus sirker* appears to me to be very decidedly separable from the above group, and to be rightly classed by Mr. Jerdon.

Plate VI.—*Prima cursitans* of Franklin. Both this and the various other Indian *Priniæ* of authors, certainly do not appear separable as a group from the African *Drymoicæ*, numerous species of which are figured in Dr. A. Smith's 'Zoology of South Africa.'

Plate VII.—The Asiatic Society has recently received from Mr. Hodgson, a female specimen of *Tchitria Paradisea*, in similar particoloured plumage to that of the male figured by Mr. Jerdon. As the middle tail-feathers of this specimen are full grown, and do not exceed those of an ordinary female, instead of being greatly elongated as in the male, this circumstance may help to convince Mr. Jerdon of the accuracy of my former statement, that "both sexes attain the white garb with full maturity," albeit the sex of a white female may not have yet been ascertained by actual dissection.

Plate XI.—*Phœnicornis flammeus*, apud Jerdon, would appear to be the same species as the *Ph. elegans* of Mr. M'Clelland and Dr. Horsfield's catalogue of the birds procured in Assam, published in *Proc. Zool. Soc.* for 1839, p. 156.*

Indication of a raised Sea coast at Malacca.

A bed of marine shells has been found at Malacca more than a mile from the sea, and at a depth of from 15 to 18 feet below the surface of the soil, during some excavations for public works, made under the superintendence of Lieut. Maidman, 24th Regt. M. N. I. They were communicated by Lieut. Spottiswoode of the same corps to William Griffith, Esq. F. L. S. of the Madras Medical Service, and forwarded to the Geological Society, with the following remarks extracted from Lieut. M. C. Spottiswoode's letter :—

" The place in which the shells are found is in a direct line about $1\frac{1}{2}$ mile from the sea, and is on a rising ground, as from the spot you can see the sea over the jungle, (not of large trees, but still of some height.) The river at the nearest point is about $\frac{1}{4}$ mile distant, and the tide has never within the memory of the inhabitants overflowed the place. This fact I ascertained at the time from men whose houses were situated there. On digging, three or four yards of sand were displaced, and then was discovered what I was told to be, London clay. About 16 feet below the surface, (depth of sand included,) the shells were found, not in a bed, but in a layer of a few inches in depth.†

" Suppose this‡ to be a vertical section, first sand, then 10 or 11 feet of clay, then shells in a regular line all round the pit, but still scattered irregularly. The pit was dug to the depth of 21 or 22 feet.

" It must have been very long since the sea was near the place; for it did not look as if it had been a creek. What influence the river might formerly have had, I cannot tell you. Maidman is my authority for its distance from the place."

* Mr. Jerdon may have his own reason for doubting the species *Ph. elegans*, and he may be right in rejecting it.—Ed.

† The peculiarities of the river ought to be noted, and the elevation of the bed of shells above the river bed.—Ed.

‡ Referring to a sectional sketch which accompanied Lieut. Spottiswoode's Letter.

Extract of a Letter from J. H. Batten, Esq. *Bengal Civil Service, dated Camp Semulka on the Cosillah River, Kumaon, December 28th*, 1843.

In the July 1843 No. 14 of your valuable 'Journal of Natural History,' which I have only lately had the opportunity of seeing, I read Captain Hutton's paper on the snow of the Himalyas; and, as I differed almost entirely from the conclusions so confidently drawn by that gentleman, I thought it right for the interests of scientific truth, to prepare some kind of answer. As, however, on a more attentive perusal I find that you yourself appear implicitly to adopt Capt. Hutton's views, and actually use these words: "we have long been conscious of the error here so well pointed out by Capt. Hutton, *in common with every one who has visited the Himalya*," I feel more inclined to address *you* in the first instance, and to ask whether you will publish a short reply which I meditate, and whether your note to Captain Hutton's paper was written after your own full and careful consideration of the subject, or merely on a general kind of acquiescence with the facts and opinions of your able contributor, who is so well known and esteemed as a collector of scientific data.

Now I am one who have visited the Himalya on the western side. I have crossed the Borendo or Boorin Pass into the Buspa valley in lower Kunawur, returning into the Rewaien mountains of Gurhwal by the Roopin Pass. I have visited the source of the Jumna at Jumnootree; and moving eastward, the sources of the Kalee or Mundaknee branch of the Ganges at Kadarnath, of the Vishnoo Gunga, or (Aluknunda) at Buddrinath and Mana, of the Pindur at the foot of the great peak Nundidevi, of the Dhonlee branch of the Ganges beyond Neetee, crossing and recrossing the Pass of that name into Thibet, of the Goree or great branch of the Sardah or Kalee, near Oonta Dhoora beyond Melum. I have, also, in my official capacity made the settlement of the Bhote Mehals of this province. My residence of more than six years in the hills has thrown me constantly in the way of European and native travellers; nor have I neglected to acquire information from the recorded labors of others. Yet, with all this experience, I am prepared to affirm, that *the* PERPETUAL *snow line is at a higher elevation on the northern slope of "the Himalya," than on the southern slope.*

The facts mentioned by Capt. Hutton appear to [illegible] only to refer to the northern sides of all mountains in those [illegible] and not to affect in any way the reports of Capt. W[illegible]ers, on which Humboldt formed his theory. *Indeed h[illegible] facts of one observer in one place falsify the facts of another [illegible] in another place?* I willingly allow that the north side of [illegible]tains the snow longer and deeper than the south side, and this observation equally applies to heights in Bhote. But Humbolt's theory is on the question of the *perpetual snow line*, and Capt. Hutton's references to Simla and Mussooree and other mountain sites,* are out of place in this question; or else he fights against a shadow, or an objection of his own creating. In no part of his paper does he quote accurately the dictum which he wishes to oppose. Who ever said the snow lies longer and deeper in the Southern slopes of the *several* mountains? What has been said, and what I now say is, that at the same moment of time (say of any day in September,) when in Thibet or Chinese Tartary, little or no snow is found at 17,000 or even 18,000 *feet odd* above the sea by one traveller, another traveller in the Himalya on the south side of the high peaks finds deep snow at 14,000 feet and *even lower*. The causes of these phenomena it is easy to dissert upon, and I am far from pinning my faith to even the illustrious Humboldt on this point. But, my present object is to state, that one traveller to the Himalya, at least in addition to Webb, should be excluded from the assertion contained in your note.

Note.—I readily confess that I may have been wrong in both the notes appended to this correspondence; the first of these notes was to the effect, that the line of perpetual snow is actually higher on the Southern than it is on the Northern face on the Himalaya, contrary to the actual measurements of Capt. Webb on both sides of the mountain chain; and the second, coinciding with the view entertained by Capt. Hutton. With regard to the first, I must observe, that I never was within forty miles of the high peaks, so that my impression of the supposed error of the measurements of Capt. Webb was derived from a distant view of the snow line, and its relative height with regard to certain peaks, the elevations of which were known, and seemed to make the snow line at least 16,000 to 17,000 feet on the South side, whilst I think it ought to be no more than about 13,000 feet in the 31° N. latitude, according to the calculations of Humboldt.—ED.

I hope I have made myself clearly understood on the points above mentioned, and that you will do me the justice to believe, that only a regard to truth, * * * * * * * *
* * * * * * * * * *
* * * * * * * * * * has induced me to occupy your valuable time with this letter.

Notice of a live Cervus frontalis, J. M.

MY DEAR SIR,

I have the pleasure to inform you of my having dispatched to you a live "Sungnai." I send it at the desire of Capt. Guthrie, who pays all expenses of transport, (and they are great,) and has offered a reward of Rupees Fifty to the person who may bring it alive to Calcutta.

This Deer was caught for Capt. Gordon, with others which have died. Ten or twelve caught for me have also died. Capt. Gordon intended to have sent the Deer to you himself, but being unable, I have done so for Capt. Guthrie, and to Capt. Guthrie will belong the honor of having dispatched to Calcutta the first live specimen.

From what I have said you will see, that Capt. Gordon had not neglected your commission, and considering the great mortality amongst the animals caught, his kindness in having made a domesticated Deer over to me, will be duly appreciated.

I am, My Dear Sir,
Yours faithfully,
WM. MCCULLOCH.

Munneepore, 16th December, 1843.

Extract from the Proceedings of the Coal Committee for the Month of June 1843.

Read a letter from J. W. Westerhout, Esq. to William Griffith, Esq., in reply to queries from the Secretary of the Coal and Mineral Committee relative to the Gold mines at Malacca.

At Gammche, Zahony, and Chandras, situated thirty-nine miles from Malacca, Gold mines are worked under the exorbitant exactions of Native Rajas, who leave the workmen hardly more than is barely sufficient to cover their expenses.

The locality of these mines was formerly under British protection, when there were upwards of a thousand inhabitants and rapidly improving, but subsequently our protection was withdrawn, and the population has dwindled down to three or four hundred.

The land is rich, the climate healthy, and elevated about 120 feet above the sea. The district at present is quite useless, but it belongs nominally to the Malay Pungools, to whom it was given up when fixing the boundary in 1833.

The Gold mines are from 12 to 250 feet deep, the Gold is detached from the pieces of rocks by pounding, and is then separated from the sand by washing, for which the numerous springs in the vicinity afford every facility. The profit of these Gold mines is said to have always been considerable, a single workman being able to obtain, without any uncertainty, two Company's Rupees weight of Gold per diem, and the mines may be worked the whole year round without interruption. The expense of labour is at present from three to four dollars per month.

Miscellaneous.

Liebig's Organic Chemistry applied to Agriculture, &c., Reviewed by Dr. Schleiden.—(Translated from the German.)*

Few books published in modern times have excited a more lively interest or attracted more attention from numerous classes all over Europe, than the publication, whose title is at the head of this paper, though apparently the number of its readers must be limited. Soon after its publication it was hailed, by a great number of people, as a most

* Since this remarkably poignant critique has appeared, another equally unfavourable has been given by Dr. Mohl, which we propose reprinting in the next number.

It may be interesting to our readers to know, that both MM. Schleiden and Mohl are distinguished authorities, the former being conspicuous for his researches on vegetable organisation generally, more particularly as regards the origin of the vegetable cell, and vegetable embryo.

ingenious production, and as a torch, calculated to spread light over the darkest mazes and labyrinths of science; but at the same time voices were heard from all sides contradicting its principles. As the number of the latter is daily increasing, it is to be apprehended that the book will fall into discredit with the same rapidity with which it has risen above the common level. In investigating the real value of this work it is not difficult to point out that part by which it obtained the approbation of so many persons in so short a time. It is much less easy to lay open with precision and clearness those numerous errors and deficiencies, which no doubt will soon produce a decided alteration, and cause it to fall as quickly as it has risen. A work may easily get into favour with the public, which is written in lively and bold language, full of confidence and certainty, and which lays down in a few principles, expressed with perspicuity and precision, those scientific results which have been obtained by many tedious and laborious researches during many centuries, and which besides boldly establishes new laws, by which it seems easy to solve with certainty the most difficult problems, and to explain the most complicated phenomena. Such a book is sure to get into favour with that portion of the public which, incapable of forming its own opinion on the matter, wishes to be put in possession of the results of scientific researches, if that end can be obtained without following the deep investigations of scientific naturalists; and especially if the book be written in a language adapted to moderate talents and pretty free from technical terms. Had the book appeared under a different title, nobody would have found fault with its author or entered into a dispute with him; for no doubt agriculturists, and other practical men, may learn many useful things from it, which they must otherwise have collected from many works with great labour. But the title of the book, and still more the account the author gives in the introduction (p. ix.) of what induced him to undertake it, has subjected his publication to strict criticism, in order to ascertain its real value in a scientific point of view. The title of the book alone shows, that a single person is not able to form a just idea of the value of its contents in all their bearings, and that the opinion of the chemist, of the agriculturist, and the physiologist, may differ much respecting that point. Up to this time the opinion of only the two first classes (chemists and agriculturists) has been published. The chemists have found fault with the author for having produced very little which is new, and for having published what was already known before, as if it had been found out by himself, without mentioning the name of the discoverer. The agriculturists have probably taken well-founded objections to many of the principles laid down by him, especially to his theory of manuring. It is now time that the physiologists should raise their voice, I mean the vegetable physiologists, as the other classes of physiologists find very little information in his book, if we except a few pages (pp. 299-346) where the author speaks of poison, miasma, and contagion. The vegetable physiologists have now to determine the value of Dr. Liebig's work as far as it relates to the science they profess. Such a step on their side is completely justified by the treatment they have experienced from this author, who, as often as an opportunity occurs (and sometimes he fetches it from afar), speaks of the physiologist with such wanton contempt, that in some respects the whole book is nothing better than a libel on this class of naturalists. Since Dr. Liebig asserts (p. 32) that even the most distinguished of our physiologists do not connect any meaning with such terms as—acids, bases, alkalis, etc., I think we shall be justified in trying to prove that we, physiologists, understand much more of chemistry than Dr. Liebig of physiology and the objects of our science. It will then be obvious which of the two has most to learn from the other.

But it may be asked, why I take so much trouble with an adversary, whose book contains so little which is exclusively his own, and that little of small importance, whilst there are found in it such numerous errors, and many things bordering on complete absurdity. I therefore find myself obliged to lay before the public what entitles the author to his attention on my part, and how it happens that it is not a disgrace for me to enter the lists against him. Dr. Liebig is no philosopher. Even in the literature of philosophy he is so extremely ignorant, that, without comment, he thinks proper to call the fancies of Schelling, the "Natural Philosophy of the Germans." Still, it must be confessed, that his work adheres closely to one great fundamental principle of philosophy ; and this he owes to the soundness and clearness of his genius, which nobody can deny him to be possessed of. But it does not appear that he has been fully conscious of the intimate connexion of that principle with researches in science. The principle I mean is the possibility of a natural science, founded exclusively on a hylological (material) view of the creation. The only principle or end of all scientific researches must be, to place all nature under strict mathematical laws, which do not admit of exceptions, and which ultimately are all reducible to the laws provided by those movements of matter, which arise from their fundamental qualities. This principle must be applied, without exception, to all objects of organic or inorganic nature. If this term is rightly understood, we must say that there is in nature only organic matter, or such as is subject to be continually changed by movements produced by internal, but material, powers; and inorganic matter, which, not being subject to changes, is subject to the mathematical laws of nature. The mental functions alone are entirely independent of these laws; but as the mind derives its origin from a source of quite a different nature, it must eternally remain excluded from the scientific (theoretic) researches of material nature, as an object which cannot be connected with them. This difference, however, is not very obvious; and only by a slow progress men have at last risen so far as to form a clear idea of this state of things. The union of the mental and material view of the creation in the same subject, has for a long period led men into error in this respect. This appears in the ancient myths, who attributed to each stone a spirit,—a god; in the more refined entelechia of Aristotle, who found himself compelled to adopt a spiritual principle for the explanation of the formation of forms; and in the monades of Leibnitz. We even find that the most ingenious investigators of nature, who, as it were, by instinct, have acquired the idea that the material world constitutes an independent body, have been cried down as atheists. But at last the day began to dawn, natural philosophy gradually freed itself from the fetters imposed on it by scholastic wisdom derived from traditions and ancient writings, and, leaving books aside, it applied itself to investigate the processes of nature by experiments, as soon as this manner of scientific research had been introduced by Galileo. From that period many phenomena have been placed without the pale of the mystical system. Kepler, Newton, and La Place, at least, have completely succeeded in liberating the movements of the heavenly bodies from all spiritual influence, and in subjecting them to the laws of motion. That portion of natural philosophy which is called physics, and chemistry, have likewise gradually attained their true position, and achieved their independence. But in those branches of natural philosophy, whose object is the investigation of organic nature, the old disorder still remains, on account of difficulties arising from the complication of the problem to be solved; and more especially, because in the most perfect organic body, in man, we continually encounter the mysterious union of mental operations and of matter, which probably will remain unexplained to all eternity. Nevertheless, in these branches, too, science continues its progress on a safe road, although for a moment it has been led astray by the poetical fictions of Schelling and his adherents. The whole science of the organic world, both in physiology and medicine, advances irresistibly, propelled by the united efforts of those who apply themselves to the investigation of these subjects. All researches now tend towards one ultimate end, namely, the establishment of a complete independence, on the part of the material world, of explanations drawn from the spiritual world, and the securing it on scientific principles. This is the bond which invisibly connects all the distinguished investigators of nature of our own times, and which unites all the different individuals engaged in the pursuit into one great school, however widely they may differ in their opinions and views. This it is which impresses on the natural philosophy of our days a peculiar character, of which it will not be deprived by the quickly-vanishing dreams of philosophical mysticism. Here I might confess that the manner in which organic chemistry is treated by Dr. Liebig, tends to the same goal, and I repeat, that on that account his book deserves to be noticed; though perhaps it will be in the end discovered that the author has solved a single problem of vegetable physiology—that most of them he did not understand—and that consequently his book is useless, as far as the advancement of vegetable physiology is concerned.

If, on the one hand, we admit that an author has directed his views towards right objects, and that he has never swerved from the idea which must give life to his labours, we must, on the other hand, ask two questions before we can conceive a precise idea of the real value of his work. We must firstly inquire what degree of clearness this leading idea has attained in his mind, and how far it has been combined with the consciousness of its scientific tendency: and, secondly, how he has applied this idea to specific objects. It is extremely difficult, I may say impossible, to separate these two questions, and to answer them singly, in giving an opinion of this publication of Dr. Liebig's. For in reference to the last question, the principal reproach to which his work is subject is, that it has been written without consideration, and without its author having previously digested the matter as he ought to have done, as is evident from the circumstance that nearly every page, and certainly every chapter, is either not in accordance with that which precedes, or is frequently in plain contradiction to it. The whole work is, in fact, a strange mixture of contradictions, superficial observations, gross ignorance, ingenious ideas, and rich and powerful combinations, with which are interwoven the opinions and views of other authors, sometimes named and sometimes not, and just historical notices; although in other places the author intentionally, as it seems, falsifies historical facts. The reader is frequently uncertain what opinion he has to form; he does not know whether he understands the views of the author, or whether he is studying ideas conceived and written down in haste, or whether, supposing that the true view of the author is made out, it is worth exposing, and proving that it does not rest on any foundation. Liebig himself does not hesitate to designate as illiterate all those who despise the value of foreign literature the more, the less they are acquainted with it; and we shall add, that it is only a proof of mental vulgarity when a man extols his own business as elevated above all others, and presents his own limited views as the only ones founded on truth. Dr. Liebig, who speaks so contemptuously of physiologists, and asserts that even the most distinguished among them do not connect any idea with such terms as carbonic acid, acids, and bases, does not show in his book that he is himself acquainted with the publications of any botanical physiologist, except those of Reum, whom nobody regards as a vegetable physiologist at all, and the general physiology of Burdach, who adheres to the poetical fancies of Schelling, which are rejected by nearly all who have acquired any reputation in these branches of science. Besides, he seems to have forgotten, or perhaps he never knew, that Müller, Schwann, and other physiologists, have distinguished themselves by important discoveries in chemistry. Indeed, Dr. Liebig would seem to know nothing about anything except chemistry, and even in that science to be only acquainted with his own views, when, among other observations, he maintains in a very arrogant way, that the art of making experiments can only be acquired in a chemical laboratory. It would seem as if he had never heard of experimental natural philosophy, and that the names of Faraday, Arago, Biot, Seebeck, &c. have never reached his ears. What conclusions, then, shall we draw from his assertions? It is a most unpleasant task to enter into a dispute with an author who evidently has not digested what he has published, for in such a case it must remain a matter of great doubt how far he intends to be answerable for his own opinions and assertions.

We are bound to support these our opinions of Dr. Liebig's work by some passages taken from the book itself. He says, p. 18, "It is certain that plants decompose carbonic acid;" p. 60 and 61, however, he thinks it *very improbable* that the carbonic acid is decomposed, and shows that it is much more probable that water is decomposed. Page 35, he says, "As pure starch of potatoes, when dissolved in nitric acid, leaves behind a ring of the finest wax, what can be objected if the chemist hence draws the conclusion that each molecule of starch is composed of concentric layers of wax and amylum, which thus *reciprocally* protect one another against the influence of water and ether?" It does not appear to have occurred to Dr. Liebig that the term, "reciprocally" must expose him to ridicule. One kind of matter must be on the external surface; and by the alternate action of water and of ether the molecule of starch should, of course, be dissolved: which, however, does not take place, as is well known. It is hard to suppose that Dr. Liebig is so ignorant of his own science as not to know that starch is easily dissolved in boiling water, diluted sulphuric acid, and diluted alkalies, and does not leave a residuum of wax; and that nitric acid not only dissolves starch, but decomposes it. Page 8, he says, "The qualities of humus and of humic acid have been transferred in an inconceivable way by vegetable physiologists to that constituent of mould to which the same name, has been applied." (By whom?—I think only by chemists.) We do not know whether to consider it as ignorance of the history of his own science, or as an intentional falsification of historical facts, when we find that Dr. Liebig does not even suspect that the whole theory of humus, and its application to explaining the manner in which plants are nourished, have been invented and fully developed by Saussure, Sprengel, Malaguti, Berzelius, Mitscherlich, Mulder, and others, who were all chemists; and that but few vegetable physiologists have adopted it from them without making any material change. Dr. Liebig does not seem to know that many vegetable physiologists have always asserted humus only to contribute to the nourishment of plants by being converted into carbonic acid. This is the opinion of Senebier, Ingenhouz, Agardh, &c. I myself heard it from my teacher Bartling; and it was only at a later period that I became acquainted with the theory of humus, as explained in books, and to which I am not inclined to give my assent. But in another part of his book he does seem to know this fact, and speaks there of Senebier, Ingenhouz, &c. We read at page 22, "the same current of air which *produced* by the rotation of the globe, has traversed the space between the equator and the poles, brings to us, on its return to the equator, the oxygen which there (where?) has been produced, and carries to it the carbonic acid of our winters?" Must we, in reading this monstrous theory of the winds, ascribe it to an entire ignorance of natural philosophy? or to an utter confusion of his ideas when the author was writing down this passage? Page 37:—"In those plants of the torrid zone which are filled with milky juices, caoutchouc and wax surround the water with a kind of impenetrable cover, similar to what is observed in oily emulsions, therefore they abound in juice. As in milk the pellicle formed on the surface prevents evaporation, thus in these plants the same effect is produced by the milky juice." Such an assertion would excite a smile on the face of a youth just beginning to study the anatomy of plants, and hardly deserves to be refuted. The whole families of Euphorbiaceæ, Asclepiadeæ, Milky Cacti, &c., consist of large thin-sided cells filled with watery juice and a little chlorophyll. Among them are distributed a few thick-sided vessels filled with a milky juice, which contains but little water. These vessels are not mechanically united with the first class of cells, and perhaps even their organic connexion may not be important. In despite of this milky juice, the watery matter of the cells would soon evaporate if it were not protected by the close texture of the epidermis. A person who applies to vegetable physiologists a language like that used by Dr. Liebig, should, we think, endeavour to understand at least the elementary principles of vegetable physiology. It is needless to produce more instances of this kind, which may be found on nearly every page; our assertions will be abundantly supported by what still remains to be introduced.

It must be considered as an unavoidable consequence of the haste with which Liebig has worked, of his striking want of scientific knowledge, and of the little consideration he has given to his subject, that his reasoning may be refuted point by point, even in matters where his views are just. In my opinion there is nothing which proves more evidently the uselessness of an author, than the circumstance, that his reasoning is open to well-founded objections while his evidence is admitted. Such a man cannot fail to create a prejudice against science itself, because many will imagine that they have put an end to a subject, however solid its foundation, when the defence of it by a weak advocate has been easily thrust aside. I feel it my duty to state this expressly, as many persons would otherwise blame me for having attacked Liebig on account of views which I myself have defended at other times. My object in writing this paper is not to treat of certain laws and principles of physiology, but to show, what Dr. Liebig does not understand—the problems which that science has to solve; and that at least, in this publication, he has not in any essential way contributed to the solution of these problems. In order to proceed regularly in the performance of this task, I shall subject the principal sections of his work, as far as they regard vegetable physiology, to a more exact and minute examination.

The first section (from 6 to 43) treats of the assimilation of carbonic acid. I have already mentioned that he begins with stating as an historical fact that which is not true. The humus of the soil has indeed been identified with artificial humus, and has been considered as the principal source from which plants receive nourishment. This, however, has not been done originally by the vegetable physiologists, but by chemists; as is evident from the circumstance that Dr. Liebig, in his short view of the theory of humus, does not produce the name of one physiologist, but only those of chemists. Further, Dr. Liebig is of opinion, that it can be shown by the strictest proof, that humus, in that form in which it exists in the soil, does not, *in the slightest way*, contribute to the nourishment of plants. According to my view of the matter, we are not yet so far advanced in our researches as to be authorised to make such an assertion. It is easy to show that Dr. Liebig has not succeeded in establishing what he promised; but, instead of it, he has adduced a fact which perhaps may give a slight probability to this view of the matter. His first observation (p. 9), is, that the cold of winter and the heat of summer deprive the humic acid of solubility in water; which is quite in accordance with the old experience, that drought in summer and a high degree of cold without snow in winter, considerably diminish the fertility of soil. This observation, therefore, may rather be considered as supporting than as refuting the theory of humus. The observation which follows, that cold water deprives the good mould only of the salts of the rain water and that it remains colourless, is not true, according to the experiments of Berzelius (viii. 386). I myself always have obtained from good mould a yellowish extract, which indeed differed considerably according to the difference of the earthy matter, but which always contained a considerable admixture of brown organic matter. By these two observations, which evidently prove nothing, Dr. Liebig thinks he has succeeded in completely disposing of humic acid (p. 10), and passes to humic salts. Here he offers us some calculations by which he intends to prove that they are equally incapable of supplying a plant with the amount of carbonic acid required for its nourishment. All calculations beginning with such phrases as, "Let us suppose," "Let us put aside for the present," &c., are usually valueless to science; and if they are made without the least regard to essential points, and are based on arbitrary suppositions, as those of Dr. Liebig, they are perfectly childish. His first calculation is to prove that the ashes obtained from a plant, if all its salts have been taken up as humates, are only sufficient to account for one-thirtieth part of the carbonic acid which is produced. Here we first meet with the erroneous assumption that potash and soda do not differ from lime in their capacity of saturation. I should have expected Dr. Liebig to know that the difference is very great. Further, he has entirely omitted ammonia, which forms the salt richest in humus, and which, in his own opinion, is introduced into the plant by the roots, on account of its great affinity to the humic acid of the soil, probably as a humate, being afterwards decomposed by the plant for the purpose of forming matters containing nitrogen. Lastly, the author has not taken notice of secretion from the roots, of which he is elsewhere a strenuous advocate. According to this theory, it would be probable that a great quantity of bases, after having given the plant this humus, are secreted, and consequently cannot be found in the ashes. But these bases can again be directly saturated with humic acid, can thus re-enter the plant, and will then undergo again decomposition and secretion, and so on. This calculation, then, is entirely void of all the fundamental data required to prove, even remotely, the improbability of the theory of humus. The second calculation has for its object the quantity of humic acid which may be introduced into a plant by the water which is contained in the soil. Liebig begins by assuming that (according to Schübler) an acre of land receives, during a period of four months' vegetation, 700,000 lbs. of rain water, which reaches plants while saturated with that salt which is the most soluble and contains the greatest quantity of humic acid, *i. e.* with lime; but by this, not one-sixth of the carbonic acid which is produced can be accounted for. This calculation is equally worthless with the last, because lime constitutes neither the most soluble salt, nor that which contains the greatest portion of humic acid. Ammonia, indeed, is such a salt; and this, according to Liebig himself, is always found in sufficient quantity. The following calculation, which I oppose to those of Dr. Liebig, will show how insignificant such estimates are:—An acre contains 40,000 square feet. If the crust of soil operative in vegetation is taken to extend to the depth of a foot, and the specific gravity of the earth at 2.0, the acre contains 4,000,000 cubic feet. Suppose that it contains *one per cent.* of humus, the humus amounts to 40,000 lbs. According to Berzelius, these materials absorb from the atmosphere in 24 hours, 40,000 lbs. of water; consequently in 120 days, during the period of vegetation, 4,800,000 lbs. of water. To these are to be added 700,000 lbs. of rain, which raises the quantity to 5,500,000 lbs. of water. In this way the plants receive 2,200 lbs. of lime saturated with humic acid, which is equal to 2,016 lbs. of humic acid, or to 1,169 lbs. carbonic acid. Now the corn and straw grown on the acre contain, according to Liebig, 1,020 lbs. carbonic acid. There is consequently, still left 149 lbs. to account for the carbonic acid consumed in forming roots and the lower part of the haulm. Again, according to the opinion of the author, the atmosphere always contains ammonia, which is readily absorbed by humus, and forms that salt which is most soluble and contains the greatest proportions of humus. If, for the formation of humate of ammonia ten times the same quantity of water is required, that quantity (700,000 lbs.) brings to the plants 70,000 lbs. of humate of ammonia. This quantity contains, according to the calculation of Mulder, 42,000 lbs. of carbonic acid, and if we suppose that only one-tenth of the water is used in the nourishment of the plants, they receive still 4,200 lbs. of carbonic acid. I could wish to learn from Dr. Liebig what the plants are to do with this immense surplus of carbonic acid?

On the other hand, the author at page 13, has made calculations which render it in the highest degree improbable that plants are nourished by humus contained in soil. After having repeated the old observation, that in forests or meadows, in despite of the crops annually taken from them, the soil continually increases the proportion of humus without the assistance of manure, he produces a calculation, according to which equal spaces of ground, whether used for the growth of forest-trees, grass, corn, or turnips, produce annually nearly the same quantity of carbonic acid. If this was true, it would prove that the production of carbonic acid is entirely independent of the mode of cultivation and the application of manure. The facts on which this calculation rests are not within my province, but Dr. F. X. Hlubek, in his examination of this our author's book, has proved, in a very satisfactory way, that these facts are mere fancies of Dr. Liebig.

The author arrives at the conclusion, that as the soil cannot be the source from which carbonic acid is derived, it must be the atmosphere. I think he has come to this conclusion too hastily. I venture to affirm, that it is certain that the vegetable matter contained in soil is changed into carbonic acid by the oxygen of the air, by way of combustion. It cannot be questioned, that the carbonic acid produced in this way is absorbed by the moisture contained in soil, and then attracted by the roots. It is therefore very probable that soil contributes much to the nourishment of plants; and this probability is increased by the observation, that the quantity of carbonic acid does not appear to have increased in forests, which for a thousand years never have been cut, and certainly not in proportion to the quantity of vegetable matter produced by the falling of leaves, the breaking of branches, &c.

Dr. Liebig next inserts (p. 15) a very absurd observation: "Humus," he says, "is produced, according to the opinion of all scientific men, by decomposition and decay. Therefore there cannot be an original humus, as there existed plants before the humus." I answer; "carbonic acid is produced, according to Dr. Liebig and the opinion of all scientific men, by the process of combustion and respiration; therefore there cannot have been an original carbonic acid, as there existed plants before animals and combustion." But of what use are such follies in a scientific work? What do we know of the nature of that process by which the earth forms her productions? I think, just nothing. Carbonic acid is a combination of carbon and oxygen; humus is a combination of carbonic acid, oxygen, and hydrogen. Does Dr. Liebig think it more difficult for nature to bring about the combination of the three last mentioned substances, than that of the two first?

After Dr. Liebig (p. 17, &c.) has repeated the well-known facts respecting the continued production of carbonic acid, and that nevertheless the portion of this matter contained in the atmosphere does apparently* not increase, he briefly asks, "what becomes of the carbonic acid?" and he answers as briefly, "it is absorbed by the leaves

* Mr. A. Dumas, in his Statics of Organic Chemistry, has shown that our eudiometric experiments are much too scanty to prove that the atmosphere is not subject to any change in the proportion of its components.

of plants from the air, decomposed into its constituents, and after the carbon has been fixed in the plant, the oxygen is emitted." This question, however, cannot be decided in so hasty a way, if it were only because the answer expresses much more than the question implies. The question, What becomes of the carbonic acid? and the answer, It remains fixed in the plants, have nothing to do with the other questions, by what organ is carbonic acid introduced into a plant? and is it there decomposed, or only fixed? That carbonic acid is the matter from which the carbon of plants is derived, is a fact which has been stated long ago, and which, up to this day, has been asserted as true, by a great number of physiologists. That under certain circumstances plants absorb carbonic acid, and emit oxygen, by means of their leaves, is likewise a fact, which has been acknowledged since the times of Senebier, Priestley, and Sáussure. But that it is certain, as Dr. Liebig thinks, that carbonic acid is dissolved in the leaves of plants, has not in any way been proved, and he himself thinks it very improbable in another part of his book. Lastly, that the leaves absorb *all* the carbonic acid which is required for the maintenance and growth of the plants from the atmosphere; that the plants, when they are perfectly formed, are not in need of the carbonic acid of the soil; and that want of moisture and complete dryness of the soil do not impede the completion of their development (p. 46);—all these propositions are mere fictions, and have evidently been written without consideration. For common experience shews, that plants must die if the soil loses its moisture entirely, and thus refutes the statement of the author in a manner which cannot be questioned. In conceiving this unfounded theory, he evidently has been influenced by a solitary instance mentioned in his Appendix (p. 181.) I do not call in doubt the credibility of Mr. W. Macnab, though many important difficulties have risen in my mind on reading his account; but I must observe, that Ficus australis is a plant whose roots grow in the air, and that it appears to me more than probable that such plants are, more than others, possessed of qualities which enable them to condense the moisture of the atmosphere. But even if this fact is admitted in all its force, it proves nothing more, than that Ficus australis constitutes an exception to this general rule. Experiments by which this question is settled may be made every day. It will be found that a plant in a pot dies if it is not watered, that in the open ground it continues to live for a considerable length of time without rain, because the soil continually absorbs the watery vapours of the atmosphere, especially during the night; but that when drought continues for a long period, plants growing in the open country suffer, especially because the drought diminishes the capacity of the humus for absorbing moisture (Mitscherlich). These facts are known to every peasant, to every gardener, but as it seems, are unknown to Dr. Liebig.

To prove the absorption of carbonic acid by leaves, the author appeals to the well-known experiments of Sáussure. According to the same experiment, he is obliged to admit that they emit carbonic acid at night; but he asserts, without any kind of proof, that this carbonic acid is derived from a quite different source, and that the quantity thus emitted is not equal to that which has previously been absorbed. But since the experiments of Sáussure, Link, and Grischow, according to which, plants vegetating in an air, to which that of the atmosphere has not access, do not change the air in its qualitive or quantitive relations, have not been reported by Dr. Liebig, I shall take the liberty to oppose these well-conducted and exact experiments, to the phrases of Dr. Liebig, and I think I may assert that in this matter there is still a great vacuum in our knowledge, to fill up which this author does not seem better qualified than physiologists.

Meyen being aware of these difficulties, was nearly the first and only physiologist to deny that the atmosphere is improved by the functions of the leaves, and he has proposed a theory, resting, indeed, on a very weak foundation. Now Dr. Liebig asserts (p. 24,) that in the writings of all vegetable physiologists and botanists, the assimilation of the carbonic acid of the air is called in doubt, and that most of them deny that the air is improved by plants. This is another proof of his great ignorance, or rather gross falsification of historical data known to every body, and it is not worth my while to answer them more fully.

Dr. Liebig, after having (p. 26) enumerated a number of single well-known facts, which have produced in his mind the certain conviction that the carbonic acid emitted at night by plants enters them originally in that state, and that the oxygen absorbed does not serve for the combustion of the carbon, he at last, (p. 30,) produces a decisive proof which, in his opinion, clearly shows that the plants give a greater quantity of oxygen to the air than they withdraw from it. He rests this proof on the known fact of air-bubbles beneath ice, which are said to be filled with pure oxygen; and this oxygen is stated to be derived only from plants. Dr. Liebig asserts that it is pure oxygen, and we must give him credit; and he adds also, that this oxygen is always increasing in quantity, and never diminishing. But, I ask, must this be considered as a proof of that great art of making experiments, only to be learnt in chemical laboratories? If it is so to be considered, I am glad that I have learnt it in other places. How is it possible that Dr. Liebig can expect to solve, in ditches and ponds, such delicate problems, in such a way as to render them in the least degree useful to science? He does not seem to know that ice absorbs gases; that certainly water is never separated from the air hermetically, as it were, by ice; that in water a continual absorption and exchange takes place between the gases; that carbonic acid is more easily absorbed by water than oxygen; that frost separates from the water the gases which it has absorbed; that such a separation especially takes place at points and edges, and, consequently, at leaves and small branches; that—but this is enough to prove, that he who considers the solution of the above-mentioned problem so very easy a task, must have but a superficial knowledge of the matter, and that this remnant of knowledge is arrogantly employed for the purpose of showing up, as ignorant fellows, all those botanists who have entertained different opinions, although founded on innumerable facts. Though I certainly am not partial to Mr. Meyen, and decidedly differ from him in the solution of the problem in question, yet I assert boldly that, in conceiving his theory, he has evinced a degree of sagacity and of knowledge of chemistry much superior to that of Dr. Liebig in his chapter on the Assimilation of Carbonic Acid. Not to mention his frequent contradictions, his historical, physical, and physiological perversions, he shows in this chapter a want of knowledge in even his own chemistry, by producing his untenable theory of starch. The only new thing which he has advanced in it, is the view that carbonic acid is assimilated by plants by means of their leaves; and this proposition must, for the present at least, be regarded as quite unfounded. In proof that carbonic acid dissolved in water is introduced into plants by their roots, I shall here produce two calculations, which rest on very different foundations, and yet agree in so remarkable a way with one another, and with other facts, that I think many will be inclined to put some value on them.

I. According to *Hales*, a sunflower, 3½ ft. high, evaporated every day 1 lb. and 4 oz.; therefore in 120 days, during its vegetation, 150 lbs. = 3 cubic feet. These, saturated, contain 3 cubic feet of carbonic acid. I shall allot to every plant 2 square feet of soil. There would therefore be on the acre, assumed by Dr. Liebig, 20,000 of such plants. 3 cubic feet of carbonic acid have the weight of about 5 oz. Therefore all the plants absorb with the water 6,250 lbs. of carbonic acid, or 1,600 lbs. of carbon. The production of carbon over the surface of an acre is, according to Liebig's calculation equal to 1,029 lbs. There remain, therefore, still 630 lbs., which have been employed in the growth of the roots, &c., as also in that of the leaves which have withered during the period of vegetation.

II. The supposed acre, if we assume one foot for the depth of the earth which contributes to the growth of the plants, contains 40,000 cubic feet.; or, if we assume the specific gravity of the earth, at an average at 2.0 it contains 400,000 lbs. of earth. These again contain 40,000 lbs. of humus, or 1 per cent. They absorb from the atmosphere, in 24 hours, 40,000 lbs. of water, and in the assumed period of vegetation, *i. e.* in 120 days, 4,800,000 lbs. of water. To this is to be added the average quantity of rain; viz. 600,000 lbs. and then we obtain, 5,400,000 lbs. of water. The sunflowers, which Hales used for his experiments, have only on the lower side of their leaves stomates by which evaporation takes place. Let us suppose that the surface of the plant is 38 square ft. but that only 2 square ft. are occupied by the stomates, by which evaporation is effected; then we find that that portion of the surface of the plant by which the evaporation goes on is equal to the surface of the earth from which it draws its nourishment. If we suppose that the evaporation does not vary, we obtain for all the plants, 2,700,000 lbs., or 54,000 cubic feet of water. With this water an equal number of cubic feet, or 5,625 lbs. of carbonic acid, are introduced into the plants, which answers to about 1,500 lbs. of carbon.

Though, from the nature of the subject, the facts on which these two calculations are founded have no claim to great exactness, and are only to be considered as a very rough estimate, yet they give a result in which the difference is not very great; and they prove at least one thing, namely,—that the carbonic acid which enters plants with water, by means of their roots, is completely sufficient to explain the source of carbon existing in the plants. When we consider, moreover, the capacity of humus to absorb carbonic acid, we shall be almost justified in assuming that the water which is absorbed by roots is completely saturated with carbonic acid.

I have now shown that Dr. Liebig has not at all understood the problems of physiology, as far as he has touched upon them in this chapter; that he has not produced any new fact, with the exception of the unfounded assertion that equal extents of soil produce equal quantities of carbon; that he does not know, or pretends not to know, that all the false theories on which he has stumbled, have been invented by chemists, and have only been adopted from them by physiologists, among whom, however, there always have been some who have entertained more just views; and lastly, that the only new thing which he has introduced, appears, according to our present knowledge, to be quite unfounded. It cannot, then, fail to excite indignation, that Dr. Liebig should, at the end of the chapter, make a violent attack upon physiologists, of whom, in his ignorance, he has formed an idea, existing only in his own fancy, and on which all his offensive language is grounded. It is rather unfortunate that in a book dedicated to Alexander Von Humboldt, the author should assert, that the most distinguished of our physiologists are unacquainted with the elements of chemistry, whilst that class of natural philosophers with pride and truth enumerate among them that great philosopher himself.

Dr. Liebig reproaches vegetable physiologists with ignorance of chemistry and physics, and says they are incapable of making experiments. As to the first point, I shall use the words of Dr. Liebig himself, and assert, that that man acts like a blockhead who treats other sciences with contempt in proportion to his ignorance of them. Whoever has read the publications of Dutrochet, Mohl, Unger, Göppert, &c., will certainly confess that they know quite as much of chemistry as can be required from persons who do not profess that science; and that in those writers no such absurd theories are found as the nonsense about alternate layers of starch and wax protecting one another reciprocally against the influence of water and ether. As to their knowledge of physics, I think they have a much greater share of it than Dr. Liebig, as is evidently proved by his Theory of the Winds.

Dr. Liebig thinks that all the talents of vegetable physiologists have been wasted in a study of the structure and formation of plants, and that they have proceeded in this task without consulting chemistry and physics. I confess that our physiologists, in their ignorance, have always been such simpletons as to think that a person must first be perfectly acquainted with all the parts of a machine—with its wheels, levers, &c., before he can expect to be able to explain its action in any reasonable way. I do not doubt that they are also of opinion, that if Dr. Liebig had only had a small idea of the structure and physiology of plants, he would have avoided expressing himself as he has done in speaking of the milky juice; or, as at p. 66, where he says: "The vegetable physiologist considers a leaf in every case only as a leaf, notwithstanding that a leaf, which produces oil of turpentine, must be of a different description from that which gives oxalic acid." A leaf is indeed always a leaf. But the physiologist has ascertained, by the anatomy of plants, that neither leaves nor stems of themselves produce oil, or any other matter, and that these are formed only in separate cells. It is indifferent whether these cells occur in the leaves or in the stem. To explain these processes, it is of the greatest importance to investigate anatomically the most minute portions of the cells; for the productive power of two cells, placed near one another in the same leaf, differs frequently much more than that of two plants distant from one another, and quite different in their habits. If Dr. Liebig had the least notion of a microscope, and its use, he would not have exposed himself to ridicule by his idle objections to the existence of fungi producing fermentation. That the microscope may lead to more certain results than common chemistry, may be proved by his view of the composition of starch; and what he says of gluten in bread (p. 36), proves nothing more than that he does not know how to use a microscope. Nobody has ever thought of distinguishing, either with the microscope or the naked eye (for in this matter it is the same), things which possess the same qualities in an optical view. But if, as is probable, gluten and dextrin have a different capacity of refracting light, and these two substances are indeed mechanically mixed up in the bread, Dr. Liebig may be certain that the distribution of gluten in bread may be discovered as well by the microscope as by his chemical processes.

As to the inability of physiologists to make experiments, I confess that we do not make experiments like those of Dr. Liebig, where a fish-pond represents the pneumatic trough, and a skating-ground a graduated tube. They know too well what they are about, and that their object is not to reason about the possibility of a chemical or physical explanation, but to ascertain how nature proceeds in her operations in each given case. We are far indeed from being able to effect this, and the principal reason of our inability must be looked for in the state of chemistry, which leaves us in the lurch, and offers nothing to our assistance except a great number of *ines* and *ides*, which are useless in the explanation of the theory of vital actions; and about as many hypotheses respecting the composition of organic matter, which are just as useless, because they do not rest on consistent ideas and are not coherent in themselves. Dr. Liebig is, no doubt, able to explain how, according to the opinion of some chemists, it may be imagined that an atom of starch is composed by the combination of his elements; but can he prove how it must be composed according to scientific principles, which do not admit of any objection? Is Dr. Liebig able to give us a theory which explains the transformation of starch into gum and sugar, &c., and which contains something more than empty phrases—such as catalys, contact, a body in activity, and so forth? So long as in these two matters, which themselves constitute the real foundation of vegetation, we cannot give a satisfactory explanation, we can hardly expect to understand the zoochemistry of the cells of plants; nevertheless, it may be hereafter found that the life of the whole plant, and of its organs, may result from the life and productive faculties of single cells. It cannot be denied that vegetable physiologists have made many experiments little to the purpose; but it is unreasonable to inveigh against them on that account; and is it not most indecent, when it is done by the chemist, and in the arrogant way of this book? Would Dr. Liebig wish to be reproached with all the nonsense which in the last thirty years has been produced by chemists? That most silly proposition—that plants are able to form metals and earths from water and air, was the result of the bad experiments of chemists. In fact, Dr. Liebig may look into the literature of starch, his own views included, to convince himself how little chemistry is entitled to reproach physiology with the mistakes which have been committed by particular individuals. Dr. Liebig, however, would no doubt be ready to answer, "other chemists are nothing to me; when I use the term Chemistry, I understand by it only myself—me, Doctor Justus Liebig, of Giessen, the only German chemist, the director of the only laboratory existing in Germany." Thus, at least, he has explained himself formerly.

What our author (p. 37) says respecting the value of experiments made for the purpose of refuting other experiments at an earliar period, is no better digested than what we have examined. Each page of the history of chemistry convinces us, that we can only expect a steady advance of the science by subjecting the more ancient and less exact experiments to the controul of others more modern and more exact, to be re-examined, rectified, or refuted. That bad experimenters make bad experiments, and, therefore, do not obtain the results which had been produced by more ancient and more exact inquiries, is an observation not remarkable for its value. In every experiment we must look at the skill with which it is made, not at the object to which it tends, and an examination of the experiments of other people has just as much value as any other scientific investigation. It is not an examination of the views of these people, which have been supported by proofs, as Dr. Liebig expresses himself very incorrectly, but an examination of the pretended proofs themselves. If it can be shewn that they cannot be relied on, the views which have been founded on them fall to the ground of themselves, without any necessity for another view of the matter in their place. But enough of this: it is not worth while examining such ill-considered matters in all their points. Let us pass on to the following chapters, of which I shall have the less to say, seeing that the previous observations apply to them also in many cases.

Dr. Liebig, in speaking of "the origin and operation of humus," briefly explains the received theory of its formation from woody fibre, but in a very superficial way (as compared with Mulder, in Bull. d. Sc. Phys. et Nat. en Neerlande, 1840, p. 1. etc.). He then gives us a short view of the development of a plant, as he supposes that it takes place. In doing this, he introduces a new law, which, as being full of very deep wisdom, he has caused to be printed in italics, namely, "The size of a plant is in proportion to the surface of its organs, namely, the leaves, which are destined to conduct food into it." How bad then must be the condition of the enormous Cactus, which has no leaves at all, or the gigantic Cecropias and Palm-trees, with the small number of their leaves! Suddenly, however, Dr. Liebig forgets his whole theory, and says, the small Turnip of Teltow, attains the weight of several pounds when planted in a soil where it is forced to take as much nourishment as it can. What has, in this case, become of Dr. Liebig's carbonic acid and ammonia, which exist everywhere in sufficient quantity, and neither of which originates in the soil? The Turnip of Teltow grows near Berlin, in a light sandy soil, and in the islands of the river Elbe, in a marshy ground, which contains much clay and a great portion of humus. But in both these places it is a small root, notwithstanding the great difference of soil and cultivation. I think Dr. Liebig, in speaking of this little Turnip, should have been aware that there are some principles and relations, which he cannot comprehend with all his genius and knowledge. I pass by his explanation of vegetable life, since he there speaks of a matter of which he has not the slightest knowledge. But I must advert to a proposition occurring at p. 49: "The nutrition of both animals and vegetables is inconceivable without a secretion of excrementitious matter." Here again is more confusion. There are many very different things which are conceivable. The secretion of excrementitious matter is in no way connected with the idea of organisation, life or nutrition. We can only learn by experience, whether or not the introduction of new matter is attended by the secretion of such matter as has become useless. It is not inconceivable that a parasitical plant, for instance, may receive nothing except assimilable nourishment; it is therefore very conceivable that nutrition can exist in plants without a secretion of excrements, more especially if the secretion of gases and aqueous vapours is not considered of that nature. But in treating every problem, not merely chemical, Dr. Liebig cannot penetrate beyond the surface. What follows contains nothing but analogies, with which physiology knows not what to do. Such are the solution of albumen in an infusion (not decoction, as Dr. Liebig says) of the acid of the stomach of a calf, the transformation of starch into sugar by means of a decoction of malt (not barley, as Dr. Liebig says). But who is it that puts a decoction of malt to the germinating grain of rice? Dr. Liebig should have known that, if indeed there be in nature operations resembling those of life, they nevertheless differ; and that the physiologists do not look for what is possible and conceivable, but for what really exists. Here, as on other occasions Dr. Liebig mentions with contempt the "vital force" of physiologists; but he evidently does not know the meaning of the term, or he would speak of it differently. By this expression is implied the fundamental cause of all (all, without exception) the processes of life. Dr. Liebig is always talking, as if vital force was applied only to a few operations related to chemical facts, which, nevertheless, are just those which are most unimportant. The formation of form is the result of vital power, and a most important one; it is obvious that this has no connexion with chemistry. Even where our author treats of mere chemical relations, there is still something in his reasoning which shows that he tries to conceal his superficial propositions behind phrases. He asserts that plants secrete what is not assimilable; but why just what is not assimilable? Why not what is assimilated? In what way does the plant distinguish one from the other? Why does it not secrete fluids through its leaves, and aeriform fluids through its roots? Why, because of their peculiar nature; and it is just this peculiar nature which is called by us vital power, until we shall acquire more just ideas, and be able to express such operations by a better term. Both in organic changes and in the chemical processes of assimilation, superficial people deceive themselves, when they fancy they have succeeded in imitating such processes in their crucibles. Let us suppose that starch is converted into sugar in a germinating plant, in the same way as in a mash-tub; can you, Dr. Liebig, explain the process of fermentation, or do you know anything about the transforming power of yeast, or sulphuric acid? Call such phenomena, then, vital force, specific, dynamic; and be content with terms which you reject with such chemical indignation. We physiologists employ these terms to express phenomena which we cannot explain; and we do not attempt to pass off our ignorance for wisdom, as the chemist does with his catalyse, contra-action, and bodies in activity. But enough. Pursuing the proper subject of this chapter, we find the old observation, that humus contributes to the nourishment of the plants by forming carbonic acid, and then another instance of the carelessness with which Dr. Liebig has formed his notions. He says, charcoal can be used as a complete substitute for mould, for it never forms carbonic acid. I have little doubt that Dr. Liebig, when he was writing this, had in his head the idea that humus condenses carbonic acid from the atmosphere, and thus introduces it into plants, and that in this important quality, which, however, he entirely omits, humus and charcoal agree. This fact, however, we do not learn from Dr. Liebig, but from Lucas, Berzelius, and Mitscherlich.

In the succeeding chapter, in treating of "the assimilation of hydrogen," Dr. Liebig thinks it much more probable that water is decomposed, than carbonic acid, though previously (p. 18.) he had declared that the latter was a fact beyond all doubt. In the absence of anything new, I may as well notice the following sentence:— "We do not know," says Liebig, "in what form the constituent parts of organic matter are produced." This knowledge is properly the ultimate object of physiology, but those who apply themselves to this science are not contented with "mere images, having no other end but to render those processes comprehensible;" and they ask, with some reason, wherefore Dr. Liebig, after having produced such a *testimonium paupertatis*, should pour forth his calumnies upon the obstinate and ignorant vegetable physiologists who shew such disinclination to feed on the riches afforded them by chemistry.

Next comes "the assimilation of nitrogen," in which nothing material is found, with the exception of the new researches of Boussingault. This is the only subject of which physiology has not yet made use. Before Boussingault's researches, both physiologists and chemists, Dr. Liebig included, were ignorant of the true origin of nitrogen in plants; and since those researches have been published, no work on physiology has been printed.

Then follows a chapter on the "inorganic constituents of vegetation" (p. 85). Here we first have a number of known facts, proving the existence of salts in plants, and next a view, which, indeed, is very ingenious, and which, if pursued, cannot fail to excite great interest. From the analysis of the ashes of two kinds of fir-wood, made by Sáussure, and of two kinds of pine-wood, made by Berthier, Dr. Liebig draws the conclusion that every species of plants absorbs from the soil a certain quantity of alkaline bases, containing an invariable proportion of oxygen, in order to saturate a quantity of vegetable acid, likewise constant, which is produced by the process of vegetation. This idea strikes the mind forcibly, and certainly deserves to be investigated by exact and very comprehensive analyses. But unhappily for Dr. Liebig, he soon afterwards states, that in Lichens oxalate of lime is to be considered as a substitute for the woody fibre, which is absent. It is hardly possible to keep one's temper in speaking of such nonsense. Woody fibre consists of elongated tubes, and oxalate of lime occurs only *within* cells, which are usually of a roundish shape; and it occurs moreover not only in Lichens, but also in other plants, as in many Cacti, which contain as much as 85 per cent. of this matter; a much larger quantity than is found in any kind of Lichen. This fact is known to every chemist's apprentice, who has attended lectures on botany. I must leave the reader to discover the value of Dr. Liebig's speculation. Our author (at p. 74,) asserts, that it can be easily proved that animal manure affects the growth of plants only by forming ammonia; but (at p. 98) he forgets what he said before, and attributes the advantageous effects of cow-dung on the banks of the Rhine to the potash it contains. It must be obvious how little science will be promoted by a book so evidently written without consideration, and, in fact, made up of unconnected accidental conceptions.

In the chapter on Cultivation, little could be expected of interest to vegetable physiologists; and having been as badly arranged as the remainder of the work, at least half its contents consist of isolated physiological observations. First, humus is again taken up, and found to be an inexhaustible source of carbonic acid, which feeds the plants. By this process, the quantity of humus contained in the soil is, he says, subject to a continual diminution. Dr. Liebig has forgotten that, in another place, he had asserted the reverse to take place. Then comes a most surprising statement. He says (p. 109), that in a soil which communicates a yellow colour to water, no plants thrive; and that few plants flourish on barren peat-soil, or marshy meadows, whose soil has that quality. One would think that Dr. Liebig had never seen a peat-moss, or a marshy meadow, or the dense mass of vegetation which is spread over it; or that he had never heard of peat being continually reproduced by the perishing vegetation that it bears, and which quickly shoots up again; or, that on this peculiar quality of peat-moors depends the inexhaustible nature of peat-pits. The matter, however, stands thus: Farmers call that soil barren in which those plants do not thrive which they cultivate, notwithstanding that it may otherwise produce a most luxuriant vegetation. On the soils named by Dr. Liebig there do, in fact, grow as many plants as on any other soil, but of peculiar kinds. Many of them, doubtless, require a large quantity of humus, as, for instance, many kinds of Moss; while Reeds and Sedges do not seem to thrive at all, except in soil containing a large quantity of free humic acid. Dr. Liebig had already settled, as we thought, all that is requisite for the growth of plants; but (at p. 109) he suddenly produces quite a new requisite, namely, the existence of free oxygen in the soil; without, however, mentioning for what purpose it serves, and whether or in what way it is introduced into plants, and what changes it undergoes there. Further on, amidst a number of well-known observations, are more erroneous conceptions. In a preceding page of his book (p. 23), he had asserted that "no matter can be considered as nutritious, or as necessary to the growth of plants, which possesses a composition either similar to, or identical with, theirs—as in such a case the assimilation could take place without the decomposition of carbonic acid by the leaves." This is mere fiction; it has no application to parasitical plants. Of equal value is what he says, p. 115 :—" Leaves serve to produce starch, woody fibre, and sugar; if we therefore bring these matters (starch, woody fibre, and sugar) into plants, by means of their roots, the vital functions of the leaves are disturbed, &c." Now woody fibre is the most insoluble vegetable matter which we know. It is incomprehensible how such a substance could be conducted by the way of the leaves to the trunk of a tree to serve there for the formation of annual rings. Starch occurs in plants only in the shape of grains, and therefore it likewise cannot be introduced into the trunk and bark by the leaves. As for sugar, it has been proved by the experiments of Sáussure and Davy, that plants thrive exceedingly in dissolved gum and sugar, if the solution is not so concentrated as to render endosmose, and consequently nutrition, impracticable. But Dr. Liebig possesses great talents in the way of omitting facts which do not suit his theory; and instead of confessing that there are many things he does not know, he prefers saying that all those things which he is unable to explain, do not exist. Thus we find (p. 116) the following proposition :—" Each grain of wheat contains within itself the matter which produces its germ and root-fibres (namely, starch and gluten); and we must suppose that these two substances are found there *exactly* in the proportion necessary for the development of those organs. But the two matters are completely consumed in the formation of the first part of the roots and leaves, and a surplus of either could in no way contribute to the formation of leaves, without a portion of the other matter exactly corresponding to it in quantity." This sounds well, and seems to be the dictum of a great genius; but, unfortunately, it is mere romance, and is contradicted by well-known facts. The proportion of gluten and starch contained in wheat varies greatly—the first between 7·0 and 35·0, and the second between 70·0 and 40.0. Can we assert that 7.70 and 35.40 form two proportions, exactly corresponding to one another? And yet the kinds of corn, thus differently constituted, are equally capable of attaining complete development.

After bringing forward a fresh supply of well-known facts, Dr. Liebig produces an idea, correct indeed, but familiar to every physiologist as soon as he begins his studies. He says (p. 120), "From this view" (the view the author had taken cannot be inferred from what precedes), "it is evident how greatly the products of a plant can vary according to the relative proportion of the nourishing matter it receives." This is just the point which renders all modern chemistry useless to vegetable phygiologists; and this is the reason why physiologists cannot, like Dr. Liebig, conduct experiments on whole acres of forest or meadows, nor in ditches and ponds. They are obliged to make multitudes of exact, tedious, and laborious observations on individual plants; because their object is to learn the processes of vegetation as they actually go on in such plants,—and not to guess at the probable effects of vegetation on the natural history of the globe. I think Dr. Liebig would have been less ready to heap his invectives upon phygiologists, if he had known that they have not to deal with a salt, composed, according to the constant formula 1. $(a + b^2) + 1\ (c + b^3)$, but to investigate organisation, which is very changeable, and gifted with a great power of adapting itself to circumstances. For, despite of all the formulas of chemistry, there always remains an unknown x. which we for the present call vital force, notwithstanding the sentence of death pronounced upon it by Dr. Liebig. But I, this moment, perceive that I have wronged him. The great chemist, who has in his pocket all explanations ready made, who, at page 18, is quite certain that plants decompose carbonic acid, and at page 60 thinks, that this is extremely improbable, feels on a sudden (p. 121) an utter consternation at discovering the miraculous effect of this vital force, which is able to produce a thing that no chemist can imitate with the most powerful galvanic pile, although it is nothing more than a simple chemical decomposition, namely, that of carbonic acid in plants, which has once more obtained his approbation. But, Sir, did you not feel, when you were writing this passage, what a silly figure you must cut in the eyes of physiologists, after having heaped upon them so many opprobrious terms? We find that 999 thousand parts of the vital functions of vegetation are inexplicable, but we perceive that the last thousandth may admit of a chemical explanation; at the same time, however, we confess that our poor chemistry has not advanced so far as to be able to imitate even this insignificant trifle, exactly in the same manner as it occurs in the organised body. In sush a case, I think the term 'vital force' would not be so very unsuitable to indicate all that is still unknown to us.

The author goes on speaking of the decomposition of carbonic acid in leaves, and says (p. 123) that it has been proved by experiments made with cut-off leaves, which of course did not receive any nitrogen together with the carbonic acid, that nitrogen is not necessarily required for the decomposition of carbonic acid. Is this the art of making experiments which is so much extolled, and can only be learnt in chemical laboratories? Does Dr. Liebig not know that every leaf itself contains a great quantity of nitrogen, and that this matter is possessed of such qualities as enable it to produce the most astonishing chemical metamorphoses and decompositions? Is it possible that he should be ignorant that every cut-off leaf, according to its nature, sooner or later, ceases to decompose carbonic acid? and what has he to answer, when I inform him that it ceases to decompose carbonic acid as soon as the nitrogen contained in it has been consumed. Such propositions as the above are not admitted into vegetable physiology. The author continues: "The carbon derived from carbonic acid assumes a state in which it is soluble, and this we call sugar, when it is sweet; gum or mucus, when tasteless, and excretions, when it is secreted by the roots, &c." Such observations as these are as worthless in chemistry as in physiology. It is nonsense to call sugar a fluid form of carbon, when oxygen and hydrogen are as essential to its formation as carbon, and as it is only by the union of these three substances that sugar is produced. Nor is there more sense in what is said of excretions, among which occurs not only matter containing nitrogen, but such varied substances as oil, resin, oxalic acid, &c.

The succeeding observations, which consist of aphorisms founded on old facts, I might leave to the agriculturists, to whom they are introduced, with the same courtesy as he has observed towards the physiologists. I must, however, notice one passage, if only to prove in how hasty and superficial a way Dr. Liebig draws conclusions. According to the experiments of Sáussure, plants of wheat yield before they are in blossoms 0,070, whilst they are in blossom 0,054, and when the corn is ripe 0,035 of ashes. Hence the author infers that plants, from the time when they begin to blossom, return to the soil a portion of their inorganic matter; which certainly is a false conclusion. These facts only shew, that the relative proportion between the organic and inorganic constituents has been changed; and this may have taken place whilst the absolute quantity of inorganic constituents in each single plant has been increased tenfold, or in any other proportion. I am decidedly of opinion, that a great increase of this matter takes place, if we consider the absolute weight of plants in blossom, and when loaded with seeds. It is quite distressing to mention such things to a chemist, for he at least should know how to estimate them.

The chapter on the Rotation of Crops and Manure contains little to interest a physiologist. The author first mentions exeretions by the roots, respecting which there exist no experiments of any value, except those of Macaire Prinsep. Although we poor physiologists may not have acquired the art of experiment in chemical laboratories, yet we know, I trust, what are the requisites of a scientific experiment; and we think those of Mr. Prinsep not made with such skill as entitles them to form the foundation of a theory, as is evident from the weighty objections made to them by Meyen in his "Physiology." A theory founded on such experiments can only be a plaything. Scientific naturalists are aware that in the complicated processes of vegetation, many things are to the considered, of which Dr. Liebig has not the most remote idea. A few propositions in this chapter, placed side by side, will show with what facility shallow people can explain things that are inscrutable to those who penetrate below the surface of the subject. "According to Macaire Prinsep, it is by their excretions that plants return to the soil such constituents as have been introduced into them during their growth. These excretions cannot be assimilated by any plants, until they again have been converted into humus. Clover secretes matter which becomes humus with great difficulty. All Clover-like plants, especially Saintfoin and Lucern, form such excretions abundantly, and continue to do it for several years in succession." From this the reader would probably infer, that no plant can thrive where Clover has been grown; but Dr. Liebig does not draw such a conclusion. It is well known that many plants grow in the midst of, and almost immediately after, Clover, at least what are commonly called weeds. According to Liebig's first and second chapter, humus in no way contributes to the nutrition of plants; nevertheless he here tells us, that one of the principal effects of the rotation of crops is the artificial production of humus, which is most completely obtained by the cultivation of Saintfoin and Lucern." Alas! for the poor farmer, who is to borrow the theory of his art from Dr. Liebig's book. But, to proceed: "It is evident," says Liebig, "that after from five to seven years the soil must be impregnated with excretions to such a degree, that all the roots will be surrounded by them; and as they remain for some time in a soluble condition, they are again introduced into a plant, which suffers injurious effects in consequence, because they are not capable of being assimilated." Dr. Liebig does not consider that roots extend, and that food enters them only by their extremities. This extremity, which is to receive nutrition, is annually leaving the place which, according to his theory, is poisoned with these pretended excretions, and it extends into a soil which is free from them. Sometimes these extremities advance over a considerable space in a short time. I think, therefore, that the bare places found in a field of Clover, after 5 or 7 years, are not produced by the roots refusing a soil impregnated with excretions, but that the life of such plants has arrived at its term, and that they could not continue to vegetate even in the best soil. If excretions were the cause of this change, the whole field would be depopulated at the same time; but we find that it is only single plants that die, and thus, according to the difference of their qualities, become sooner or later extinct. Thus bare places are formed on the field of Clover, but these places do not remain without vegetation until again converted into humus by the sun and atmosphere; on the contrary, even before the Clover has entirely died, they are covered with small plants, which thrive very well, although, according to Liebig, the soil has been poisoned by unassimilable excretions. It seems as if the author never saw a field, and that the bare places in it are known to him only from books on rural economy, where the term "bare places" is used to imply those spots where the cultivated plants do not grow, but not a bare soil destitute of vegetation. In his explanation of this subject, we find, p. 153, the following proposition: "Though a certain quantity of carbon in the soil be sufficient to bring many plants to complete development, it is not sufficient to provide their different organs with the greatest possible supply of nourishment." According to my weak understanding, nothing is in this passage clear, except its absurdity. No plant can attain more than its complete development, and the quantity required to produce that effect is called the maximum of nourishment, whilst a minimum implies, that the nourishment is so scanty, as to be hardly sufficient to maintain the life of the plant. Possibly Dr. Liebig has here confounded the plant with the field, and intended to say, that even when some plants in a field attain their complete development, there may not be sufficient nourishment for all of them, so that the field does not yield the maximum of produce. At p. 74, Dr. Liebig promises to prove that "all animal manure acts on vegetation only by forming ammonia." But at p. 154, where he treats of manure more copiously, he says, the opinion that manure acts on plants by the nitrogen it contains, and that this matter is assimilated by the plants for the formation of gluten, is quite void of foundation. For, continues he, the quantity of nitrogen contained in animal manure is so small, that it cannot be taken into account. At p. 74, he himself had produced the well-known facts, which prove the increase of gluten in Wheat, as soon as manure containing much nitrogen (*i. e.* animal excrements) is employed; and in the following pages he proves beyond all doubt, that we know no means by which the gluten of cultivated plants can be increased, except from animal excrements, and that "the powerful effect of this kind of manure can only be ascribed to the quantity of nitrogen it contains." I have no doubt that Dr. Liebig, in speaking of this matter, applies the terms "animal manure" and "animal excrements," in one place to solid matters, which contain only a small quantity of nitrogen, but are rich in salts, and in another to the fluid excrements, which contain much nitrogen, and only a small quantity of salts. But if so, his meaning can only be guessed at by persons, who bring to his book a knowledge of the matter as complete as his own.

But my patience begins to be exhausted, and so, I fear, does that of my reader. I shall therefore, quit Dr. Liebig, his contradictions, his confusion, his possible explanations, and his impossible conclusions, his physiological blunders, and his chemical mistakes, with a short moral, chemical, and physiological lecture. [This is the substance of some long observations, for which we have not room.]

The ostrich, says the fable, hides its head in a bush when hunted, thinking that what it sees not, exists not. On a former occasion, Dr. Liebig unsuccessfully denied the existence of the fungi of fermentation; he now thinks to proceed with more prudence by not taking notice of them. But, Sir, you are much too late. Every person, who has a good miscroscope, knowns that they exist and are composed of cells. It would have been wiser to attack them, for your silence may induce people to think you ignorant of their existence. Two substances are required to produce fermentation in the most simple cases, namely, a solution of sugar and yeast. The product is alcohol and carbonic acid; water and a little ferment (?) remain undecomposed. A theory of fermentation is now demanded, as was formerly the case with the formation of salts; an explanation of the latter was found when the bases and acids had been decomposed into their constituents; the law of saturation could never have been discovered otherwise. Now, then, for the problem of yeast. We know tolerably well the nature of sugar and water, as far as regards their constituents; but as for yeast, do you know anything of that, Dr. Liebig? Did you ever inquire whether it is a simple body or a compound; and if the last, did you ascertain what the elements are of which it is composed, how they are combined, and how far each contributes to the production of fermentation? You have not! You must be joking. What! a great man like you. who has acquired the art of experimenting in chemical laboratories, to attempt to establish the theory of a process, one-half of which is completely unknown to him? The thing is impossible! Matters containing nitrogen are among the essentials requisite for the formation of yeast. In what state are those matters when in the wort? What changes do they undergo in forming yeast? And how are we to explain the remarkable fact, that ferment, which is entirely exhausted, much resembles woody fibre, and is therefore destitute of nitrogen? Whence is derived this woody fibre met with thus unexpectedly? Here now we, poor, ignorant vegetable physiologists apply to chemistry for assistance. Since you cannot answer us, permit me to read you a short physiological lecture:—Cells in plants are only formed where sugar or gum occur, and a substance containing nitrogen; this nitrogen forms nuclei, and afterwards changes the sugar or gum altogether into fibrous matter (faserstoff); the cell being completed, it afterwards grows only by distention. In wort exist all the material conditions required for the formation of cells; the other conditions we are unacquainted with. When the yeast, which originates in the wort, is examined by a microscope, cells are found somewhat large, and frequently connected with each other; with care, the whole process of their increase may be perceived. Such cells, at first, always consist of the nucleus containing nitrogen; besides which, there frequently appear other smaller kernels in the interior of the cells, which are otherwise filled with clear, watery juice. Such cells may easily be broken by pressure; when their contents come out, a small empty bag remains. As soon as the wort no longer contains matter capable of maintaining vegetation, the formation of yeast ceases. When much alcohol has been formed, this renders vegetation impossible, and wine ceases to ferment. When beer-yeast is well washed with distilled water, and rubbed to a powder in an agate mortar, and then treated with water, alcohol, ether, &c., there remains fibrous matter (faserstoff) as a residuum, and the dissolving agents extract from the yeast a little gum, matter resembling wax or fat, and a substance containing nitrogen. My purposes are sufficiently served by this chemical analysis, which was not made for the purpose of publication; besides, I am only a poor physiologist, whose art of making laboratory experiments was learned from the deceased Stromeyer, my venerable teacher. You, I hope, will soon publish a more correct analysis of yeast, and then perhaps—but not at present—you may be able to give us a theory of fermentation, which shall at least have some utility. Till that event takes place, I offer you this trifle as a proof that you may learn a good deal of physiology, and even a little chemistry, from the physiologists.—*From the Gardener's Chronicle, for* 1842.

OPHIOPSIS PROCERUS Agass.

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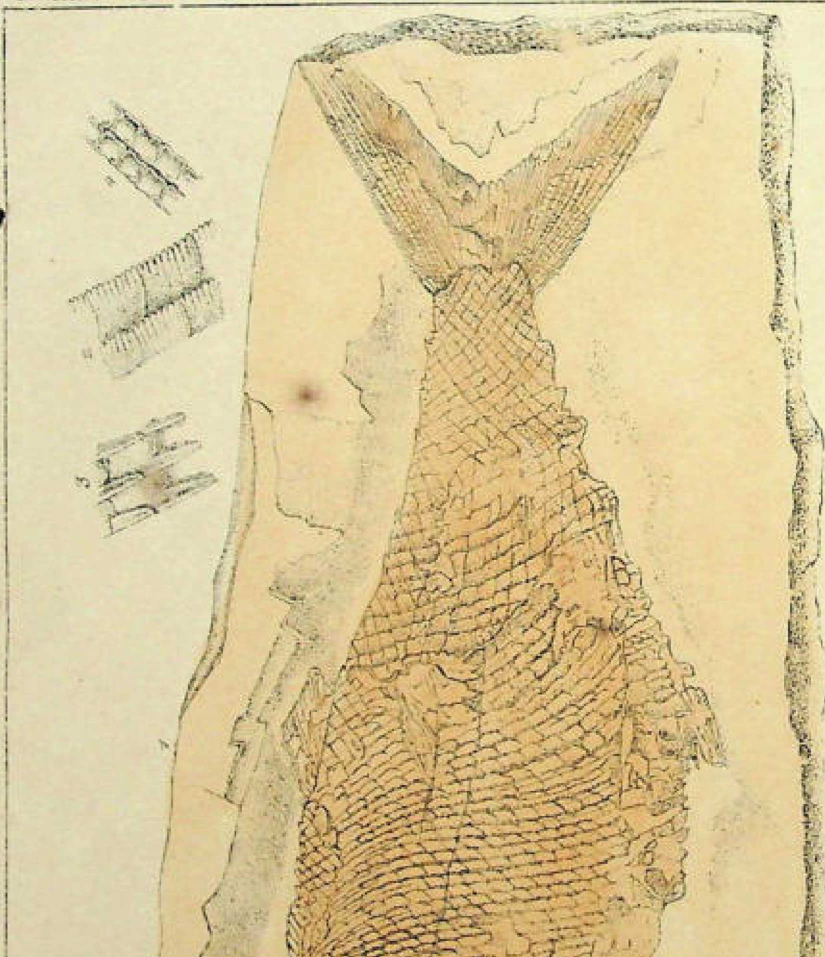
THRISSOPS INTERMEDIUS v. Münst.



PHOLIDOPHORUS LATUS Agass.

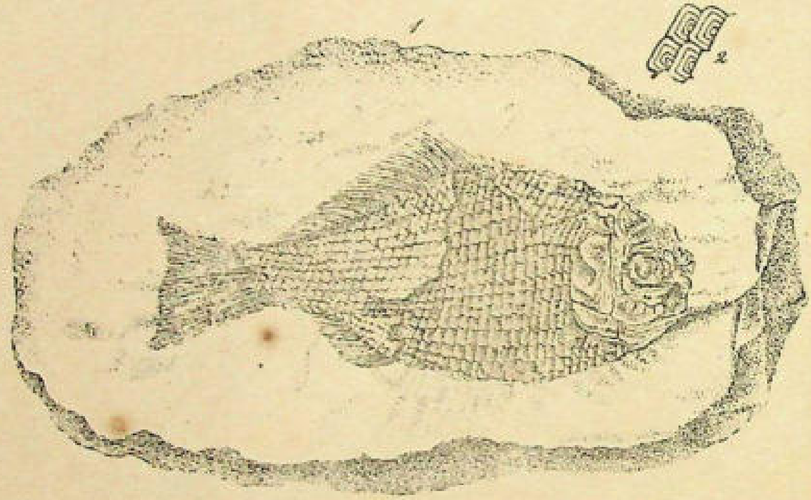


Fig. 1. 2 TETRAGONOLEPIS DORSALIS *Agass.*

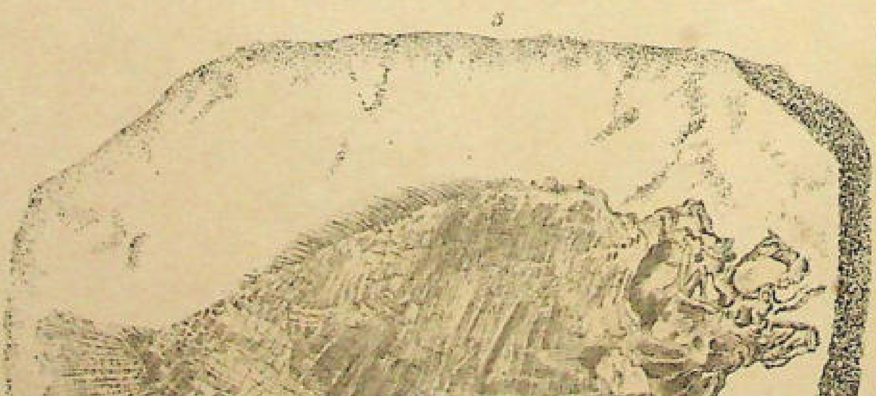


Fig 3. TETRAGONOLEPIS OVALIS *Agass.*

Fig. 1.

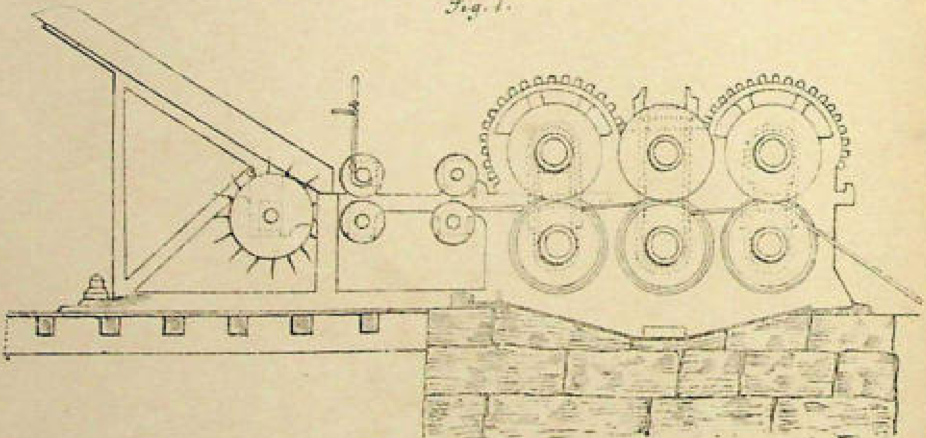
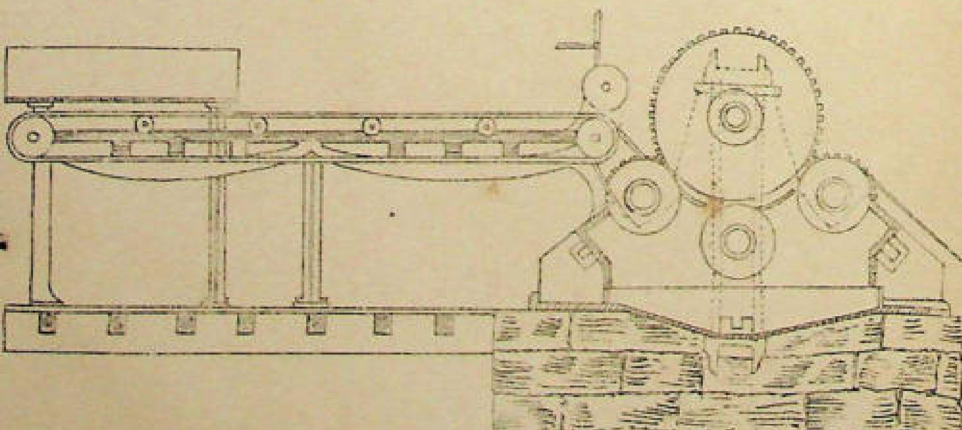


Fig. 2.



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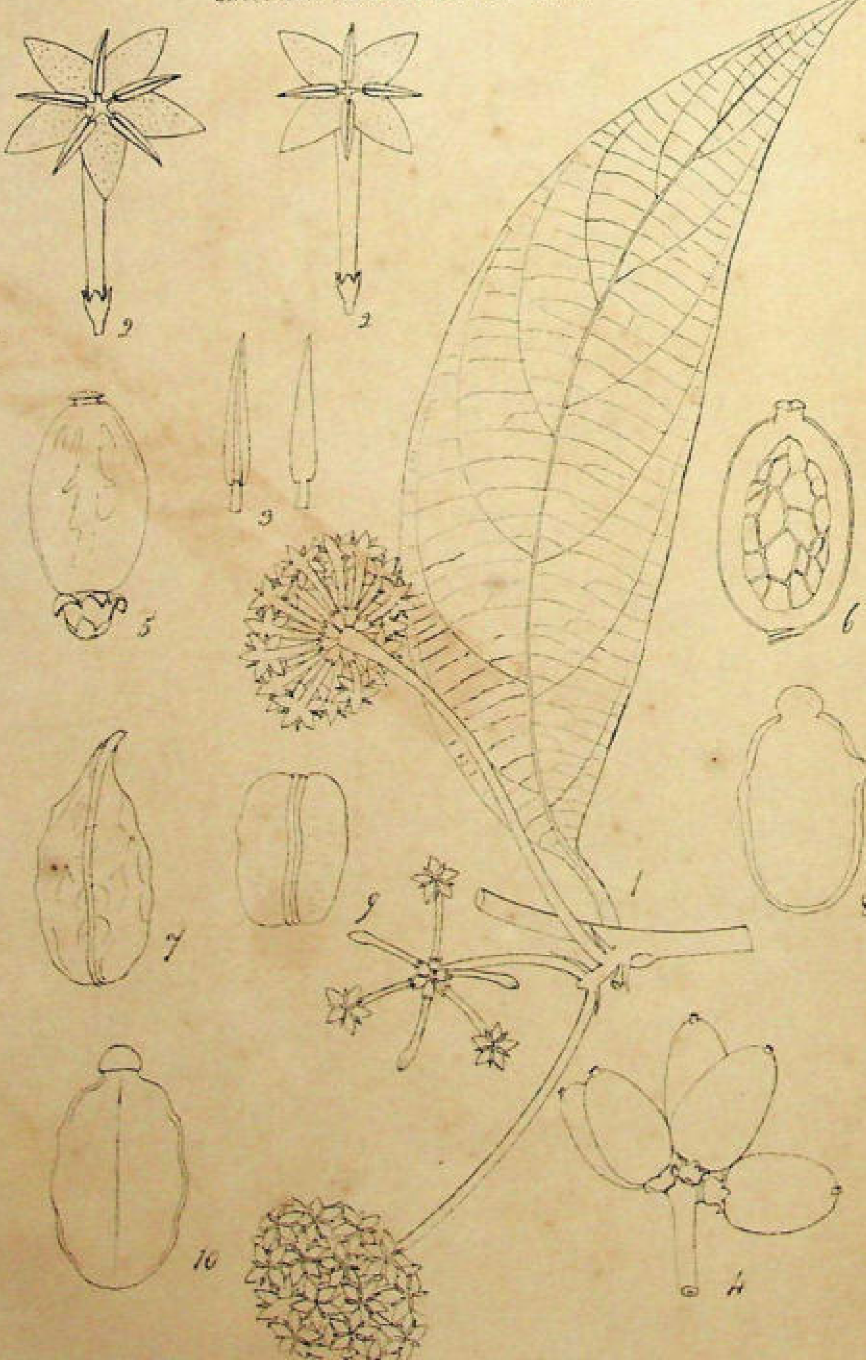

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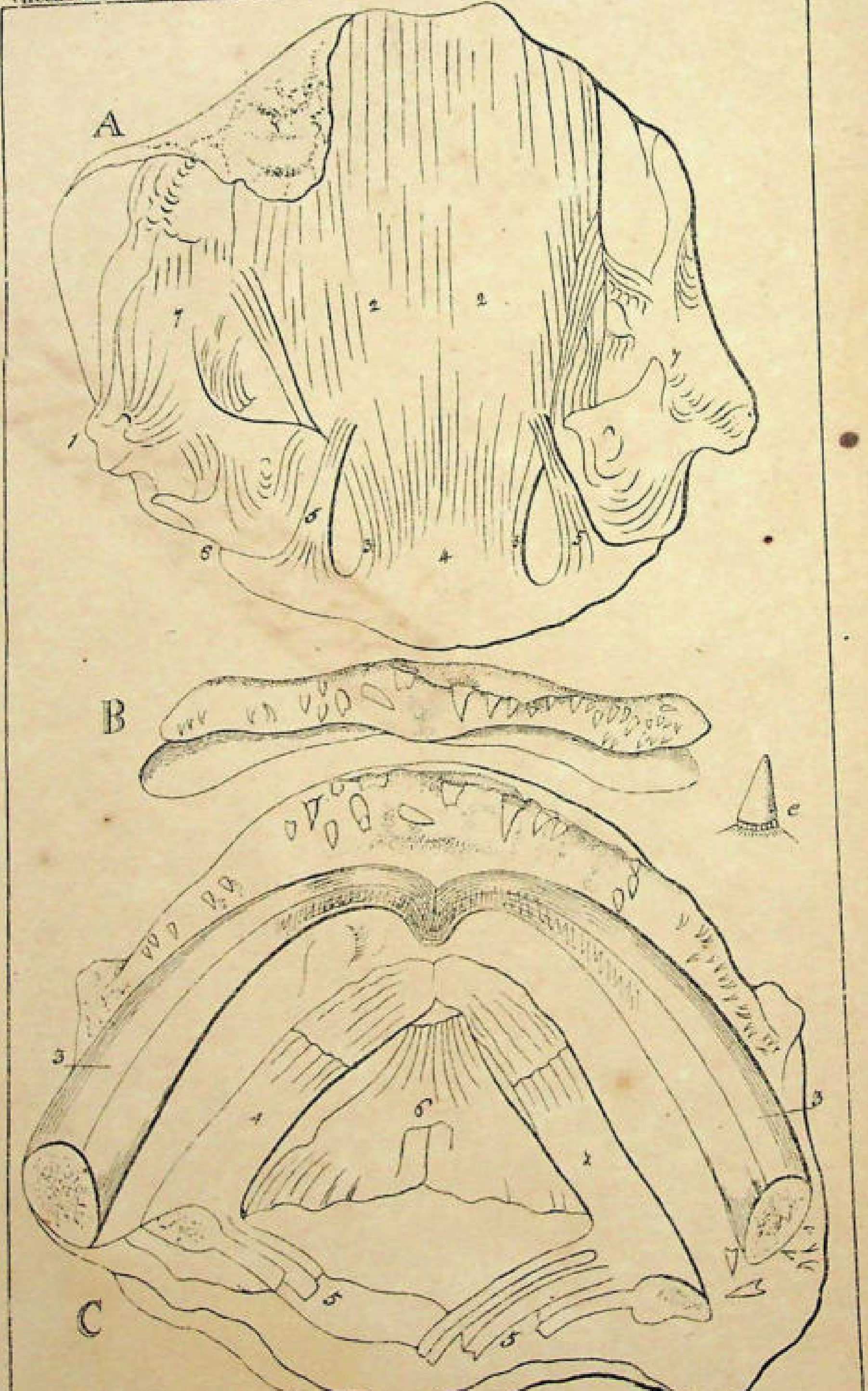
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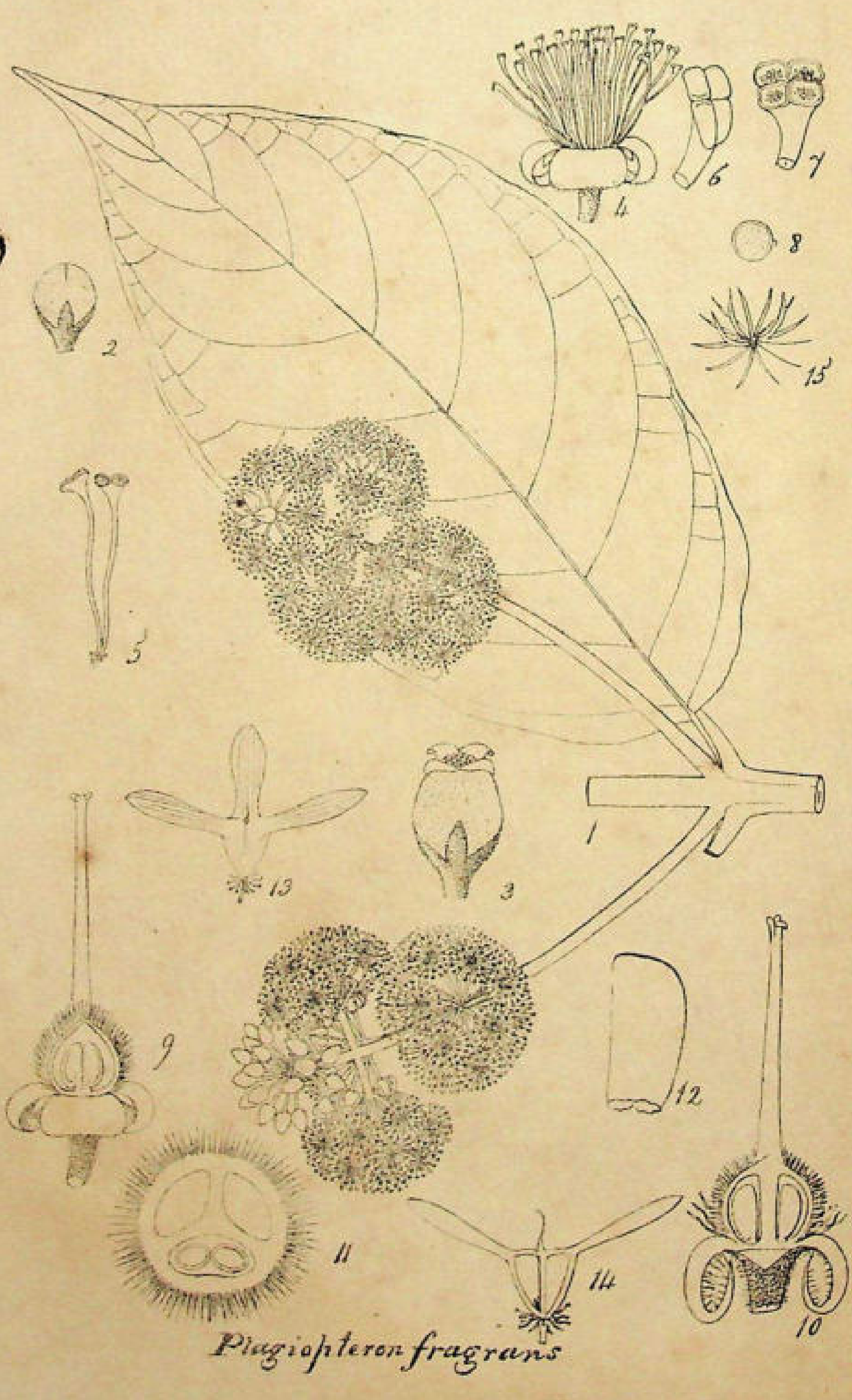
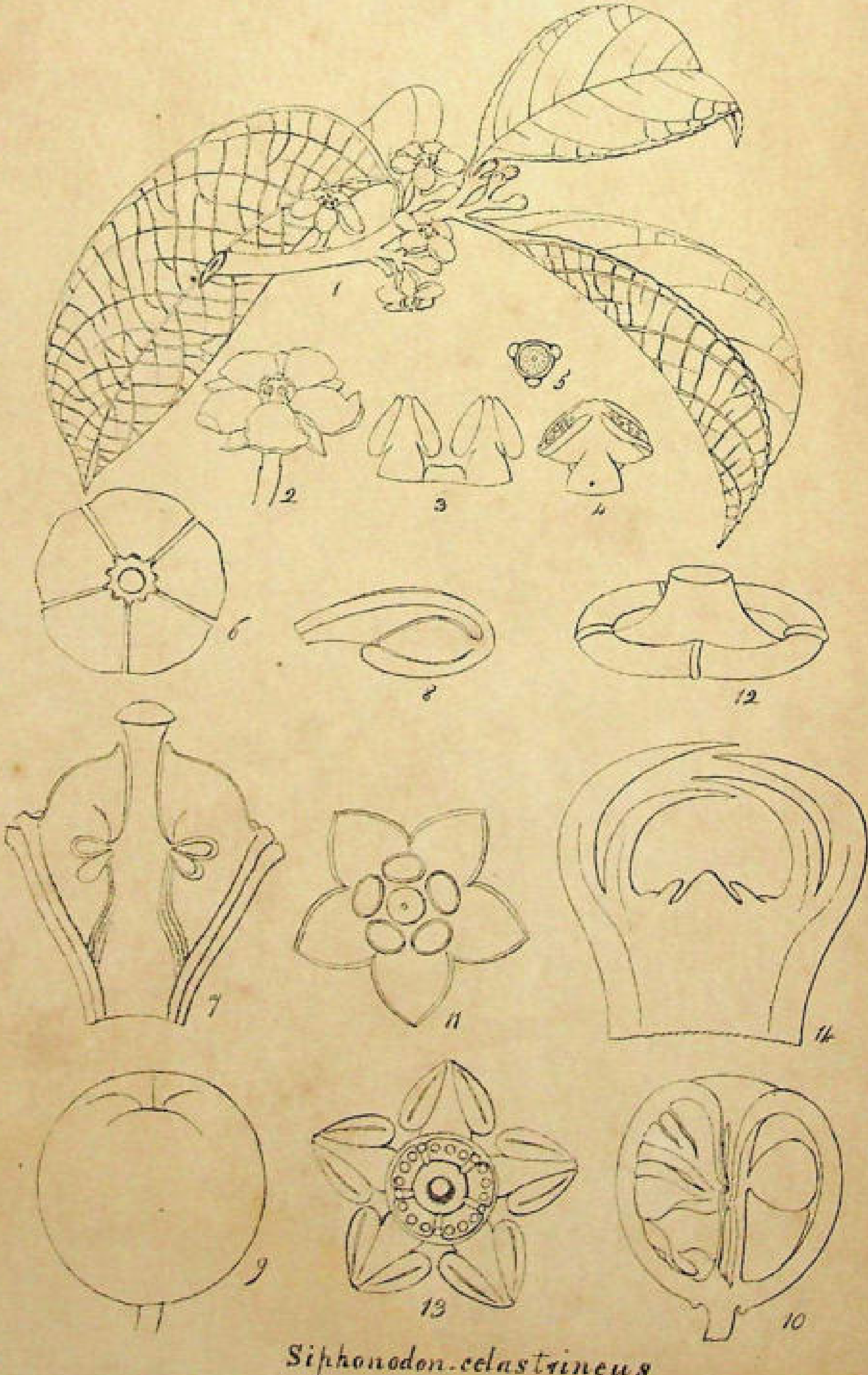


Plagiopteron fragrans



Siphonodon. celastrineus

Pl XV. XVI

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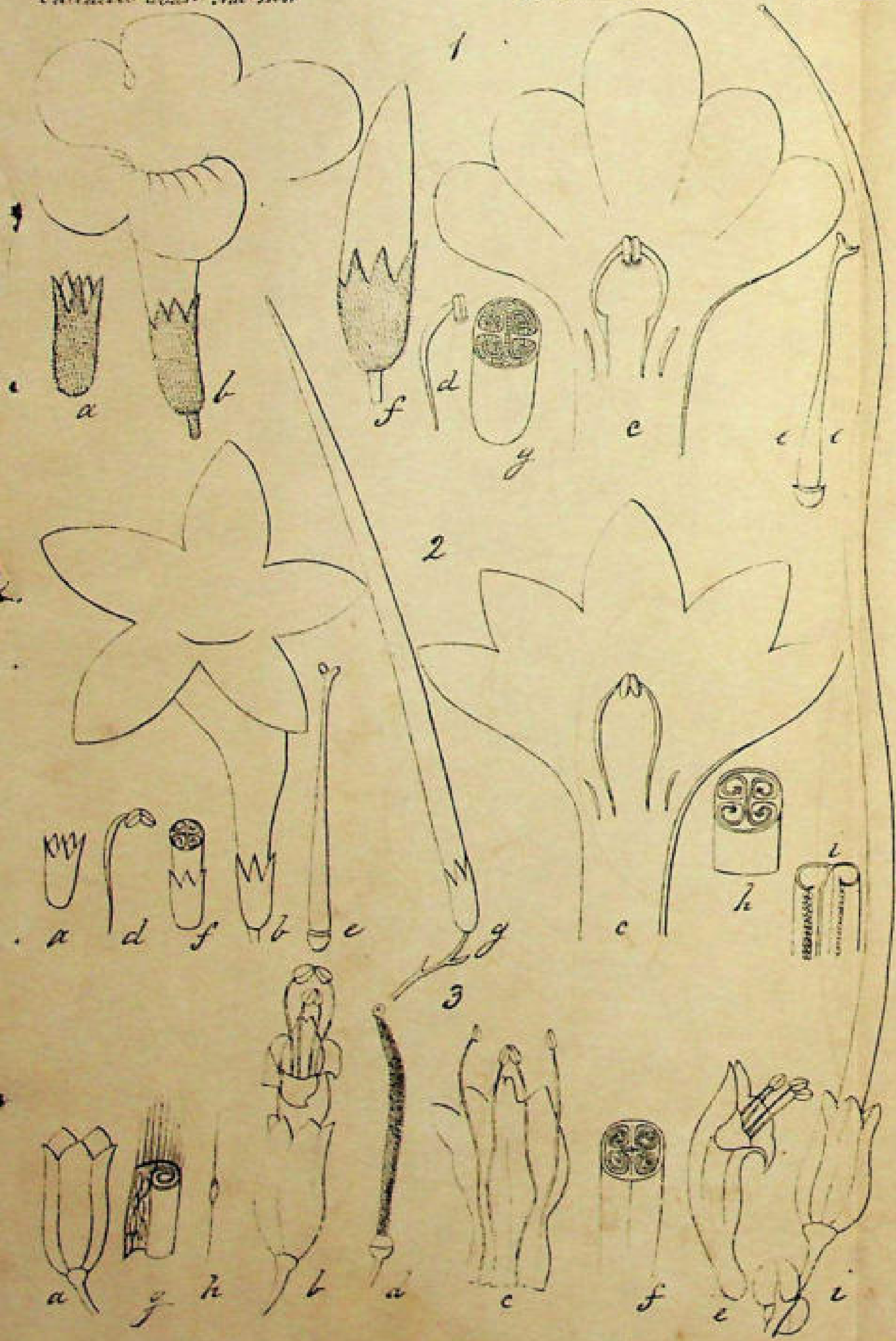
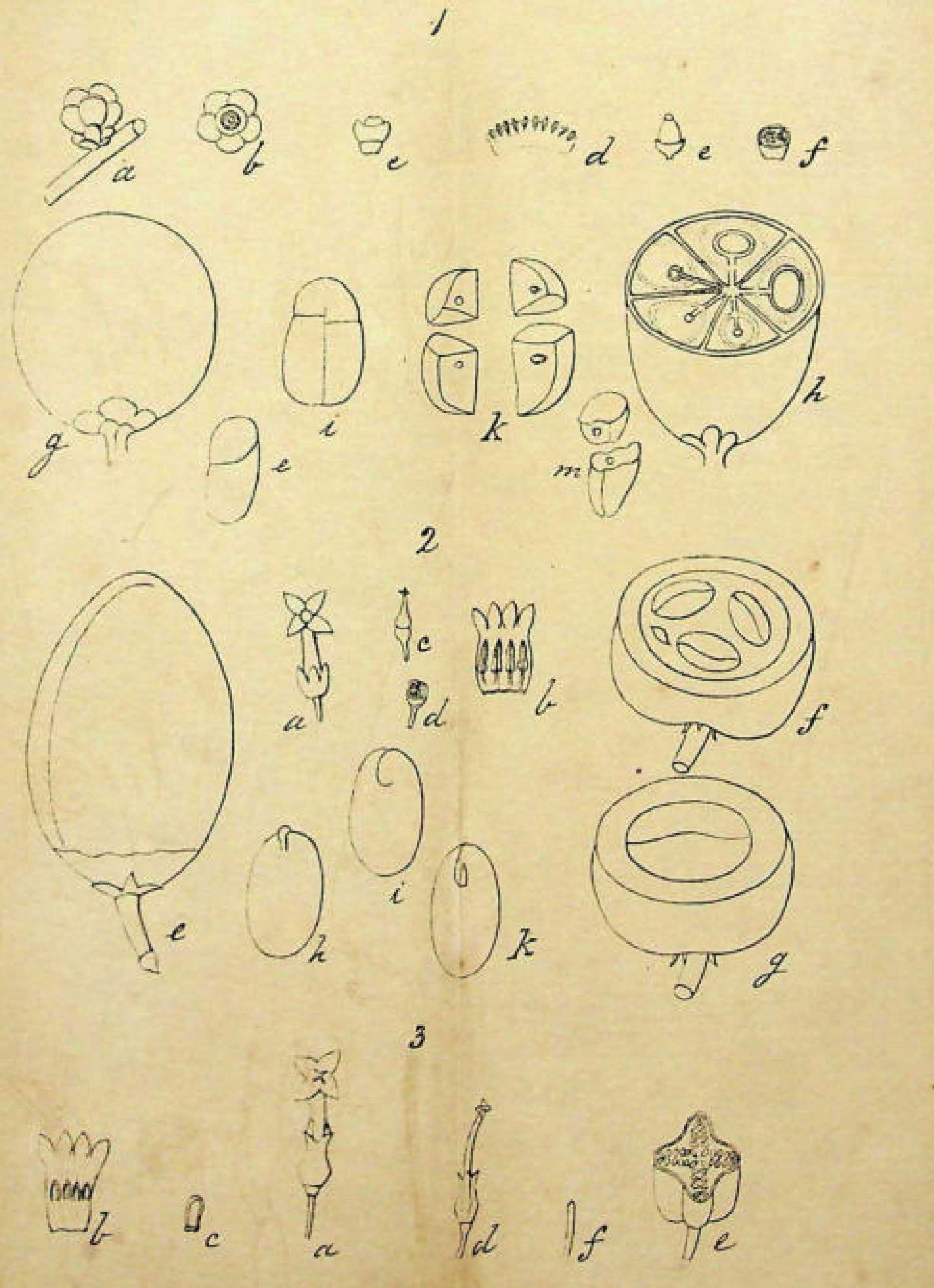
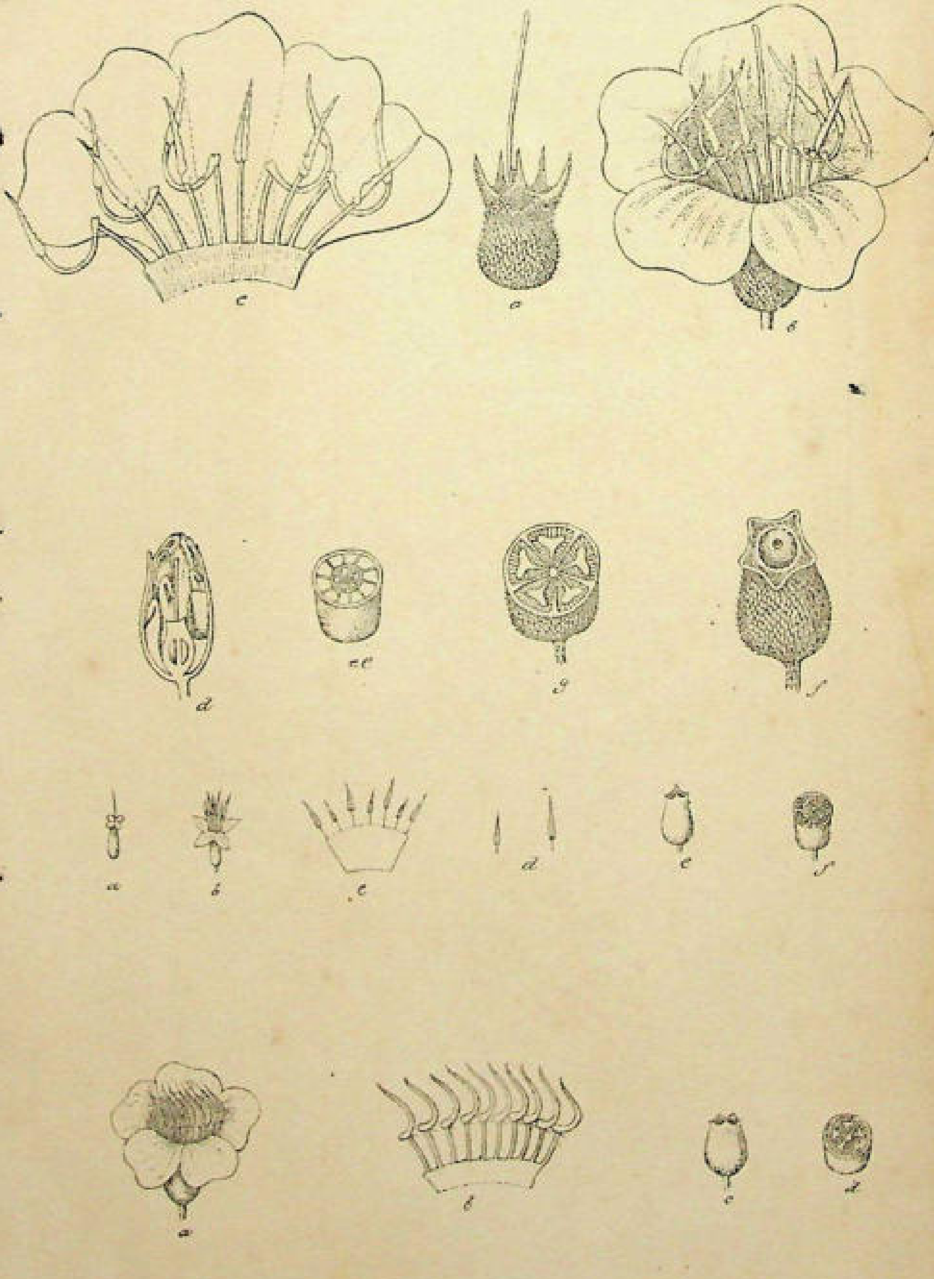
Trans. Linn. Soc. Vol XIV Tab. II.



Trans. Linn. Soc. Vol XV Tab. IV



Pl. XVIII



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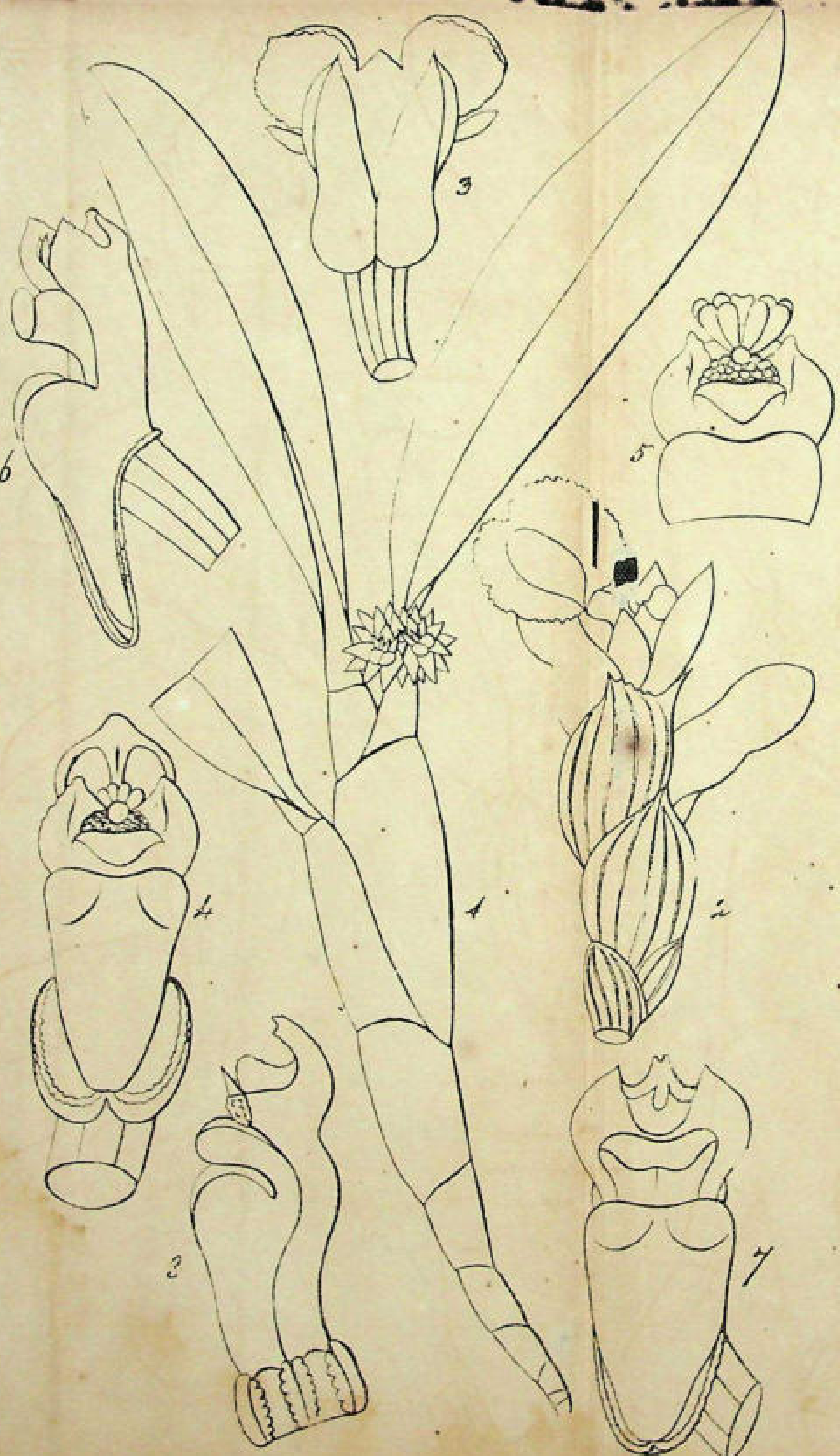
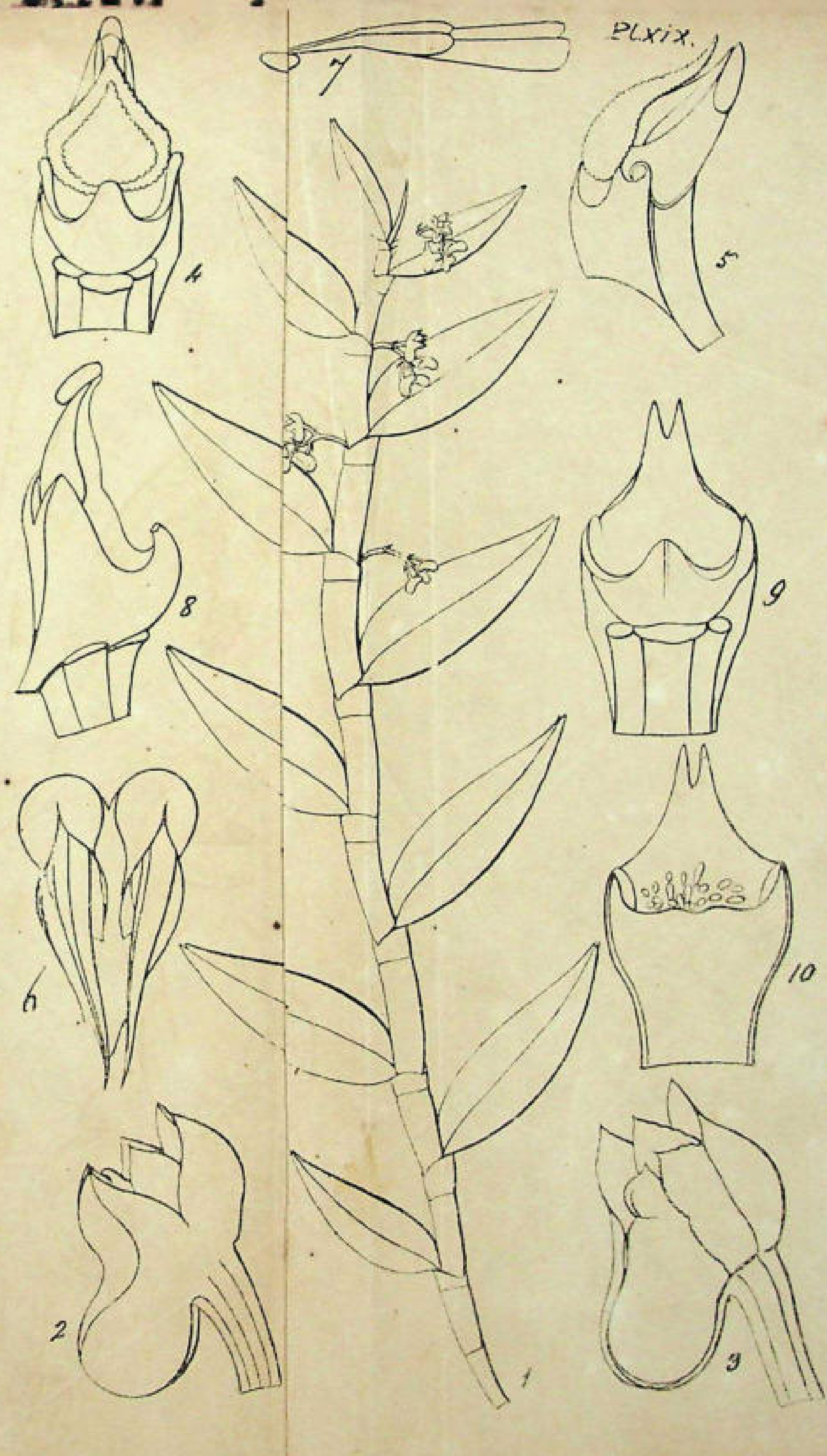


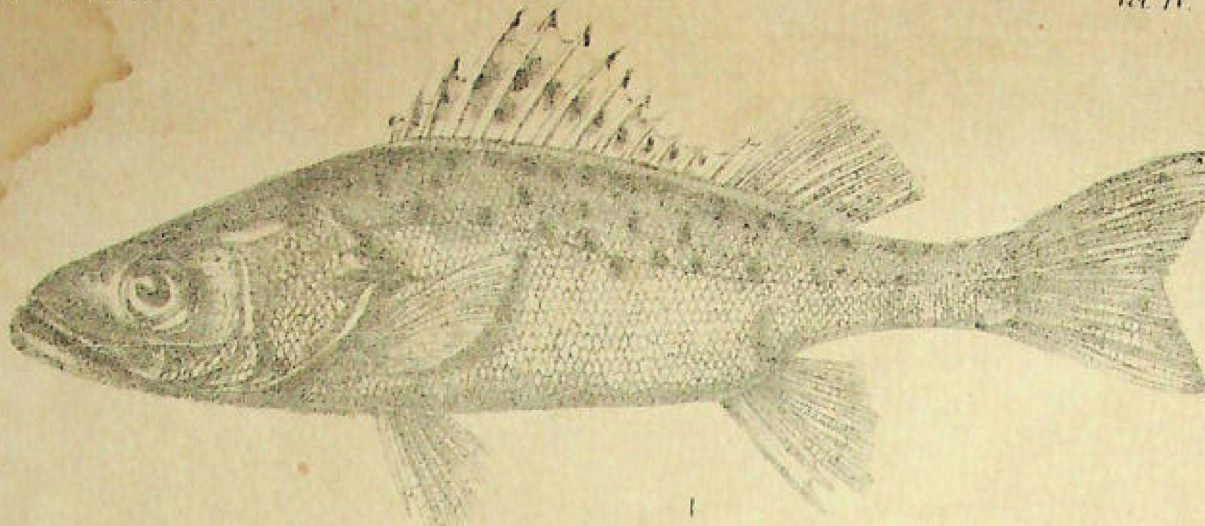
Agrostophyllum Khasiyanum.



Appendicula Lewisii.

Habenaria tenuis

Habenaria humigera



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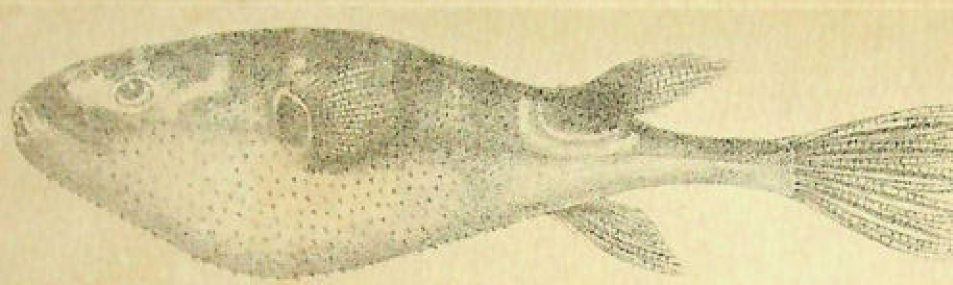

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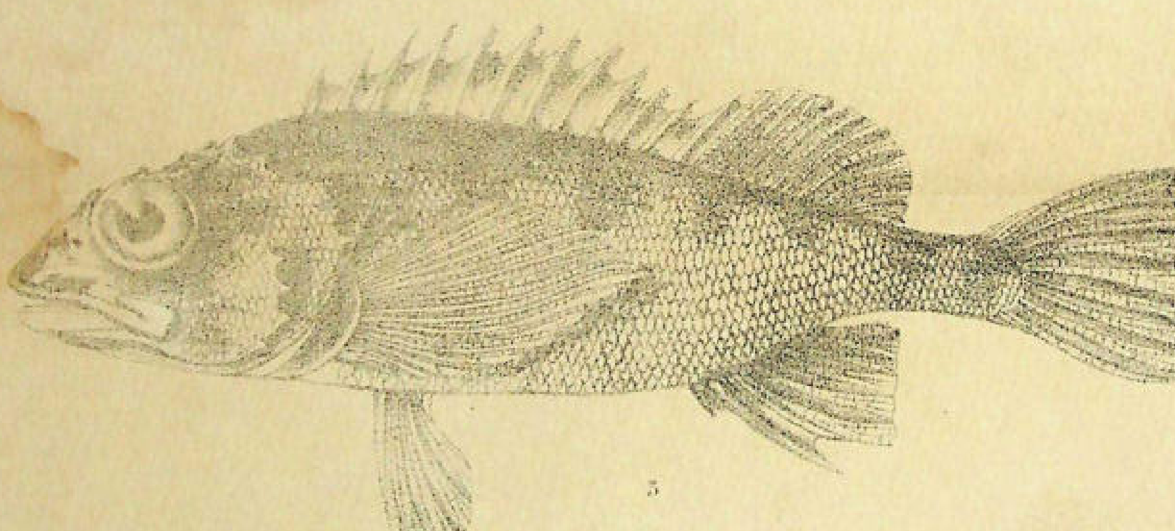

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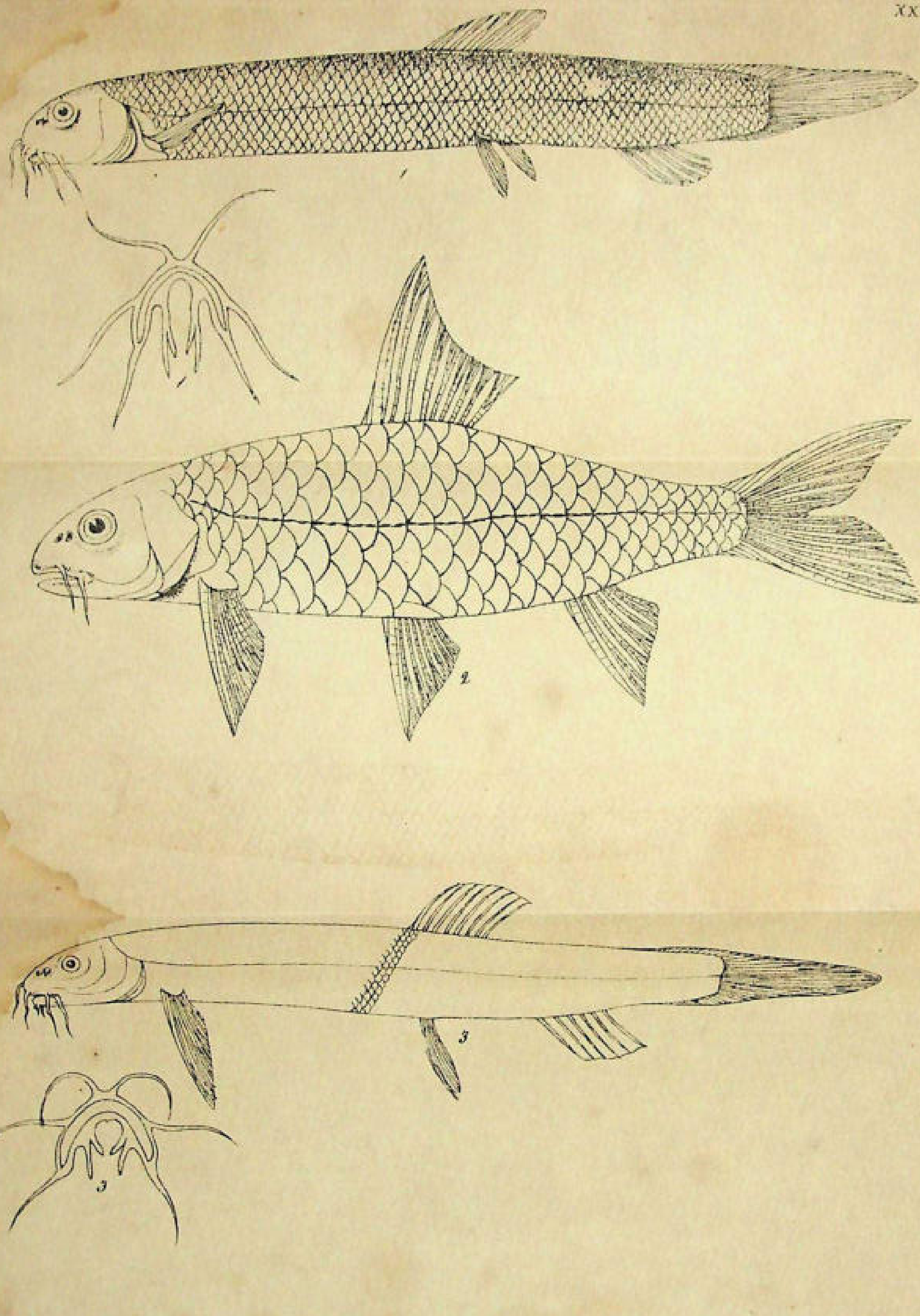
Pl. XXII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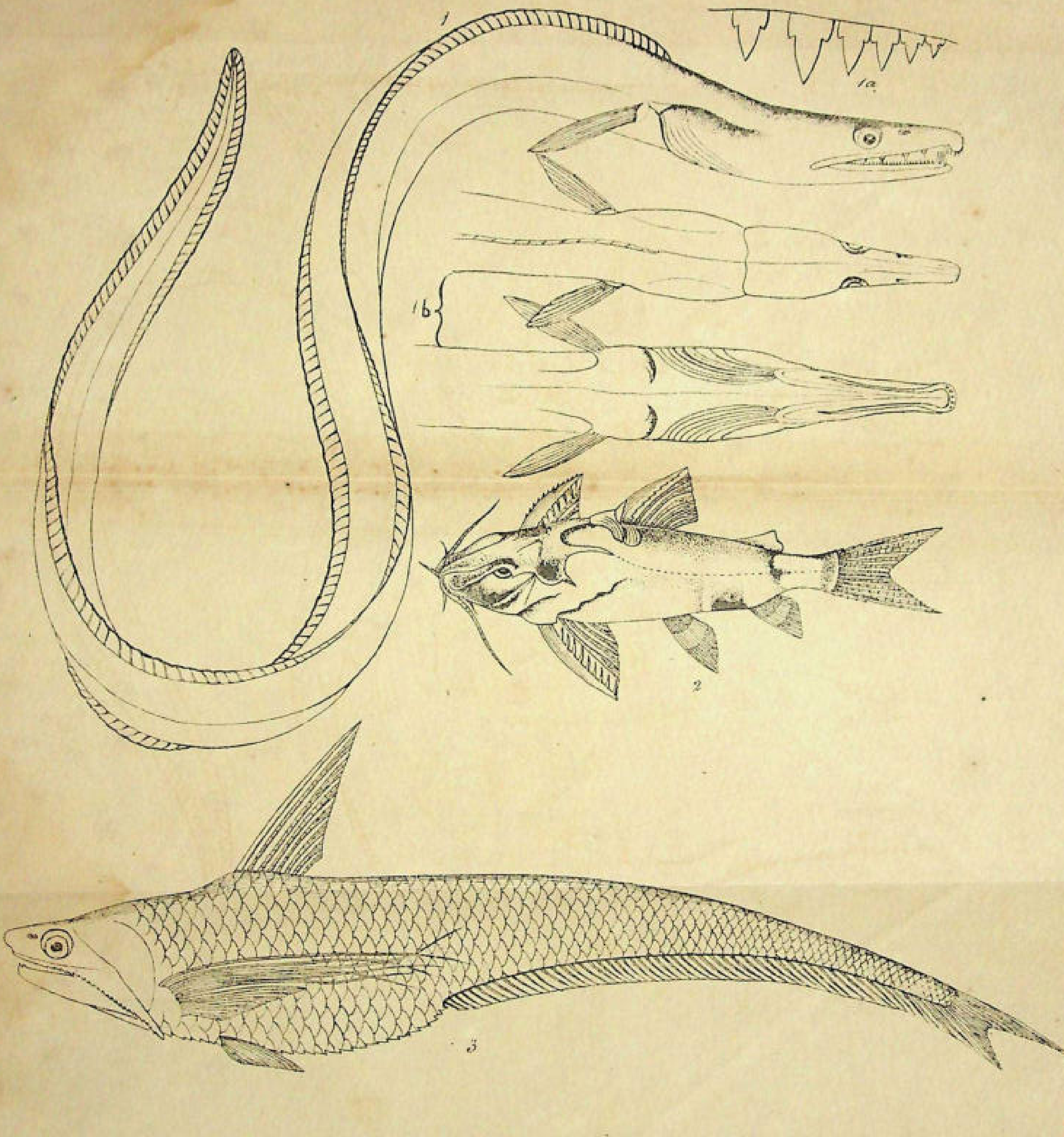
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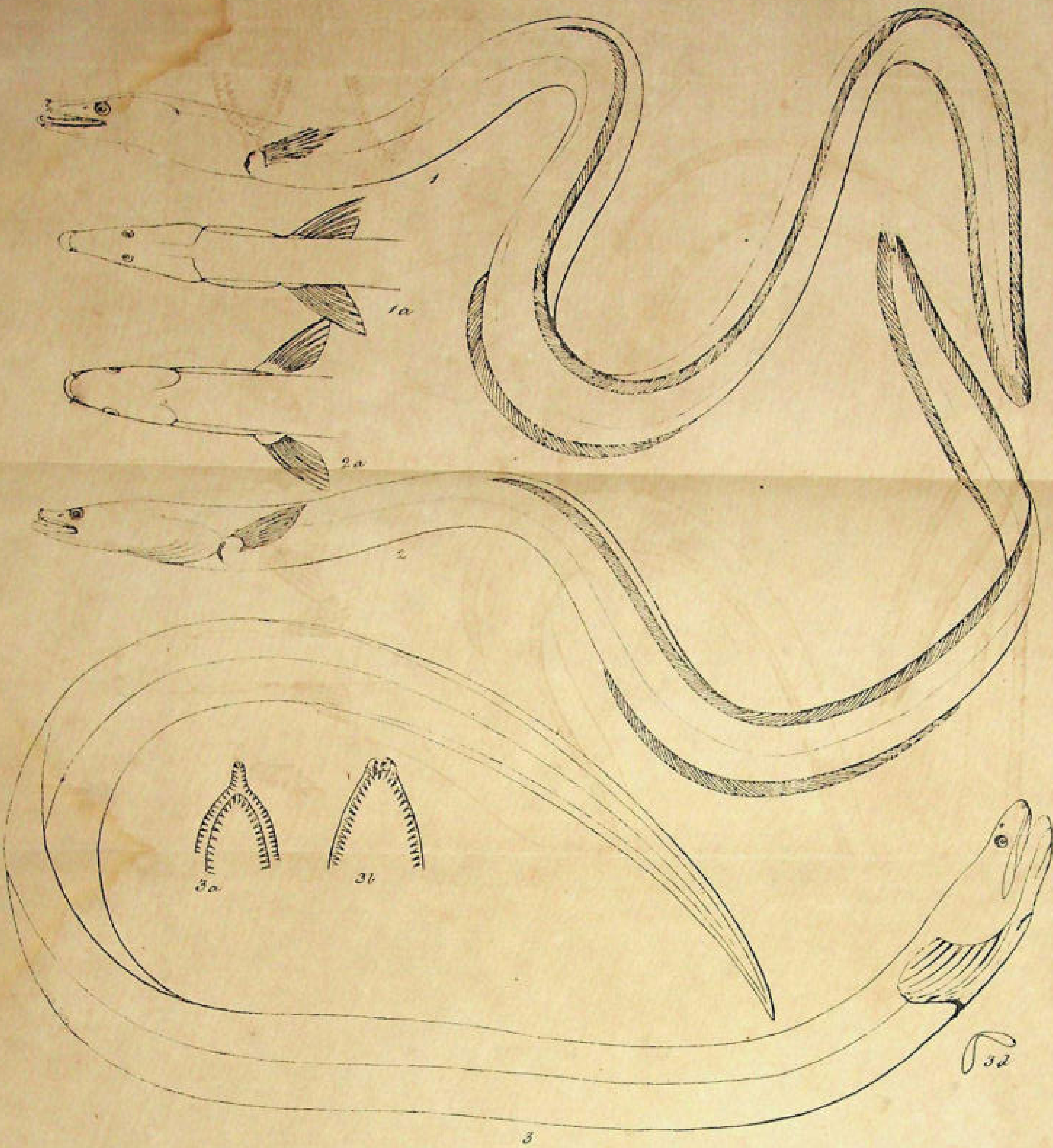
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3a
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3d
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