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"It will flourish, if naturalists, chemists, antiquaries, philologers, and men of science different parts of *Asia*, will commit their observations to writing, and send them to Asiatic Society at Calcutta. It will languish, if such communications shall be long itted; and it will die away, if they shall entirely cease." SIR WM. JONES.

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LIST OF CONTRIBUTORS.

Page.

ALCOCK, ALFRED;—*An Instance of the Natural Repellant Effect of "Warning Colours"* 539

————;—*Description of a new species of* Branchipus *from Calcutta. (Plate X)* 538

————;—*Materials for a Carcinological Fauna of India. No. 2. The Brachyura Oxystoma. (Plates VI–VIII)* 134

————;—*Natural History Notes from H. M. Indian Marine Survey Steamer 'Investigator,' Commander C. F. Oldham, R. N., commanding. Series II. No. 23. A Supplementary List of the Marine Fishes of India, with iption of 2 New Genera and 8 New Species* 301

————, *and* FINN, F.;—*An Account of the Reptilia collected by Dr. F. P. Maynard, Captain A. H. McMahon, C. I. E., and the Members of the Afghan-Baluch Boundary Commission of* 1896. *(Plates XI–XV)* 550

ANDERSON, A. R. S.;—*Natural History Notes from the R. I. M. Survey Steamer 'Investigator,' Commander C. F. Oldham, R. N., commanding. Series II. No. 21. An Account of the Deep Sea Crustacea collected during the season* 1894-95 88

BHADURI, JYOTIBHUSHAN;—*Note on the Decomposition of Mercurous Chloride and Estimation of Free Chlorine* 84

————;—*On the Transformation of Hypochlorites to Chlorates: being the Elliott Prize Essay for* 1895. *(Plates III–V)* 66

FINN, F.;—*Contributions to the Theory of Warning Colours and Mimicry, No. II. Experiments with a Lizard.* (Calotes versicolor) 42

————;—*List of the Birds collected by the Afghan-Baluch Boundary Commission of* 1896 566

HENDERSON, J. R.;—*Natural History Notes from H. M. Indian Marine Survey Steamer 'Investigator,' Commander C. F. Oldham, R. N., commanding. Series II. No. 24. Report on the Paguridæ collected during the Season* 1893-94 516

KING, GEORGE;—*Descriptions of some New Indian Trees* 114

————;—*Materials for a Flora of the Malayan Peninsula* 339

————;—*Notes on the Indian Species of* Vitis, *Linn* 108

Page.

KING, GEORGE, *and* PANTLING, R.;—*A second series of New Orchids from Sikkim* 118

————, *and* PRAIN, D.;—*On* Croftia, *a new Indo-Chinese genus of Scitaminex.* (*Plate IX*) 297

NAG, NAGENDRA CHANDRA;—*Notes from the Chemical Laboratory of the Presidency College, Calcutta. Notes on New Salts of Cobalt and Nickel* 548

PEDLER, A., *and* BHADURI, JYOTIBHUSAN;—*Notes on the action of Nitric Oxide on Alkalies* 545

PRAIN, D.;—*Novicix Indicæ X. Some additional Fumariaceæ* 10

————;—*Novicix Indicæ XI. Two additional species of* Lagotis. (*Plates I and II*) 57

————;—*Novicix Indicæ XII. Description of a new genus of Orchidaceæ* 106

————;—*Novicix Indicæ XIII. Further Notes on Indian Convolvulaceæ; with descriptions of three additional species* 536

————;—*Novicix Indicæ XIV. Some additional Solanaceæ* 541

RANKING, G. S. A.;—*A Note on the Nature of the Substance formed during fermentation, from which Indigo Blue is eventually formed in Indigo Manufacture; and on Indigo Brown* 48

RAY, P. C.;—*On Mercurous Nitrite* 1

Dates of Issue. Part II, 1896.

No. I.—Containing pp. 1–56, was issued on May 1st, 1896.

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„ III.—Containing pp. 301–544, with Plates VI–VIII and X, was issued on October 1st, 1896.

„ IV.—Containing pp. 545–567, with Plates XI–XV, was issued on April 12th, 1897.

LIST OF PLATES.

No. I.—*Lagotis pharica.*
„ II.— „ *crassifolia.*
„ III.—
„ IV.— } On the Transformation of Hypochlorites to Chlorates.
„ V.—

„ VI.— *Calappa pustulosa.*
Calappa wood-masoni.
Pseudophilyra wood-masoni.
Leucosia corallicola.
Leucosia sima.
Leucosia truncata.
Pseudophilyra blanfordi.

„ VII.— *Philyra corallicola.*
Philyra sexangula.
Ebalia wood-masoni.
Ebalia diadumena.
Nursia blanfordi.
Nursia nasuta.
Nursia persica.

„ VIII.— *Heteronucia vesiculosa.*
Pariphiculus rostratus.
Actæomorpha morum.
Tlos patella.

„ IX.—*Croftia spectabilis.*
„ X.—*Branchipus bengalensis.*
„ XI.— Map showing roughly the route traversed by the Baluch-Afghan Boundary Commission of 1896.
„ XII.—*Phrynocephalus euptilopus.*
„ XIII.—*Scaptira aporosceles.*
„ XIV.—*Lytorhynchus maynardi.*
„ XV.—*Eristicophis macmahonii*

JOURNAL

OF THE

ASIATIC SOCIETY OF BENGAL.

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No. I.—1896.

On Mercurous Nitrite.—*By* P. C. RÂY, D. Sc.

(Read December, 1895.)

Preliminary.

Having recently had occasion to prepare mercurous nitrate in quantity by the action of dilute nitric acid in the cold on mercury, I was rather struck by the appearance of a yellow crystalline deposit. At first sight it was taken to be a basic salt, but the formation of such a salt in a strongly acid solution was contrary to ordinary experience. A preliminary test proved it, however, to be at once a mercurous salt as well as a *nitrite*. The interesting compound promised thus amply to repay an investigation.

Historical.

Lefort, Gerhardt and Marignac, especially the last, have studied and described in detail the action of nitric acid on mercury under varying circumstances. We have to labour here under the serious disadvantage of not having access to the original memoirs of these French chemists. Fortunately, a complete resumé of Marignac's work is to be found in Fremy's *Encyclopédie Chimique*. The information as regards mercurous nitrite, however, is scarcely worth anything.* Roscoe and

* The words which have a direct bearing on the present subject are quoted here: "L'azotite mercureux se forme .. en meme temps que l'azotate mercurique, d'apres Lefort, chaque fois que l'on attaque du mercure par de l'acide nitrique. D'autre part, Gerhardt n'admet pas l'existence de l'azotite mercureux et il considère les produits obtenus comme de l'azotate mercuroso-mercurique." Tome III., p. 240.

Schorlemmer in their well-known treatise do not so much as mention this compound, nor is there any reference to it to be found in the latest edition of Watt's *Dictionary of Chemistry*.

Method of Preparation.

Yellow nitric acid, sp. gr. 1·410, is diluted with water in the portion of 1 to 3 in a flask or beaker. A large excess of mercury is once poured into the liquid. The heat of solution of the acid water helps to start the reaction. A gentle effervescence of gases once takes place, and in the course of about an hour yellow need resembling prismatic sulphur, begin to appear on the surface of mercu After a few hours the liquid together with the mercury is carefu decanted off, and the salt shaken out of the vessel over porous tile remove the adhering mother-liquor.

For purposes of analysis, *etc.*, it is preferable to collect the fi day's or at most the second day's crops only, partly because minu globules of mercury get entangled among the mass of the crystalli deposit, which it is tedious to get rid of, and partly because the com position of the salt varies on standing in the liquid. Thus it is found that if the salt instead of being removed is allowed to remain in contact with the mercury and the mother-liquor, it gradually disappears and in its place transparent, perfectly colourless, crystals are formed, which grow in size with time. These latter will be described under the name of "Marignac's salt," which is a basic mercurous nitrate.

Qualitative tests.

The new compound among others answers to the following tests:—

1. Dilute sulphuric acid slowly evolves nitrous fumes: more readily on heating.

2. On warming with a large excess of water, globules of mercury separate out. In the cold the decomposition is only partial.

The *perfectly clear* mother-liquor, decanted off the mercury, gives the following reactions:—

(*a*) Boiled with an excess of pure caustic soda solution, it yields a black dense precipitate, the filtrate from which, after acidification with dilute sulphuric acid, rapidly decolorizes potassium permanganate solution and instantly sets free iodine from potassium iodide.

(*b*) Sodium chloride throws down a copious white precipitate; after removal of the calomel, the filtrate is now divided into several portions; to one is added caustic soda and a yellow precipitate is the result, another portion treated with potassium iodide gives an orange precipitate; whilst a third portion on addition of hydrochloric and phosphorous acids yields a further quantity of mercurous chloride.

It is thus evident that in the clear solution we have both a *mercurous* and a *mercuric* salt as well as a *nitrite*. Urea does not give the faintest opalescence to the liquid, showing the absence of mercuric *nitrate*.

Quantitative Analysis.

A. *Estimation of Mercury.*

In determining the composition of the salt, the amount of mercury in it will have the predominating voice, on account of its high atomic weight; the nitrogen playing only a minor part. The estimation of this metal will therefore be described somewhat in detail.

It has already been shewn that when the salt is heated with a large bulk of water, metallic mercury separates out, leaving in solution both an *ous* and an *ic* salt. The mercury thus liberated sometimes collects readily into a single globule; sometimes it remains as a grey powder, the whole of which it is difficult to aggregate into globules, even after continued heating with hydrochloric acid. For estimation, the mercury is now transferred to a tared crucible and kept under a dessicator. The mercury weighed in this form will be termed "free" mercury all along.

The solution decanted off the mercury with the rinsings of the vessel is considerably diluted with water and an excess of hydrochloric and phosphorous acids added to it. The mixture is now allowed to stand overnight and the precipitate of mercurous chloride weighed in the usual way. When, however, it is desired to estimate the *ous* and the *ic* salts separately, treatment with sodium chloride is resorted to previous to the addition of hydrochloric and phosphorous acids, and the calomel then weighed in two instalments. Although this method yields accurate results, it often proves a very tedious one. After removal of the calomel by $HCl + H_3PO_3$, and further dilution of the filtrate with water, a small quantity of precipitate, varying from a few centi- to milligrams is generally obtained the succeeding day, and so on. Probably it was the nitrous acid necessarily present in the liquid which caused this kind of retardation in the precipitation of calomel.*

In a few cases the mercury in the *ic* salt was estimated as the *sulphide*. But this method is almost equally troublesome on account of the large quantity of sulphur set free. The pores of the filter-paper get choked up and the filtration, though carried on under reduced pressure with the aid of Bunsen's pump, proceeds very slowly. Moreover the precipitate has to be digested with a strong solution of sodium

* In the estimation of mercurous nitrate no such retardation occurs.

sulphite, thoroughly washed with hot water, dried and re-washed with carbon bisulphide, purified by being kept over mercury and re-distilled. Unless the precipitate is treated once more with carbon bisulphide, the result is apt to be too high. There is thus not much to choose between these methods. Both, however, give satisfactory results when conducted with care and patience.

Preparation I.—0·8695 gram. substance gave 0·274 gram. "free" mercury = 31·5 per cent. "free" mercury. 1·1895 gram. substance kept over H_2SO_4 in the dessicator; July 27th 1895. July 30th, wt. = 1·1 gram.; after a month's stay in the dessicator, the wt. was constant 1·184 gram. 1·184 gram. substance gave 0·3485 gram. "free" Hg = 29·43 per cent. "free" Hg; 0·246 gram. Hg_2Cl_2 from the *ous* salt solution = 17·7 per cent. Hg.; and 0·422 gram. Hg_2Cl_2 from the *ic* s = 30·27 per cent. Hg.

Preparation II.—1·2865 gram. substance gave 0·3957 gram. "free" Hg, = 30·76 per cent.; 0·25 gram. Hg_2Cl_2 from the *ous* salt = 16·5 per cent. Hg; and 0·4645 gram. Hg_2Cl_2 from the *ic* salt = 30·69 per cent. Hg. 1·224 gram. substance gave 0·3575 gram. "free" Hg, = 29·2 per cent.; 0·243 gram. Hg_2Cl_2 from the *ous* portion = 16·86 per cent. Hg; and 0·437 gram. Hg_2Cl_2 from the *ic* portion = 30·31 per cent. Hg.

Preparation III.—1·641 gram. substance gave 0·5025 gram. "free" Hg, = 30·62 per cent.; 0·348 gram. Hg_2Cl_2 from the *ous* salt = 17·8 per cent. Hg; and 0·5965 gram. HgS from the *ic* salt = 31·33 per cent. Hg.

The results are presented here in a tabulated form for convenience of reference.

	"Free" Mercury.	Mercury in the *ic* Salt.	Mercury in the *ous* Salt.	Total per cent. of Mercury.	
1.	31·5	...	...	...	
2.	[29·43]	30·27	17·7	78·67	mean 78·56
3.	30·76	30·69	16·5	77·95	
4.	[29·2]	30·31	16·86	77·87	
5.	30·62	31·33	17·8	79·75	

The percentage of "free mercury" in analyis (2) and (4) respectively comes out too low. The cause of this has been already explained.

Whenever the mercury separates out as fine grey powder it is difficult to collect the whole of it into globules; during the decantation of the liquid a part of it is carried off, and during the process of boiling with hydrochloric acid to induce coagulation another portion is lost by volatilisation. As Fresenius himself remarks: "in general a little mercury is lost." In analysis (5) the percentage of mercury in the *ic* salt is a little too high, because this was estimated as HgS (see *ante* (4)). It would be safe to take 30·7 as the percentage of mercury both in the "free" state as well as in the *ic* salt, and this number has been actually taken in calculating the percentage in (2) and (4).

B. *Estimation of Nitrogen.*

The salt was boiled with water and after separation of "free" mercury, the clear liquid was made up to a definite volume and generally 4 c.c. of it treated in the nitrometer. In the case of very dilute solutions of alkaline nitrites and nitrates it is generally the custom to take a larger volume of the liquid, evaporate it to dryness and then dissolve the residue in the minimum quantity (say 2 c.c.) of water. But unfortunately this could not be done in the present case, as thereby insoluble basic salts were formed. In dealing with small quantities any experimental errors would no doubt be highly magnified and thus tend to vitiate the result; but the method is one which admits of rigorous exactitude, as was proved by blank experiments with dilute solutions of protassium nitrate.*

Preparation IV. (*a*) Substance=0·2554 gram.; Volume of solution =65 c.c.

4 c.c. Sol.=1·5 c.c. NO; t=33°C; p=760 mean (mean of 4 cocordant estimations). Whence NO=11·46 per cent.

(*b*) Substance=2·008 gram.; Vol. of Sol.=226 c.c.

4 c.c. Sol. =3·5 c.c. NO (mean of 3 estimations); t=31° C; p=760 m.m.

Whence NO = 11·87 per cent.

(*c*) Substance = 2·299 gram.; Vol. of Sol. =234 c.c.

4 c.c. Sol. =3·9 c.c. NO (mean of 4 estimations); t=32°C; p=760 m.m.

Whence NO =11·93 per cent.

* One who has made the estimation of nitrites and nitrates almost his life-long study testifies as regards the Crum-Frankland process, "that in the absence of organic matter and with proper manipulation in the shaking tube, the method is one of great accuracy, and capable of determining extremely small quantities of nitrates or nitrites." Warington—Chem. Soc. Jour. 1879, page 387.

Evidence as to the salt being a nitrite pure and simple.

As the Crum-Frankland does not enable us to discriminate between the *nitrate* and the *nitrite*, use was made of the well known reactio between urea and nitrous acid.*

It was found that the solution of the *ous* and *ic* salt was on slowly and imperfectly acted upon by dilute sulphuric acid, it w therefore treated with pure caustic soda and warmed. In this w the nitrite was converted into an alkaline salt.

Substance = 0·7285 gram.; Vol. of Sol. = 100 c.c.

After absorption of CO_2 by strong lye:

4 c.c. sol. = 2·85 c.c. N
5 do. = 3·55 do.
10 do. = 7·10 do.

t = 32°C.
p = 756 m.m.

Whence NO = 11·7 per cent.

As the urea also gives up the whole of its nitrogen according to th equation given below, the experimental error is thus diminished by hal

$$2\,HNO_2 + CON_2H_4 = CO_2 + 2N_2 + 3H_2O.$$

Dunstan and Dymond's method of estimating nitrites was also applied; but in this case it is extremely difficult to prevent leakage of traces of air. The result in general was rather high.

The mean of the several estimations of nitric oxide is 11·74.

Discussion of the Results and Theoretical Considerations.

The results accord well with the formula:

$$HgNO_2 + 1/2\,H_2O.\dagger$$

		Theory.	Found.
Hg	= 200·00	78·43	78·55
NO	= 30·00	11·77	11·74
O	= 16·00	6·27	
$1/2H_2O$	= 9·00	3·53	
	255·00	100·00	

On dilution with a sufficiently large quantity of water, the salt moreover undergoes dissociation; thus:

$$Hg_2(NO_2)_2 = Hg + Hg(NO_2)_2.$$

* For details of this process see "A gasometric method of determining nitrous acid," by P. F. Frankland. Chem. Soc. Jour. LIII, 364.

† While correcting the proofs I may as well mention here that the salt has the formula Hg_2NO_2. Since the memoir was presented to the Society, I have made repeated analyses of it, the mercury being estimated as sulphide, as phosphorous acid gives very low results in presence of nitrous acid. The percentage of "free" mercury has been found to be 31·41, that in the *ic* salt, 31·41 and that in the *ous* salt, 17·8: total 80·62. Theory for Hg_2NO_2 requires 81·3.

The amount of mercury set free being equal to that contained in the *ic* salt, quantitative proof of which has been given above. The sociation of mercurous nitrite is analogous to that of calomel:*

$$Hg_2Cl_2 = Hg + HgCl_2.$$

Diminution of pressure in one case playing the rôle of dilution in other; nearly 22 per cent. of the salt, however, dissolves *as such*, and ation has no further effect in increasing the proportion of dissocia-n. (*Vide* table, p. 4).

The present compound throws additional light on the action of ric acid on the copper-mercury group of metals. It is now admitted chemists that "in their relation to nitric acid metals must be divid- into two classes." To the former belong those which produce monia and hydroxylamine from it; *e. g.* Tin, Zinc, Cadmium, Iron, luminium, Potassium, &c., while the latter includes Copper, Silver, Mercury and Bismuth. These seem to enter into direct union with the itrogen of the acid, instead of displacing its hydrogen. The formation f the *nitro* compounds of the fatty series by V. Meyer's method lends additional support to this theory. This *nitronic* constitution of nitrous acid, as Divers puts it, also explains the advantage of red or yellow nitric acid in dissolving metals of the silver-mercury class.†

$$\begin{matrix} Ag \\ Ag \end{matrix} + H \mid NO_2 + HO \mid NO_2 = \begin{matrix} Ag\ NO_2 \\ Ag\ NO_2 \end{matrix} + HOH.$$

Indeed, the presence of nitrous acid seems to be *sine quâ non* for the dissolution of metals like silver, mercury, &c., as was first pointed out by Russell.‡ This chemist also showed that when silver dissolves in nitric acid, "silver *nitrite* is formed in quantity, partly in solution in the silver nitrite liquor, partly as crystals." The stability of silver nitrite in presence of strong nitric acid is noteworthy, as ordinary nitrites are decomposed even by the weakest acids. The nitronic nature of silver nitrite affords a ready explanation of this apparent anomaly.

Acworth and Armstrong in their classical researches found "that "the amount of gas [NO] obtained by decomposing silver nitrite by "nitric acid varies according to the strength of the acid, *being greater "the weaker the acid"* (the italics are ours).....again "no amount of

* Harris and V. Meyer's recent experiments fully bear out the conclusion arrived at by Odling years ago. See "Ueber den Molekularzustand des Calomeldampfes" Berichte: 27 (1894) p. 1482.

† Divers: Chem. Soc. Journ. for 1883 Trans., p. 443; also *ibid.* Trans. for 1885, p. 231.

‡ "On the action of Hydrogen on Silver Nitrate," Chem. Soc. Journ. Trans. [2] xii. 3.

heating will effect this [decomposition] if the acid be concentrated."* Mercurous nitrite seems to behave exactly like silver nitrite.

The traces of nitrous acid, present in the yellow nitric acid doubt, start the reaction, but how to account for the continued for tion of mercurous nitrite? For, this small quantity is soon use according to the equation given above. There must be a pa reaction going on to keep up the supply of nitrous acid. Acworth Armstrong thus explain the action of copper on nitric acid.†

$$Cu + 2\,HNO_3 = 2\,H + Cu(NO_3)_2$$
$$2\,H + HNO_3 = HNO_2 + OH_2$$
$$3\,HNO_2 = 2\,NO + HNO_3 + OH_2.$$

Adopting this view, the mercurous *nitrite* would continue to formed for some time, and being insoluble in the menstruum, would precipated; whilst mercurous nitrate would remain in solution. T strength of the acid also would go on diminishing, till a time arriv when mercurous nitrite is no longer stable in this liquid, the nitro acid decomposing according to the equation:

$$3\,HNO_2 = 2\,NO + HNO_3 + OH_2$$

and Marignac's salt begins to be formed. The transformation of the nitrite into nitrate is however very slow, the process extending over weeks.

During the initial stages of the reaction the reverse change seems to take place; for, on the surface of the mercury somewhat brisk effervescence goes on, but proportionally very little nitric oxide escapes. During its upward ascent most part of it is absorbed, thus:—

$$2\,NO + HNO_3 + H_2O = 3\,HNO_2.$$

A strong proof in favour of this view seems to be the fact that as soon as the superincumbent liquid is poured off, torrents of red fumes appear on the surface of mercury.‡

* On the Reduction of Nitric Acid, &c., Chem. Soc. Journ., Vol. LI. (1877), p. 54 *et seq.*

† Whether NO is formed through the agency of *nascent* hydrogen, or by the *direct* action of the metal on nitric acid must be left at present an open question. *Cf.* Deville: De l'état naissant, *Compt. Rend.*, 1870, LXX., 22, 550.

‡ Veley also arrives at this conclusion. "If the conditions are such that "these metals [Copper, Mercury and Bismuth] dissolve, it would appear that the "metallic nitrite is at first formed, together with nitric oxide. The former is de- "composed by the excess of nitric acid to liberate nitrous acid, whilst the latter "reduces the nitric acid to form a further quantity of nitrous acid."

"Eventually the net result is the product of two reverse chemical changes "represented by the equations —

(1) $2\,NO + HNO_3 + H_2O = 3\,HNO_2$.
(2) $3\,HNO_2 = 2\,NO + HNO_3 + H_2O$."

Proc. Royal Soc. (1890), 48, page 458.

The place of mercury in the Periodic System would naturally justify the expectation that it would yield the *analogue* of silver nitrite, [illegible]he present compound is a realisation of it.

Although the compounds of monatomic mercury resemble the [illegible]sponding ones of silver, there is a sharp distinction between them. [illegible]er never gives basic or hydrated salts, whilst the compounds of [illegible]ury with nitric or nitrous acids seem to be almost invariably basic [illegible]ydrated or both.

It has already been said that for purpose of analysis the first or [illegible]nd day's crop should be collected; after a longer time a granular [illegible] of yellow rhombic tabular prisms (?) is obtained, which is [illegible]er richer in the percentage of mercury and at the same time much [illegible]stable. When this salt, after being dried on the porous tile, is kept [illegible]e bottle, it constantly evolves nitrous fumes.

Temperature also seems to have important bearing on the forma[illegible]n of the present salt. The ordinary temperature of the Laboratory [illegible]the summer season, 31° to 30°C., seems to be very favourable for the [illegible]owth of the needles.

The different mercurous nitrites and nitrates and *mercuric nitrite*, as also an attempt to prepare nitro-ethane with the aid of the compound now described, will form the subject of subsequent communications.

Noviciæ Indicæ X. *Some additional* Fumariaceæ.—*By* D. Prain.

[Read 4th December, 1895.]

The remarks made at the commencement of the ninth contribu of species new to the Indian Flora apply to the present one also.

The *Fumariaceæ* form in reality only a suborder of *Papavera* The limitation of genera here has given even greater trouble thar the case of *Papaveraceæ* proper, while of late years systematists h had to contend with a complicated synonymy due to a well-meant but, writer believes, too rigid application of the rules regarding priority nomenclature. As in the present paper the writer adheres both to generic limits and the generic names of the *Flora of British India*, as no new genera belonging to the group have been reported from In no new generic key is required.

1. HYPECOUM Tournef.

Key to the Indian species.

* Leaf segments linear; flowers yellow; fruits pendulous thickish ... ... 1. *H. parviflorum.*

** Leaf segments oblong; flowers pale purple or white with purple streaks, rarely yellow; fruits ascending narrow ... 2. *H. leptocarpum.*

1. Hypecoum parviflorum *Kar. & Kir. Bull. Soc. Mosc.* xv. 141 (1842). H. procumbens *H. f. & T. Flor. Ind.* 275 (1855); *Flor. Brit. Ind.* i. 120 (1872) *nec Linn.* H. pendulum *Boiss. Flor. Or.* i. 125 (1867) *in parte, syn.* H. caucasicum *Koch exclus. vix Linn.*

Add to localities of F. B. I.:—N.-W. Himalaya; Gilgit, *Giles!*

Substitute for distrib. of F. B. I.:—Beluchistan, Afghanistan, Western Persia, Turkestan, Yarkand, Soongaria.

This species comes just within the western border of the Indian region. It is a plant with precisely the habit of *Hypecoum pendulum*, with which species M. Boissier has identified it but differs so markedly in certain respects that Sir J. D. Hooker and Dr. Thomson, in both their treatises on the Indian species, have preferred to include it in *H. procumbens*. It does not agree in habit with this latter species nearly so well, but its fruits, being more decidedly dehiscent into joints than those of true *H. pendulum* are, agree better with those of *H. procumbens*. It will be noted that Hooker and Thomson include the plant in a species that has 3-lobed outer petals, while Boissier includes it in one that has entire outer petals. Both courses are justifiable because in the Indian plant this character breaks down; some of the specimens have entire, others have 3-lobed petals. The original Soongarian specimens on which Karelin and Kirilow's species was founded have entire outer petals as in *H. pendulum*; the characters on which they have relied in distinguishing their plant are the greater tendency to dehiscence of capsule seg-

ments and the fact that the epidermis remains entire after the segments have fallen away. This is characteristic of the Indian specimens also, whether the outer petals be lobed or entire, and it is on this account that the writer makes the identi-on noted above. Thus considered the plant is seen to be a very distinct raphical form occupying the eastern portion of the Mediterranean and Central n region. The differences implied by their fruit-characters are however so dedly only differences of degree, that in a monographic review of the genus ould probably be preferable to unite *H. parviflorum* with *H. pendulum* as M. sier has proposed. For the purposes of a local Flora it is obviously better to w Sir J. D. Hooker and Dr. Thomson in separating them.

2. Hypecoum leptocarpum *H. f. & T. Flor. Ind.* 276 (1855); *Flor. t. Ind.* i. 120 (1872); *Franchet, Bull. Soc. Bot. Fr.* xxxiii. 391 86); *Maxim., Flor. Tangut.* 37; *Enum. Mongol.* 36.

Add to localities of F. B. I.:—Badakshan, *Giles!* Pangi, *Heyde!* maon, *Duthie!* Bootan, Chumbi and Phari, *Dr. King's Collectors!* STRIB. E. Tibet (*Thorold!*) S. E. Tibet (*King's Collectors!*) N. Tibet *Przewalski!*) China; Kansu (*Potanin!*) Szechuen (*Pratt!*) Yunnan *Delavay!*)

This very distinct species comes just within the northern border of the Indian region. Its area lies to the east of that occupied by the preceding but without overlapping it. Very nearly related to this and perhaps only varietally distinct is *H. chinense* Franchet, [*Pl. David.* i. 27 (1884)]. This differs somewhat from *H. leptocarpum* in foliage and differs moreover in having yellow petals. The colour noted for the petals of *H. leptocarpum* are "pale purple" (*Hooker*) and "pink," "rose," "slate-coloured," "bluish-white," "white with purple-streaks" (various collectors sent by Dr. King); in one gathering from Chumbi, the petals have been noted as "yellow." This gathering therefore, agrees with M. Franchet's plant, which comes from the neighbourhood of Pekin, as to flowers; at the same time it has the foliage of the other specimens and could not be separated, even as a variety, from *H. leptocarpum*. The existence of this form strongly supports M. Franchet's suspicion (*loc. cit.*) that *H. chinense* is merely a variety of *H. leptocarpum*. In Northern Tibet and Mongolia the flowers, Mr. Maximowicz says, are always pale-yellow, never blue.

DICENTRA Borkh.

Key to the Indian species.

* Bracts elongate, capsules narrow linear, coriaceous:—
  † Bracts as long as pedicels; capsules torulose, seeds opaque ... ... 1. *D. torulosa.*
  †† Bracts shorter than pedicels; capsules not torulose, seeds shining ... ... 2. *D. Royleæ.*
** Bracts very small, capsules broad (seeds shining):—
  † Capsule membranous, acute at both ends, early dehiscent ... ... 3. *D. Macrocapnos.*
  †† Capsule fleshy, ovate-cordate, tardily or not dehiscent 4. *D. scandens.*

In habit, the Himalayan *Dicentras* differ widely from all the North Asian and North American forms; in this respect they agree with the American plant known as *Adlumia cirrhosa*, which, differing as it does from *Dicentra* only in having its 4 petals united, scarcely deserves generic rank.

1. Dicentra torulosa *H. f. & T., Flor. Ind.* 272 (1855); *Brit. Ind.* i. 121 (1872). Khasia; *Griffith! Mann! Collett!* Bur Mynela, *Anderson!* Distrib. Yunnan (*Delavay!*)

M. Franchet has shown the writer Chinese specimens of this species rec received at Herb. Paris.

2. Dicentra Roylei *H. f. & T., Flor. Ind.* 273 (1855); *Flor. Ind.* i. 121 (1872). Corydalis scandens *Franch. Bull. Soc. Bot.* xxxiii. 391 (1886); *Pl. Delavay.* 44 (1889) *nec Spreng.*

Kamaon: Simla, *Lady Dalhousie!* Mussoorie *Royle! Falcon* Dippi, 8,000 ft. *Brandis* 3272! Bootan: *Griffith!* Khasia: *Griffi Robertson!* Distrib. Yunnan (*Delavay!*)

This is the second of the scandent group of *Dicentras* characteristic of t Himalayan region that extends to South-west China. M. Franchet in referri the whole genus *Dicentra* to *Corydalis* adopts a course with which the writer i much inclined to agree, but which in a paper like the present it is not advisable to follow. The step is only a reversion to the view advocated by Sprengel. By a *lapsus calami* the specific name of another North-west Himalayan plant has been given in the *Plantæ Delavayanæ*; Delavay's specimens show that the Yunnan plant is *D. Roylei*.

3. Dicentra Macrocapnos *Prain.* Dicentra scandens *H. f. & T. Flor. Ind.* 273 (1855); *Gen. Pl.* i. 55 (1862); *Flor. Brit. Ind.* i. 121 (1872) *nec Walp.* Dactylicapnos thalictrifolia *Wall. Cat.* n. 1426/2 *tantum* (1829) *nequaquam Tent. Flor Nepal.* Macrocapnos *Royle* ex *Lindl. Nat. Syst.* ed. ii. 439 (1836); *Royle Ill.* 68 (1839).

Garhwal: *Edgeworth!* above Kinoli, *Duthie* n. 3820! above Ghát, 7–8,000 ft. *Duthie* n. 3821! Kamaon: Dwarahat and Sobah, *Saharanpur Collectors!* near Kaladoongi, etc., *Davidson! Blinkworth* (Wall. Cat. n. 1426/2)! *Royle!*

Nepal is also given as a locality for this species both in *Flor. Ind.* and *Flor. Brit. Ind.* This is the result of Dr. Wallich having, in the distribution of the E. I. C. Herbarium, mixed specimens of this species sent him by Blinkworth, with his own *Dactylicapnos thalictrifolia* from Nepal. But though Wallich erred in his identification he did not issue Blinkworth's plant as a Nepalese one, the original tickets as well as the lithographed catalogue alike indicate carefully that Blinkworth's plant (which is Wallich's n. 1426/2) came from Kamaon. Wallich's n. 1426/1, which he himself collected in Nepal, is *not* a mixture of two species; it is his own *Dactylicapnos thalictrifolia* and is *the only Dicentra* that he obtained in Nepal. The Wallichian error was pointed out by Royle (*Ill.* 68) in 1839, but his remarks were unfortunately ignored by Walpers (*Repert.* i. 118) when in 1842 he revised the

genus. Indeed Walpers deliberately identifies the present plant, which is Royle's *Macrocapnos*, with *Dactylicapnos* of Wallich, although Royle is careful to point out that Wallich's plant is quite different from his. Sir J. D. Hooker and Dr. Thomson, willing to invent a new name for the Kamaon species, use Walpers' name for it, aining Wallich's for the Nepal species seeing that it was the plant which Wallich ginally described. Unfortunately, however, the use of Walper's name did not ginate with himself but with Don, who employed it, without any of the nders of Wallich or of Walpers, for the Nepal plant. This original description odr. Flor. Nep. 198) is indeed so meagre that it might apply to either species but fact remains that it can only apply to the Nepal one, since the Kamaon plant, med *D. scandens* in the *Flora of British India*, had not then been collected, l has not even yet been obtained in Nepal. And, as if this were not ough, we find that in the account of the Nepal plant in Sweet's *Brit. Fl. rden*, Don's name *Diclytra scandens* of the *Prodr. Flor. Nep.* is expressly ted to be the same as Wallich's *Dactylicapnos thalictrifolia* of the *Tent. or. Nep.*; this account is written by Don himself. This being the case Walper's name must go to designate, as he intended that it should, the plant lready named by Don *Diclytra scandens*. The best distinctive name for the Kamaon plant seems then to be that which Royle had proposed to use generically; it has accordingly been here adopted.

4. Dicentra scandens *Walp. Rep.* i. 118 (1842)—*syn.* Macrocapnos *Royle exclus.* Diclytra scandens *D. Don, Prodr. Fl. Nep.* 198 (25). Corydalis scandens *Spreng. Syst. Veg.* iv. cur. post. 265 (1827). Diclytra scandens *G. Don, Gen. Syst.* i. 140 (1831). Dactylicapnos thalictrifolia *Wall. Tent. Fl. Nep.* 51. t. 39 (1826); *Cat.* n. 1426/1 *tantum* (1829); *G. Don, Gen. Syst.* i. 141 (1831); *D. Don* in *Sweet, Brit. Fl. Gard.* ser. ii. t. 127 (1832). Dicentra thalictrifolia *H. f. & T. Flor. Ind.* 273 (1855); *Flor. Brit. Ind.* i. 121 (1872).

Nepal: Noakote, *Wallich* n. 1426/1! Sikkim; very common. Bootan; *Griffith!* Khasia; very common. Mishmi: Yeu, in woods, *Griffith!*

There is little doubt that this species is quite distinct from the preceding in spite of their having been considered identical by Wallich. The bibliographical confusion that has prevailed as the result of this identification has been discussed above under the Kamaon species.

3. CORYDALIS DC.

Key to the Indian species.

* Base of stem naked; rootstock short (unknown in *C. lathyroides*) capsules not inflated :—
† Stem arising from apex of a solitary tuber; leaves 3-nately divided :—
‡ Tuber globose; stem leaves opposite :—
§ Leaves long petioled, spur wide infundibuliform, (spur recurved, tip incurved) ... ... 1. *C. diphylla.*
§§ Leaves sessile or subsessile, spur cylindric :—
¶ Spur slightly recurved, tip straight ... ... 2. *C. persica.*
¶¶ Spur much recurved throughout its length, (flowers horse-shoe shaped, *twice as large as in the two preceding species*) ... ... 3. *C. cyrtocentra.*
‡‡ Tuber obconic; stem leaves alternate ... ... 4. *C. alpestris.*
†† Stem arising from apex of a rootstock with fasciculate roots some at least of which are tuberous (doubtful in *C. lathyroides*) :
‡ Flowers subumbellate, blue :—
§ Cauline leaves subsessile, palmately divided, bracts laciniate ... ... 5. *C. cachemiriana.*
§§ Cauline leaf distinctly petioled, 3-foliolate, bracts entire ... ... 6. *C. trifoliolata.*
‡‡ Flowers in elongated racemes, yellow :—
§ Cauline leaves divided :—
¶ Stems slender branching; leaves simply pinnate, lobes ovate, obtuse ... ... 7. *C. lathyroides.*
¶¶ Stems simple or only branched in the inflorescence; leaves primarily but unequally ternately divided, lobes acute :—
× Cauline leaves 2, close under inflorescence, segments very long linear ... 8. *C. graminea.*
× × Cauline leaves numerous, scattered along stem, segments oblong ... ... 9. *C. polygalina.*
§§ Cauline leaves entire lanceolate; radical leaves equally ternate ... ... 10. *C. juncea.*
** Base of stem surrounded by old leaf sheaths :—
† Stem arising from apex of short rootstock with fasciculate roots; leaves ternate, stems branched :—
‡ Capsules narrow linear, seeds 1-seriate (unknown in No. 13) :—
§ Leaves unequally ternate, (*i.e.* lateral segments manifestly smaller than terminal); cauline sessile, (*i.e.* lateral segments arising at base of petiole) ... ... 11. *C. flaccida.*
§§ Leaves equally ternate, (*i.e.* lateral segments not manifestly smaller than terminal); cauline long petioled, petioles vaginate at base :—
¶ Leaves twice ternately divided ... ... 12. *C. leptocarpa.*
¶¶ Leaves three times ternately divided ... ... 13. *C. triternata.*
‡‡ Capsules oval, seeds 2-seriate, leaves equally 2-3 times ternately cut, cauline petioles very long, with much expanded basal sheaths ... ... 14. *C. Laelia.*
†† Stem arising from apex of elongated, cylindric, or t[illegible]ock :—
‡ Capsules not inflated, leaves much divided :—

§ Leaves primarily ternately divided, (*i.e.* only 1 pair of late[illegible]
the lowest pair opposite, more subdivided and manifestly larger than [illegible]
¶ Stems simple:—
× Cauline leaves 0, or casually 1; petals not winged ... ... 15. *C. erithmifolia.*
×× Cauline leaves 2, opposite; petals winged ... ... 16. *C. Falconeri.*
¶¶ Stems branched:—
× Dwarf, very small, slightly branched plants with numerous close-set leaves, the leaf segments almost always mucronate, the petioles winged throughout their length, the flowers in dense corymbs partly, and the fruits completely, hidden amongst large foliaceous bracts:—
‖ Petioles not so wide as leaf-segments, petiolules not expanded; leaves equally ternate; seeds few (2-4); spur shorter than lamina ... ... 17. *C. mucronifera.*
‖‖ Petioles broader than the leaf-segments, petiolules also winged; spur longer than the lamina:—
⊙ Leaves equally ternate; seeds 8-9; *flowers thrice the size of those in* n. 17 *and* n. 19 ... ... 18. *C. Hendersonii.*
⊙⊙ Leaves unequally ternate, (*i.e.*, terminal lobe much larger and more subdivided than the lateral); seeds few (2–4); *lobules of leaves and bracts with long setaceous tips* ... ... 19. *C. Boweri.*
×× Elongated, diffusely branched plants with slender stems and scattered leaves with narrow petioles, the flowers in elongated racemes, the bracts very small:—
‖ Leaves equally twice ternate, the terminal segment not sensibly larger than the lateral:—
⊙ Lower outer petal not saccate, spur of upper as long as lamina, slightly recurved; capsule linear, seeds 1-seriate; upper bracts very small, subentire ... ... 20. *C. Casimiriana.*
⊙⊙ Lower outer petal saccate, spur of upper shorter than lamina, straight; capsules oval, seeds 2-seriate; all bracts subequal incised 21. *C. longipes.*
‖‖ Leaves very unequally ternate;; the terminal segment much exceeding and more subdivided than the lateral which may casually be only sub-opposite:—
⊙ Leaf-segments two to three times completely divided; ultimate segments distinct:—
+ Stems branched at base only; (a very slender plant with 1-2 cauline leaves, with minute rounded or oblong ultimate segments) ... ... 22. *C. filicina.*
++ Stems branching throughout:—
a. Terminal leaf-segment again twice trisect:—

Key to the Indian species—Corydalis—*Continued*:

** †† ‡ § ¶¶ ×× ||| ⊙ *Continued.*

++ *a. Continued*:

a. Primary lateral segments hardly exceeding secondary next above; spur slender tapering, slightly recurved, *the staminal process attached to its anterior wall for three-fourths of its length* ... 23. *C. crispa.*

β. Primary lateral segments much exceeding secondary next above; spur stout cylindric straight, tip obtuse slightly incurved ... ... 24. *C. Kingii.*

b. Terminal leaf-segment pinnatisect, the primary lateral segments considerably exceeding the secondary segments next above; spur slender straight:—

a. Ultimate leaf-segments rounded; seeds opaque, punctulate ... ... 25. *C. cornuta.*

β. Ultimate leaf-segments linear or oblong; seeds shining, smooth ... ... 26. *C. ramosa.*

⊙⊙ Leaf-segments once to twice completely divided; ultimate segments decurrent:—

\+ Racemes dense-fld., bracts entire, small, shorter than pedicels 27. *C. chærophylla.*

++ Racemes lax-fld., bracts incised, leafy, longer than pedicels 28. *C. geraniifolia.*

§§ Leaves pinnatisect, (*i. e.* the lowest pair of segments not exceeding the others):—

¶ Stems simple:—

× Cauline leaves none, or one to two low down on the stem:—

|| Leaf-segments much divided, ultimate lobules lanceolate or linear acute; (bracts broadly cuneate, deeply incised) .. .. 29. *C. Govaniana.*

||| Leaf-segments little divided, ultimate lobules ovate or orbicular, obtuse:—

⊙ Leaves simply pinnate, lobes large; bracts broad entire ... 30. *C. elegans.*

⊙⊙ Leaves pinnatisect, lobes small; bracts narrow entire or incised ... 31. *C. tibetica.*

×× Cauline leaves several, disposed throughout the stem:—

|| Leaf-segments much divided, ultimate lobules very small, ovate, discrete; stem leaves 2–4 alternate, bracts broad usually incised ... ... 32. *C. Duthiei.*

||| Leaf-segments little divided, ultimate segments large, oblong, confluent; stem leaves 4, in 2 subopposite pairs, bracts broad entire ... ... 33. *C. Clarkei.*

¶¶ Stems branched:—

× Spur of upper petal tapering towards point, or if obtuse then not saccate:—

|| Branching confined to region of inflorescence only:—

⊙ Leaf-segments simply pinnatisect, lobules ovate:—

\+ Petals uncrested:—

a. Branches few, bu[illegible] incised or up[illegible] *chetiana.*

b. Branches nume[illegible] *keri.*

++ Petals winged :—
a. Branches f[redacted]
a. Bracts entire ; stem *often* [redacted]*iana*.
b. Bracts incised ... ... 37. *C. Gortschakovii*.
b. Branches numerous, lowest bracts large ovate leafy much incised, the rest all linear entire small ; *flowers and fruits smaller than in the 2 preceding species* ... 38. *C. thyrsiflora*.
⊙⊙ Leaf segments 2-3-times pinnatisect lobes linear :—
+ Petals broadly winged ; branches numerous ; *spur very short* 39. *C. meifolia*.
++ Petals uncrested ; branches few, spur nearly as long as lamina ; *lower leaves opposite* ... ... 40. *C. dubia*.
‖ Branching not confined to region of inflorescence ; leaves much divided :—
⊙ Cauline leaves and branches opposite, flowers subumbellate ; *spur very short, wings of petals very broad* ... ... 41. *C. latiflora*.
⊙⊙ Cauline leaves and branches alternate, flowers in racemes :—
+ Stem branching near base only, racemes lax bracts very large, foliaceous, laciniate to near their bases ... ... 42. *C. pulchella*.
++ Stem branching throughout :—
a. Racemes lax, bracts small ; long, diffusely branching plants ... ... 43. *C. Stracheyi*.
b. Racemes dense, bracts large cuneate laciniate to their middle ; usually dwarf plants with stems sometimes unbranched and cauline leaves often subopposite ... 44. *C. nana*.
× × Spur of upper petal distinctly saccate :—
‖ Stem branched in inflorescence only or casually simple ... ... 45. *C. stricta*.
‖‖ Stems branched throughout :—
⊙ Capsule ovate, seeds 2-seriate, leaves 2-3-pinnatisect ... ... 46. *C. rupestris*.
⊙⊙ Capsules linear, seeds 1-seriate :—
+ Capsules tortuous ; leaves 2-3 pinnatisect ... ... 47. *C. ophiocarpa*.
++ Capsules straight :—
a. Leaves 2-3-pinnatisect ... ... 48. *C. aduncа*.
b. Leaves simply pinnate :—
a. Pinnae flabellate, broad ; pedicels very short :—
1. Bracts small, shorter than the buds ... 49. *C. flabellata*.
2. Bracts setaceous, exceeding the buds ... 50. *C. adiantifolia*.
β. Pinnae narrowly cuneate ; pedicels conspicuous... 51. *C. Schelesnowiana*.

‡‡ Capsule inflated, leaves reniform, subentire or 3-5-lobed to -partite ; stems simple, or branched in region of inflorescence only ... ... 52. *C. crassifolia*.

Since 1872, when the account of this genus in the *Flora of British India* was published, the number of species reported from the Indian area has been doubled. For our acquaintance with eight of the newly reported species from the n[orth]-west Himalayan region, we are indebted to the exertions of Mr. Duthie of Sah[a]pur; ten more are due to the extensive exploration of the provinces of Sikkim Chumbi conducted by Dr. King during the past twenty years. Four others the north-west and north-east frontiers have been obtained by Dr. Aitchison Ellis, Mr. Lace and Dr. Watt. The remaining species, recognised in this pap[er] separate, are plants known at the time of publication of the *Flora of British I[ndia]* but in that work referred to other species. In nearly every case they had alr[eady] received the rank of varieties; in *every* instance not only their existence but the that they exhibit characters deviating from those of the species to which they been tentatively referred, has been pointed out by Sir Joseph Hooker and Thomson; their present recognition as species apart is due to the communic[ation] since 1872 of more extensive material for study.

In the foregoing Key, which has been prepared principally with a view t[o] assistance of field botanists, pains has been taken to *avoid* as far as possible the of floral characters. The characters derived from the flowers do not in the writ[er's] experience assist one greatly in classification. The relative length of spur [to] lamina of the larger outer petal is not quite a reliable character; though in t[he] majority of cases this relationship remains fairly uniform, there are some in wh[ich] it does not, there being considerable variability in the absolute length of s[pur] within the limits of some at least of the species here recognised, without any c[or]responding alteration of dimensions on the part of the lamina. The presence or absence of wings to the petals is another character that, taken by itself, appears to fail; at all events among Indian species it has been found necessary to include in[to] at least two, *C. cashemiriana* and *C tibetica*, that are widely divergent, forms which save for the complete absence of wings to the petals cannot be distinguished from their respective types. Nor is colour of material assistance. In the large majority of Indian species the flowers are some shade of yellow, in one instance (*C. ophiocarpa*) so faint that the flowers are almost white; in the remaining species the flowers are mauve or purple. But one species with usually purple flowers (*C flaccida*) sometimes has yellow petals, and two species usually with yellow flowers (*C. meifolia* and *C. crispa*) sometimes have them mauve.

That good characters for purposes of classification are likely to be obtained from the fruit and seed is very probable. But in a considerable number of cases ripe fruits and seeds are still unknown; it is very difficult to obtain the fruits of autumn flowering species owing to the necessity that collectors are under of hurrying away, before their fruits are fully ripe, from the inclement altitudes that many of the species affect. In the meantime, therefore, it has been deemed advisable to use for purposes of arrangement and, as far as possible of specific diagnosis also, the more general characters derived from habit and foliage.

It may be mentioned that it has been found impossible in drawing up the Key to retain unbroken the section of species with fibrous roots and 1-seriate seeds proposed in the *Flora of British India*. One of the three species included in that section proves to be possessed of a fusiform rootstock and to be more nearly allied to *C. flabellata* and *C. adiantifolia*, two species with also 1-seriate seeds though already placed in the other section. On the other hand *C. Laelia*, a new species from Sikkim, has fascicled fibrous roots and oval capsules with 2-seriate seeds. The sec-

tions recognised in the most recent revision of the natural order* seem already to require reconsideration on account of the enormous accession during recent years of Chinese species; the writer therefore refrains for the present from giving names to, ...en from attempting to define, the limits of the more or less natural groups that ... in the genus. It is however only just to those who may consult this Key, to ... in that it has been made to adapt itself to as natural a serial arrangement of ...ndian species as it has been possible to draw up; in no single instance has a ...s been *intentionally* removed from the vicinity of its nearest allies to suit the ...ncies or to facilitate the construction of an artificial Key.

...f the species in the list the first three and the forty-sixth (*C. rupestris*) belong ...e flora of the Orient, the remainder of the north-west Frontier and almost all ...north-west Himalayan ones are species whose affinities are with the Altaian and ...ian flora; those of the Central and Eastern Himalaya, with very few excep-..., show on the other hand Chinese affinities.

The number exhibited within brackets after the serial number of each species ...e list indicates to the student the serial number it bears in the *Flora of British ...ia*.

1. (4.) Corydalis diphylla *Wall. Tent. Flor. Nep.* 54; leaves opposite long-petioled, twice ternately cut, primary petiolules not exceeding ... petiole in length; spur widely infundibuliform rapidly tapering, ...use slightly incurved at tip. *Wall. Cat.* 1430. C. longipes *Don*, ...dy. 198 *(not of DC.)* C. Hamiltoniana *Don, Syst. Gard.* i. 142. Corydalis sp. *Griff. Icon. Pl. Asiat.* t. 658, f. 3. C. rutaefolia *H. f. & T. Flor. Ind.* 262; *Flor. Brit. Ind.* i. 122 *(not of Sibth.)*

Central and Western Himalaya: Nepal, *Wallich* n. 1430! n. 1433 *in part!* Kamaon; common. Kashmir; common. Hazara; *Stewart!* Kurram Valley, *Duthie's Collectors!* Distrib. Afghanistan.

This species has a globose tuber; the "long slender root" *(De Candolle)* or "slender rootstock" *(Hooker & Thomson)* ascribed to it is in reality that part of the stem between the deeply buried tuber and the surface of the soil.

The species is easily distinguished from its nearest allies, *C. rutaefolia*, *C. Ledebouriana*, *C. persica*, *C. cyrtocentra*, *C. darwasica*, *C. macrocentra* and *C. Seweerzovii* by its long-petioled leaves.

Dr. Aitchison, in reaffirming M. Boissier's contention that the Afghan plant united to this by Drs. Hooker and Thomson is different from *C. rutaefolia*, has not called attention to the fact that, while this is the case, the Afghan plant to which Boissier and he refer is even more distinct from the Himalayan one than it is from true *C. rutaefolia*. In any case Dr. Aitchison's synonymy is slightly at fault; granting *C. Griffithii* to be the same as *C. rutaefolia* H. f. & T. *(not of* Sibth.), which is what he claims *(Journ. Linn. Soc.* xix. 151), the name *C. diphylla* Wall., which is about 30 years prior to Boissier's, ought to have been used. Not only however are the two species quite distinct, they are not even representative forms growing in distinct areas; quite recently Mr. Duthie's collectors have obtained true *C. diphylla* as well as *C. persica* (*C. Griffithii*) in the Kurram Valley, while Genl. Gatacre on the other hand has collected *C. persica* in the Ziarat Valley.

* Prantl and Kundig, in Engler, *Natürlich. Pflanzenfam.*

2. (*sub* 4.) Corydalis persica *Cham. & Schlecht., Linnæa* i. 567; leaves opposite sessile or short petioled twice ternately cut; spur not infundibuliform, obtuse recurved and slightly incurved at tip. *Boiss. Flor. Orient.* i. 127. C. Griffithsii *Boiss. Diagn.* ser. 2. i. 15. Griffithii *Boiss. Flor. Orient.* i. 127; *Aitchison, Journ. Linn. Soc.* 151. Corydalis sp. *Griff. Ic. Pl. As.* t. 658, f. 2.

North-West Himalaya: Ziarat Valley, 7,000 feet, *Gatacre!* Kur Vally, *Aitchison! Duthie's Collectors!* Distrib. Afghanistan; North Persia.

Near the preceding species, but hardly, as Aitchison suggests, the same. I the leaves as in *C. rutæfolia* may either be sessile or shortly petioled but ove petioled they are easily distinguished from the leaves of *C. diphylla* by having primary petiolules longer than the petioles. The flowers too are quite different, differences being not at all badly shown even in the indifferent reproduction Griffith's drawing.

Mr. Boissier has himself expressed the belief that his own *C. Griffithii* d not differ sufficiently from *C. persica*. Dr. Regel has gone further and has identi *C. persica* with *C. verticillaris* DC.; had this been justifiable then M. de Candoll as being the older name, is the one that should have been used. But it see better in the mean time to keep *C. verticillaris*, which has flowers with strai spurs, more like those of *C. rutæfolia* proper, apart from *C. persica*. The specim from Turkestan referred to *C. persica* by Dr. Regel (*Act. Hort Petrop.* viii. 694 have flowers with broad explanate lips to the outer petals, in this way differing rather markedly from all the remaining opposite-leaved members of this section. Among the material of the genus kindly lent the writer for study by Dr. Batalion from the Imperial Herbarium, St. Petersburg, is one specimen which shows that originally Dr. Regel had thought of separating the broad-lipped plant under the name *C. darwasica* Regel; this name the writer proposes to sustain. The *figure* given by Dr. Regel does not show clearly the character of the lips.

3. (—.) Corydalis cyrtocentra *Prain;* leaves opposite, sessile, twice ternately cut, petiolules very long; spur very long, not infundibuliform much recurved throughout, erect from the base and overarching the lamina of its lip; inner petals projecting beyond outer.

North-West Himalaya: Chitral, *Younghusband!*

Habit of *C. Ledebouriana* and the other sessile-leaved members of this group. *Flowers* 1 in. long, twice as large as in the two preceding species, spur not incurved at tip. *Bracts* large ovate entire, longer than the pedicels.

This very closely approaches *C. macrocentra* Regel, from which however it differs in having smaller leaves, entire bracts, shorter pedicels, purple or pink, not yellow flowers, and ovules more numerous and in 2-rows. The spur of *C. macrocentra* is moreover at first straight and horizontal as in *C. Semenowii*, not erect from the base as in this species. As regards leaves and bracts it more resembles *C. Semenowii;* more closely still does it approach *C. Ledebouriana*, of which it may ultimately prove to be an extreme large-flowered form. The spur in *C. Ledebouriana* is however in most cases very different, having usually an incurved tip, and being generally somewhat inflated; there are however some specimens of *C. Ledebouriana* from Tur-

kestan with flowers that, though much smaller, a good deal resemble those of *C. macrocentra*.

That the species of the opposite leaved group do not essentially differ from the ...ous-rooted *Corydalis* with alternate leaves, is evident from the fact that occasion- the leaves (as already pointed out by M. de Candolle for *C. rutaefolia*) may be opposite only. Moreover even when patently opposite not infrequently one of leaves exceeds the other in size and then it is very usual to find, especially in *phylla* and in *C. macrocentra*, in the axil of the larger leaf a branch that may be fy shoot only or may be an inflorescence. Sometimes branches occur in the of both leaves; this however is rare: more rare still is it to find that these two ches alone are present, the central axis remaining undeveloped.

4. . (—.) CORYDALIS ALPESTRIS *C. A. Mey. Verzeichn. Pfl. Cauc.* (1831); leaves alternate 3-sect segments all sessile deeply 3-sect, s oblong mucronulate entire or 2-3-toothed mucronulate; raceme -fld., flowers close-set, bracts ovate-acute entire equalling the pedicels, ter petals shorter than the much-upturned obtuse slightly incurved ur. *Ledeb. Flor. Ross.* i. 98 (1842). Corydalis pauciflora VAR. parvi- ra *Regel, Bull. Soc. Mosc.* xxxiv. 136 (1861); *Boiss. Flor. Orient.* i. 131 867). C. pauciflora VAR latiloba *Maxim. Flor. Tangut.* 38, t. 24 (1889). KASHMIR: Musjid Valley, 13-14,000 feet, *Duthie* n. 13238! DISTRIB. ...aucasus and (*fide* Regel) eastward to Kamtschatka and Alaska.

Rootstock a short solid conical scaly tuber dividing below; stems 1½–4 in., not or hardly longer than the 2–4 scattered cauline leaves in the axils of which arise small leafy shoots, and with 2-3 lanceolate scales between tuber and lowest leaf; petioles 2–3 in., blades ¾ in. diam., segments ⅓–½ in. lobules ⅛ in. wide; radical leaves 1-2 similar to cauline but smaller; bracts ¼ in. long ⅛ in. wide; flowers ⅔ in. long.

A very interesting addition to the Indian Flora, one of the results of Mr. Duthie's journey of 1893. By Dr. Regel, M. Boissier, and Mr. Maximowicz, Dr. Meyer's species has been reduced to *C. pauciflora* Pers. [*Synops.* ii. 269 (1807)]. But there is little doubt that Dr. Meyer and Mr. Ledebour were justified in treating this as a species. There are tangible differences in the flowers and in the leaves —differences which both Regel and Boissier admit; even however if these possessed but the trivial value assigned them, there remains the character of axillary branches, which, though neglected by Ledebour and Regel, nevertheless exists in the Caucasus specimens of the plant presented to Herb. Calcutta by Dr. Radde, and is also figured and commented on by Mr. Maximowicz. Other alternate-leaved species of *Corydalis* (§ *Capnites*) have it is true the normally simple stems casually branched. But in the writer's experience not only is branching in these species a purely occasional feature, the branches when they occur appear not in the axils of the leaves as in *C. alpestris*, but in the axils of the *leaf-scales* below the lowest stem-leaf.

That *C. pauciflora* VAR. *latiloba* Maxim. and *C. pauciflora* VAR. *parviflora* Regel differ as varieties, the writer quite believes. He believes further that the present plant might perhaps to be considered varietally distinct from both. But while this is the case, he is convinced that all three are to be considered "varieties" of one species, *C. alpestris*, which it is much better to separate from *C. pauciflora*, and which is well characterised by the presence of leafy shoots in its axils.

The true *C. pauciflora* has been very excellently figured by Ledebour in *Ic. Pl.*

Fl. Alt. t. 450. The usually-quoted figure by Delessert in *Ic. Select.* ii. t. 9. fig. A. is either a very bad representation or has been drawn from another species; the drawing shows flowers with the spur much shorter than the petals. The citation of this plate as representing Persoon's plant should be abandoned by botanists.

5. (5.) CORYDALIS CASHMERIANA *Royle* (*errore* Kashmiriana *Hook. f. & T. Flor. Ind.*; Cachemiriana *H. f. & T. Flor. Brit. Ind.*); roots with scaly tip, emitting from its base a fascicle of fusiform fibrous roots.

VAR. *typica*: outer petals subequal, both crested; spur slightly curved, as long as lower lip, almost as long as lamina of upper lip; bracts rarely more than 3-fid.

NORTH-WEST HIMALAYA: Kashmir; *Royle! Duthie!* to West Nepal, *Duthie!*

Stems 4–12 in. (in Mr. Duthie's most recently collected Kashmir specimens spur 11 mm. long, lower petal 11 mm., lamina of upper petal 12 mm. long.

VAR. *brevicornu* Prain: outer petals subequal, both crested, spur straight, shorter than the lamina of upper lip; bracts often 4-6 fid.

EASTERN HIMALAYA: Sikkim, rare. Chumbi and Phari, very common.

Stems 4–10 in. (often 10 in. in Chumbi specimens); spur 5-6 mm. long; lower petal 11 mm., lamina of upper petal 12 mm. long.

VAR. *ecristata* Prain: outer petals devoid of crests, lower longer than upper; spur much curved, longer than lamina of upper lip; bracts much divided.

EASTERN HIMALAYA: Sikkim, in Jongri and on the Nepal Frontier, common.

Stems 2–4 in. always dwarf; flowers usually much larger than in the preceding varieties, the extreme measurements being—*minimum*, spur 10 mm., lower outer petal 10 mm., lamina of upper petal 8 mm.; *maximum*, spur 15 mm., lower outer petal 12 mm., lamina of upper petal 10 mm.

It is not improbable that this last very distinct variety may prove to be a species apart. Though reported as often as eight times it has unfortunately not yet been collected in fruit. The species most nearly related to the group of forms included under *C. cashmeriana* are the next described, which differs in the points noted in its diagnosis and *C. oxypetala* Franchet, from Yunnan, which differs in having all its bracts entire, in having more flowers arranged in an elongated not a subumbellate inflorescence, in having shorter and thicker pedicels, and in having longer and narrower capsules. It is also nearly related to *C. pachycentra* Franchet, from Yunnan and *C. curviflora* Maxim. from Kansu; along with these it helps to form a very natural group of closely allied forms.

6. (—.) CORYDALIS TRIFOLIOLATA *Franch. Bull. Soc. Bot. Fr.* xxxiii. 392 (1886); radical leaf solitary 3–5-sect, cauline solitary 3-folio-

Fl. Alt. t. 450. The usually-quoted figure by Delessert in *Ic. Select.* ii, t. 9, fig. A. is either a very bad representation or has been drawn from another species; the drawing shows flowers with the spur much shorter than the petals. The citation of this plate as representing Persoon's plant should be abandoned botanists.

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6. (—.) Corydalis trifoliolata *Franch. Bull. Soc. Bot. Fr.* xxxiii. 392 (1886); radical leaf solitary 3–5-sect, cauline solitary 3-folio-

ate long petioled, flowers subumbellate, bracts entire ovate longer than the short pedicels, spur straight shorter than the upper petal. *Plantae Delavayanae* 46 t. 14 a. (1889).

Sikkim: Natong, *Dr. King's Collectors!* Too-ko-la *Cummins!* ...reib. Yunnan.

Rootstock small, emitting from base a fascicle of fusiform tubers. *Stems* solitary ... in. *Radical leaves* long petioled early withering, petioles 1-2 in. blade ¼ in. ...s, *cauline* near top of stem, petiole ½ in. long, lobes ⅔ in. long, ¼ in. wide; flowers ... long, yellow and purple; racemes terminal 2–4 fld.; bracts ¼ in. long, ⅓ in. ...s; sepals minute. *Capsule* linear-oblong.

Very nearly related to *C. erypetala* and to *C. cashmeriana*; from the former it ...rs in having subumbellate flowers, from the latter in having entire bracts; from ... it differs in having a solitary, petioled cauline leaf.

7. (—.) Corydalis lathyroides *Prain;* erect very slender, ...lical leaves 0, stem-leaves two rather wide apart in upper half of ...m, each with an axillary leafy branch; racemes at ends of stem and ...anches 3–5-fld., bracts very small ovate entire; flowers small yellow.

N.-W. Himalaya: Kumaon; Rálam Valley, 10-11,000 feet, on rocks, ...*hie* n. 2708!

Rootstock not collected, the stems rigid, with a subopposite pair of very small le...ales at its base. *Stem* 4–8 in., branches 3-4 in. Cauline *leaves* 2½ in. long, se... simply 3-jugate pinnate, the pinnæ ovate obtuse ⅓ in. long by ¼ in. across, gla...s beneath entire or slightly 2-, rarely 3-lobed. *Bracts* very small, ⅓₀ in., ped... ½ in., capsules ¼ in. narrowly oblong, style persistent, stigma 2-lobed; *seeds* very small black shining.

This is such a very distinct plant that it is impossible to refrain from providing a description in spite of its having been incompletely collected. The flowers are reported by Mr. Duthie as yellow, they are unfortunately in so advanced a state that they do not admit of satisfactory examination; the length of spur relatively to lamina cannot be made out and the presence or absence of crests on the petals cannot be determined. But by their small size, not much exceeding that of the corolla in *C. claviculata*, the flowers differ much from those of all Asiatic species except the Chinese *C. racemosa* Pers., which in other respects this in no way resembles. The absence of rootstock makes it impossible to assign the species with certainty to its true section. Obviously however, in spite of its much smaller size, its nearest ally is *C. paeoniaefolia* Pers., concerning the sectional position of which also some dubiety still exists.

8. (—.) Corydalis graminea *Prain;* erect slender, radical leaves very long-petioled segments narrowly lanceolate 3 (terminal), or 5 (three terminal with a pair opposite lower down), stem-leaves two near the apex and close together the lower short petioled with 5 segments, the upper sessile with 3 segments, each with axillary racemes; racemes 5–10 fld. bracts all linear entire much shorter than pedicels, upper petal as long as the straight cylindric spur.

Sikkim: Peykiongla, 13,000 feet, *King's Collectors!* near Pemberingo, *Cummins!*

Stem 6–8 in. *Radical* petioles 7–9 in. segments 1½–3 in. long, ½–¾ in. wide, l cauline petiole ¼ in., ½–1 in. below upper sessile leaf; cauline leaf-segments sim to radical but shorter and narrower; bracts ¼ in., pedicels ½ in.; flowers yellow long, both outer petals winged.

Very near to *C. linearioides* Maxim. from Kansu and *C. Prattii* Franch. Szechuen which resemble each other in racemes and bracts, but have different s and radical leaves. Of the present species the rootstock has not as yet been col ed so that in this respect it cannot be compared with either. From both, howev differs in having larger flowers and entire, not laciniate, bracts as well as in ha secondary racemes in the axils of the two cauline leaves. Of Indian species it closely approaches *C. polygalina*, of which it has much the flowers and which sometimes has axillary racemes. In *C. polygalina* however the foliage is different, while the cauline leaves are numerous and scattered along the stem.

9. (6.) Corydalis polygalina *H. f. & T.*

Add to description of F. B. I.:—

Stems simple or with axillary racemes, several from a stoutish rootstock wi scaly tip, which emits numerous lateral and basal much elongated narrowly fusif roots; radical leaves 2–4, long-petioled, 3-sect with always the terminal petiol and occasionally the lateral sessile segments again trisect, lobules all oblong-la late subequal.

Add to localities:—Chumbi; Sham-chen *Dungboo!* Syam-ch en *King's Collectors!*

Nearly related to *C. gramínea*, the characters of which species serve to indicate that this also, in spite of its numerous stem-leaves, is really a member of the same group as the various 2-foliate species referred to in the preceding note. Its most intimate ally is however *C. Delavayi* Franch. [*Bull. Soc. Bot. Fr.* xxxiii. 393 (1886); *Plant. Delavay.* 46, t. 14 b. (1889)] from Yunnan, which differs from this species in having the radical leaves more divided, the crest on the upper petal smaller, and the rootstock smaller with the roots more slender. No single one of these characters would be sufficient to separate the two plants specifically; perhaps even their combination only entitles the Yunnan plant to varietal rank.

10. (7.) Corydalis juncea *Wall.*

Add to description of F. B. I.:—

Radical leaves solitary very long petioled, 3-sect, segments long petioluled again 3 sect, lobes sessile 3-partite, ultimate divisions ovate acute to (rarely) linear-lanceolate. *Seeds* brown, arillate, very minutely pitted, occasionally 1-seriate.

Two very distinct forms of this species occur in Sikkim; one, exactly like the original plant from Nepal, with rather long slender pedicels much exceeding the bracts and with the petiole of the radical leaf shorter than the stem. This form extends eastward to Phari, Chumbi and Bootan. The other form, confined to Eastern Sikkim and East Nepal has flowers nearly twice as large, pedicels not exceeding the bracts and a radical leaf with petiole as long as the stem. But intermediate forms occur and it is not possible to treat the two forms even as distinct varieties.

11. (2.) Corydalis flaccida *H. f. & T.*

In one gathering, from Cho-la in Sikkim, the Native Collector records the flowers as "yellow;" in all the others the flowers are said to be "purple," "dark-[illegible]ple," or "reddish-blue."

12. (3.) Corydalis leptocarpa *H. f. & T.*

Add to localities of F. B. I.:—Assam: Naga Hills, at Kohima and [illegible]soma *Prain!* on Japvo, *Colomb!* Manipur: Khongwi Valley, *Watt!* [illegible]per Burma: Mynela, *Anderson!*

13. (—.) Corydalis triternata *Franch.?*

Tall, leaves thrice ternate and ultimate segments again 3-partite to [illegible]t, the lobules spathulate.

Manipur: Chingsow, at 7-8,000 feet, *Watt* n. 6314!

Stems 1-2 ft. roots tufted; radical petioles 8–10 in., cauline 3-4 in., primary [illegible]iolules 2 in., secondary ½-¾ in., lobules glaucous beneath ¾ in. long, ⅛-¼ in. across. This plant, very distinct from any other Indian species, may possibly prove to be the same as M. Franchet's *C. triternata* of which it closely imitates the foliage. It also, however, resembles somewhat *C. Davidi* Franchet, from E. Tibet and *C. Balansæ* Prain,* from Tonkin; this latter, however, rather belongs to the group containing *C. ophiocarpa*. Till flowers and fruits are reported, the identity or non-identity of the present species with any of these cannot be vouched for. Its tufted roots indicate that its natural alliance is with *C. leptocarpa*, with which species it has in fact been by Dr. Watt tentatively placed.

14. (—.) Corydalis Laelia *Prain;* erect, quite glabrous, leafy, leaves equally ternate, segments again ternate, lobes 2-jugately pinnatipartite, ultimate lobules lanceolate 2-3-fid, radical petioles very long, all broadly vaginate in lower third; racemes in large wide-spreading panicles, lowest bract leafy incised the remainder linear as long as the pedicels.

Eastern Himalaya: Sikkim; Lingtoo, Natoot, Patangla, *King's Collectors!* Chumbi; Lu-ma-poo, Kungboo, *King's Collectors!* Bootan; in Upper Dichu Valley, *Cummins!*

* Corydalis Balansæ *Prain;* tall, leaves glaucous beneath, 2-pinnatisect, the lobules ovate unequally 3-5-lobed; racemes lax many-fld terminal and axillary, flowers white, bracts small ovate-acute pedicels very short; outer petals spathulate apex obcordate mucronulate, dorsal wings very small, upper lamina 4 times as long as saccate incurved spur; inner petals with projecting apical wing; capsules narrow subfalcate apex acute; seeds 1-seriate compressed black, minutely puncticulate and with large strophiole.

Tonkin: Langson, "à l'entrée des grottes," *Balansa* n. 1557!

Stems 12–18 in. petioles 3–4 in. long. pinnæ 8-jugate in subopposite pairs, petiolules 1 in., segments ¾–1 in. by ½-¾ in. lobes shallow. *Flowers* ⅔ in. *Capsules* 1½ in. long.

Perhaps nearest to *C. ophiocarpa* but with larger flowers and very different foliage and fruits.

Roots numerous tufted from sides and base of very short stock. *Stems* 2-3 feet high. Radical *petioles* 1-1½ feet, cauline 6 in., petiolules ½ in., laminæ 3 in. across. *Flowers* ¾-1 in. bright yellow, the upper petal equalling the straight spur, both outer petals broadly winged. *Capsules* ovate.

This very fine species much resembles *C. thyrsiflora* (*C. Gortschakovii* H. T., *vix* Schrenk); it has very similar flowers and fruits. But though in ge habit these two agree so closely they are in reality extremely different; *C. th flora* has pinnate, not ternate leaves, and has a long fusiform rootstock, not a tuft of fibrous roots.

15. (8.) Corydalis crithmifolia *Royle*.

16. (9.) Corydalis Falconeri *H. f. & T.*

17. (—.) Corydalis mucronifera *Maxim. Flor. Tangut.* 5 24 f. 19; stem short breaking into diffuse cæspitose branches from base, leaves petioled 3-sect, segments shortly stalked 3-partite, ultim lobes linear oblong obtuse; racemes few-fld., flowers hidden among large rhomboid flabellate-multifid bracts.

Eastern Himalaya: Phari, at Ting, *Dr. King's Collectors!* Distr Tibet.

Glaucous; rootstock cylindric $\frac{3}{16}$ in. diam. 2-3 in. long; stems 1½-2 in.; ra leaves numerous with flattened winged petioles ½-¾ in. long, narrower than the le segments. *Flowers* yellow ¼ in., sepals small laciniate, spur slightly incurved shorter than the upper lip which is uncrested or has only a slight crest near middle; ovary oval 4-5-ovuled rather longer than style; fruit oblong usually 2-seeded twice as long as persistent style, sharply deflexed and buried amongst the bracts by an abrupt curvature of the apex of pedicel; seeds black, shining.

The only difference between the plant from Phari and that of North Tibet is that the leaf-segments and the tips of the laciniæ of the bracts are not mucronate in the southern locality. However, as Mr. Maximowicz's figures and description explain, they are not always mucronate even in the original locality.

18. (—.) Corydalis Hendersonii *Hemsley, Journ. Linn. Soc.* xxx. 109 (1894); small, stoutish, glabrous, slightly branched, leaves long petioled 3-fid, radical many withering, cauline numerous close-set, segments long stalked 3-sect, ultimate lobes also long stalked and twice tripartite lobules oblong obtuse very small with or without a very short terminal mucro; racemes congested few-fld., flowers almost hidden among the large foliaceous bracts. C. tibetica *Henders. Lahore to Yarkand*, p. 309 *nec H. f. & T.*

N.-W. Himalaya: Zo-gi-la, *Stewart!* Taglang Pass, *Heyde!* Distrib. Yarkand (*Henderson!*); Tibet (*Thorold!*).

Glaucescent; *rootstock* cylindric $\frac{3}{16}$ in. diam. 2 to 3 in. or more long; stems 2-3 in.; all the leaves with flattened winged petioles 1 in. long ¼ in. across, their margins beset with very small glandular hairs, petiolules ¼ in. ultimate lobules narrowly spathulate mucronate or not. *Flowers* yellow ¾ in. long, sepals small obliquely triangular subentire, subpersistent; spur straight almost as long as upper lip which is boat-shaped with slightly reflexed margins and uncrested; ovary oval 10-ovuled

only ½ as long as style; fruit oblong 8-9 seeded, twice as long as persistent style, sharply deflexed and buried amongst the bracts by a sharp curvature of the much elongated pedicel; seeds reniform-orbicular, minutely punctiulate, strophiolate. Resembles generally *C. mucronifera* Maxim. and *C. Bowcri* Hemsl. but differs the former in having petioles much broader than its leaf-segments, from the in having its leaves equally ternate. Like *C. mucronifera* it differs also from wcri in not having its leaf-segments, even when mucronate, which they by no always are, prolonged into a setaceous tip. From both species *C. Hendersonii* s in having flowers three times as large and seeds three times as numerous.

19. (—.) Corydalis Bowerı *Hemsl. Journ. Linn. Soc.* xxx, 108; short breaking into diffuse cæspitose branches from the base, es very long petioled primarily 3-sect, lateral segments short-stalked rtite, terminal long-stalked 2-jugate pinnate, ultimate lobes linear-eolate terminating in a very long setaceous tip; racemes congested -fld., flowers almost hidden among the large rhomboid flabellate-ltifid setaceo-mucronulate bracts.

N.-W. Himalaya: Kamaon, Nipchang Valley, 13-14,000 feet, Shibu Dárma, 12-13,000 feet, and near Naibil, in Kutti Yangti Valley, aus, at 11-12,000 feet, *Duthie* n. 2705! Distrib. Tibet (*Thorold!*).

Glaucous; *rootstock* cylindric $\frac{1}{10}$ in. diam. 2 to 3 in. or more in length; *stems* 2-3 in.; radical leaves numerous, with flattened winged petioles 2 in. long ⅛ in. across at length disappearing, petiolules ½ in., ultimate lobules narrowly spathulate and ending in a long setaceous tip. *Flowers* yellow ¾ in., sepals small laciniate, persistent; spur slightly incurved rather longer than upper lip which is uncrested or has only a slight crest near middle; ovary oval 4-5-ovuled two-thirds length of style; fruit oblong usually 2-seeded, twice as long as persistent style, sharply deflexed and buried amongst the bracts by an abrupt curvature of the apex of the somewhat elongated pedicel; seeds strophiolate.

Except for the longer spur and the much longer style, this in flower much resembles, and in fruit almost repeats the characters of *C. mucronifera*. The foliage, however, is very different, more resembling that of *C. Hendersonii* though the leaves differ in not being equally ternate and in having long setaceous tips, while the flowers are one-third the size of the flowers of *C. Hendersonii*.

20. (*sub* 16.) Corydalis Casimiriana *Duthie & Prain*; sub-glaucous, much branched slender, leaves long-petioled equally twice ternate, segments 3-5 oblong deeply cut, racemes lax few-fld. terminating long slender branches; bracts small, the lower cut into lobes, the upper entire; outer petals winged the lower not saccate the upper with long slender recurved spur; capsule linear, seeds 1-seriate. C. longipes *Wall. Tent. Flor. Nep.* 53 t. 42 fig., partly only in text; *Cat.* n. 1433 in part; *Maxim. Flor. Tangut.* 51 *not of DC.*

Himalaya: Kashmir, Kolahir above Liddarwat, on wet rocks, 11-12,000 feet *Duthie* n. 13521! Kamaon, frequent, *Duthie* nn. 2713! 5312! 5314! Nepal; *Wallich* n. 1433 (*mixed with* C. diphylla *and with* C. longipes)! *Scully* n. 290! Sikkim; Tongloo, and Saudakpho

10,000 ft. *Gamble* n. 22! Jongri, *Anderson* 366! 369! *Gammie! King's Collectors!* Lachung, *Hooker* (the Sikkim "*sibirica*" of *Herb. Ind. Or.*)! *Gammie* n. 372! Kapoop and Cho-le-la, *King's Collectors!* Chumbi; very common, *King's Collectors!* Phari; *Dungboo* n. 4544! Distrib. S. T. (*Lama Ujyen Gyatsko* n. 344).

Stems weak, much branched, leafy. *Leaves* membranous. *Flowers* yellow long; posticous petal shorter than the slender spur. *Capsule* varying from in Chumbi, Sikkim and Nepal specimens to ½ in. in Kashmir and Kamaon ones style 2-lobed.

This and the next species, taken together, constitute the *Corydalis sibiri* Indian authors. The only character which this plant has in common with *C. si* is its 2-lobed stigma; it differs in habit, foliage, floral structure and fruit. The though similar are a little smaller. In habit it almost exactly repeats characters of the next species (*C. longipes*) which has flowers extremely like t of *C. sibirica*; the double confusion resulting from the union first of *C. Casimiri* and *C. longipes* because they are identical in habit though totally different flower and fruit, and again of *C. longipes* and *C. sibirica* because, while of differ habit, their flowers and fruits are identical, has led to the belief that *C. sibirica* very variable species. The examination of specimens of *C. sibirica* collected Turczaninow near Lake Baikal and elsewhere, and at the river Kolyma by Augu tinowicz, leads me to doubt whether the genuine *C. sibirica* is a variable specie And the careful analysis of flowers and examination of fruits from 28 different gatherings of *C. Casimiriana* and from 31 different gatherings of *C. longipes*, shows that neither of these is in the least degree variable, at all events in the direction of passing into each other. An apparent exception to this is a solitary gathering from Chumbi which, with flowers exceedingly like those of *C. Casimiriana*, has unripe capsules like those of *C. longipes*. But the evidence that we have in this plant an intermediate between *C. Casimiriana* and *C. longipes* is far from complete. Its flowers instead of being intermediate in form between those of the other two have a spur with an exaggerated curvature. The stigma too differs from that in either *C. Casimiriana* or *C. longipes* and resembles that of *C. tongolensis* Franchet from Szechuen, another nearly related but nevertheless quite distinct species.

21. (*sub* 16.) Corydalis longipes *DC. Prodr.* i. 128; sub-glaucous, much branched, slender, leaves long-petioled equally twice ternate, segments 3–5, ovate deeply cut, racemes lax few-fld. terminating long slender branches, bracts small all cut into narrow lobes; outer petals crested, the lower pouched at base, the upper with stout or slender straight or slightly recurved spur; capsule oval, seeds 2-seriate. *Wall. Tent. Flor. Nep.* 53 in part and excluding fig.; *Cat.* n. 1433 in part. C. sibirica *Maxim. Flor. Tangut.* 51 as to spp. from Kamaon and Khasia. C. filiformis *Royle, Ill.* 68.

Himalaya: Garhwal, near Mussoorie, *Royle! King!* Kamaon, Ralam, *Strachey and Winterbottom!* Nepal: *Wallich* (mixed with preceding and with *C. diphylla*)! Sikkim: Tongloo, *Thomson! Anderson* n. 364! 365! *King! Gamble* n. 8426! Sandakpho, *Gamble* n. 3903! *King's Collectors!* Jongri, common, *King's Collectors!* Singalelah, *Kurz!*

Clarke nn. 12585! 12710! Khasia; Shillong, etc., *Hooker and Thomson! Clarke* n. 7300! n. 44266! *Mann! Gallatly! Murdoch!*

Stems weak, much branched, leafy. *Leaves* membranous, flowers yellow ¼ in. posticous petal as long as its spur. *Capsule* ¾ in., style as in *C. Casimiriana*.

On Dr. Royle's original sheets of *C. filiformis* this is the plant distributed. it would appear as if Dr. Royle had distinguished this from the preceding species though he does not mention *C. Casimiriana* under any name in *Ill. Him.* he has d it *C. longipes* in Herb. Saharanpur. Dr. Wallich's n. 1433 is a mixture of this, *Casimiriana* and of his own *C. diphylla*; the latter fact probably explains se of the name *C. longipes* by Don to designate *C. diphylla*. This is also the from Kamaon and Khasia referred by Mr. Maximowicz, doubtfully as to itself. o the exclusion of *C. longipes* Maxim. *not of* DC. (*C. Casimiriana* Duthie &), to *C. sibirica*. When preparing the present paper the writer came to the conclusion as Mr. Maximowicz, *viz*:—that the species with capsules in which seeds are 1-seriate must be *C. longipes* DC., since M. de Candolle has described *ngipes* as having *linear* capsules. This view possessed the great advantage of bling the use of Royle's name *C. filiformis*—regarding which, owing to the existence uthentic specimens, there was no dubiety possible—for the plant with *ovate* cap- s. And when duplicates were distributed from Calcutta to the great European rbaria, the species with *linear* capsules was issued as *C. longipes* and that with *ate* capsules as *C. filiformis*. But before publishing this paper, the writer took the liberty of referring the matter for final decision to Mr. C. de Candolle. He and Mr. Buser have most kindly compared specimens of both plants with the type specimen of *C. longipes* in the *Prodromus* Herbarium. The result of their examination is that the original description of the capsules of *C. longipes* does not accord with their actual condition; the true *C. longipes* is in reality the same as *C. filiformis* Royle. In consequence of this the plant with linear capsules is still unnamed and Mr. Duthie and the writer have named it *C. Casimiriana* as a slight recognition of the obligation under which Mr. C. de Candolle's kindness has placed them. Students of the genus should therefore note that sheets issued from Calcutta as *C. longipes* are in reality *C. Casimiriana*; those issued as *C. filiformis* should be known as *C. longipes*, that being the oldest name.

These two species, along with *C. tongolensis* and *C. gracilis*, form a very natural group of species that perhaps only differ from each other as species of secondary rank.*

* This is not the only instance in *Corydalis* where two species repeat practically every vegetative character and only differ slightly in flower and more considerably in fruit. A good example of the same parallelism among Eastern Asiatic species is exhibited by the well-known Eastern Chinese and Japanese species *C. incisa* Pers. and a species from Central China which has been named in Herb. Paris and Herb Calcutta by M. Franchet and the writer; the following is a brief diagnosis.

Corydalis Hemsleyana *Franchet & Prain*; rootstock rather slender dividing at apex, crowned with radical leaves and emitting numerous slender flexuous stems; leaves alternate long-petioled, twice ternate, segments ovate-oblong acutely incised; bracts oblong-cuneate incised shorter than the pedicels; sepals laciniate; outer petals both crested, and with explanate margins; fruit wide-ovate acute at both ends.

Central China: Hupeh, *Henry* n. 3729!

Very near *C. incisa* Pers. from which it differs in its smaller size (stems 8 instead of 20 in.), larger flowers with spur rather longer than lamina, and shorter wider fruits.

22. (—.) CORYDALIS FILICINA *Prain;* glaucous, very slender, branched at the base only, leaves long petioled, 3-nate, the lateral segments again twice ternate the terminal 2-jugate pinnate its lobes ternate, ultimate lobules all very small widely oblong irregularly lo racemes rather dense few-fld., bracts incised shorter than pedicels, straight.

SIKKIM: Ney-go-lah, on the Singalelah range, *Dr. King's Collec*

Rootstock thin wiry, stems filiform 4–6 in. cauline leaf solitary, short-pet sometimes 0, radical petioles 2 in. secondary petiolules ¼ in., lobules ⅛ in. a *Flowers* yellow ¾ in. upper petal slightly ridged near middle but not truly wi spur as long as lamina, attached to inner petals by a projecting marginal tooth.

A very distinct species. The capsules unfortunately are not yet ripe.

23. (—.) CORYDALIS CRISPA *Prain;* stems short rather sle diffusely branching from the base and freely branching through leaves all short petioled, radical withering, unequally ternate, the late lobes again ternate the central longer-stalked and twice ternate, petioles expanded to the first division, segments irregularly 3–5-lob racemes dense many-fld. terminating stems and branches, lower pedic very long exceeding the long linear bracts; upper outer petal winge with a much recurved slender blunt spur as long as lamina; capsules oblong small, seeds shining.

EASTERN HIMALAYA: Chumbi; at Perm-la, near Chum-la-ri, and at Syam-po, *King's Collector!* Phari; Goop, etc., *Dungboo!* DISTRIB. S. Tibet (*Lama Ujyen Gyatsko* n. 325).

Rootstock rather slender 10–12 in. long, breaking at crown into many again diffusely branching heads, stems 6–8 in, leaves 1½-2 in. petioles ½ in. ultimate segments ⅛-¼ in. across. *Flowers* ½ in., blue and white, or yellow with purple tips, the wing of upper petal extending half-way along the much recurved spur. *Capsule* ¼ in.

A very distinct species, of the same group as *C. longipes* which it resembles in its recurved spur and *C. ramosa* which it resembles in habit, but unlike any other Indian species in having the process from the upper staminal phalanx not free inside the spur but attached to its anterior wall for ⅔ths of its length.

24. (—.) CORYDALIS KINGII *Prain;* sub-glaucous, stems slender branching; cauline leaves 1–3 scattered, unequally ternately divided, lateral segments sub-opposite arising close to stem long-petioluled and again ternately divided, terminal very long-petioluled and again twice ternately divided with distinct secondary petiolules, ultimate segments all 3-fid to -sect. lobules obovate acute, radical leaves vanishing; racemes lax-flowered, terminating slender branches, bracts large obovate acute; pedicels long; sepals obliquely cordate acuminate subentire; outer petals shortly narrowly winged near tips, limb of upper broad; spur cylindric straight except at the obtuse slightly incurved tip, ⅓ longer than lamina; young capsule long very slender; seeds 1-seriate.

PHARI; *Lama Ujyen Gyatsko*, n. 100!

Rhizome very slender, $\frac{1}{10}$ in. diam. clothed toward apex with numerous lanceolate [illegible]s, and emitting from tip slender stems much attenuated at point of origin from [illegible] of scales; *stems* 6–12 in.; leaves 3 in. long, 2 in. across; petiole $\frac{1}{2}$ in.; primary [illegible]l petiolules 1 in.; central petiolule 1·5 in., its secondary petiolule $\frac{1}{2}$–$\frac{1}{2}$ in.; [illegible] bracts $\frac{1}{4}$ in. long, $\frac{1}{8}$ in across, entire, upper smaller; pedicels $\frac{1}{2}$–$\frac{1}{4}$ in. [illegible]rs purple $\frac{1}{2}$ in. long, spur $\frac{1}{8}$ in.

A very distinct species in habit recalling the *C. juncea* group but with very [illegible]ent rootstock and flowers, and in foliage somewhat resembling *C. flaccida* but [illegible] with very different flowers and rhizome. As regards flowers it most closely [illegible]bles *C. decumbens* Pers. from Japan, but it has a relatively longer spur and its [illegible]argins are not explanate; its rootstock too is altogether different, that of [illegible]*cumbens* being tuberous. *C. Kingii* is not very nearly related to any Indian [illegible]es.

25. (17.) CORYDALIS CORNUTA *Royle*.

Add to synonyms of F. B. I.:—Corydalis ramosa VAR.—*Aitch. [illegible]rn. Linn. Soc.* xix. 152 (*not of Wallich*). DISTRIB. Afghanistan; [illegible]uram Valley, *Aitchison* n. 298! 324)!*

26. (15/2.) CORYDALIS RAMOSA *Wall. Cat.* 1434; stem erect or [illegible]procumbent branched, leaves twice ternately divided, ultimate segments ovate, lanceolate, racemes terminal lax many-fld., bracts leafy incised.

VAR. typica; stems erect; habit and foliage of *C. sibirica* Pers., from which the plant is only distinguishable by its different flowers. *Wall Cat.* 1434, *partly*. C. chaerophylla *Royle* in *Herb. N. W. Ind. not of Wall.* C. erecta *Falc. MSS.* in *Herb. Saharanpur.*

NORTH-WEST HIMALAYA: Kamaon, *Blinkworth* in *Herb. Wall.* (n. 1434 partly)! *Royle! Strachey and Winterbottom* n. 11! *Reid!* Garhwal, *Falconer! Duthie* n. 944! *Gamble* n. 24300! Simla; *Thomson! Brandis! Gamble* n. 4299! n. 6201! *Duthie* n. 7247! n. 7248! n. 8754! Bashahr; *Lace* n. 905! Pangi; *Stoliczka! Ellis* n. 382! n. 1276! n. 1516! *Brandis* n. 3271! n. 3610! Dalhousie; *Clarke* n. 22514!

* Nearly related to this species and to the next is a species from Szechuen of which, as it has not yet been described, an account is now given.

CORYDALIS DRAKEANA *Prain*; stems erect branching, leaves twice ternately-divided ultimate segments ovate incised racemes terminal lax, flowers very few distant, bracts large leafy spathulate entire.

CHINA: Szechuen, near Tachien-lu, *Pratt* n. 461!

Habit of *C. ramosa* and *C. cornuta*, foliage most resembling that of the latter. *Flowers* $\frac{1}{2}$ in. yellow, racemes 6–8 in. but only 4-5 fld. Bracts large $\frac{1}{4}$ in. to 1 in. much exceeding the short pedicels. *Capsules* linear to narrow oblong $\frac{3}{4}$ in. to 1 in long, seeds 1- or irregularly 2-seriate shining

Very near to *C. cornuta* but with shining seeds. Easily distinguished from *C. ramosa* by its different foliage, its longer narrower capsules and its very large entire bracts.

n. 22517! Kashmir; at Gund in Sind Valley *Gammie!* near Shishna Nág, at 12,000 feet, in Liddar Valley, *Duthie* n. 14131! Nowbeg, at 6,500 feet, *Clarke* n. 31249 (issued as *C. sibirica*)!

VAR. vaginans *H. f. & T. Flor. Ind.* i. 267; stems weaker pro bent; habit and foliage of *C. sibirica* VAR. *intermedia* Regel. C. nans *Royle, Ill. Him.* 68. C. ramosa VAR. vaginans *H. f. & T. Brit. Ind.* i. 125.

NORTH-WEST HIMALAYA: Kunawar, at Kanum, *Royle!* L *Jaeschke* n. 255! *Thomson!* Pangi; *Stoliczka!* Bashahr; *Lace* n. Garhwal; *Duthie* n. 946! n. 5320! Simla; *Gamble* n. 1402! Kash near Sonamurg, *Falconer! Clarke* n. 30879! *Duthie*, n. 13593! Kum *Blinkworth* in *Herb. Wall.* (n. 1434 partly)!

A good deal of confusion has taken place regarding this species, probably o to the fact that the Wallichian types were collected by Blinkworth and, being numerous, are therefore not well represented in Herbaria. In the t Herbarium at the Linnean Society, however, both the erect and the lax plants, w do not differ except in habit, are represented. The species happens to b very easily recognised and distinct one; the only Indian species that can be c founded with it is *C. cornuta* and a diagnosis is at once effected by the spe To help in removing the confusion, all the localities and all the numbered sheets present in Herb. Calcutta and in Herb. Saharanpur are cited for the convenience of students elsewhere.

The plant described as *C. vaginans* by Royle is the one of *lax* habit; the original specimens described in *Ill. Him.* (from Kanum in Kanawar) are at Saharanpur and have been examined by the writer. Both in Herb. Saharanpur and in his distributed herbarium Dr. Royle consistently named the *erect* one *C. chaerophylla*, he having mistaken it for Dr. Wallich's plant of that name; Dr. Falconer having discovered Dr. Royle's mistake, but not having ascertained that the *erect* plant was included in Dr. Wallich's *C. ramosa* named it at Saharanpur *C. erecta*, but has noted his doubt as to its being different specifically from Dr. Royle's *C. vaginans*. In the *Flora Indica* and the *Flora of British India*, *C. ramosa* VAR. *vaginans* is exactly equivalent to *C. ramosa* Wall. (*Cat.* 1434), *i.e.*, it includes both *C. vaginans* Royle and *C. erecta* Falc. The species does not occur in Sikkim or in Nepal. The Sikkim plant included in *C. ramosa* in the *Flora of British India*, as var. 1. *glauca*, and which forms VAR. a of *C. ramosa* in the *Flora Indica*, has pinnate-leaves and is *C. Stracheyi*, a form very considerably removed from the present species. The small species included as VAR. *nana* is *C. nana* Royle; it also has pinnate leaves and is equally far removed.

C. ramosa is much more nearly related to *C. sibirica* Pers. than is the *C. sibirica* of Indian authors. It has exactly its habit and foliage (even imitating *C. sibirica* in its variations), has the same inflorescence and the same fruits and seeds. The solitary difference is in the flower; in *C. sibirica* the spur is slightly recurved, in this species it is distinctly incurved and longer.

27. (18.) CORYDALIS CHAEROPHYLLA, *DC.*

Add to localities of F. B. I.:—NAGA HILLS: Japvo, *Watt!* Pulinabadza, *Prain!*

28. (*sub* 18.) Corydalis geraniifolia *H. f. & T. Flor. Ind.* 269 (1855); stem sub-erect leafy branched, leaves deltoid decompound, racemes terminal simple or sparingly branched, bracts all large leafy ovate-acute ...ate or only 3-fid rarely entire, spur very slender longer than the ...a, incurved at the tip. C. chaerophylla *H. f. & T. Flor. Brit.* ... 126 (1872) *nec DC.*

Sikkim Himalaya, frequent, 8-9,000 feet *Hooker! Thomson!* ...e! etc.

...ery near *C. chaerophylla*, with which it is associated in the *Flora of British* ... but with very different bracts and flowers; the bracts of *C. chaerophylla* being ...cluding the lowest) small while those of this species are all large. The spur ... much longer and is incurved at the end in place of being, as it is in ...*erophylla*, straight or recurved from the middle. No intermediates occur.

29. (11.) Corydalis Govaniana *Wall.*

30. (10.) Corydalis elegans *Wall.*

Recent collections of this species are:—Near the Nipchang glacier, ...ma, 15–16,000 feet, *Duthie* n. 2710! Rakam Valley, 14–15,000 feet, ...*thie* n. 2711! Kutti Yangti Valley, 15,000 feet and Lebung Pass, ...–17,000 feet, *Duthie* n. 5322!

The species seems strictly confined to Kamaon. The plant from Deotsu added ...he species in the *Flor. Brit. Ind.*, but not included in the earlier account of the ...*a Indica*, belongs to a very distinct species.

31. (12.) Corydalis tibetica *H. f. & T.*

Mr. Duthie's n. 11,933 from Shingo Valley, Baltistan, on rocks at 10-11,000 feet ...be only a lax state of this species but may equally well prove specifically ...nct. The same indefatigable collector's n. 11,818 from Marpu Nullah, Baltistan, ...–12,000 feet has somewhat different foliage from the types of *C. tibetica*; it also ...ncrested outer petals. But this is the case with Dr. Thomson's specimens of ...*betica* issued in *Herb. Ind. Or H. f. & T. T.* and with Mr. Duthie's n. 12005 from ...ur Nullah, Baltistan at 12–13,000 feet. Our other Calcutta and Saharanpur ...mples are crested as described in *Flora of British India*.

32. (—.) Corydalis Duthiei *Maxim. Flor. Tangut.* 49, t. 25. fig. ...-17; medium, tufted, diffuse, green, glabrous; radical leaves oblong ...-5-jugately pinnate, ultimate lobules numerous, small, ovate-acute; stems simple leafy; racemes ovoid dense many-fld.; flowers yellow subvertical, outer petals winged, the wing of upper extending as far as tip of the straight conical spur slightly shorter than lamina.

var. *typica;* lobes of leaves imbricately overlapping; bracts broad, entire except the lowest; stem leaves 1–2.

North-West Himalaya; Sanch Pass, 14,000 feet, *Ellis* n. 1682!

var. *sikkimensis;* lobes of leaves discrete; bracts all incised; stem leaves 3–4.

Sikkim; Tholoong, "very high, near the snow," *Dr. King's Collector!*

Stems 4-6 in. not exceeding radical leaves. *Flowers* ¾ in. winged very like those of *C. melifolia* but with a much larger spur, which is more like that of *C. dubia*. In foliage this much resembles *C. conspersa* Maxim. which has however very different flowers.

Mr. Maximowicz quotes Dr. Watt as the original collector of the species. T a mistake arising from Mr. Ellis the actual collector, having used field t supplied him by Dr. Watt, with Dr. Watt's name left unobliterated. The r is not of much moment, but is mentioned in case the citation should lead to di on the part of any one unacquainted with the actual circumstances.

33. (*sub* 10.) Corydalis Clarkei *Prain*; medium, tufted, di glaucescent, glabrous; radical leaves oblong 4–5-jugately pinnate, mate lobules few large decurrent acute; stem simple, cauline leaves 2 subopposite pairs; racemes oblong dense many-fld., flowers light y subvertical, outer petals winged the wing of the upper extending way down the straight obtuse spur; capsule very broadly ovate, ob

Kashmir: Alimalikimat and Deotsu, *Falconer!* Barjila, 12,000 f *Clarke!* above Tilail, 13–14,000 feet, *Duthie* n. 13922!

Stems 10 in. Radical leaves 6-8 in. petioles 3 in. vaginate, cauline leaves 2-3 *Flowers* ⅝ in. long. *Capsules* ½ in. long nearly ¼ in. across.

The foliage of this species recalls that of *C. Moorcroftiana* which it also rese bles in having at times branches in the region of the inflorescence; one of Falconer's Alimalikimat specimens is so branched. But it differs in having its st leaves, in all the specimens, subopposed in 2 pairs; its fruits moreover are v different, being much shorter and broader and being obtuse instead of acute. very broad flowers are almost identical with those of *C. elegans* with which, in *Flora of British India*, though not in the *Flora Indica*, it has been associated. altogether dissimilar leaves, very differently disposed, make it however impossib treat it as a variety of that species.

34. (—.) Corydalis Franchetiana *Prain*; radical leaves num ous 2-pinnatisect, segments lanceolate, cauline leaves alternate numer passing into bracts; raceme terminal many-fld.; bracts broad lo 3–5-fid., hardly equalling the very long pedicels.

Eastern Himalaya; Chumbi; at Sham Chen, *Dungboo!*

Stem 10–16 in. rather stout, flexuous, 5–10-leaved; radical leaves 6–8 in. lo petiole 4 in. long, lamina 1–1½ in. across, pinnae 2–4-paired sub-orbicular ¾ in. across lobes 2-3-jugate, ultimate segments oblong-lanceolate acute; radical leaves pinnatipartite, petioles short, winged. *Flowers* ¾ in. long, yellow with purple tips; *racemes* lax, 4 in. long; in one specimen axillary racemes occur in the axils of the 3 uppermost stem leaves; bracts 1 in., pedicels 1 ¼ in. long. *Posticous* petal vaulted, acute, nearly as long as the slender spur. *Pedicels* recurved in fruit, capsules immature.

Very near the preceding species, but distinguished by its numerous scattered stem-leaves and its flowers with uncrested petals.

35. (*sub* 14.) Corydalis Hookeri *Prain*: medium, diffusely branching, stems numerous ascending; radical leaves numerous 2-pin-

natisect, segments narrowly ovate 2-3-fid, cauline leaves alternate 3-5-jugate; racemes numerous terminal and in axils of the upper stem-leaves, many-fld.; bracts all narrow the lowest incised the rest all [illegible] longer than the pedicels; petals without crests, spur of upper [illegible] shorter than the lip; ovary ovate obtuse.

[illegible] Nepalese Tibet; *Hooker!* S.-E. Tibet; Tsang, *Lama Ujyen* [illegible]*sko*, n. 162!

Stems 3–8 in. rather slender, flexuous; radical leaves 3-4 in. long, including [illegible] 1½-2 in. narrowly vaginate, cauline 3–5 short-petioled 1½-2½ in., segments [illegible]y ½ in., lobules ¼ in.; pedicels short, flowers yellow ¾ in Spur slender conical [illegible]lightly incurved; capsules ¼ in. long, ⅛ in. diam.

This is the plant from Nepalese Tibet referred to under *C. Gortschakovii* in *Flor.* [illegible]67 and *Flor. Brit. Ind.* i. 123. The inflorescences and bracts *do* much resemble [illegible] of *C. thyrsiflora*, to which the descriptions of *C. Gortschakovii* cited apply. [illegible]he outer petals are entirely without crests and in this respect resemble those [illegible]. *Franchetiana*. A fine suite of specimens of the same plant from South-East [illegible]t shows however that this plant is quite distinct from any other Indian species [illegible] that it approaches most nearly to *C. straminea* Maxim., from which it differs [illegible]aving a longer more slender spur; it has been named in honour of its distin-[illegible]ished discoverer.

[illegible]6. (13.) Corydalis Moorcroftiana *Wall.; H. f. & T., Flor. Ind.* [illegible]d *Flor. Brit. Ind.*

37. (—.) Corydalis Gortschakovii *Schrenk.*

[illegible] An examination of the many Yarkand, Hindu Khush and Kashmir specimens in [illegible]b. Calcutta, and of over two hundred specimens from Turkestan, Soongaria and [illegible]i, kindly lent to the writer for study from Herb. St. Petersburg by Dr. Batalin, [illegible]s that this is undoubtedly the plant described as *C. Moorcroftiana* by Boissier [illegible]. *Orient.* i. 131] and indicates that probably this is the original *C. Moorcroftiana* [illegible]allich. Should this prove to be the case, Schrenk's name must give place [illegible]Vallich's. Whether a new name must be given to designate the species with [illegible]re bracts—the *C. Moorcroftiana* of the *Flora of British India*—is somewhat doubt-[illegible] its flowers are exactly those of *C. Gortschakovii* and, in the writer's opinion, the [illegible]erences between the two plants are hardly specific. *C. Gortschakovii* H. f. & T., [illegible]*described*, is not Schrenk's plant but the next species.

38. (14.) Corydalis thyrsiflora *Prain.* C. Gortschakovii *H.* [illegible]. *& T. Flor. Ind.* 266.; *Flor. Brit. Ind.* i. 125, *not of Schrenk.*

Distinguished from the preceding by its thyrsoid panicles, its bracts all linear except the lowest, not progressively diminishing in size upwards, its smaller flowers and its smaller obtuse, not acute, capsules.

North-West Himalaya: Laka, *Edgeworth* n. 55! *Clarke* n. 24635! Kamaon, *Strachey and Winterbottom* n. 12! *Duthie* n. 3826! Ladak, *Hay! Stoliczka!* Kashmir: Zircotal, *Falconer* (Kew Dist. n. 126)! Sonamurg *Gammie! Levinge* (*Clarke* n. 27217)! Kamri valley, *Duthie* n. 12532! *Giles* n. 659! Liddar Valley *Duthie* n. 13347! 13421! Baltistan; *Duthie* n. 13856!

This species imitates the appearance and habit of, and has almost identical flowers and fruits with, *Corydalis Laelia* which, however, differs in having ternate leaves and tufted roots. It has also the habit and leaves of *Corydalis Semenovii* Regel and *Corydalis straminea* Maxim., but has very different flowers from eit these; its inflorescence is very like that of *C. Hookeri*.

39. (21.) CORYDALIS MEIFOLIA *Wall.*

Exclude from synonyms of F. B. I., C. Hoffmeisteri *Klotzsch Pr. Waldem*, 129 t. 35.

VAR. *typica*; stems erect, ultimate leaf-segments linear; post petal with lamina usually three times as long as spur; flowers us yellow (*Wallich*), deep yellow (*Duthie*), or lemon-coloured (*Dut* occasionally reddish-yellow (*Duthie*); stems 6-18 in.

CENTRAL HIMALAYA: Nepal, *Wallich! Scully!* NORTH-WEST H LAYA: Lahul, *Hay!* Bashahr, *Lace* n. 557! Kunawar, *Vicary!* Kan *Duthie* n. 2704! n. 2706! EAST HIMALAYA: Sikkim, *Hooker! Gammie*

VAR. *violacea*; stems erect, ultimate leaf-segments linear; postic petal with lamina usually only twice as long as spur; flowers d mauve (*Duthie*) or a "beautiful purple" (*Vicary*); stems 12-18 in. violacea *Vicary MSS.* in *Herb. Calcutta*.

NORTH-WEST HIMALAYA: Garhwal; *Vicary* n. 50! *Duthie* n. 95 Rotang Pass, *Edgeworth! Brandis* n. 3270! Lahul, *Jaeschke!*

VAR. *sikkimensis*; stems flexuous, ultimate leaf-segments usua narrow lanceolate (one half broader and much shorter than in the t preceding varieties); posticous petal with lamina usually three ti as long as spur; flowers yellow with purple tips (*Hooker*); yellow brown (*Gammie*); orange yellow, red and yellow, greenish yellow outside yellow and inside red, (*various native collectors*); stems 4-6 in

EASTERN HIMALAYA: Sikkim, Chumbi, Phari and South-East Tib very common.

Corydalis violacea Vicary, at first sight seems very distinct. It must how be recollected as regards the colour-character that the flowers are variously pu or yellow in several other species. Among Indian species *Corydalis flaccida*, usua purple but at times yellow; *Corydalis crispa*, usually yellow but at times blue, m be cited as parallel examples. Then *Duthie* n. 2704 with reddish-yellow flowe forms a connecting link in the North-West Himalaya; all stages of "intermediates," though no specimens with uniformly purple flowers have been reported from Sikkim and Chumbi. Again, as regards the character derived from length of spur, *Lace* n. 557 with yellow flowers has this organ as long as it is in VAR. *violacea*; and while all the Sikkim and Chumbi specimens have a short spur as in VAR. *typica* those from South Tibet (*Lama Ujyen Gyatsko* n. 231) have spurs nearly, though not quite, as long as in VAR. *violacea*. VAR. *sikkimensis* is not a very good variety, the differences in habit mentioned are differences of degree only, not differences of kind.

40. (—.) CORYDALIS DUBIA *Prain*; stems short flexuous simple, or branched in the inflorescence, leaves 4–5-jugately pinnate, radical

numerous longer than stems, cauline lowest pair opposite, upper scattered passing into bracts; flowers few racemose, bracts leafy incised; outer ...ls without crests, the upper with a long incurved spur two-thirds the ...th of lamina.

...Eastern Himalaya: Phari; Tern-la, *Dungboo!* South Tibet, *King's ...ctor!*

Rootstock very slender, 8 in. long, scaly; *stem* 4-6 in., radical leaves 8 in. (petioles ...long); pinnæ imbricately overlapping ultimate pinnules oblong or linear very ... numerous; *flowers* whitish-yellow, 1 in. long.

The rootstock is like that of *C. latiflora* which it also resembles in having its ...t pair of stem leaves opposite. But its leaf-segments are many times more ...rous and smaller, its stems are stouter and, instead of giving off two leafless ...l branches in the axils of a solitary pair of opposite cauline leaves each stem is ...nged beyond the pair as a leafy sometimes branching stem with alternate leaves; ...s, too, incised in place of linear bracts and racemose in place of subumbellate ...ers; these yellow, not blue, are without crests and have a long spur.

41. (19.) Corydalis latiflora *H. f. & T.*

42. (—.) Corydalis pulchella *Aitch. & Hemsl. Journ. Linn. ...oc.* xix. 151, t. 4.; stems rather short, erect, branching only at the base, ...aves glaucous, 4–6-jugately 3-pinnatisect, ultimate lobules narrowly ...nceolate, radical numerous almost as long as stems, cauline few scat...red; flowers in lax racemes, pedicels shorter than the ovate large ...nnatisect bracts; outer petals without crests, the upper with a slender ...ghtly incurved spur rather longer than the lip; capsules linear-oblong, ...iting pedicels sharply decurved, seeds 2-seriate, black, shining. C. ...ifolia *Aitch. Journ. Linn. Soc.* xviii. 32 *not of Wall.*

Afghanistan: Safed Koh range, 9–11,000 feet, *Aitchison* n. 201! ...9! 789! *Duthie's Collector!*

Rootstock of several pliant fibrous bundles; *stems* 10 in. rather slender; *leaves* ...9 in. long (petioles 4–5 in.); segments ½ in. across, ultimate lobules very narrow; ...*cts* ½–¾ in., *pedicels* ¼ in.; *flowers* yellow, narrow, ⅝ in. long; *capsule* ⅝ in. long.

A very distinct species, hitherto only obtained in the Kurram Valley.

It may be noted that the name of this species dates from 1882 and is therefore ...uch anterior to the name *C. pulchella* Franch. [*Pl. Delavay.* 45. t. 13 b (1889)] applied to a species from Yunnan with leaves and flowers resembling those of *C. nana* Royle but with a leafless stem and a very different rootstock. A new name has therefore to be provided for the Yunnan plant; as there is already a *C. Franchetiana*, it might be known as *C. Adrieni.*

43. (15/1.) Corydalis Stracheyi *Duthie;* glaucous, stems procumbent weak branched, leaves 5–6-jugately pinnatisect, segments 2–4-jugately pinnatipartite, lobes 3–5-fid ultimate lobules linear to narrowly ovate; racemes terminal lax many-fld., lowest bracts large incised, the rest 3-fid or entire, small. C. ramosa *H. f. & T. Flor. Ind.* 267; *Flor. Brit. Ind.* i. 125 *not of Wall.*

VAR. *typica*; outer petals crested.

NORTH-WEST HIMALAYA: Kumaon: Pindari, 12,000 feet, *Strachey and Winterbottom* n. 9! Ralam Valley, *Duthie* n. 2712! near Lebung glacier 15–16,000 feet, *Duthie* n. 5317! Garhwal, in Damdar Valley, 11–12 feet, etc. *Duthie* n. 949*a*! and n. 949*d*! Kuari Pass, 11–12,000 *Duthie* n. 3822! and n. 3824! CENTRAL HIMALAYA: Nepal, *Scully*, n. EASTERN HIMALAYA: Sikkim; Singlelah range 13,000 *Thomson! And* n. 370! *Kurz!* Jongri, about 15,000 feet, common; *Dr. King's collec* Lachoong, *Dungboo!* Tankra, 13,000 feet, *Gammie!* Tangkala, *K collector!* Chumbi; Ko-poop *King's collector!*

VAR. *ecristata*; outer petals without wings.

EASTERN HIMALAYA: South Tibet, *Lama Ujyen Gyatsko*, n. 256!

Rootstock dividing below, 3–6 in. long. *Stems* 8–15 in. leafy, very flexuous. Ra *leaves* very few long petioled. *Flowers* ½ in. long, yellow, or yellow with brow purple tips; racemes 1-2 in; upper lamina rather longer than the straight s *Capsules* obovate-oblong obtuse, pedicels deflexed.

A very distinct species, most nearly related to *C. meifolia*; not very ne allied to *C. ramosa*. The uncrested "variety" is not improbably a quite dist species.

44. (15/3.) CORYDALIS NANA *Royle, Ill.* 68 (1839); small, ofte dwarf, stems ascending, cauline leaves usually 3, with or without sho axillary branches, leaves 4-5-jugately pinnatisect segments 2-3-jugate pinnatipartite, lobes multifid; racemes terminal congested many-fl flowers partially hidden among the large cuneate flabellate multipart bracts. C. ramosa VAR. nana *H. f. & T. Flor. Ind.* 267; *Flor. B Ind.* i. 125. C. Hoffmeisteri *Klotzsch, Reis. Pr. Wald. Bot.* 129 t (1862).

NORTH-WEST HIMALAYA: Kamaon; *Strachey* and *Winterbottom* n. 14! 17! *Duthie* n. 2701! 2702! 2703! 5316! 5318! Garhwal; *Dut* n. 949 b.! 949 c.! 951! 951 a.!

Rootstock rather stout, dividing below, 3–6 in. long. *Stems* 1–4 in. leafy, usu the lowest 2 leaves subopposite the third close under the inflorescence; radical f long-petioled, cauline subsessile. *Flower* ½ in. long, blueish-grey tipped with gree racemes ½ in. or less; upper lamina rather longer than straight spur, outer peta with short crests. *Capsules* obovate-obtuse, partially buried among the bracts, pedicels very abruptly recurved.

Also a very distinct species, though nearest to the preceding. The writer has been able to ascertain the identity of this species with *C. Hoffmeisteri* owing to the great kindness of Prof. Engler and Dr. Urban, who very generously sent an example of Dr. Hoffmeister's original plant to the Calcutta Herb. from the Royal Herb., Berlin.

45. (20.) CORYDALIS STRICTA *Steph.*

46. (—.) CORYDALIS RUPESTRIS *Kotschy, Boiss. Diagn.* ser. 1, vi. 8; glaucous, stem flexuous branched, leaves all long-petioled 2-pin-

natisect, lobes 4-5-jugate, ultimate segments 1–3-jugately 3-partite, lobules subacute, radical rather few not larger than scattered cauline; emes simple laxly 12–20-fld., bracts linear-lanceolate entire half as as pedicels; capsules widely elliptic compressed; seeds 2-seriate. *Flor. Orient.* i. 131.

British Beluchistan: Ziarat, *Lace* n. 3768! *A. V. Monro!* rib. Persia.

Rootstock stout woody, crowned with withered sheaths. *Stems* 4–12 in. branched base. *Leaves* 6–8 in. (petioles 4 in.), lobes remote. *Flowers* ½-¾ in. long, pedicels ½ in.; sepals ovate acuminate; petals without wings, yellow, upper times as long as obtuse spur, lower distinctly saccate at base. *Capsule* ½ in. in. wide.

earest among Indian species to *C. aduncа* with which it agrees in habit and , but differing from the other Indian members of the group by its wide . M. Boissier has inadvertently described the outer petals as broadly winged. ugh the kindness of M. Barbey the writer has been able to examine flowers of ypo specimens in Herb. Boissier; in all of them the outer petals are with- ings precisely as in the Beluchistan plant.

47. (1.) Corydalis ophiocarpa *H. f. & T.* C. streptocarpa *axim. Mel. Biol.* x. 48; *Bull. Ac. Imp. Petersb* xxiv. 30; *Flor. Tangut.* , t. 11, fig. 9–20.

Distrib. China.

This species has a saccate spur; as, moreover, recent specimens collected by Mr. tling have an elongated rootstock, it seems to be more naturally located alongside *. aduncа, C. flabellata* and *C. adiantifolia* which, like itself, have 1–seriate seeds. Pantling reports the flowers as white. Mr. Maximowicz's species the writer can- differentiate from this.

48. (—.) Corydalis aduncа *Maxim. Bull. Ac. Imp. Petersb.* v. 29; glaucous, stems branched, leaves all long-petioled 2-pinnati- t lobes 4-5-jugate, ultimate segments 1–2-jugate 3-partite, lobules te-oblong obtuse, radical rather few not larger than scattered cau- ; racemes simple laxly 12–20 fld., bracts linear-lanceolate, entire, ost as long as pedicels; capsules linear, seeds 1-seriate. *Maxim. l. Biol.* x. 47; *Flor. Tangut.* 46 t. 6; *Flor. Mongol.* 38, *syn.* C. Schelez- nowiana *Rgl. & Schmalh. exclus.*

N.-W. Himalaya: Kamaon; exposed dry rocks near Nabhi in Kutti Valley, 12,000 feet, *Duthie* n 2707! Distrib. Kansu, Mongolia, Tangut, Turkestan.

Rootstock stout woody, crowned with withered sheaths. *Stems* 6–18 in. branched from base. *Leaves* 5-6 in. (petioles 2½-3 in.) lobes remote. *Flowers* ¾ in., lower pedicels ½ in.; sepals ovate-acuminate; petals yellow, upper three times as long as obtuse spur. *Capsule* ½-¾ in. long ⅛ in. wide.

Of Indian species this is nearest to *C. flabellata* and *C. adiantifolia* but differs from both in its foliage, which more resembles that of *C. rupestris. C. albicaulis* Franch.

[*Pl. David.* i. 30 t. 8] is, Mr. Maximowicz thinks, only a variety of this species; the two plants certainly are very closely allied.

Mr. Maximowicz has also reduced to his *C. aduncа* the form named *C. Schelesnowiana* by Dr. Regel. So far as the rather meagre examples in London and went, the writer was prepared to accept the reduction. But Dr. Batalin having lent him for study many excellent specimens of Dr. Regel's species, the writer been able to ascertain that Mr. Maximowicz's reduction cannot be sustained and found on the contrary that the true *C. Schelesnowiana* is identical with a collected in Gilgit by Dr. Giles that has been issued, erroneously, from Herb. cutta, as *C. adiantifolia*.

49. (22.) Corydalis flabellata *Edgeworth*.

The true *C. flabellata*, i.e., the species of this group with flabellate leave very minute bracts, extends to Kashgar, where it was collected by Bellew. only recent gathering the writer has seen is one made by Heyde in Pangi in 18

50. (23.) Corydalis adiantifolia *H. f. & T.* C. flab *Maxim. Flor. Tangut.* 47, *vix Edgew.*

It is now considered doubtful whether this form, which resembles in fo the preceding and only differs in having subulate bracts exceeding the buds, ca separated as a species from *C. flabellata*. Mr. Clarke has collected in the Karak (*Clarke* n. 30115!) specimens that are exactly identical with the Zanskar spe mens of Dr. Thomson on which *C. adiantifolia* was founded; these specime have been issued by Mr. Clarke as *C. flabellata* and Mr. Maximowicz (*loc. cit.*) h expressed his agreement with Mr. Clarke's identification. In Herb. Calcutta, t Mr. Kurz, Mr. Brace and others have always identified *C. adiantifolia* with *C. flab lata* with the result that when *C. Schelesnowiana* was first reported it was assumed be *C. adiantifolia* and issued under that name. Recently Capt. Hunter-Weston, R. has again obtained the long-bracted plant of Zanskar and the Karakoram Chorbat in Baltistan and there is, in Herb., Saharunpur, a note by Dr. Stapf on These Baltistan sheets indicating the very close affinity of the plant to *C. flabella*

Near as the two species are, however, and advisable as their reduction may from a monographer's point of view, the writer cannot agree with Mr. Clarke, Maximowicz and Dr. Stapf. The two plants differ very markedly in the poi indicated by Sir Joseph Hooker and Dr. Thomson; if intermediates exist they h not yet been reported, and till they come to hand he prefers to regard *C. adiantif* H. f. & T. as a distinct species.

51. (—.) Corydalis Schelesnowiana *Regel & Schmalh.*, *Fedtsch.* 4; glabrous, very glaucous, stems stoutish erect rigid mu branched; radical and lower cauline leaves very long petioled 2-pinnatisect, lobes 3–4-jugate, ultimate segments 2–3-fid cuneate at base, lobules obovate-obtuse; racemes simple, or slightly branched near base, terminating stem and branches, laxly many-fld.; bracts subulate rather shorter than the rigid pedicels; capsules linear, seeds 1-seriate.

North-West Himalaya: Gilgit; Mastuj, 8,000 feet, in damp soil, *Giles* n. 99! Distrib. Turkestan.

Rootstock stout; *stems* 18–24 in.; *leaves* thick, lower petioles 4–6 in. segments 1 in. long, ¼ in. across; central *raceme* 6–8 in. lateral 3–6 in; bracts flaccid, pedicels

¼ in.; *flowers* orange-yellow, ½ in. long, spur slightly saccate at base scarcely half as long as lips; *capsules* flattened, ¾ in. long.

This species is very nearly related to *C. fabellata* and *C. adiantifolia* but has different leaf-segments and rather smaller flowers. Its nearest ally is *C. paniculigera* Regel and Schmalh., which has similar habit and foliage and very similar flowers and fruits, but which differs in having a paniculate inflorescence.

52. (24.) CORYDALIS CRASSIFOLIA *Royle*.

The writer finds from the St. Petersburg Herbm. specimens lent for study by Dr. Batalin, that *C. Fedtschenkoana* Regel [*Pl. Fedtsch.* 3], of which its author did not know the fruit and which he compared with the very different *C. stricta*, has capsules indistinguishable from those of *C. crassifolia*. The two species then form together an exceedingly distinct natural group. A South African species, *Corydalis vesicaria* (*Cysticapnos africana*), has very similar capsules; they are not however, as Bentham and Hooker contend (*Gen. Plant.* i. 56) "exactly as in *C. crassifolia*;" in *C. vesicaria* the placentas, in place of being nerviform, are diffused; the seeds, in place of having an appendage, are, as in the other South African species, naked.*

* Among the specimens collected by Mr. Pratt in Szechuen there is a very fine species of *Corydalis* that does not appear to have been yet described; it represents a group with a rootstock unlike that of any of the Indian species and resembling the rootstocks met with in the species of *Dicentra* (§ *Cucullaria*). The species may be diagnosed as follows.

CORYDALIS BALSAMIFLORA *Prain*; rootstock bulbiferous, crown with solitary long-petioled radical leaf and emitting a slender flexuous leafless stem; leaf ternate, circumference ovate, the lobes pinnatipartite, ultimate segments narrowly oblong or spathulate obtuse entire or 2-fid; bracts large leafy sessile pinnatisect; raceme few-fld., pedicels very long and flowers very large, purple, the spur long slightly infundibuliform somewhat incurved and obtuse at apex as long as wingless lamina; ovary narrow ovules 1-seriate extending from end to end of placentas.

SZECHUEN: near Tachienlu, *Pratt* n. 781.

Rootstock with thick fleshy bulbiferous scales; *petiole* 4 in. long, lamina 1·25 in. diam.; *stem* 10–12 in.; lower bracts 1·5 in. long, 1 in. across; lower pedicels 1·5 in. long. *Flowers* 1·25 in long.

The flowers here are as large as in *C. temulifolia* Franch. from Central China which has however a very different rootstock and has a narrower shorter straight conical spur. Very like this species as regards rootstock is another from Szechuen (Pratt. n. 822) of which the flowers are as yet unknown but which differs from *C. balsamiflora* in having two scattered stem-leaves and obovate fruits with seeds in 2-rows confined to the upper part of the capsule.

Contributions to the Theory of Warning Colours and Mimicry, No. II. Experiments with a Lizard (Calotes versicolor).—*By* Frank Finn, B. A., F. Z. S., *Deputy Superintendent of the Indian Museum.*

[Read March 1896.]

Although I have made experiments with other species of birds besides the Babbler used for the experiments detailed in my paper in the *J. A. S. B.*, XLIV, p. 344, I prefer to record in the second place my experiences with the common Garden Lizard of India (*Calotes versicolor*), as being more complete. That this lizard eats butterflies there is no doubt; its semi-arboreal habits lead it to meet with them, and I have had specimens of these insects whose wings exhibited semi-circular notches which could only have resulted from the unsuccessful attack of one of these reptiles. I have observed such injuries in the case of *Catopsilia* and of both sexes of *Elymnias cendularis*. Moreover, I found lepidopterous remains in the stomach of an individual captured in the evening on a *Lantana* bush which was a great resort of butterflies.

These lizards are not such satisfactory subjects for experiment as birds, owing to their extreme deliberation in catching and eating their prey. As with the Babblers, I have with *Calotes* been able to check my experiments made on specimens in captivity, with other experiments made on specimens at large; but in the present case I do not know that any of the animals were identical, though some of my first captives, as stated below, were released in the Museum compound.

Dr. Alcock very kindly allowed me the use of a large cage of wire gauze placed in my office in which to confine the subjects of my first experiments: four specimens of *Calotes*, three of them fine, and the fourth of fair size. For three or four days after I got these, I gave them no butterflies, but threw in a plentiful supply of the maggots (those of a Muscid fly) usually employed here for feeding insectivorous birds. These turned in due course into flies, and when the lizards appeared to be eating these, and also some cockroaches (*Periplaneta americana*), I commenced the experiments given below, in regard to which I have to acknowledge Mr. Barlow's assistance in making observations.

Experiments with Lizards in Confinement. Series A.

May 14th.—Put in four *Danais chrysippus*, and six non-warningly-coloured butterflies, mostly *Junonias*. After a time, I found three of the latter dead, apparently from natural causes. One *D. chrysippus* was on the floor with one wing gone, evidently mauled. Another *chrysippus* was alive and minus the tip of one forewing; nothing else was to be seen. There were flies about, and one lizard at least was eating

them. I found two *D. chrysippus* wings on the floor, and took out the dead plain-coloured specimens and the mutilated *D. chrysippus*, leaving the other still alive.

May 15th.—A few flies were still about. The *D. chrysippus* left overnight was dead but uneaten, though its head seemed to have been chewed.

I put in one *Junonia* and one *Euploea*, and one each of *Danais genutia* and *chrysippus*. Plenty of flies were soon to be seen, yet at the end of the afternoon all the butterflies seemed to have been eaten. In the evening, I put in one each of *Danais limniace*, *genutia*, *and chrysippus*, and seven non-warningly-coloured specimens. Before leaving, I saw a lizard with the *D. limniace* in its mouth.

May 16th.—Found a *Junonia* (dead) and a *Catopsilia* (alive) floating in the water-pan; two other plain-coloured specimens on the ground, dead, apparently from natural causes; one *D. chrysippus*, living, but minus much of its forewings, and many flies, nothing else. At the end of this day the *Catopsilia* was dead, apparently naturally, and the *D. chrysippus* had disappeared, though there were flies about. I then put in four male *Elymnias undularis*, one *Papilio aristolochiae*, and one *Euploea*.

May 17th.—To-day I found three *Elymnias* and the *Euploea* unhurt, but only two wings of the *Papilio aristolochiae*, which Mr. Barlow had seen a lizard trying to catch; there were flies to be seen. Before long I noticed an *Elymnias* notched; later two of these disappeared. I found the dead *Catopsilia* apparently eaten; possibly others had been also. I put in one *D. limniace* and two non-warningly-coloured specimens.

May 18th.—The *Euploea* remained alive and untouched all day. I found the *Elymnias* recently dead, with antennae gone and wings notched. The others had disappeared. There were flies in the cage. A large cockroach was soon mostly eaten. I put in some fresh maggots.

May 20th.—The *Euploea*, dead naturally, untouched, as also the dry body of the *Elymnias*. Some dead plain coloured specimens have been untouched all the time.

May 21st.—There were hardly any flies in the cage and I gave the lizards two large grey ones. In the evening I put in one each of *Danais genutia* and *limniace*, and *Euploea*, two *Catopsilia*, and one *Junonia* (this last dead). Soon a *Catopsilia*, going very close to a lizard, was snapped at, without hurry, but escaped by the tearing of its wing, to be soon eaten by another lizard which got a hold on its body.

A very large silkworm moth was in the cage most of the day, but not attacked. Mr. Barlow saw a lizard approach, but stop at some distance, apparently frightened.

May 22nd.—No butterflies left to-day but dead *Junonia*. No flies. The wings of the moth were torn, and later only the wings were found, so that some lizard had at last eaten it. I put in a headless cockroach, which was soon attacked, but the lizard apparently got pricked in the mouth, and the insect was not eaten. I put in in the evening two *Catopsilias*, two *Papilio eurypylus*, one *Euploea*, one *Danais genutia*, and a few small dragonflies. Almost immediately a *Catopsilia* was seized, but relinquished by a lizard. I saw another lizard with the *Euploea* in its mouth, which it ate. Shortly after I found a wing of one *Papilio*. A Mynah's egg untouched all day.

May 23rd.—Every butterfly gone but a *Catopsilia*, which was recently dead and unmutilated though the wings were somewhat torn, it appeared to have died naturally, it was the same specimen which I had seen taken and left yesterday. No flies were in the cage, and the cockroach left yesterday was not eaten. I took out the *Catopsilia*.

EXPERIMENTS WITH LIZARDS IN CONFINEMENT. SERIES B.

I now liberated three of the lizards, reserving only the finest, put in two large black and yellow dragonflies in the evening.

May 27th.—These dragonflies were uneaten, though the lizard had apparently had no food since the 22nd. I saw about this time some other small dragonflies, apparently those put in before. I put in a large protectively-coloured moth, which before long disappeared.

May 28th.—The lizard, which now seemed to be very hungry, ate three or four cockroaches when put in, before Mr. Barlow's eyes, but left more still uneaten by the evening. I then put in one each of *Danais limniace*, *D. genutia*, *D. chrysippus*, *Euploea*, and *Catopsilia*, and a large brown species. I soon saw the lizard swallowing the *D. chrysippus*, none of the others having been attacked as yet. I then put in a large protectively-coloured moth, much like the Yellow-underwing.

May 29th.—In the morning *D. limniace* was alive and unhurt, but none of the other insects put in were to be seen but one cockroach.

Three hours later, *D. limniace* being still untouched, I put in a large grey fly, which the lizard immediately ate, as it did another put in some little time after. Not long after I put in a third, and the lizard rushed past the *D. limniace* and eagerly took it.

A small gecko put in was not attacked: soon afterwards the *D. limniace* was gone, some of its wings being left, and the cockroach still there, and I put in a *Papilio eurypylus*, which was uneaten when I left.

May 30th.—The *Papilio* was gone this morning, but the gecko and some cockroaches were still there.

Ceased experimenting with this lizard, which I killed to feed some birds.

A month afterwards I commenced experimenting with lizards in their natural state in the Museum compound, the butterflies being usually disabled by having the anterior nervure of the fore-wings broken. Owing to the above-mentioned deliberation of the lizards' movements, the work of watching them was very tedious, and I did not always see the final result. I commenced experiments by offering a cockroach, as stated below.

EXPERIMENTS ON LIZARDS AT LIBERTY.

July 7th.—Gave a decapitated cockroach to a big lizard in the compound. The lizard rushed to the insect, and after a little hesitation, apparently on account of the kicking legs, seized and carried it off; I did not see what then happened, as the lizard on my approach went up a shrub.

July 9th.—A *Papilio demoleus* and a *Danais genutia* offered to a lizard, were not attacked. I therefore offered them to another. The *Danais* disappeared when I was not looking, but it might have fluttered away. I took away the other.

July 10th.—Offered a *Danais chrysippus* to lizards. One attacked and let it go (or lost hold) once or twice; then this lizard was attacked by a bigger one and a scuffle ensued, and the lizards ran off fighting and left the butterfly, which did not seem hurt, and was not eventually taken, though I let it remain for a little.

July 12th.—In the morning, put a plain-coloured species (*Junonia* I think) and a *Danais chrysippus* near a large *Calotes*. The lizard took the former, which was nearest, and went off with it.

I then offered a *D. genutia* to another *Calotes*, which took and ate it.

I gave another *D. genutia* to a smaller specimen of this lizard, which seized it and ran off with it in its mouth as after a little time I approached.

I then offered an *Euploea* to another large lizard. After a little time he attacked it, but it got away, and he pursued it; then another smaller lizard appeared and possibly there was a fight. If the butterfly was taken, this was done quickly, for I could not find it, nor did I see it in the possession of the lizards.

I then offered a *D. limniace* to the first of these two lizards, but it did not offer to touch it. I put the same insect not far from a smaller lizard, which bit off a piece of wing, and then after a little while went away. I put the same specimen near another, which apeared to see it, and yet ran past, possibly attracted by a fight between lizards further on.

July 15*th.*—Offered in the evening a *Danais genutia* to a large lizard, which ultimately took and ate it with much chewing.

July 16*th.*—Put one specimen each of *Danais genutia* and *D. limniace* near a lizard, which did not seem inclined to attack them. I therefore put them before another, which, after a while, passing close to the *D. limniace* which was lying still nearest to him, seized the *D. genutia*, and when approached went off with the insect in its mouth.

The *D. limniace* was dead, killed by ants when first put out, I think. In the evening I put an *Euploea* near a big *Calotes*, I believe the same to which I had offered this butterfly before (July 12th), but though I left it there for some time, it was not taken.

July 17*th.*—Offered an *Euploea* to a fat and sickly-looking lizard, probably heavy with eggs. The insect was not touched, though left near for some time.

I put the butterfly not far from another lizard, and not long after saw a lizard (apparently not the same individual) with it in its mouth. The lizard ran off with its prey. Exposed a *Euploea* on a tree trunk for some time within a few inches of a big lizard. Ultimately it disappeared, and the lizard appeared to have moved further up.

July 18*th.*—In the evening put an *Euploea* and a *Catopsilia* on rough ground near a fair-sized lizard, the *Catopsilia* being a little the further off. The lizard stalked, seized, and ate the *Euploea*. A bigger lizard, which had watched the proceeding with apparent interest, then took and ate the *Catopsilia*, more quickly than the other had done the *Euploea*, no doubt because this butterfly was smaller. He did not attack at once, though apparently in no fear of the other.

Exposed specimens of *Danais genutia* and a plain-coloured species to two lizards, but failed to attract them; they were probably afraid of me.

July 24*th.*—Offered a non-warningly-coloured species to a large *Calotes* near the tank, with a *Danais genutia* placed nearer the lizard. After a time the lizard took and ate the *Danais* before my eyes. Put a *D. genutia* and a non-warningly-coloured specimen near a lizard on a tree. I waited some time, but neither was touched; the lizards had been a little frightened.

Threw a *D. genutia* almost under the nose of a big *Calotes* on the tree, but though I waited some time, he did not catch it, but moved off towards another lizard.

July 27*th.*—Put specimens of *Danais limniace* and *Papilio demoleus* not far from a lizard (near the tank). He did not attack, but after a time I found only the wing of the *D. limniace*, and another lizard ran off, which *might* have taken it.

July 28th.—Put out a large *Catopsilia* and a *Danais limniace* near the lizards' tree by the tank. Some while afterwards the *Catopsilia* was gone; but it might have got away, as breaking the costal nervure does not disable these as it does Danaids. The *Danais* was still there.

Later in the day I put this *Danais* near another lizard, before very long the lizard stalked and seized it with a spring and slowly ate it before me.

July 30th.—Offered in the morning a *Papilio aristolochiae* to a big *Calotes* near the tank. In a little while I saw him with it in his mouth, and he then ran off with it. I offered another *P. aristolochiae* to another large lizard. He stalked it almost immediately, seized it after a pause, chewed it slowly, and had got all down but part of one fore-wing when he disappeared, no doubt frightened. Later on I exposed a *Catopsilia* on the tree by the tank; it was on a leaf not far from a lizard, and this soon had it in its mouth and ate it.

August 1st.—Exposed a *Papilio demoleus* to a *Calotes* in the Art School compound; the insect weak but not disabled, fell at a little distance; then I disabled a fine *Papilio aristolochiae* and threw it to the lizard. It fell very near and was immediately seized and slowly eaten, all but parts of two wings and a leg, knocked off at the last. Meanwhile the *P. demoleus* was fluttering about, and the lizard must have seen it. I then took it away.

August 2nd.—I offered to a *Calotes* in the Art School compound a *Papilio eurypylus* and *P. aristolochiae*. He soon attacked, paused and went on over *P. eurypylus* which was nearest, seized *P. aristolochiae*, and ate it all but part of the forewings a hindwing and the abdomen, which I found afterwards. As the abdomen was not chewed, and had the unchewed wing attached to it, I supposed the lizard had chewed it off unwittingly.

This lizard did not seem inclined to eat *P. eurypylus* afterwards, but another to which I threw the insect soon seized it by the wing and began to chew this; and as I soon missed both, no doubt retired with its prey.

I do not know if the first lizard was the same as yesterday's; it was about the same place.

November 2nd.—In the morning I exposed to a lizard a *Delias eucharis* which was almost immediately seized, and the lizard began apparently to chew it, when a movement of mine startled it, as it remained still, holding the insect in its mouth (a common habit) and it ran off with its prey.

November 10th.—Exposed a red-eyed skipper (*Matapa aria*) near a large *Calotes*, which after a little seized and ate it.

Since this date I have seen a small *Calotes* seize and eat a small conspicuous orange-red insect, apparently a "lady-bird."

The behaviour of these reptiles certainly does not appear to afford support to the belief that the *butterflies*, at any rate, usually considered nauseous, are distasteful to them.

A Note on the Nature of the Substance formed during fermentation, from which Indigo Blue is eventually formed in Indigo Manufacture; and on Indigo Brown.—*By* Surg.-Lt.-Col. G. S. A. Ranking, B.A., M.D., M.R.A.S.

[Read March, 1896.]

Indigo liquor when properly fermented is a greenish yellow infusion having a very marked greenish fluorescence. In reaction it varies, though the reaction is faintly alkaline when the liquor is most favourably fermented. A distinctly acid reaction always indicates unfavourable fermentation, and results in loss of produce of Indigo-blue.

It contains a substance in solution which forms a yellow solution with alkalies, and from this yellow solution Indigo-blue may be very readily obtained by simple agitation with air.

Now the nature of this Indigo-forming substance has been hitherto undecided. That it very closely resembles Indigo-white cannot be denied, as will be seen from a comparison of the reactions of Vat-liquor and solutions of Indigo-white respectively with metallic salts, hereinafter set out in tabular form. (*See* Table page 51.)

But there are certain difficulties in the way of any theory which would declare them to be identically the same, of which one is this, that Indigo-white is well known to be insoluble except in alkalis, whereas it is certain that in acid Vat-liquor the Indigo-forming body is present in solution.

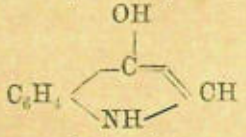
For many years I held the opinion that the substance present in the Vat-liquor after fermentation is so nearly allied to Indigo-white as to be practically identical with that body, and I considered that it might be an isomer of Indigo-white, which differed from that body by being soluble in acids, as well as in alkalies; I have, however, as a result of further research, come to the conclusion that the body present differs from Indigo-white in composition, though in its reactions with metallic salts it is apparently identical, and I have been led to conclude that it is probably Indoxyl (C_8H_7NO) a body containing one more atom of Hydrogen than does Indigo-white.

There are only two substances known to chemists which yield Indigo-blue on agitation of their solutions with air. These are:—

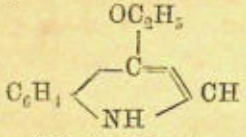
(*a*) Indigo-white (C_8H_6NO) soluble in alkalis to yellow solution, playing the part of a weak acid.

(*b*) Indoxyl (C_8H_7NO) soluble in acids or alkalis, and its solution in hot water showing a yellowish green fluorescence.

"It is simultaneously an acid and a base: its alkaline solution absorbs Oxygen from the air with formation of Indigo-blue: which is also formed when ferric chloride is added to its hydrochloric acid solution." * Now it requires very little further enquiry, before we are struck with the similarity of the physical characters of this body and those of the body existing in Indigo Vat-liquor after fermentation. When we look a little further, and enquire into the chemical behaviour of Indoxyl, we find that it contains two atoms of replaceable Hydrogen. It forms derivatives in which one of these atoms is displaced, thus Ethyl-Indoxyl $C_8H_6NO(C_2H_5)$ is Indoxyl in which one atom of Hydrogen is replaced by Ethyl: graphically—

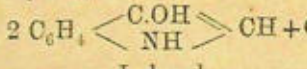


Indoxyl



Ethyl-Indoxyl.

From this we may infer that a Potass-Indoxyl (C_8H_6NOK) Sod-Indoxyl ($C_8H_6NO\,Na$). Ammon Indoxyl ($C_8H_6NO\,Am$) are theoretically possible. We may also notice that if we simply remove this atom of Hydrogen we should convert Indoxyl into Indigo-white, thus

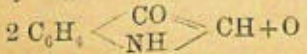


Indoxyl

Indigo-white.



and this indicates that the above would represent the graphic formula of Indigo-white. Further oxidation would give us Indigo-blue, the atom of Hydrogen contained in the CH group being removed: thus †



Indigo-white



Indigo-blue.

* Roscoe and Schorlemmer, Vol. III. p. 40.

† R. and S., Vol. III. page 42.

Now in fermented Indigo-liquor we have a body present which forms by the action of air Indigo-blue. It must therefore be, so far as is known at present, one of two bodies: Indigo-white or Indoxyl. Which of these two it is the following considerations will help to decide.

It is soluble in water and the solution has generally a faintly alkaline reaction but may be acid. It therefore seems not to be Indigo-white.

On the other hand its solution shows a very characteristic green fluorescence, and, moreover, if treated with HCl and Fe_2Cl_6 yields Indigo-blue, which fact strongly supports the view that Indoxyl is present: the above reaction being one of the characteristics of Indoxyl (*vide* R. and S. *loc. cit.*)

But supposing it to be Indoxyl, as it really seems that it may be, how can we account for the fact that it reacts with the salts of the metals just as does Indigo-white. To explain this we must briefly reconsider our position. We found that Indoxyl has two replaceable Hydrogen atoms, one in the OH group, the other in the CH group, and that if both these atoms are removed Indigo-blue is left.

First consider what occurs when an alkaline solution of Indigo-white is treated with a solution of a metallic salt. (See Table Column I).

A double compound is formed consisting of the metal and Indigo-blue, the metal having secondarily replaced the replaceable atom of Hydrogen. These compounds may be shown to consist of Indigo-blue and the metallic base, by treatment with strong sulphuric acid * and subsequent addition of water, when Indigo-blue will be thrown down and the metal remain in combination with the acid.

Now I imagine that, in the case of the Vat-liquor containing Indoxyl, what happens is this, we recollect it has two atoms of replaceable Hydrogen, and both of these are removed, thus

(*a*) $C_8H_7NO + 2\ KOH.$

$= C_8H_5NO.K.K.$ (Alkaline solution) $+ 2\ H_2O.$

(*b*) $C_8H_5NO.K.K. + BaCl^2.$

$= C_8H_5NO.Ba + 2\ K\ Cl.$

The result being ultimately the same as in the case of white Indigo, with this difference that the Indoxyl is the more powerful reducing agent of the two, and needs more oxygen; so that the ultimate reactions of the metals with alkaline solutions of Indoxyl and Indigo-

* 1. $C_8H_5NO.\ Ba + H_2SO_4 + O = C_8H_5NO + Ba\ SO_4 + H_2O$, atmospheric oxidation occurring as part of the reaction.

N. B.—It should be noticed that the composition of the double compound of Indigo-blue and metal in the case of Barium points to an original compound in which there were two atoms of replaceable Hydrogen, such as Indoxyl.

white are the same, the only difference being in the proportions of the reagents required:* and this would explain how it is that the Indigo Vat-liquor while giving the reactions of Indigo-white with alkalis and metals, still may have an acid reaction originally, if the body present is Indoxyl C_8H_7NO=or ψ Indoxyl. Which we might call an acid Indigo-white on the analogy of the acid carbonates.

Having regard to the fact that CO_2 is largely present during Indigo fermentation it is not improbable that at some stage Indoxylic acid

$$C_6H_4 \begin{matrix} CO \\ NH \end{matrix} > CH.CO_2.H$$

is present, but as this, by the splitting off of CO_2, yields Indoxyl, and in alkaline solution behaves just as does Indoxyl, yielding Indigo-blue by oxidation, this does not in any way affect the foregoing explanation of the reactions occurring during the manufacturing process.

The following table shews the reactions above referred to.

Table shewing comparison of reactions of Indigo Vat-liquor after due fermentation, with those of Reduced or white Indigo.

The reactions of Reduced Indigo *vide* Watts Dicty. of Chemistry, ed. 1865, Vol. III.	Reactions of fermented Indigo liquor with the reagents mentioned.	
	Reagent.	Result.
Earth metals and heavy metals give a white ppt. turning blue in air.	$BaCl_2$	White ppt. becoming dark blue in air.
Magnesium compound is partly soluble, partly white ppt. turning blue, partly a yellow solution.	$MgSO_4$	White ppt. becoming blue in air. Filtrate yellow.
Aluminium compound white, but rapidly turns blue in the filter.	$Al_2(SO_4)^3$	White ppt. becoming blue rapidly.
Manganous compound dirty green, yields no sublimate of Indigo-blue.	$MnCl_2$	Bluish green ppt. No sublimate on heating.
Zinc compound is white, rapidly blue in air and then yields a sublimate of Indigo-blue when heated.	$ZnSO_4$	White ppt. becoming rapidly blue. *No sublimate obtained.*
Lead compound white and slightly crystalline, turns rapidly blue on exposure to air, if then heated it detonates slightly and yields reduced lead.	$Pb(NO_3)^2$	White ppt. *inclining to green*, blue on exposure to air, on heating deflagrates yielding Pb.
Ferrous compound is white, quickly blue on exposure to air: if then heated, yields no sublimate of Indigo-blue.	$FeSO_4$	Whitish green ppt., passing through green to blue (also some ferric hydrate ppt. owing to impurity of ferrous salt.)

* In the case of Indigo-white we should have the following reactions:

(*a*) $2\,C_8H_6NO + 2\,KOH = 2\,C_8H_5NO.K.K.$ (alkaline solution) $+ 2\,H_2O$.

(*b*) As in case of Indoxyl-Barium compound.

The reactions of Reduced Indigo *vide* Watts Dicty. of Chemistry, ed. 1865, Vol. III.	Reactions of fermented Indigo liquor with the reagents mentioned.	
	Reagent.	Result.
Cobalt compound grass green yields no sublimate of Indigo-blue.	$Co\ Cl_2$	Grass green ppt. becoming dark bluish green, yields no sublimate of Indigo-blue.
Nitrate of silver produces in aqueous solution of the potassium compound a ppt. which is at first transparent brown and then becomes black; it is not acted upon by the air, but when heated produces a gentle explosion and yields a sublimate of Indigo-blue, and a residue of metallic silver.	$Ag\ NO_3$	Brown ppt. becoming black glossy looking not altered in air: when heated after drying detonated slightly * yielding sublimate of Indigo-blue. Residue metallic silver or oxide of silver: not sol. in NH^4HO— Sol. in HNO^3 repptd. by HCl ∴ Ag.

N.B.—All the above reactions were obtained in Vat-liquor rendered distinctly alkaline with KOH dilute, with which a yellow solution was formed rapidly oxidising with formation of Indigo-blue.

It is therefore necessary to add the alkali to each portion of the Vat-liquor separately to get trustworthy results. The similarity of the reactions of fermented Indigo-liquor and of a solution of reduced Indigo is seen in the above series. The italics in the third column shew the only points of difference observed.

A few more remarks upon the above precipitates obtained from fermented Indigo Vat-liquor will be of interest. All the precipitates enumerated in the above Table, with one exception, when dried at 100°C and treated in a porcelain capsule with strong H_2SO_4 yield a dark green solution, which upon the addition of water deposits Indigo-blue, the filtrate in the case of the soluble sulphates giving the characteristic reactions of the metallic base used as a precipitant.

There is, however, one noticeable exception to this rule in the case of the Sodium-silver-indigo compound, which does not detonate on heating and yields a sublimate *of a brown colour, not of Indigo-blue* — on treatment with concentrated H_2SO_4 it turns brown and yields no Indigo-blue on the addition of water. I have thought it interesting to examine the composition of this salt, and have arrived at the conclusion that the Indigo in it is not Indigo-blue, but one of the other compounds,

* Absence of $\begin{matrix}COOH\\COOH\end{matrix}$ proved.

probably one of the so-called "Indigo-browns" of which as I shall shew there appear to be at least two.

This Sodium-silver-indigo compound is like the potassium-silver-indigo compound in appearance, but is browner, and does not detonate when heated, nor does it yield a sublimate of Indigo-blue. It is insoluble in water, alcohol, or ether, partially soluble in dilute nitric acid with decomposition of the acid. Partially soluble in NH_4HO dilute, with which it forms a dark brown solution leaving a black residue in powder; less easily soluble in Na OH or KOH to brown solution. Sodium chloride gives no precipitate. The ammoniacal solution is brown by reflected light, deep vinous red by transmitted light, it passes through filter paper unchanged (A), leaving a fine black powder on the filter (B).

(1) A. Filtrate of NH_4HO solution. Added HCl in excess, no ppt. With HNO_3 dil. decolorized on boiling, and gives with HCl a white ppt. sol. in NH_4HO; HNO_3 driven off by evaporating to dryness, confirmed with K_2CrO_4.

(2) Portion of filtrate evaporated to dryness over a water bath was greenish black with metallic lustre, when heated gave a faint brown sublimate not yielding Indigo-blue on treatment with H_2SO_4 conc. and subsequent addition of water. This lustrous residue dissolved in HNO_3 dil. on boiling, and gave the reactions of silver with HCl and with K_2Cro_4.

(3) Portion dried in a crucible and ignited gave a dark violet residue with metallic lustre.

Washed with strong H_2SO_4 the violet portions turned green (trace of Indigo); then washed well with H_2O and then digested the residue in NH_4HO, but nothing was dissolved $\therefore$ no Ag_2O.

Again washed with H_2O and dissolved in HNO_3 the solution became turbid on adding HCl dil. and cleared up on adding AmO $\therefore$ Ag, confirmed by K_2CrO_4.

It thus appears that the portion of the ppt. of the Sodium-silver-indigo compound which is soluble in Ammonia, contains traces of Indigo-blue but the majority of the Indigo is present as one of the Indigo-browns to be hereinafter referred to, decolorizing with HNO_3 with characteristic smell of hyperoxidized Indigo products.

B The portion of the Sodium-silver-indigo ppt. which does not dissolve in NH_4HO is left on the filter in the form of a fine black powder. This portion was thoroughly washed with weak Ammonia solution and finally with H_2O and dried at 100°C. When dry it formed a very fine grey powder, so fine as not to be capable of being scraped off the filter. Filter digested in boiling HNO_3 dil. 10% the grey ppt. dissolves to a colourless solution giving the reactions of Ag. No residue left. The ppt. insoluble in NH_4HO is thus proved to be metallic silver.

It is thus evident that in the case of the Sodium-silver-indigo salt the resulting compound is made up of metallic silver, traces of Ag_2O and an Indigo-brown insoluble in water and alcohol but soluble in NH_3.*

It would appear therefore that while with the other metals the Indoxyl combines with them and is oxidised to Indigo-blue, in the case of the Sodium-silver-indigo compound the Indigo is further oxidised, reducing the silver to the metallic condition, itself being a brown substance soluble in NH_4HO but not soluble in H_2O. Now this is interesting as throwing light upon the way in which Indigo-brown (a source of great loss in manufacture) is formed. The Indigo-brown however which results from the improper fermentation of Indigo liquor is soluble in water.

Now it occurred to me to try whether, by a process of reduction from this last product, we could get a less highly oxidised Indigo-brown, and the results are most interesting. The solid extract obtained from dry Indigo leaves a brown resinous looking substance soluble in water, obtained by evaporation to dryness of a watery extract of dry Indigo leaves, was reduced in acid solution by means of Zinc: a brown powder was thrown down and on separation by filtration and washing was found to be insoluble in water but soluble in NH_4HO thus behaving exactly like the brown Indigo compound found to be in the Sodium-indigo-silver compound.

The inference is therefore possibly just that this Indigo-brown occupies a position intermediate between Indigo-blue and the soluble Indigo-brown resulting from the action of heat, alkalies, or improper fermentation on Indigo Vat-liquor: inasmuch as it is produced by a degree of oxidation which reduces the silver to the metallic state; and is also obtainable by reducing agencies from the soluble Indigo-brown formed in dry Indigo leaves.

It is therefore a further possible deduction from the facts observed, that an improper oxidation of the Indigo Vat-liquor will result in Indigo-brown instead of Indigo-blue: possibly this occurs during manufacture owing to the prolonged "beating" which is necessary to secure the deposition of the Indigo-blue in cases where fermentation has not gone on properly, as it is only formed in a small quantity in laboratory experiments with the plants, where all the stages can be more carefully controlled than is possible in actual practice owing to the various distances from which plant has to be brought and the irregular steeping which of necessity results.

However this may be I am certain that alkalinity† of the water

* *Cf.* Indihumin (Schunck.)

† Acidity of the steeping water leads to the production of a red compound soluble in water from which it may be separated by agitation with Ether ?Indirubin.

used to macerate the Indigo plant, the application of heat during maceration ("steeping"), and last but not least prolonged "beating" in order to oxidise imperfectly fermented Vat-liquor, all result in the formation of the soluble Indigo-brown and should therefore be avoided in manufacture.

The gases evolved during fermentation I have found to be principally Carbon dioxide and Nitrogen in the following proportions $CO_2 = 31$ per cent. $N = 62$ per cent. Hydrogen forms a very small proportion of the evolved gases, only 6·75 per cent.

Marsh gas also seems to be very sparingly generated during fermentation of Indigo. I propose to extend my observations on the evolved gases at some future opportunity.

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Noviciæ Indicæ XI.—*Two additional species of* Lagotis.—*By* D. Prain.

Plates I and II.

[Received and read, 1st April.]

Lagotis is the only Indian genus of the natural order *Selaginex*. It is almost purely alpine in Indian territory; only two of the truly Himalayan forms (*L. glauca* var. *sikkimensis* and *L. spectabilis*) come as low down as 11,000 feet. A species that extends from Armenia to Afghanistan, but that has not yet been collected within the British border though it has been found in Waziristan just beyond it, comes as low down as 6,000 feet; most of the Himalayan forms, however, occur at from 15,000—18,000 feet elevation.

The forms that have been recognised as distinct by different writers have varied considerably in number and extent. This is owing to the difficulty of finding characters that are constant either in the flowers or in the leaves and stems. To such an extent does this variability go that in 1881, Mr. Maximowicz [*Bull. Ac. Petersb.* xxvii. 522 *et seq.*] published a review of the genus in which, while he tentatively recognised five more or less distinct forms, he expressed the opinion that probably future taxonomists would be constrained to reduce the number of legitimate species to two only.

In making this prediction it is clear that the material of our Himalayan forms at his disposal had been all too scanty and it is evident also that, in making his enumeration, Mr. Maximowicz had overlooked a paper in the Society's *Journal* [vol. xxxix. (1870)] wherein the late Mr. Kurz described two new forms belonging to the genus. One of these must undoubtedly have fallen within the limits of *L. glauca* as that species has been understood by Mr. Maximowicz; the other is, however, so remarkable and so distinct that there is every reason to suppose that Mr. Maximowicz would have accorded it the specific rank claimed for it by Mr. Kurz.

In the *Flora of British India*, vol. iv, Sir Joseph Hooker has given an excellent account of the Indian forms reported up to August 1885. Here the validity of one of Mr. Kurz's species (*L. globosa*) is incontrovertibly established; one of Dr. Ruprecht's (*L. decumbens*), merged in *L. glauca* by Mr. Maximowicz, is also justified; another very distinct and remarkable form (*L. Clarkei*) is also for the first time defined.

Of the other Kurzian species (*L. spectabilis*), which Sir Joseph tentatively maintains, it is remarked that it does not perhaps differ from *L. glauca*; to that species, following Mr. Maximowicz, Sir Joseph refers the *L. cashmeriana* and *L. kunawarensis* of Royle, as well as a somewhat distinct form which he names *L. glauca* VAR. *sikkimensis*. At the same time Sir Joseph has indicated very clearly the differences that exist between *L. cashmeriana* and *L. kunawarensis*—differences that suggest specific distinction.

The plentiful accession of Himalayan material during the past ten years makes it necessary to recognise two forms more. One of these, from Phari, is very distinct and though in some respects related both to *L. globosa* and to *L. decumbens* it is in no sense intermediate between these two; its claim to specific rank appears to be as unimpeachable as the corresponding claim for *L. globosa* or *L. Clarkei*. The other is by no means so satisfactory. It combines certain characters of *L. cashmeriana*, which it resembles in habit, with some characters of *L. glauca*, from the Sikkim variety of which its flowers and from the North-west Himalayan variety of which its inflorescence are hardly distinguishable.

However much may be said, from the monographer's standpoint, in favour of the inclusion of *L. cashmeriana* in *L. glauca* there is no doubt that from the point of view of the field-botanist the location of *L. cashmeriana* and *L. glauca* VAR. *kunawarensis* in one species is not advisable. And the same may be said of the union of *L. glauca* VAR. *sikkimensis* and *L. spectabilis*. Even from the monographer's standpoint the writer is inclined to doubt whether much is gained by merging either *Lagotis cashmeriana* or *L. Stelleri* in *L. glauca*; in

Plates Nos. VI.—VIII. will be issued with a subsequent Number.

the subjoined key these forms have accordingly been given specific rank.

The genus *Lagotis* was founded by Gaertner in 1770 (*Nov. Comm. Acad. Petrop.* xiv., pt. i., p. 533, t. xviii., f. 2) on a plant from Kamtschatka described by Gmelin (*Flor. Sibir.* iii. 219) in 1768 as a *Veronica*. A somewhat different form of the same species collected by Pallas was described by that author in 1776 (*Reise Prov. Russ. Reichs.* iii. 710, t. A, fig. 1) as *Gymnandra borealis*. The younger Linnæus united these two plants and referred them in 1781 to the genus *Bartsia* (Bartsia Gymnandra *Linn. f. Suppl. Plant.* 278); in this he was followed by Willdenow in 1800 (*Sp. Pl.* ed. iv. iii. 186), and by Pursh in 1814 (*Flor. Amer. Septen.* ii. 430). Lamarck, in the French edition of Pallas (1793), referred the species of this genus to *Paederota*.

In 1811, however, Willdenow (*Gesell. Naturf. Freunde Berlin Mag.* v. p. 390 *et seq.*) recognised the right to separate generic rank of the plants mentioned; for some reason Willdenow chose to employ the name *Gymnandra* of Pallas in preference to the older name *Lagotis* of Gaertner, being followed in this by Chamisso and Schlechtendal who monographed the genus in 1827 (*Linnæa* ii. p. 560, *et seq.*); by Choisy who monographed it again in 1848 (*DC. Prodr.* xii., 24 *et seq.*); by Ledebour who described the Russian species in 1849 (*Flor. Ross.* iii. 331, *et seq.*) and by Boissier who described the Oriental species in 1879 (*Flor. Orient.* iv. 527). Endlicher too in 1838 (*Gen. Plant.* 689); Meisner, between 1836–43 (*Gen. Plant.* i. 307, ii. 218); and Bentham and Hooker in 1876 (*Gen. Plant.* ii. 1129) used by preference the name *Gymnandra*. Dr. Ruprecht had endeavoured in 1845 (*Flor. Samojed. Cis.* 49) and again in 1870 (*Sert. Tianschan.* '61) to re-establish the true name; but it was not till 1881, that the indefensible usage was formally discredited at the instance of Mr. Maximowicz who, in his paper referred to above, restored the name *Lagotis*. In this he has been followed by Mr. Rolfe [*Journ. Linn. Soc.* xx. 349 (1884)] and by Sir Joseph Hooker in the *Flora of British India*, vol. iv; it is therefore to be hoped that the name *Gymnandra* may not re-appear in future lists.

Willdenow in his revision of 1811 recognised as many as eight species, all of which he figured; Chamisso and Schlechtendal, however, reduced these to three; in this they were followed by Choisy in his monograph. Maximowicz whose treatment touches, perhaps, the opposite extreme, reduced all of them to *L. glauca*. The writer's treatment differs slightly from that of all the authors mentioned; it recognises but two species in the group of forms figured by Willdenow, though it approaches that of Chamisso and of Choisy since one of the two species recognised admits of division into two varieties.

For convenience of consultation these reductions are here shown in tabular form.

Gmelin (1768).	Gaertner (1770).	Pallas (1776).	Linnæus fil. 1781). Willdenow (1800).	Willdenow (1811).	Chamisso and Schlechtendal (1827).	Choisy (1848).	Maximowicz (1881).	Present paper.
Veronica.	Lagotis.	Gymnandra.	Bartsia.	Gymnandra.	Gymnandra.	Gymnandra.	Lagotis.	Lagotis.
		borealis.	*Gymnandra* (in part).	1. *integrifolia.*				
				2. *altaica.*	3. *Pallasii.*	1. *borealis.*	*glauca*, subsp. *borealis*, var. *Pallasii.*	*glauca*, var. *Pallasii*; (L. Pallasii *Rupr.*)
				6. *elongata.*				
[n. 33].	*glauca.*		*Gymnandra* (in part).	7. *ovata.*	1. *Gmelini.*	2. *Gmelini.*	*glauca*, subsp. *borealis*, var. *Gmelini.*	*glauca*, var. *typica*; (L. glauca *Gaertner*).
				8. *reniformis.*				
				3. *minor.*				
				4. *dentata.*	2. *Stelleri.*	4. *Stelleri*	*glauca*, subsp. *borealis*, var. *Stelleri.*	*Stelleri.*
				5. *gracilis.*				

Endlicher and Meisner both followed their predecessors in referring the genus to the natural order *Scrophularineæ*; Choisy first placed it in its true natural order, being in this followed by all subsequent authors. In 1776 Pallas mentioned that his *Gymnandra* had already been named *Gerberia* by Steller. This name is also quoted by Choisy; Dr. Ruprecht, however, tells us [*Beitr. Pflanzenk. Russ. Reich.* vii. 69 (1850)] that the *Gerberia* of Steller is really a *Coptis*, not a *Lagotis*.

In order that the relationship of the two forms now described to those hitherto known may be more easily understood a key is appended in which are included all the species of *Lagotis* known to or recognised by the writer.

The writer in concluding this note would wish to express his obligation to Mr. Dyer, Director of the Royal Gardens, Kew, who has kindly permitted critical Indian specimens of *Lagotis* to be compared in Kew Herbarium, and his thanks to Mr. Rolfe of the Kew Staff by whom the necessary comparisons were made.

LAGOTIS Gaertn.

Key to the known species.

* Rhizomes elongated oblique, scapes usually as long as or longer than the leaves :—
  † Calyx of two oblong sepals, bracts so large as to conceal the flowers :—
    ‡ Bracts membranous; sepals slightly unequal :—
      § Heads globose; filaments slender as long as upper lip ... ... 1. *L. globosa.*
      § § Heads spicate; anthers subsessile ... 2. *L. decumbens.*
    ‡ ‡ Bracts herbaceous; sepals similar; (heads oval-oblong, filaments slender longer than the upper lip) ... ... 3. *L. pharica.*
  † † Calyx gamophyllous :—
    ‡ Bracts smaller than the large spathaceous galeate calyx which conceals the corolla ... 4. *L. Clarkei.*
    ‡ ‡ Bracts equalling or exceeding the dorsally plane 2-lobed calyx beyond which the corolla is far exserted :—
      ⊙ Lips of corolla shorter than the tube :—
        § Neck of rhizome naked; (small plants) :—
          ¶ Filaments adnate to lower half to three-fourths of margin of upper lip; flower-heads ovate-oblong, leaves smooth, thin ... ... 5. *L. cashmeriana.*
          ¶ ¶ Anthers subsessile; flower-heads narrowly spicate, leaves subrugose ... 6. *L. crassifolia.*
        § § Neck of rhizome crowned with persistent, *not fibrous*, sheaths :—
          ¶ Basal sheaths thinly membranous dull, flower-heads ovate-oblong ... 7. *L. Stelleri.*

¶ ¶ Basal sheaths thickly membranous shining, flower-heads spicate :—
× Cauline leaves much smaller than radical ... ... 8. *L. glauca.*
× × Cauline leaves large, almost equalling lamina of radical .. 9. *L. spectabilis.*
⊙ ⊙ Lips of corolla as long as the tube ... 10. *L. brevituba.*
* * Rhizomes short premorse (crowned with *fibrous* sheaths); scapes leafless, shorter than the leaves; (calyx gamophyllous) :—
† Stolons 0; calyx winged; (disc reduced to one anterior lobe) ... ... 11. *L. Korolkowi.*
† † Stoloniferous; calyx not winged :—
‡ Glabrous; disc reduced to one anterior lobe ... 12. *L. stolonifera.*
‡ ‡ Pubernlous; disc 4-lobed ... ... 13. *L. brachystachya.*

1. Lagotis globosa *Hook. fil. Flor. Brit. Ind.* iv. 558 (1885). Gymnandra globosa *Kurz, Journ. As. Soc. Beng.* xxxix. pt. 2, 80. t. 7, f. 1. (1870).

Western Tibet and Gilgit.

2. Lagotis decumbens *Rupr. Sert. Tianschan.* 64 (1870); *Hook. fil. Flor. Brit. Ind.* iv. 559 (1885). L. glauca sub-sp. australis *Maxim. Bull. Acad. Imp. Petersb.* xxvii. 523 (1881) *partim, pl. himal. exclus.*

Western Tibet and Tianschan Mts.

3. Lagotis pharica *Prain*; (Plate I.) leaves long-petioled, ovate-oblong, pinnately lobed, scape few-leaved; bracts equalling the flowers, ovate-oblong, imbricate, forming an ovate head.

South-Eastern Tibet: Tern-la, one day north of Phari, *Dungboo!*

Rootstock small, stoloniferous; roots very long and numerous. *Leaves* 1·5 in. long, ·75 in. wide, base truncate; petioles 2 in. long, narrow throughout. *Flowering stems* ascending, as long as the leaves, with a few leafy bracts near top. *Spike* ·75–1 in. bracts ·3 in. long, entire, obtuse, thickly herbaceous. *Flowers* ·3 in. *Sepals* 2, acute, equal and similar. *Lower corolla-lip* usually 3-cleft, upper 2-fid to -cleft. *Filaments* slender, exceeding the upper lip. *Style* included, stigma notched. *Fruit* narrowly oblong.

Nearly related to *L. globosa*, with which it agrees in having very long filaments and in having lobed leaves, though the leaves in this species are not so deeply cut; also to *L. decumbens* which it approaches in style of inflorescence. From both it differs in having thick, herbaceous, relatively smaller bracts. The lobing of the corolla, as a reference to the plate will show, is exceedingly variable in this species, particularly in the upper lip where each lobe may be again 2-fid, or at times even 3-fid. In most species of *Lagotis* the greatest variability is in the lower lip.

4. Lagotis Clarkei *Hook. fil. Flor. Brit. Ind.* iv. 559 (1885).

Sikkim; 13,000 to 16,000 feet. Yak-la *Clarke!* Tankra-la *G. Gammie! King's Collector!* Pan-ding- la, near Jongri, *King's Collector!* Chumbi; at Ka-poop, *King's Collector!*

The flowers are reported variously as "light-yellow," "yellowish-green," and "white." The lower lip of the corolla is *entire*, ovate-oblong, rather wider than the upper lip.

5. Lagotis cashmeriana *Rupr. Sert. Tianschan.* 64 (1870). L. glauca sub-sp. australis *Maxim. Bull. Acad. Imp. Petersb.* xxvii. 523 (1881) *quoad pl. himal. partim.* L. glauca var. cashmeriana *Hook. fil. Flor. Brit. Ind.* iv. 559 (1885). Gymnandra cashmeriana *Royle* in *Benth. Scroph. Ind.* 47 (1835); *Ill. Himal.* 291, t. 73, f. 3 (1839); *Choisy* in *DC. Prodr.* xii. 25 (1848). G. Stelleri *Herb. Ind. Or. H. f. & T. vix Cham. & Schlecht.*

North-West Himalaya: Chamba to Kashmir.

M. Choisy (*loc. cit.*) felt disinclined to separate this form from *L. Stelleri*, and Drs. Hooker and Thomson when issuing their Indian Herbarium were even more decidedly of the same opinion. Unfortunately the writer has never had an opportunity of examining *L. Stelleri* of which there is no example at Calcutta. His friend Mr. Rolfe who, under instructions from Mr. Dyer, Director of the Royal Gardens, Kew, has kindly examined the specimens sent from Calcutta for comparison with the material in Kew Herbarium, writes:—"*Lagotis Stelleri* is "apparently distinct from *L. glauca* var. *cashmeriana* Hook. f. And whatever the "difference between *L. glauca* and the forms since distinguished from it, they are "more than mere synonyms. Possibly some are geographical forms."

In deference to this expression of opinion the writer, while following M. Choisy in keeping up *L. Stelleri*, regarding the claim of which form to specific rank that author expresses no doubt, has felt compelled to retain specific rank for *L. cashmeriana* also. For whatever its relationship to *L. Stelleri*, may be, there is, in the writer's opinion, no doubt that *L. cashmeriana* cannot, with any approach to either convenience or accuracy, be placed in *L. glauca*.

6. Lagotis crassifolia *Prain*; (Plate II) radical leaves ovate obtuse or subacute, base cuneate, margin serrate, petiole stout narrow; cauline similar but sessile; spike elongate, bracts ovate acute shorter than the flowers.

Sikkim: Tankra, *G. Gammie!* Phari: *King's Collector!* South-Eastern Tibet; Tern-la, one day north-east of Phari, *King's Collector!* prov. Tsang, *Lama Ujyen Gyatsko!*

Rootstock stout naked, with thick fleshy fibres. *Leaves* thickly fleshy, subrugose; radical 1–2 in. long, ½–1 in. wide, petiole 2—2½ in.; cauline ½–¾ in. *Flowering stems* several, 2–4 in. high, decumbent below, rather slender; spikes 1½–2½ in., bracts ½–¾ in. *Calyx* dorsally plane, 2-lobed at tip, longer than tube of corolla and bracts. *Corolla* tube hardly ½ longer than lips, lower lip 2-fid, casually 3-fid. *Anthers* subsessile. *Style* included.

In size and appearance this resembles *L. cashmeriana*, but has very different flowers. As regards texture of leaves this approaches *L. brevituba*; as regards corolla it is almost exactly intermediate between *L. brevituba* and *L. glauca* var. *sikkimensis*. Under the system of treatment adopted by Mr. Maximowicz, this form would doubtless also be placed in *L. glauca*. Mr. Rolfe, however, who is one of the

foremost living authorities on this difficult natural order, agrees with the writer in considering the form distinct.

7. Lagotis Stelleri *Rupr. Beitr. Pflanzenk. Russ. Reich.* ii. 49 (1845); vii. 69 (1850). L. glauca var. Stelleri *Trautv. Act. Hort. Petrop.* v. 95 (1877); *Maxim. Mel. Biol.* xi. 298 (1881). Gerberia Stelleri *Pall. Mss.* ex *Lamk Voy. Pall.* ed. Gall. *App.* 225 (1793). Gymnandra minor *Willd. Gesell. Nat. Fr. Berlin Mag.* v. 393. t. 9. f. 3 (1811). G. dentata *Willd. loc. cit.* 394. t. 9. f. 4 (1811). G. gracilis *Willd. loc. cit.* t. 9. f. 5 (1811). G. Stelleri *Ledeb.* ex *Spreng. Syst. Veg.* ii. 773 (1825); *Cham. & Schlecht. Linnaea* ii. 563 (1827); *Choisy* in *DC. Prodr.* xii. 25 (1848); *Ledeb. Flor. Ross.* iii. 332 (1849). G. borealis var. inter Lenam et Oceanum lect. *Pall. It.* iii. 711 (1776).

Arctic Siberia and Arctic America.

8. Lagotis glauca *Gaertn. ampl.*

Himalaya; Siberia; Mongolia; North-West America.

var. typica. Lagotis glauca *Gaertn. Nov. Comm. Acad. Petrop.* xiv. 534, t. 18 (1770); *Rupr. Sert. Tianschan* 64 (1870); *Rolfe, Journ. Linn. Soc.* xx. 349 (1884). Veronica foliis inferioribus ovatis crenatis, superioribus rotundis mucronatis, caule spica terminato *Gmel. Flor. Sibir.* iii. 219 n. 33 (1768). Bartsia Gymnandra *Linn. f. Suppl.* 278 (1781) *in parte; Willd. Sp. Pl.* iii. 186 (1800) *in parte*; *Pursh, Flor. Amer. Septen.* ii. 430 (1814). Gymnandra elongata *Willd. Gesell. Nat. Fr. Berlin Mag.* v. 395 t. 10. f. 7 (1811). G. ovata *Willd. loc. cit.* 395 t. 10. f. 8 (1811). G. reniformis *Willd. loc. cit.* 396 t. 10. f. 9 (1811). G. Gmelini *Cham. & Schlecht. Linnaea*, ii. 561 (1827); *Hook. Flor. Bor. Amer.* ii. 102 (1836); *Choisy* in *DC. Prodr.* xii. 25 (1848); *Ledeb. Flor. Ross.* iii. 332 (1849). G. borealis var. in Kamtschatka et ins. Beringii *Pall. It.* iii. 711 (1776). L. glauca var. typica *Trautv. Act. Hort. Petrop.* v. 95 (1877) *in parte.* L. glauca sub-sp. borealis var. Gmelini *Maxim. Mel. Biol.* xi. 298 (1881).

Eastern Siberia; Kamtschatka; North-West America.

var. Pallasii *Trautv. Enum. Pl. Schrenk.* 875 (1866). Lagotis Pallasii *Rupr. Sert. Tianschan.* 64 (1870); *Rolfe, Journ. Linn. Soc.* xx. 349 (1884). Bartsia Gymnandra *Linn. fil. Suppl.* 278 (1781) *in parte; Willd. Sp. Pl.* iii. 186 (1800) *in parte.* Gymnandra borealis *Pall. It.* iii. 710 t. A. f. 1 (1776); *Choisy* in *DC. Prodr.* xii. 25 (1848) *syn.* G. elongata *Willd. exclus.* G. integrifolia *Willd. Gesell. Nat. Fr. Berlin Mag.* v. 392 t. 9, f. 1 (1811). G. altaica *Willd. loc. cit.* 393. t. 9, f. 2 (1811); *Bunge* in *Ledeb. Fl. Altaic* ii. 420 (1830). G. Pallasii *Cham. & Schlecht. Linnaea* ii. 564 (1827). G. longiflora *Kar. & Kir. Enum. Pl. Soongar.* 148 (1840). Paederota borealis *Lamk. Voy. Pall.* ed. Gall. *App.* 227 (1793). Lagotis glauca sub-sp. borealis var. Pallasii *Maxim. Mel. Biol.* xi. 298 (1881).

Russia to Siberia; Turkestan to Mongolia.

var. kunawarensis *Hook. fil. Flor. Brit. Ind.* iv. 560 (1885). Gymnandra kunawarensis *Royle* in *Benth. Scroph. Ind.* 47 (1835); *Choisy, DC. Prodr.* xii. 25 (1848). Lagotis glauca sub-sp. australis *Maxim. Mel. Biol.* xi. 298 (1881) *in parte.*

North-West Himalaya; Rajhoti, north of Kamaon, 15,000 feet, *Strachey & Winterbottom.* Kunawar, 12-15,000 feet, *Royle.* Laka, *Edgeworth!* Garhwal, *King!* Kamaon, near Bidang in the Dhauli Valley, 11–15,000 feet, *Duthie* n. 3262! Garhwal, at Owrie Gadh in the Nila Valley, 14–15,000 feet, *Duthie* n. 572! Kashmir; Astore at Harpookund pass, *Winterbottom* n. 792! Baltistan at Marpa Nullah, 13–15,000 feet, *Duthie* n. 11801! at Golteri Nullah in the Shingo Valley, 11,000 feet, *Duthie* n. 11862! Also specimens with white flowers in Karpuchu Valley, at 13–14,000 feet, *Duthie!*

var. sikkimensis *Hook. fil. Flor. Brit. Ind.* iv. 560 (1885).

Sikkim; Jongri *Watt! G. Gammie! King's Collectors!* Gnatong *Cummins!* Chumbi, at Natoot, *King's Collectors!* below Ghora-la, *Waddell's Collectors!*

9. Lagotis spectabilis *Hook. fil. Flor. Brit. Ind.* iv. 560 (1885). Gymnandra spectabilis *Kurz, Journ. As. Soc. Beng.* xxxix. pt. 2, 80 (1870).

Sikkim: Phalloot, 14–15,000 feet *T. Thomson! Kurz! G. Gammie! King's Collector!*

This form the writer had found it difficult to separate from *L. glauca* var. *sikkimensis* by any good characters, the leading difference between the two being the larger stem-leaves of *L. spectabilis.* Mr. Rolfe, however, writes that it is "doubtful if they are identical, though nearly allied;" for the present, therefore it seems better to follow Sir J. Hooker in giving the plant specific rank. This appears to be a very local form, all our gatherings coming from the same neighbourhood; one striking peculiarity which it exhibits is that the specimens dry a pale straw colour, all the other forms of *Lagotis* drying black.

10. Lagotis brevituba *Maxim. Bull. Acad. Imp. Petersb.* xxvii. 524 (1881).

Western China.

11. Lagotis Korolkowi *Maxim. Bull. Acad. Imp. Petersb.* xxvii. 524 (1881). Gymnandra Korolkowi *Regel & Schmalh. Act. Hort. Petrop.* v. 627 (1877).

Turkestan: Alatau Mts.

12. Lagotis stolonifera *Maxim. Bull. Acad. Imp. Petersb.* xxvii. 524 (1881). Gymnandra stolonifera *C. Koch. Linnaea,* xvii. 289 (1843); *Ledeb. Flor. Ross.* iii. 333 (1849); *Jaub. & Spach, Ill.* t. 254 (1849); *Boiss. Flor. Or.* iv. 527 (1879); *Aitchison, Journ. Linn. Soc.* xviii. 85

(1880); *Hook. fil. Flor. Brit. Ind.* iv. 558 (1885). G. armena *Boiss. Diagn.* ser. i. iv. 75 (1844); *Choisy* in *DC. Prodr.* xii. 26 (1848).

Asia Minor; Armenia; Persia; Afghanistan; Waziristan.

13. Lagotis brachystachya *Maxim. Bull. Acad Imp. Petersb.* xxvii. 525 (1881).

Western China.

† EXPLANATION OF THE PLATES.

Plate I. Lagotis pharica *Prain.*

1. Bract. 2. Flower showing 2-lobed calyx: corolla with 3-fid lower lip and each lobe of upper lip again 2-fid. 3 Flower showing 2-lobed calyx: corolla with only 2-fid lower lip, and each lobe of upper lip again 3-fid. 4. Corolla with 3-fid lower, and 2-fid upper lip, laid open. 5. Stamens. 6. Ovary and style. 7. Ripe fruit. 8. The same opened. 9. Seed. *All enlarged.*

Plate II. Lagotis crassifolia *Prain.*

1. Bract and calyx, corolla removed. 2. Corolla laid open, with stamens and pistil. 3. Ripe fruit. 4. Fruit opened, exposing seed. 5. Seeds. *All enlarged.*

On the Transformation of Hypochlorites to Chlorates: being the Elliott Prize Essay for 1895.—*By* Jyotibhushan Bhaduri, M.A., *Offg. Demonstrator of Chemistry in the Presidency College, Calcutta.*

[Read March 1896.]

Contents.

Introduction	66
Estimation of chlorates	67
,, hypochlorites	70
Action of chlorine on sodic hydrate	74
Transformation of sodic hypochlorite in the dark (cold) ...	76
Transformation at 100° C in the dark	78

Introductory.

The transformation of hypochlorites to chlorates is familiar to every student of Chemistry. Though some exact knowledge has been

† [Additional note: 21.5.96. In Acta Hort. Petrop. xiv., received in Herb. Calc. since the foregoing was printed, M. Batalin describes (*l. c* 177) a new species, *Lagotis ramalana*, clearly very distinct from any of the preceding. Its place in the key should be next after *L. pharica*, the diagnosis being as follows:—

Scape leafy, heads oblong, flowers shorter than bracts, leaf-blades one-third as long as petioles; upper lip of corolla deeply divided; plants 8–15 cm. high ....3 *L. pharica.*

Scape leafless, heads globose, flowers longer than bracts, leaf-blades nearly as long as petioles; upper lip entire or only emarginate; plants only 3·5 cm. high ..... 3* *L. ramalana.*

3* Lagotis ramalana, Batalin, Acta Hort. Petrop. xiv. 177 (1895).

Eastern Tibet.]

gained in this direction by the researches of Lunge and Landolt (*Society of Chemical Industrial, Journal* 1885, 722) on the transformation of bleach-liquor into calcium chlorate—a subject vitally connected with the manufacture of potassium chlorate—yet the circumstances under which the change takes place have not been satisfactorily explained. To throw light on them the following investigation has been undertaken.

The instability of the hypochlorites, &c., and the absence of characteristic tests for their presence, render their detection, separation and direct estimation extremely difficult. Hypochlorites and chlorates when present in a mixture had always been indirectly estimated.

Before the present investigation was undertaken the methods that have been employed were tested as to their correctness. As measuring of liquids by means of pipettes, even when very carefully graduated, is attended with several sources of error, all the test solutions were made by weight.

Estimation of chlorates.

Three distinct methods were employed:—

(i). Reduction of chlorates by zinc copper couple. The solution was filtered, and as the residue invariably contained traces of chloride in the form of insoluble zinc oxychloride, it was acidified with pure dilute nitric acid and thoroughly washed. The precipitated zinc hydrate (there being always free alkali present) was dissolved by the addition of more acid, and then the solution was digested with precipitated calcium carbonate and estimated gravimetrically as silver chloride, or volumetrically by standard silver nitrate solution.

(ii). (*a*) Digestion with stannous chloride in hydrochloric acid solution, and titration of the excess by permanganate.

(*b*) Digestion with ferrous sulphate precipitated by alcohol, and titration of the residual iron by bichromate or permanganate. The purity of the ferrous sulphate was tested by igniting the salt in a platinum crucible and weighing as oxide. The results were highly satisfactory. Thus:—

Weight of Salt.	Wt. of Fe_2O_3.	Percentage of Fe as determined.	Calculated percentage of Fe.
1·8710 grams ...	0·5400 gm.	20·20	
1·7914 „ ...	0·5167 „	20·19	20·15
1·5129 „ ...	0·4367 „	20·20	

The slightly higher result was due to slight efflorescence of the salt. In actual analysis the salt was dissolved in dilute sulphuric acid, the

trace of "*ic*" iron reduced by a small crystal of sodium sulphite and the solution freely boiled to expel every trace of sulphur dioxide. After the precipitation of iron as ferrous hydrate, by pure sodic hydrate, the alkaline chlorate was added. The whole was then boiled for a few minutes. When the reduction of the chlorate was complete, hydrochloric acid was added to redissolve the precipitate. Reduction in alkaline solution was found imperative. Many experiments were lost owing to the evolution of distinct amounts of chlorine in the attempt to effect the reduction in presence of free sulphuric and hydrochloric acids. In all cases, however, the boiling of solutions and subsequent cooling and titration were effected in an atmosphere of carbon dioxide.

Objections have been raised by Fresenius that titrations by permanganate are not admissible in presence of free hydrochloric acid, or chloride and sulphuric acid. They have, however, been disputed by Dr. Fleischer. The liberation of free chlorine can be entirely prevented, according to Zimmermann, by the presence of a sufficient quantity of manganous sulphate, so that the determinations are rendered more exact. My own observations have led me to believe that the results are perfectly concordant when the titrations are made in cold dilute solutions and in presence of not too large an excess of free hydrochloric acid. When excess is suspected, it is to be partially neutralised with pure sodic carbonate, but care must always be taken to maintain the solution acid, otherwise the volume of permanganate required will be appreciably higher. To establish the above points the following experiments were performed :—

A. Without hydrochloric acid (that present being in stannous chloride).

(i) 10·230 gms. of $SnCl_2$ = 51·20 c.c. Permanganate
(ii) 5·897 „ „ = 29·40 „ „
(iii) 5·259 „ „ = 26·25 „ „
∴ 10 gms. $SnCl_2$ = 49·97 c.c. Permanganate.

B. With 1 c.c. strong hydrochloric acid for 5 c.c. stannous chloride solution present.

(i) 5·39 gms. of $SnCl_2$ = 26·90 c.c. Permanganate
(ii) 7·5 „ „ = 37·45 „ „
(iii) 8·32 „ „ = 41·50 „ „
∴ 10 gms. $SnCl_2$ = 49·91 c.c. Permanganate.

It is evident from the results given above, that the difference between two series of experiments (0·06 in 50) is very slight, and can be accounted for as errors of experiments.

The following analysis of ferrous ammonium sulphate shows striking concordance of the results :—

(i) 1·1054 gms. of the double salt in presence of 2 c.c. concen-

trated sulphuric acid and 2 c.c. hydrochloric acid, required 28·2 c.c. permanganate, or 0·0392 gm = 1 c.c. permanganate.

(ii) 1·4874 gms. of the double salt in presence of dilute sulphuric acid only required 37·9 c.c. permanganate, or 0·03924 gm. = 1 c.c. permanganate.

These two numbers are very nearly the same, and in fact agree more than might be expected. Other estimations gave precisely similar results.

Having thus convinced myself of the applicability of the permanganate method in hydrochloric acid solution, a solution of pure potassium chlorate containing 0·01 gm. of available oxygen per gram of the solution was made, and the following test experiments performed.

Two grams of the dried chlorate when ignited left a residue of 1·2176 grams of KCl. Therefore oxygen present is 39·12 % while the calculated quantity is 39·16 %. Also 1 c.c. $Sn\,Cl_2$ is equal to 6·35 c.c. permanganate, and 1 grm. permanganate is equal to 0·00554 gm. Iron.

(i) 15·68 gms. $Sn\,Cl_2$ + 5·055 gms. $KClO_3$ required 35·8 c.c. permanganate.

$$\therefore \text{ Available oxygen} = (15{\cdot}68 \times 6{\cdot}35 - 35{\cdot}8) \times \frac{{\cdot}00554}{7}$$

$$= 0{\cdot}05047 \text{ gm.}$$

(ii) 16·149 gms. $Sn\,Cl_2$ + 5·014 gms. $KClO_3$ = 39·1 c.c. permanganate.

$\therefore$ Available oxygen = 0·05026 gm.

(iii) 3·41 gms. double salt + 5·047 gms. $KClO_3$ = 24·2 c.c. permanganate = 24·2 × 0·0054 = 0·1341 gm. Iron.

$\therefore$ 5·047 gms. $KClO_3$ = 0·05043 gms. oxygen.

(iv) 3·12 gms. double salt + 5·039 gms. $KClO_3$ = 17 c.c. permanganate.

$\therefore$ 5·039 gms. $KClO_3$ = 0·05036 oxygen.

Method of experiment.	$Sn\,Cl_2$ method.		Ferrous Ammonio-Sulphate method.	
No. of experiment	I	II	III	IV
Estimated value	0·05047	0·05026	0·05043	0·05036
Calculated value	0·05055	0·05014	0·05047	0·05039

(iii) The solution of the chlorate was distilled with pure concentrated hydrochloric acid in Bunsen's distilling bulb. Various other acids (boric acid, phosphoric acid, acetic acid, sulphuric acid) were tried. The first three failed to decompose the chlorate. As calcite was used to carry off the chlorine, &c., from the bulb to the absorption apparatus,

the apparatus had to be modified. In one form the solution of chlorate and pieces of calcite were introduced into the bulb and then a thin test tube filled with hydrochloric acid and sufficiently narrow to pass through the mouth, was introduced. The apparatus was adjusted, and then slightly inclined to allow the acid to decompose the chlorate, &c. In the second form, pieces of calcite were introduced in the leading tube and the chlorate in the bulb, both being held in a horizontal position. The acid was then rapidly introduced and immediately afterwards the stopper was replaced, the apparatus being still in horizontal position. The other end was then introduced into the absorption bulb and the whole apparatus made vertical. The results obtained by these methods are perfectly concordant, but the second method is more expeditious than the first. The quantity of acid must be in excess (about 5 c.c. strong hydrochloric acid for 2 to 3 c.c. of potassium chlorate solution). When marble was used, the small quantity of chlorine which oxidised the "*ous*" iron to "*ic*" iron was calculated and added to the available oxygen. The liberated iodine was transferred to a porcelain dish, and titrated by thiosulphate standardised by solid iodine purified by Stas's method.

1 c.c. Thiosulphate = 0·01272 gm. Iodine.

Number of experiment.	I.	II.	III.	IV.	V.
Weight of $KClO_3$ solution used ...	2·5 gms.	2·5 gms.	3 gms.	3 gms.	3 gms.
Vol. of strong HCl added ...	5 c.c.	5 c.c.	5 c.c.	5 c.c.	5 c.c.
Vol. of Thiosulphate required ...	31·25 c.c.	31·15 c.c.	37·3 c.c.	37·4 c.c.	37·3 c.c.
Mean	31·2		37·33		

Hence 1 gm. of $KClO_3$ = 12·48 c.c. of thiosulphate solution from I and II, and 12·44 c.c. from III, IV and V. Thus taking 12·46 as the mean the amount of available oxygen = $12·46 \times ·01272 \times \frac{8}{127} = 0·01002$ gm. The actual quantity of available oxygen = 0·01 gm. Hence all the three methods gave equally accurate results and preference was given to one or the other, as circumstances required.

Estimation of hypochlorites.

Hypochlorous acid as well as hypochlorites can be estimated in exactly the same way as chlorates. In this case ferrous sulphate and not the double salt should be used, as a part of the ammonia might be completely decomposed liberating free nitrogen, thus causing a loss of chlorine. Chlorates may be expected to liberate nitrogen, but my own experiments prove that no such decomposition actually takes place.

The preparation of hypochlorites in a weighable state, so that the available chlorine can be calculated, is almost impossible. Kingzett obtained crystals of very nearly pure calcium hypochlorite (*Journ. Chem. Soc.*, [2]. 13, 404) containing an unknown number of molecules of water. The greatest precautions as to increase of temperature, contact with dust and exposure to actinic rays, can not prevent decomposition when hypochlorites are evaporated *in vacuô* over sulphuric acid. No direct evidence can therefore be adduced to test one method or the other. Concordance of results as obtained by different methods is the only test.

It has already been stated that phosphoric acid failed to decompose chlorates. Similar experiments were performed with the result that the whole of the hypochlorous acid was carried along with carbon dioxide into the absorption apparatus, and liberated iodine from potassium iodide. The residue (when chlorate was likewise present) when distilled with pure hydrochloric acid gave the chlorine of the chlorate. Direct estimation of chlorate and hypochlorite in a mixture containing the same is thus rendered possible and practicable.

Hypochlorites can also be estimated by the action of potassium iodide in acid (HCl or H_3PO_4) solution.

To test whether any free oxygen is liberated from the decomposition of hypochlorous acid, the apparatus, as given in the annexed diagram (Plate III) was used.

The distilling bulb, parts of which were all fitted by grinding, contained water and pieces of marble or calcite (freed from air by boiling with water) introduced through A. Through B, a solution of potassium iodide was introduced in C, so that the level was slightly below the open end of the tube C. The U tube contained a more dilute solution of the same. Air from the apparatus was expelled by passing carbon dioxide though D, and when the bubbles were perfectly absorbed by potash solution contained in the gas measuring tube in the mercurial trough, the stop cock S was closed, and the solution of hypochlorite introduced in the bulb E. As the pressure inside the apparatus was greater than the atmospheric pressure, the solution was introduced by a very careful blowing, and then the sides carefully washed down. Pure syrupy phosphoric acid was similarly introduced, the stop cock S closed, and the bulb slowly heated to boiling on an asbestos board. The hypochlorous acid along with the carbon dioxide generated inside the apparatus passed through the solution. Iodine was thus liberated. Evolution of carbon dioxide was kept steady, but even after an hour no oxygen was found in the measuring tube. Hence no loss of chlorine takes place when hypochlorous acid is distilled with phosphoric acid in dilute solution.

Action of acids on potassium iodide.

Having had frequent occasion to notice the slight colouration of potassium iodide, both in the solid state and in solution, the action of dilute acids such as had been used in previous estimations was tried. Potassium iodide as ordinarily sold for medicinal purposes is decomposed by most acids—pure dilute phosphoric, hydrochloric, sulphuric, acetic acids, &c. It has been asserted (*Fresenius's Quantitative Analysis*, seventh edition, p. 104) that the pure iodide should not liberate iodine by the action of dilute sulphuric acid. This statement appears to be incorrect. Various samples, purified according to different methods, to remove the iodate (reduction by sodium amalgam, fusion with and without charcoal, and crystallization from alcohol) gave invariably the blue colouration with starch paste and dilute sulphuric acid. Water boiled and cooled in absence of air was used to prevent the action of dissolved oxygen. The amount of iodine which was thus liberated, when the titrations were made in dilute solutions, was however too small to affect the accuracy of results, and hence no blank experiments were necessary.

The distillation (with hydrochloric acid) method is equally applicable, but greater precautions are necessary owing to the ready decomposition of hypochlorites. The hypochlorite which I had to use being mixed with excess of free alkali, previous acidification was necessary. When dilute hydrochloric acid was used, free chlorine was liberated, a small portion of which escaped before potassium iodide was added. Hence the operation was performed in a closed vessel. A mixture of a solution of potassium iodide and dilute phosphoric acid was found to act equally well, and gave results identical with the first. It also simplified the operation. When however the iodide was added first, and then the acid, invariably a greater quantity of iodine was liberated. Mixtures containing different quantities of chloride, chlorate, hypochlorite and free alkali were analysed, and the following results obtained:—

	Volume of solution used.	*a.* Volume of thiosulphate used (first KI and then acid being added.)	*b.* Volume of thiosulphate used (a mixture of KI and acid being added).
I. ...	10 c.c. ...	33·1 c.c. (mean of three) ...	32·8 c.c. (mean of three).
II. ...	10 c.c. ...	28·88 c.c. (mean of five) ...	28·6 c.c. (mean of three).
III. ...	10 c.c. ..	29·00 c.c. (mean of two) ...	28·8 c.c. (mean of two).
IV. ...	10 c.c. ...	37·50 c.c. (mean of three)...	37·2 c.c. (mean of three).

It is evident from the above table that results from operations (*a*) and (*b*) differ to a small extent, about 1 to 1·5 %. The cause of this disagreement has not been investigated.

Most of the methods described above give the available chlorine in a mixture of chlorate and hypochlorite. Direct titration by potassium iodide and dilute acid originally introduced by Bunsen, but modified by Wagner, is said to give chlorine of the hypochlorite even in presence of chlorates. Experiments prove the contrary. In fact, tacit assumption of the accuracy of the method gave me the greatest trouble. Higher results were always obtained with thiosulphate than with arsenite or distillation (with H_3PO_4) method. The following table gives the results of some of the analyses :—

	Vol. or weight of solution.	Vol. of thiosulphate with a mixture of KI and H_3PO_4.	Vol. of thiosulphate by Penot's method.*	Remarks.
I ...	5 c.c. ...	17·66 c.c. ...	17·28 c.c. ...	The solution was kept for a few days in diffused light.
II ...	10 c.c. ...	21·8 c.c. ...	21·7 c.c. ...	
III ...	10 c.c. ...	20·7 c.c. ...	20·4 c.c. ...	
IV ...	10 gms. ...	26·6 c.c. ...	26·45 c.c. ...	
V ...	10 c.c. ...	19·8 c.c. ...	19·4 c.c. ...	The solution was kept for a month in the dark.
VI ...	10 c.c. ...	109 c.c. ...	108·4 c.c. ...	A strong solution kept for five days in the dark.
VII ...	10 c.c. ...	17·1 c.c. ...	17·1 c.c. ...	Freshly prepared solution of hypochlorite which contained only a trace of chlorate.

Hypochlorites in presence of chlorates, best estimated by Penot's method.

The method then can give approximate but not accurate results. Iodine separates out from an acid solution of potassium iodide in presence of a chlorate, the quantity increasing with duration of contact, temperature, amount of free acid and of chlorate, and other circumstances. The conditions are rather too numerous to be maintained unchanged during the course of several analyses. In fact, at the boiling temperature in a sealed tube, the decomposition is complete, and chlorates may be estimated from the free iodine, a blank experiment being made for the iodine separated owing to the action of the acid on potas-

* The volume of thiosulphate is calculated from its determined relation with arsenite.

sium iodide. Alkaline solutions on the other hand remain perfectly unaltered in a boiling solution of a chlorate. In this respect the behaviour of potassium iodide as to liberation of iodine is exactly similar to the oxidation of arsenious oxide (arsenites) to arsenic oxide (arseniates). Arsenites in alkaline solution are readily oxidised by hypochlorites, but are without any action upon chlorates. Hence only Penot's method was found applicable. The solution which had been used being strongly alkaline owing to the presence of free sodic hydrate, separation of the latter was necessary before potassium iodide could be added. This was attempted to prevent the spotting operation in Penot's process. Direct estimation however proved abortive. Mercuric chloride, copper sulphate, &c., were used to separate the alkali in the form of insoluble hydrates or oxides, but part of the hypochlorite seemed to be decomposed precipitating oxychlorides. When magnesium sulphate was used, magnesium hydrate was precipitated, but on subsequent addition of potassium iodide, the liberated iodine combined with the hydrate, rendering the process useless.

Action of chlorine on sodic hydrate.

Preparation of sodic hypochlorite.

The hypochlorite was made by passing washed chlorine through a solution of sodic hydrate made from metallic sodium. Its strength in different experiments varied from 1·5 to 25 %. The temperature at which absorption took place also varied from 25° C. to 33° C., and the passage of the gas continued in some experiments for four to five hours. The solution in dilute condition was colourless, but had a greenish yellow colour in a more concentrated form. It had a distinct and peculiar smell unlike chlorine. This was so characteristic that the intensity of odour gave an appoximate idea of the strength of hypochlorite present in a solution. Though the solution was strongly alkaline owing to the presence of free alkali, yet immediate liberation of iodine from a solution of potassium iodide took place. The solution instantly turned the brilliant surface of mercury yellowish red, oxychloride of mercury being produced. In connection with this it was further observed that the colour changed in the course of few hours from greenish yellow to purple, even when kept in the dark. This was due to the powerful oxidising and solvent action of hypochlorites in alkaline solution. The manganous silicate contained in the glass was oxidised, even in the strongly alkaline solution, and in presence of a chloride, and converted into sodium permanganate. A solution of sodic hydrate however did not under like conditions turn purple. As these experiments were performed in the dark room, the transformation (see pp. 76–79), had there been any, must have been insignificant.

Table showing the action of Chlorine on a Solution of Sodic Hydrate.

No. of sample.	Percentage of Na OH before passing chlorine.	Volume of solution used.	(*d*) Chlorine of the hypochlorite (Penot's method).	(*e*) Chlorine of chlorate.	(*f*) Chlorine of the hypochlorite and chlorate.	(*g*) Total chlorine by reduction.	Duration of absorption.	Remarks.
I ...	1·50	10 c.c.	0·1241 gm.	trace.	0·1244 gm.	0·1250 gm.	1½ hours.	Solution colourless, absorption in yellow light; absorption very nearly complete.
II ...	2·40	„	0·1547 „	trace.	0·1553 „	0·1555 „	Do.	Solution slightly greenish, absorption in yellow light.
III ...	5·00	„	0·2754 „	0·0015 gm.	0·2776 „	0·2785 „	2 hours.	Solution distinctly greenish, absorption in yellow light.
IV ...	7·10	„	0·2191 „	trace.	0·2207 „	0·2210 „	Do.	Do. do.
V ...	8·47	„	0·1906 „	0·0032 gm.	0·1945 „	0·1961 „	3½ hours.	Do. absorption in diffused light, but the solution protected from light by a zinc cylinder.
VI ...	8·98	„	0·3157 „	0·0015 „	0·3177 „	0·3198 „	2½ hours.	Do. absorption in the dark.
VII ...	12·00	„	0·4632 „	0·0230 „	0·4879 „	0·4891 „	4½ hours.	Do. do.
VIII ...	21·10	„	0·5589 „	0·0323 „	0·5935 „	0·5951 „	2½ hours.	Do. do.
IX ...	27·30	„	0·8743 „	0·0500 „	0·9258 „	0·9270 „	4 hours.	Do. do.

In order to study the action of chlorine on a solution of sodic hydrate, a certain volume of freshly prepared solution of sodium hypochlorite, prepared as before, was reduced either by zinc copper couple or alkaline ferrous hydrate, and the total chlorine estimated volumetrically by standard silver nitrate. The hypochlorite and chlorate were then estimated separately as detailed in previous sections. The percentage of alkali was estimated by (i) titration with semi-normal hydrochloric acid (before passing chlorine), and (ii) converting into anhydrous sodium sulphate and weighing as such. These experiments were repeated at least twice with the same solution. On page 75 the results of analyses (about fifty) are given in a tabular form. Results from columns (*d*) and (*e*)—available chlorine of hypochlorite and chlorate, have been added, and put in (*f*), side by side with (*g*) which represents the total chlorine.

Solutions from iii. to ix. all turned purple when kept in litre flasks. The colour was due to the formation of permanganate, the glass of the vessels used furnishing the manganese. The last five sets of experiments were performed at temperatures which were decidedly lower (some 5° C) than the temperatures of the first four sets of experiments. It is clear from the above table that the amount of chlorate which is formed in solution up to 7 °/₀ of concentration (free NaOH) is insignificant, and hence the following equation represents under the above mentioned circumstances the action of chlorine on sodium hydrate :—

$$2\,NaOH + Cl_2 = NaOCl + NaCl + HOH.$$

Above 10 °/₀ concentration, the secondary reaction—transformation—becomes more distinct, and when the concentration exceeds 20 °/₀, time becomes an important factor in bringing about the change. In the course of one series of experiments such a solution which was kept in the dark showed a change of only 6 °/₀ in twenty-four hours. When, however, chlorine was passed for about an hour the change in another part of the same solution amounted to 1·5 °/₀. Evidently then the presence of free alkali retards the transformation. This fact will be noticed in the next section, dealing with the transformation in the dark.

Transformation of the cold solution in the dark.

Temperature 25–28°C.

A number of tubes containing definite volumes of hypochlorite solution of known strength was sealed and kept in closed drawers in the photographic room of the laboratory in which sometimes yellow and

sometimes red rays entered. Some of them were exhausted, and some contained air. Several stoppered bottles and flasks were also used, and the experiments lasted for three months. They were dividedinto three sets :—

(i) Those exposed in orange yellow rays.
(ii) Those exposed to ruby rays.
(iii) Those kept in absolute darkness.

The solution in all the three sets of experiments, on examination, was found to change colour, from colourless and pale yellow to colourless and distinct pink. Flakes of silica separated in those tubes in which the contact was prolonged. On shaking, the solution turned milky owing to the separation of minute air-bubles (capable of rekindling a glowing chip of wood—hence oxygen). They, however, disappeared after few minutes leaving the solution clear. The following preliminary experiment was performed.

In a 250 c.c. flask closed with an india-rubber stopper and provided with a delivery tube, 200 c.c. of a strongly alkaline solution of sodium hypochlorite was introduced, care being taken not to allow any trace of the solution to come in contact with the stopper. The open end of the delivery tube dipped under mercury in a mercurial trough above which a measuring tube filled with mercury was placed. The apparatus was kept *in situ* for two weeks. After the expiration of the above period the solution was examined. The colour did not sensibly change, although the temperature varied from 28° to 33° C. No gas was found in the tube. On shaking, however, minute bubles of gas were liberated, but the quantity of oxygen was too small to overcome the mercurial pressure.

10 c.c. original solution contained 0·2191 gram of available chlorine of hypochlorite and 0·0045 gram of chlorate, making in all 0·2236 gram. The sample contained 0·2245 gram of chlorine (total). Considerable difference, however, was observed when the solution was analysed after two weeks, 0·1987 gram of chlorine of hypochlorite and 0·0242 of chlorate were found. The total available chlorine was thus 0·2229 gram, a quantity very nearly the same as before. The experiment was repeated with fresh solution, the duration in this case being a week. Exactly similar results were obtained. Liberation of oxygen was beyond doubt. Several other qualitative experiments were made by keeping solutions in the so-called condensation tubes provided with stopcocks. All these have led me to the same conclusion. The following table contains some of the results of the analysis (expressed in grams). In order to simplify comparison the available chlorine has been expressed in terms of oxygen.

After passing chlorine but before transformation.			After transformation.					Remarks.
Free Na OH.	Na OCl.	Na OCl as oxygen.	Unchanged Na OCl as oxygen.	Chlorate as oxygen.	Free oxygen.	Total oxygen.	Volume of oxygen.	
0·51	0·328	0·0705	0·0628	0·0022	0·0054	0·0076		
0·51	0·328	0·0705	0·0632	0·00156	0·00572	0·00728	4 c.c.	Kept in complete darkness for a month.
0·51	0·328	0·0705			0·00486		3·4 c.c.	„ „ „ 25 days.
0·51	0·328	0·0705		0·00256	0·006	0·00856		„ „ „ one month and 5 days.
0·51	0·328	0·0705	0·0323	0·0351	0·0014	0·0365	2 c.c.	Kept in yellow light, the stopper was occasionaly removed.
0·51	0·328	0·0705	0·0251	0·0048	0·0007	0·0055	0·5 c.c.	„ „ „ „
1·44	0·5589	0·1197	0·1191	0·0005				Kept in yellow light for a day.
1·44	0·5589	0·1197	0·1194	0·0003				Kept in darkness for a day.
1·44	0·5589	0·1197	0·119	0·0003				„ „ „
1·15	0·84	0·18	0·1769	0·0023				Kept in yellow light for two hours.
1·15	0·84	0·18	0·174	0·0045				„ „ four „

From the above it is evident that a solution of sodium hypochlorite slowly decomposes even when kept in absolute darkness. The rate of decomposition increases with the refrangibility of the rays. Yellow rays are far more powerful than red rays. The transformation is one into chlorate and free oxygen.

The experiment was repeated with a 5 per cent. solution of sodic hydrate. It was saturated with chlorine and the excess of chlorine carefully removed by bubling dry air (free from carbonic acid) through the solution. A solution of hypochlorite containing free alkali was then cautiously added drop by drop so long as the smell of chlorine persisted. Non-existence of free chlorine was proved by the mercury reaction. The solution was so unstable that no systematic experiment was found possible. In the course of an hour it changed its *titre* by several per-cents. It was kept in a brown stoppered bottle in the dark room. After some three hours the stopper was removed, when a distinct smell of chlorine was perceived. The liberation of chlorine increased with time, but there seemed to be a limit. On shaking, however, the smell very nearly disappeared, but the absorption of chlorine by the free alkali which must have been simultaneously formed was never complete. The behaviour of sodium hypochlorite in aqueous solution is very peculiar. Under ordinary circumstances in presence of free alkali it decomposes into free oxygen and a chloride, a chlorate being at the same time formed. In the other case it seems to dissociate into free chlorine and free alkali.

Influence of pressure.

The action of pressure on a solution of sodium hypochlorite is interesting. Minute bubbles of oxygen are given up when diffused light acts on it for some time. Since sodium hydrate dissolves notable quantities of free oxygen, these bubbles are not seen until after some time. When, however, a tube containing some of the above solution is exhausted of air (pressure 5-6 cm. of mercury) the decomposition is accelerated and a regular evolution of oxygen begins, so much so as to render the solution slightly milky.

TRANSFORMATION IN THE DARK AT A TEMPERATURE OF 100° C.

The methods adopted in these experiments were very nearly identical with the previous ones. The tubes were, however, stouter, as a good deal of internal pressure was produced in some of these experiments owing to the generation of a comparatively large volume of gas. In fact, when the duration of heating was prolonged to some fifteen to twenty hours, some of the tubes exploded, thus rendering a whole set

	(a) Percentage of free Na OH.	(b) Percentage of Na O Cl.	(c) (Before transformation) Weight of hypochlorite in gms. as oxygen.	(d) Weight of hypochlorite not transformed.	(e) Weight of transformed hypochlorite.
A. i.	After one hour's heating in the steam bath (temperature				
1	12·400	5·520	0·12400	0·06690	0·05710
2	6·200	2·760	0·06200	0·05240	0·00960
3	3·100	1·380	0·03100	0·02690	0·00410
4	1·550	0·690	0·01550	0·01224	0·00330
5	0·775	0·345	0·00775	0·00579	0·00196
A. ii.	After three hours' heating in the steam bath (temperature				
	12·400	5·520	0·12400	0·03610	0·0879
	6·200	2·760	0·06200	0·04080	0·0212
	3·100	1·380	0·03100	0·02230	0·0087
	1·550	0·690	0·01550	0·00971	0·00579
	0·775	0·345	0·00775	0·00455	0·00320
A. iii.	After six and a half hours' heating in the steam bath				
	12·400	5·520	0·12400	0·01324	0·11076
	6·200	2·760	0·06200	0·0294	0·0326
	3·100	1·380	0·03100	0·01737	0·01363
	1·550	0·690	0·01550	0·00711	0·00839
	0·775	0·345	0·00775	0·00253	0·00522
B. i.	After one and a half hours' heating in the steam bath				
	8·400	8·72	0·1956	0·0764	0·1192
	4·200	4·36	0·0978	0·0703	0·0275
	2·100	2·18	0·0489	0·0395	0·00935
	1·050	1·09	0·02444	0·0189	0·0055
	0·575	0·545	0·01222	0·00794	0·00428
B. ii.	After two hours' heating in the steam bath (temperature				
	8·400	8·72	0·1956	0·0637	0·1319
	4·200	4·36	0·0978	0·0670	0·0308
	2·100	2·18	0·0489	0·366	0·0123
	1·050	1·09	0·02444	0·0175	0·00691
	0·575	0·545	0·01222	0·00715	0·00507
C. i.	After four hours' heating in the steam bath (temperature				
	5·1	3·3	0·0705	0·0352	0·0353
D.	After one and a half hours' heating in the water bath				
	3·200	6·9	0·1545	0·11696	0·03754
	1·600	3·45	0·0774	0·06625	0·01115
	1·065	2·30	0·0515	0·0463	0·0052
	0·800	1·72	0·0387	0·03705	0·00165
	0·640	1·38	0·0309	0·02815	0·00275
	0·400	0·86	0·01931	0·01545	0·00386

(*f*) Percentage decomposition.	(*g*) Volume of free oxygen.	(*h*) Weight of oxygen of chlorate.	Weight of free oxygen.	Ratio of oxygen of chlorate to free oxygen.
100° to 100·5°C).				
46	9·5 c.c.	0·0445	0·0136	1 to 0·306
15·5	2·6 c.c.	0·0059	0·0037	1 to 0·627
12·9				
21·				
25·3				
100° to 100·5°C).				
70·9	19·2 c.c.	0·06044	0·02746	1 to 0·454
34·2	6·5 c.c.	0·0119	0·0093	1 to 0·781
29·	3·1 c.c.	0·0043	0·0044	1 to 1·02
36·8				
41·3				
(temperature 100° to 100·5°C).				
89·4	29 c.c.	0·0693	0·0415	1 to 0·6
52·6	11·5 c.c.	0·0160	0·0186	1 to 1·04
44·7	5·5 c.c.	0·00577	0·00786	1 to 1·36
54·7	4·2 c.c.	0·00239	0·0060	1 to 2·51
67·4				
(temperature 100° to 100·5°C).				
61·	17 c.c.	0·0949	0·0243	1 to 0·256
28·4	5 c.c.	0·0203	0·0072	1 to 0·355
19·3	4 c.c.	0·00363	0·00572	1 to 1·57
22·7	2·5 c.c.	0·00193	0·00357	1 to 1·82
35·				
100° to 100·5°C).				
67·1	22·5 c.c.	0·0997	0·0322	1 to 0·323
30·7	7 c.c.	0·0208	0·01	1 to 0·481
25·	5·5 c.c.	0·00444	0·00786	1 to 1·77
27·5				
42·5				
100° to 100·5°C).				
50·	11 c.c.	0·0196	0·0157	1 to 0·8
(temperature 98° to 100°C.)				
24·3	9 c.c.	0·02467	0·01287	1 to 0·514
14·4	6 c.c.	0·00257	0·00858	1 to 3·34
10·1	3 c.c.	0·00091	0·00429	1 to 4·71
4·3	1 c.c.	0·000224	0·00143	1 to 6·39
8·9				
20·				

of experiments useless. As the solution of hypochlorite invariably contained free alkali, chloride and traces of chlorate, the amount of hypochlorite could not give results which might be compared. In order that the experiments should be strictly comparable the same sample of hypochlorite was diluted to requisite strengths, and then the tubes were partially filled. As in most cases preliminary experiments were made to know approximately the volume of oxygen disengaged from solutions of similar strength, the volumes of the tubes were so regulated that the internal pressures were very nearly the same in all. Duplicate experiments were in almost all cases made. The operation of filling was done as quickly as possible in the dark room, and the already narrow end of the tube drawn to a capillary bore in the blowpipe flame. When perfectly cold the end was sealed. In no case, however, did the time of complete operation exceed ten minutes. When the required number of tubes was ready they were at once introduced into the steam chamber heated to 100° C. After the required number of hours they were removed to the dark room and allowed to cool. The time required to heat the tubes to 100° C was thus very nearly the same as the time to cool down to the original temperature. Caustic soda dissolves oxygen to an appreciable extent, and the solubility, as with all gases, increases with pressure. The gas thus dissolved escapes slowly when the pressure is relieved, and as sufficient time could not be allowed for fear of decomposition, a small quantity was generally lost. The loss had no effect when the total volume of oxygen was considerable. Hence the volume of oxygen and therefore its weight should be taken as approximate, and not strictly accurate when the quantity was small. The ratio of the *chloratic* oxygen to free oxygen should also be taken in the same light under similar circumstances. The preceding table contains the results of numerous analyses performed at different times with solutions of different strength heated to different periods of time.

Comparing the percentage decompositions of a number of solutions in which relative quantities of free alkali, chloride, chlorate and hypochlorite are the same, but with gradually diminished absolute quantities, the following peculiarities are observed. The decomposition diminishes with dilution up to a certain point when it is minimum. Further diminution in concentration instead of diminishing increases the decomposition. This peculiar deportment of the hypochlorite solution is seen not only with similar solutions heated for different periods of time, but also in all solutions which have been examined some of which only are given. The ratios of hypochlorite to free alkali in the three solutions mentioned in the table are approximately in (A) 2 : 5, in (B) 2 : 2, and in (C)2 : 1. The relation between concentration and percentage decomposition is very strikingly shown in Plate IV.

The decomposition curves A. i, ii and iii of similar solutions are very nearly similar. There is a close resemblance between the curves B. i and ii. Special stress need not be given to the curve D because the solutions to which it corresponds were not heated to the same temperature as the other solutions. Referring however, to all the curves it is seen that the greatest depressions—minimum decompositions—lie very nearly in the same vertical line. The exact strength of the solution which decomposes least has not been determined, but it appears to lie intermediate between 1·5 and 1·7 per cent of Sodium hypochlorite. The influence of the other constituents can be neglected, as all the solutions containing widely different quantities of chlorate, chloride and free alkali lead to the same general conclusion. Taking 1·6 per cent to be the approximate number, the ratio between the number of molecules of water to sodium hypochlorite is easily calculated:

$$NaOCl \text{ (molecular weight } 74{\cdot}5) = 1{\cdot}6\ \%$$

$$H_2O \text{ (molecular weight } 18) = 98{\cdot}4\ \%$$

∴ no. of molecules of water : no. of molecules of sodium hypochlorite

$$\frac{98{\cdot}4}{18} : \frac{1{\cdot}6}{74{\cdot}5} :: 263 : 1.$$

In other words an aqueous solution of sodium hypochlorite is most stable when the number of molecules of the salt in solution is approximately 0·4 %. As the electric conductivity of such a solution has not been determined I cannot venture to offer any opinion as to what bearing it has on Arrhenius' theory of electrolytic dissociation. It seems probable that this number is different for different hypochlorites and from these numbers the ratio of the molecular weights of these compounds may be determined.

Leaving the curves of percentage decomposition in relation to concentration, the other curves of percentage decomposition with the duration of heating may be shortly noticed (Pl. V). All these lead to the same conclusion, namely the actual increase of decomposition during any interval diminishes as the time from which the initial decomposition began increases. The data however, for the present, are not sufficiently numerous for comparison of the different curves.

Referring to the columns (*g*) and (*h*) in the table,[1] it is seen that in all cases oxygen and a chlorate are simultaneously produced. The last column shows in the clearest manner that at the end of the first hour the amount of oxygen that is disengaged varies from one-fourth to one half of the quantity of oxygen fixed in the chlorate. As the duration of heating is prolonged the quantity of free oxygen increases, but in no case is this quantity greater than the oxygen of the chlorate, although

[1] *Ante*, p. 81.

the strength of the solution varies from 3 to 8·7 per cent. and the duration of heating from one to six hours and a half. As the strength of the solution diminishes the liberation of free oxygen increases. Comparing the ratios of the decomposition products in Ai, ii, iii and Bi and ii with D,[1] the nature of the decomposition is seen to vary perceptibly. The solutions in D are gradually heated, and it is doubtful whether at all they attain the temperature of 100° C. For the same weight of chlorate formed the quantity of oxygen diminishes with the rapidity with which the solutions are heated. In all probability, therefore, the first application of heat on a rather strong solution of sodium hypochlorite causes it to be entirely transformed into chlorate according to the generally accepted equation

$$3\,NaClO = NaClO_3 + 9\,NaCl.$$

As the quantity of chlorate increases another reaction sets in:

$$2\,NaClO = 2\,NaCl + O_2.$$

These two equations being interdependent, I have not found it possible to express the transformation by a simple equation.

Note on the Decomposition of Mercurous Chloride and Estimation of Free Chlorine.—*By* JYOTIBHUSHAN BHADURI, M.A. *Communicated by the President.*

[Recd. 25th March, Read 1st April, 1896.]

In the previous paper "On the transformation of hypochlorites" mention was made of the fact that under certain circumstances a solution of sodium hypochlorite gave out chlorine. More recent quantitative experiments[2] prove that in very nearly alkali-free solutions oxygen and chlorine are simultaneously liberated. The analysis of such a mixture without loss of unaltered hypochlorite is not an easy matter.

The solution contains, to begin with, a chloride, hypochlorite and a trace of chlorate. It may at the very beginning contain a small quantity of free alkali, but after decomposition, especially when heated from 150° to 160° C., the silica of the glass is dissolved by the alkali, forming soluble silicates. Moreover, free alkali and free chlorine can not exist side by side in the same solution.

Separation of chlorine and hypochlorous acid.

In neutral or alkaline solutions chlorides and chlorates of the alkali metals have no action on mercury. Free chlorine combines with it, when the mercury is present in excess, forming mercurous chloride. Hypochlorites form

[1] Plate IV.

[2] The results of which will be communicated later on.

mercuric oxide.[1] Sometimes, however, chlorine and a hypochlorite by their mutual decomposition form free hypochlorous acid.[2] This acid combines with mercury and forms mercuric oxychloride, a substance as insoluble in water as mercurous chloride. When, therefore, such a solution, containing mercurous chloride, mercuric oxide or oxychloride, free mercury, and soluble chloride and chlorate, is filtered, the first three remain on the filter paper. The residue is then thoroughly washed and then treated with the least excess of dilute hydrochloric acid and the residue of mercurous chloride and free mercury thoroughly washed. The quantity of mercury existing as mercuric chloride in the second filtrate[3] will give the amount of hypochlorous acid. Free chlorine is represented by mercurous chloride. The chlorine of the last named substance is generally estimated by decomposing the compound after gentle digestion with alkali hydrate (fixed).[4] Some volumetric determinations having given tolerably accurate results,[5] the following analyses were made to see whether the decomposition is complete or not. The sample of chloride was first treated with hot water and then repeatedly with cold water and finally with rectified spirit in the filter pump. It was then dried in the steam bath for two hours when its weight was found constant. Absence of any soluble mercury salt was proved by treating a small quantity with hot water and passing sulphuretted hydrogen through the filtrate.

Action of cold alkali on mercurous chloride.

No.	Wt. of Hg Cl grams.	Wt. of Ag Cl.	Corresponding chlorine.	% of Cl.	Remarks.
D.	1·5600	..	·2300	14·75	Excess of Ag NO_3 added and titrated by Vohlard's method.
E.	3·1958	1·9358	·4805	15·02	Gravimetric method.
F.	2·2351	1·3577	·3358	15·02	„ „ (Gooch's crucible).
G.	1·9444	1·1800	·2919	15·02	Gravimetric method (Gooch's crucible).

[1] According to the following equation :—Na O Cl + Hg = Hg O + Na Cl.

[2] The reaction is most probably Na (O Cl) + Cl_2 + H_2O = NaCl + 2HOCl. (S. C. J. 1885, 722).

[3] For Hg O, $HgCl_2 + 2HCl = 2HgCl_2 + H_2O$.

[4] Watt's Dic. Chem. (new edition) Vol. iii. p. 316. Fresivius, Quant. Anal. 7th Ed., p. 360. Fremy in his Encycl. Chem. does not mention anything.

[5] For these I am indebted to my elder brother, Babu Chandrabhushan Bhaduri, B.A. The silver solution was weaker than it was supposed to be, so the value of chlorine was very near the truth. On recalculation the difference is found to be about 2 per cent.

No.	Wt. of Hg Cl grams.	Wt. of Ag Cl.	Corresponding chlorine.	% of Cl.	Remarks.
H.	1·6022	·9721	·2405	15·01	
J.	3·7957	2·2822	·5646	14·87	
K.	1·5163	·9219	·2281	15·04	Solution heated.
L.	2·4107	1·4410	·3565	14·79	
M.	2·6857	1·6017	·3962	14·75	
Z.	1·4826	...	·2219	14·97	
A′.	1·8000	...	·2659	14·77	Volumetric method with chromate indicator.
B′.	3·9362	...	·5837	14·83	

The theoretical percentage of chlorine is 15·07. The estimation of chlorine has been made in the gravimetric way at least twenty times. In each case the result has been found to be lower than the theoretical quantity. The final washing was in each case tested for chlorine. Some of the results, however, agree among themselves. Hence it appears that the decomposition is never complete and is dependent upon other circumstances. It is also evident from the previous experiments that the amounts which are obtained when the solutions are heated agree more with the theoretical quantity than those obtained from cold solutions. In some of these experiments the alkali remained in contact overnight with no better results.

Action of boiling caustic-soda on mercurous chloride.

The action of heat was next tried. The weighed quantity of mercurous chloride was treated with an excess of pure sodic hydrate solution and the whole heated nearly to the boiling point for about fifteen minutes and when cold filtered. The residue was once more treated with caustic soda and then thoroughly washed. The chlorine in the filtrate after acidification was determined as before. In titrating this liquid with standard silver nitrate solution, I have found it convenient to slightly acidify the solution with dilute nitric acid and then evaporate to a small bulk, say 25 to 30 c.c. with excess of pure precipitated calcium carbonate. The following table contains some of the results of the analyses :—

No.	Wt. of Hg Cl. grams.	Wt. of Ag Cl.	Wt. of Cl. grams.	% of Cl.	Remarks.
N	·9634	...	·1452	15·06	Volumetric process.
Q	1·4466	·8800	·2177	15·05	Gravimetric ,,
R	1·7190	1·0465	·2589	15·06	,, ,,
S	1·7648	1·0748	·2650	15·07	,, ,,
V	·8927	...	·1346	15·08	Volumetric ,,

These results closely agree not only among themselves but also with the theoretical quantity. But they appear to be very slightly low. The reason probably appears to be this. Mercurous oxide dissolves to a small extent in water and caustic soda solution. When, however, such a solution is acidified with dilute nitric acid, slight opalescence is sometimes noticed. On subsequent addition of silver nitrate, silver chloride is precipitated, and this carries down with it traces of mercurous chloride. Silver chloride before it is weighed is heated to incipient fusion, a temperature sufficient to volatilize traces of mercurous chloride. Thus a trace of chlorine is lost. Sufficient stress cannot be given to this explanation, as the difference between actual and theoretical quantities can be reduced to a trifling amount by careful manipulation.

It is evident from the above experiments in conjunction with those mentioned before, that neither gentle warming nor prolonged contact in the cold is sufficient to bring about complete decomposition of the mercurous chloride by solution of caustic soda. The coating of mercurous oxide and the repellent tendency of mercurous chloride to become moistened with water prevent intimate contact with the solution. Complete decomposition is only obtained when the solution is heated to the boiling point and, to be certain, repeating the operation once more with fresh solution of the alkali.

Solubility of mercurous oxide in water.

When the precipitate of mercurous oxide is heated with water or solution of caustic soda and then filtered in the hot state, the filtrate after acidification with pure hydrochloric acid is at once turned brownish black when sulphuretted hydrogen is passed through. On heating, the precipitate settles rapidly and this black substance gives all the reactions of mercury. As already mentioned, there was no soluble salt of mercury in the residue. It dissolved with slight separation of mercury in pure dilute nitric acid and this solution gave no precipitate, not even opalescence with silver nitrate. It is therefore evident that the whole of chlorine must have been eliminated in the form of soluble chloride, and the presence of mercury in the filtrate is due to the solution of mercurous oxide in water (mercuric oxide and metallic mercury, the products of decomposition being practically insoluble, the former 1 in 1,50000). In cold water too, mercurous oxide dissolves to a small exten.

Summary.

The best method of procedure, therefore, is to decompose the mercurous chloride by the alkali at the boiling temperature but to filter when cold and wash with cold water. Volumetric estimations of chlorine and silver have been tried but they appear to me to be less trustworthy than these estimations obtained gravimetrically.

Natural History Notes from the R. I. M. Survey Steamer 'Investigator,' *Commander C. F. Oldham, R. N.*, commanding. Series II, No. 21. *An Account of the Deep Sea Crustacea collected during the season* 1894-95,—*By* A. R. S. Anderson, B. A., M. B., *Surgeon Naturalist to the Survey.*

[Received 28th April—Read 6th May.]

The following paper gives a description of the 56 species of Crustacea, excluding Cirripeds, Amphipods and Pagurids collected by the R. I. M. S. 'Investigator' during the working season 1894-95.

From the middle of October 1894 to the beginning of January 1895, while at work in the Arabian Sea between Cape Monza—some 20 miles to the west of Karachi and Bombay—four hauls of the trawl were made between 100 and 200 fms.; but, with the exception of large numbers of *Selenocera hextii*, no crustaceans were obtained.

In the same area, two hauls were effected at 890 and 947 fms. and resulted in the capture of respectively 8 and 11 different species of crustaceans; of these only four are new to the Indian fauna, *viz. Acanthephyra cristata*, Faxon, *Nephropsis Suhmi*, Bate, *Calastacus investigatoris* and *Galacantha trachynotus*, the two last being hitherto undescribed species. One Isopod, *Aega* sp., was also obtained at 947 fms., and is new to our record and apparently new to science.

On the passages between Bombay and Trincomali and *vice versâ* 6 trawls, varying in depth from 637 to 931 fms. were made and resulted in the capture of 0, 4, 6, 5, 7 and 8 species of crustaceans. Four of these species were new to the Indian fauna, but of these two, *Nephropsis Suhmi* and *Galacantha trachynotus*, were also obtained this season between Karachi and Bombay: the remaining two species were *Eucopia sculpticauda* and *Bentheuphausia amblyops*.

In four trawls between 180 and 406 fms. 5, 7, 3 and 21 species of crustaceans were obtained, of which 5 only are new to the Indian record, and of these one had also been captured at 951 fms. this season; 3 of the remainder, *Pandalus alcocki* and *Munidopsis wardeni*, both from 406 fms., and *Trichopeltarion ovale* from 180 fms. prove to be new species. The fifth, *Lithodes agasizii* from 406 fms., is the first recorded specimen of a *Lithodes* from Indian waters.

List of the stations, over 200 fms. from which crustaceans were obtained.

Station No.	Lat. N.	Long. E.	Depth in fathoms.	Corrected bottom temp. F.	Surface temp. F.	Nature of bottom.
183	23°08′22″	65°49′45″	890	40°.5	72°	Soft gray mud.
184	22°14′25″	67°08′55″	947	40°.5	75°.5	Soft gray mud.
192	15°11′	72°28′	912–931	39°.5	81°	Soft gray mud.
193	15°11′	72°28′	931	39°.5	81°	Soft gray mud.
194	13°47′	72°3′45″	891	41°	81°	Soft gray mud.
197	9°34′57″	75°36′30″	406	48°	81°.8	Green mud.
198	8°55′	81°17′30″	764	42°.25	81°	Green mud.
199	8°40′	81°27′35″	800–637	41° 42°.25	83°.5	Green mud.
201	8°29′05″	81°31′35″	320–295	49° 49°.8	84°.5 85°	Green mud.
203	5°50′30″	80°25′30″	364	48°	85°.5	Green mud.
204	6°50′20″	79°36′	180–217	53°	84°.8	Broken coral.

MALCOSTRACA.

Order SCHIZOPODA.

Family **Lophogastridæ.**

GNATHOPHAUSIA, W.-Suhm.

1. *Gnathophausia brevispinis*, Wood-Mason.

Wood-Mason, Ann. Mag. Nat. Hist., (6) VII., 1891, p. 188, and Oct. 1891, pp. 269, 270; Faxon, Mem. Mus. Comp. Zool., Vol. XVIII., pp. 216–218, pl. J.

Arabian sea; Station 184; 947 fms.

2. *Gnathophausia zoëa*, Suhm, G. O. Sars.

G. O. Sars, Challenger Schizopoda, p. 44, pl. vi., figs. 6–10; A. Milne Edwards Rec. Fig. Crust., pl. 7; Alcock and Anderson, J. A. S. B., Vol. LXIII., pt. ii., 1894, p. 143; Faxon, Mem. Mus. Comp. Zool., Vol. XVIII., p. 215.

? G. Sarsii, Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 187.

Colour in life, bright scarlet.

Arabian sea, Station 183, 890 fms.

Family **Eucopiidæ.**

Eucopia, Dana, G. O. Sars.

3. *Eucopia australis*, Dana, Sars.

Dana, U. S. Explor. Exped., Crustacea, pt. i., p. 609, pl. 40, fig. 10 a–m; G. O. Sars, 'Challenger' Schizopoda, p. 55, pls. ix. and x.; Wood-Mason Ann. Mag. Nat. Hist., Oct. 1891, p. 270; Faxon, Mem. Mus. Comp. Zool., Vol. XVIII., pp. 218, 219.

Six specimens were obtained, 5 of these being captured in the same haul with an equal number of *Eucopia sculpticauda*.

Stations 183 and 198; 890 and 764 fms.

4. *Eucopia sculpticauda*, Faxon.

W. Faxon, Bull. Mus. Comp. Zool., Vol. XXIV., No. 7, 1893, p. 218; *Id.*, Mem. Mus. Comp. Zool., Vol. XVIII., pp. 219–221, pl. k., fig. 2, 2*d*, pl. liii., fig. 1–1*d*.

Eight specimens, varying in length from 21 to 75 millim., were captured at depths ranging from 406 down to 931 fms. Unfortunately all the specimens, owing to the great delicacy of their tissues and the tenuity of their legs, are more or less imperfect, although in some the deficiency merely amounts to an abbreviation of the antennal flagella.

This species differs from *Eucopia australis* and from Sars' definition of the genus in the presence of small branchiæ at the base of the last pair of legs.

Colour in life, dark crimson lake. Eyes brown in spirit.

New to the Indian fauna.

Stations 193, 197, 198 and 199; 931, 406, 764 and 800—637 fms. respectively.

Family **Euphausiidæ.**

Bentheuphausia, G. O. Sars.

5. *Bentheuphausia amblyops*, G. O. Sars.

G. O. Sars, 'Challenger' Schizopoda, pp. 109–114, pl. xix.

New to the Indian fauna.

Station 198; 764 fms.

Order DECAPODA.

Sub-order MACRURA.

Tribe *PENÆIDEA.*

Family **Penæidæ.**

Sub-family *Parapenæina.*

Parapenæus, S. I. Smith.

6. *Parapenæus fissurus*, (Sp. Bate.)

Penæus fissurus, Sp. Bte., 'Challenger' Macrura, p. 263, pl. xxxvi. fig. 1; *Para-*

penæus fissurus, Alcock and Anderson, J. A. S. B, Vol. LXIII., Pt. ii., 1894 p. 144.

Colours in life, white mottled with red.

Off west coast of Ceylon, Station 204; 180–217 fms.

Sub-family *Solenocerina.*

SOLENOCERA Lucas.

7. *Solenocera hextii*, Wood-Mason.

Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 188, and Oct. 1891, p. 275 Alcock and Anderson, J. A. S. B., Vol. LXIII. Pt. ii., 1894, p. 145; and Ill. Zoo. R. I. M. S. 'Investigator,' Crustacea, Pt. iv., pl. xxvi. fig. 5 (to be published in 1896).

Hitherto this species has only been recorded from the Bay of Bengal ranging as far east as Chittagong. This season it was obtained in large numbers in the Arabian Sea off the mouths of the Indus at depths varying from 35 to 170 fms. on a muddy bottom.

HALIPORUS, Spence Bate.

8. *Haliporus æqualis*, Sp. Bate.

Spence Bate, 'Challenger' Macrura, p. 285, pl. xli., fig. 1; and Alcock and Anderson, J. A. S. B., Vol. LXIII, pt. ii., 1894, p. 140.

Off Cochin coast, Station 197, 406 fms.

Sub-family *Aristæina.*

ARISTÆUS, Duvernoy, Wood-Mason.

9. *Aristæus crassipes*, Wood-Mason.

Wood-Mason Ann. Mag. Nat. Hist, Oct. 1891, pp. 281, 282. fig. 7; Alcock and Anderson, J. A. S. B., Vol. LXIII, pt. ii., 1894, p. 147.

Many specimens, exhibiting the marked sexual differences previously described, were trawled off the Cochin coast at Station 197, 406 fms.

10. *Aristæus semidentatus*, Sp. Bate.

Hemipenæus semidentatus, Spence Bate, 'Challenger' Macrura, p. 305, pl. xlix. fig. 1; *Aristæus semidentatus*, Wood-Mason, Ann. Mag. Nat. Hist., Oct. 1891, p. 280 and Alcock and Anderson, J. A. S. B., Vol. LXIII., pt. ii., 1894, p. 146.

Colour in life, red.

Station 201; 320–296 fms.

Sub-family **Benthesicymina.**

GENNADAS, Spence Bate.

11. *Gennadas parvus*, Spence Bate.

Spence Bate, Ann. Mag. Nat. Hist. (5) viii., p. 191, and 'Challenger' Macrura,

p. 340, pl. lix.; Wood-Mason and Alcock, Ann. Mag. Nat. Hist., Feb. 1891, p. 189 and Oct. 1891, p. 286.

Stations 193, 194 and 198; 931, 891 and 764 fms. respectively.

Family **Sergestidæ**.

SERGESTES, Edw.

12. *Sergestes rubroguttatus*, Wood-Mason.

Wood-Mason, Ann. Mag. Nat. Hist., Nov. 1891, pp. 354, 355, fig. 10.

South of Ceylon, Station 198, 764 fms.

13. *Sergestes robustus*, Smith.

S. I. Smith, Rep. U. S. Fish. Comm., 1882, (1884), p. 416, pl. viii., figs. 3–6, and 1885 (1886), p. [93], pl. xx., fig. 6; and Bull. Mus. Comp. Zool., X., p. 97, pl. xvi., figs. 5–8; Alcock and Anderson, J. A. S. B., Vol. LXIII., pt. ii., 1894, p. 148.

Colour in life, crimson dots on a colourless background, the intestinal tract showing through the transparent body-wall as a crimson tube.

Stations 194, 197 and 203; 891, 406 and 364 fms.

Tribe *CARIDEA*.

Family **Glyphocrangonidæ**.

GLYPHOCRANGON, A. Milne-Edwards.

14. *Glyphocrangon unguiculata*, Wood-Mason.

Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, pp. 193, 194; and Ill. Zool. 'Investigator,' Crustacea, Pt. ii., pl. vii., fig. 2.

Five females from the Arabian sea, Station 184; 947 fms.

15. *Glyphocrangon prionota*, Wood-Mason.

Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 192; Alcock and Anderson, J. A. S. B., Vol. LXIII., Pt. ii., 1894, p. 151; and Ill. Zool. 'Investigator,' Crustacea, Pt. ii., pl. vi., fig. 1.

Many male and female specimens, both young and adult, were taken in the Arabian sea at Stations 183, 184 and 193; 890, 947 and 931 fms. respectively.

Family **Pandalidæ**.

PANDALUS, Leach.

16. *Pandalus alcocki*, n. sp.

This species bears a considerable resemblance to *Nothocaris binoculus*, Sp. Bte., but differs from it in the following particulars. The

dorsal carina begins near the middle of the carapace and in the gastric region supports four movable spines which gradually increase in length from behind forwards. The rostrum, about 1⅓ as long as the carapace, is armed dorsally with 2 fixed teeth, the posterior situated midway between its fellow and the anterior movable spine and above the centre of the cornea. In front of these teeth the rostrum slopes downwards as far as the extremity of the first antennal base; thence it becomes straight and ascends slightly to near its tip where it again assumes a gentle downward curve. Except for the two teeth near the base it is dorsally unarmed, while its lower margin is 4–7 toothed, the number of teeth increasing with the size of the specimen.

The eye bears no ocellus distinct from the large cornea.

The meri of the last three thoracic legs are armed on their lower margins with a few teeth, that of the 5th leg bears the fewest or none, that of the 3rd the largest number of teeth, while the 4th bears an intermediate number.

The telson is shorter than the caudal plates.

Colour in life red. Eggs very minute and numerous.

Many specimens, both males and ovigerous females, from Station 406 fms.

PLESIONIKA, Spence Bate.

17. *Plesionika bifurca*, Alcock and Anderson.

Alcock and Anderson, J. A. S. B., Vol. LXIII., pt. ii., 1894, pp. 155 and 156.

Station 197; 406 fms.

Family **Acanthephyridæ**.

ACANTHEPHYRA, A. Milne-Edwards.

18. *Acanthephyra brachytelsonis*, Sp. Bate.

Spence Bate, 'Challenger' Macrura, p. 753, pl. cxxvi., fig. 7; Wood-Mason, Ann. Mag. Nat. Hist., May 1892, pp. 362, 363, fig. 4; Alcock and Anderson, J. A. S. B., Vol. LXIII., pt. ii., 1894, p. 156; and Ill. Zool. R. I. M. S., 'Investigator,' Crustacea, pl. iii., fig. 2.

The largest specimen obtained this year measured 157 millim. from tip of rostrum to the end of telson.

Stations 183, 184, 192, 193, 194 and 199; 890, 947, 912-931, 931-991 and 800-637 fms. respectively.

19. *Acanthephyra armata*, A. M. E., var. *fimbriata*, W.-M.

Wood-Mason, Ann. Mag. Nat. Hist., May 1892, p. 359, fig. 2; Alcock and Anderson, J. A. S. B., Vol. LXIII., pt. ii., 1894, p. 156; and Ill. Zool. R. I. M. S. 'Investigator,' Crustacea, pt. i., pl. iii., fig. i.

Station 197; 406 fms.

20. *Acanthephyra curtirostris*, Wood-Mason.

Wood-Mason, Ann. Mag. Nat. Hist. (6) VII., p. 195, and Ann. Mag. Nat. Hist., May 1892, pp. 364, 365 and fig. 5; Ill. Zool. R. I. M. S. 'Investigator,' pl. iii., fig. 4: Faxon, Mem. Mus. Comp. Zool., Vol. XVIII., pp. 164–167, pl. xliii., figs. 2–5.

In four small specimens obtained this year, the largest of which is an ovigerous female 36 millims. in length, the tooth on the antero-inferior margin of the laminar part of the rostrum is absent.

At the distal end of the dorsal surface of the carpus of the 1st pereiopods is a small blunt recurved tubercle, and, leading to it, an oblique line of short stout hairs on the inner surface of the palms of the same pair of legs.

Both margins of the inner, and the inner margin of the outer, plate of the swimmeret are minutely serrate.

Stations 198 and 203; 764 and 364 fms.

21. *Acanthephyra cristata*, Faxon.

Faxon, Bull. Mus. Comp. Zool., XXIV., 206, 1893; Memoirs Mus. Comp. Z Vol. XVIII., pp. 162–164, pl. xliii., fig. 1, 1*a*, 1*b*: Ill. Zool. R. I. M. S. 'Inv gator,' Crustacea, pt. iv., pl. xxv., figs. 2, 2*a*.

The end of the telson, which was wanting in both Faxon's sp mens, is prolonged into a sharp spine armed on both sides with mov teeth, of which one on each side at a little distance from the specially large and strong. Both margins of the inner and the i margin of the outer plate of the swimmeret are minutely serrate clothed with long silky hairs.

Colour in life, dark crimson.

Length from tip of rostrum to end of telson 67·5 millims.

Station 183; 890 fms.

HOPLOPHORUS, EDW.

22. *Hoplophorus gracilirostris*, A. Milne-Edwards.

A. Milne-Edwards, Ann. Sci. Nat. Zool., (6) XI. 4, p. 6; and Rec. Fig. Crust.; Wood-Mason and Alcock, Ann. Mag. Nat. Hist., May 1892, p. 365; and Alcock and Anderson, J. A. S. B., Vol. LXIII., pt ii., 1894, p. 157.

Several specimens from stations 201 and 203; 320–296 and 364 fms. When placed in a tub of water they swam about with grea vigour, but were unable to maintain an upright position, always turning over on one side. They would appear, as previously mentioned, to live at no great depth, as the specimens of *Lyreidus*, *Ethusa*, *Uroptychus* and *Nephropsis*, all bottom dwellers, which were captured at the same stations as the *Hoplophorus*, were quite dead on reaching the surface.

Colour in life bright transparent red with golden coloured glisten-

ing patches on merus of last three thoracic legs, on carpus and coxa of 5th pair of legs and on the abdominal pleuræ. Telson and uropods colourless. Eggs purplish red.

EPHYRINA, S. I. Smith.

23. *Ephyrina hoskynii*, Wood-Mason.

Wood-Mason, Ann. Mag. Nat. Hist., February 1891, p. 194.

Stations 183 and 199; 890 and 800-637 fms. respectively.

Family **Palæmonidæ.**

PALÆMONELLA, Dana.

24. *Palæmonella laccadivensis*, Alcock and Anderson.

Alcock and Anderson, J. A. S. B., Vol. LXIII., pt. ii., 1894, p. 157; and Ill. Zool. R. I. M. S. 'Investigator,' Crustacea, pt. iv., pl. xxvi., fig. 4 (1896).

The rostrum, in the larger specimen obtained this year, is deeper, more horizontal and bears only nine spines on its upper margin, a wider wide interval separating the 1st from the 2nd and the 8th from the 9th spines.

The fingers of the larger of the 2nd pair of legs are flattened so as to form two broad opposing surfaces, end in recurved hooks, and are furnished each in its proximal half with two small sharp interlocking denticles in addition to the blunt tubercle which the movable finger bears close to its articular end.

A female, bearing very numerous small eggs, and measuring 50 millims. from tip of rostrum to end of telson was trawled at Station 197, 406 fms.

Family **Pasiphæidæ.**

PHYE, Wood-Mason.

25. *Phye alcocki*, Wood-Mason.

Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1893, p. 164; and Ill. Zool. 'Investigator,' Crustacea, pt. i., pl. iii., fig. 5.

Stations 184 and 197; 947 and 406 fms.

Family **Nematocarcinidæ.**

NEMATOCARCINUS, A. Milne-Edwards.

26. *Nematocarcinus gracilis*, Sp. Bte.

Spence Bate, 'Challenger' Macrura, p. 815, pl. cxxxii., fig. 8; and Alcock and Anderson, J. A. S. B., Vol. LXIII., pt. ii., 1894, p. 160.

Station 197; 406 fms.

ing patches on merus of last three thoracic legs, on carpus and coxa of 5th pair of legs and on the abdominal pleuræ. Telson and uropods colourless. Eggs purplish red.

EPHYRINA, S. I. Smith.

23. *Ephyrina hoskynii*, Wood-Mason.

Wood-Mason, Ann. Mag. Nat. Hist., February 1891, p. 194.

Stations 183 and 199; 890 and 800-637 fms. respectively.

Family **Palæmonidæ.**

PALÆMONELLA, Dana.

24. *Palæmonella laccadivensis*, Alcock and Anderson.

Alcock and Anderson, J. A. S. B., Vol. LXIII., pt. ii., 1894, p. 157; and Ill. Zool. R. I. M. S. 'Investigator,' Crustacea, pt. iv., pl. xxvi., fig. 4 (1896).

The rostrum, in the larger specimen obtained this year, is deeper, more horizontal and bears only nine spines on its upper margin, a ...er wide interval separating the 1st from the 2nd and the 8th from ...9th spines.

The fingers of the larger of the 2nd pair of legs are flattened so as ...rm two broad opposing surfaces, end in recurved hooks, and are ...ished each in its proximal half with two small sharp interlocking ...rcles in addition to the blunt tubercle which the movable finger ...es close to its articular end.

A female, bearing very numerous small eggs, and measuring 50 ...ms. from tip of rostrum to end of telson was trawled at Station 197, ...fms.

Family **Pasiphæidæ.**

PHYE, Wood-Mason.

25. *Phye alcocki*, Wood-Mason.

Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1893, p. 164; and Ill. Zool. 'Investi...gator,' Crustacea, pt. i., pl. iii., fig. 5.

Stations 184 and 197; 947 and 406 fms.

Family **Nematocarcinidæ.**

NEMATOCARCINUS, A. Milne-Edwards.

26. *Nematocarcinus gracilis*, Sp. Bte.

Spence Bate, 'Challenger' Macrura, p. 815, pl. cxxxii., fig. 8; and Alcock and Anderson, J. A. S. B., Vol. LXIII., pt. ii., 1894, p. 160.

Station 197; 406 fms.

Tribe *ASTACIDEA.*

Family **Homaridæ.**

PHOBERUS, A. Milne-Edwards.

27. *Phoberus cæcus*, A. Milne-Edw., var. *sublevis*, W.-M.

Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 197; Alcock and Anderson, J. A. S. B., Vol. LXIII., pt. ii., 1894, p. 21.

The female, captured this year at Station 192, 912–931 fms., differs both from the female taken last year and from the male previously caught in possessing 2 spines on the upper margin of the rostrum.

Length, from tip of rostrum to end of telson, 122 millims.

NEPHROPSIS, Wood-Mason.

28. *Nephropsis Stewarti*, Wood-Mason.

Wood-Mason, J. A. S. B., 1873, Vol. LXIII., pt. 2, p. 39, pl. iv.; and Ann. Mag. Nat. Hist., (4) XII., 1873, p. 59; A. Milne-Edwards, Ann. Sci. Nat. Zool., (5) XIX. pl. xx., figs. 1–3; and Alcock and Anderson, J. A. S. B., Vol. LXIII., pt. ii., 18 p. 161; Illustrations of the Zoology of the R. I. M. S. 'Investigator,' Crust pt. iv., pl. xxvii., figs. 1, 1a.

A male, measuring 141 millim, from tip of rostrum to end of te was captured at Station 197; 406 fms.

29. *Nephropsis atlantica*, Norman.

Norman, P. R. S., Edin., 1881-82, Vol. XI., p. 684; Wood-Mason and A Ann. Mag. Nat. Hist., Feb. 1891, p. 198, fig. 4; and Alcock and Anderson, J. A. Vol. LXIII., pt. ii., 1894, p. 162.

Station 201; 320–296 fms.

30. *Nephropsis suhmi*, Sp. Bate.

Spence Bate, 'Challenger' Macrura, pp. 181–183, pl. xxiii., fig. 3, and pl. xx fig. 2.

Seven specimens of this species, which is new to the Indian faun varying from a male of 83 millims, and a female of 82·6 millims., to 32 millims. in length, were captured at 5 stations at depths between 890 and 947 fms. The teeth on the anterior margins of the pleura of the first four abdominal somites vary both in size and numbers; in some case none in others one large and two smaller teeth are present.

In a specimen 83 millims. in length the flagellum of the 1st antenn measures 25 millims., that of the 2nd antenna 186 millims.

The absence of a joint in the outer plate of the caudal swimmeret was both noted and figured by Spence Bate; but, owing to the smallness and immaturity of his single specimen, he seems to have been doubtful of the permanence of this character. In none of these

specimens is there any vestige of a joint in these plates. This character at once serves to distinguish *Nephropsis suhmi* from the other three ndian species of this genus, *atlantica*, *stewarti* and *carpenteri*, in all of the joint is very apparent. Indeed it isolates this species from r Homarids and forms a connecting link with the nearly allied *ie*.

our in life pale orange with a broad whitish stripe on the of the abdomen and posterior part of the carapace. Antennal urless. Hairs on dactyli of last 4 pereiopods crimson. Cornea

ns 183, 184, 192, 193, 194; 890, 947, 912-931, and 891 fms. ly.

Family **Callianassidæ.**

Calocaris, Bell.

31. *Calocaris macandreæ*, Bell.

lcock and Anderson, J. A. S. B., Vol. LXIII., pt. ii., 1894, p. 163, where of references is given.

Three very small specimens, the largest only 24 millims. in length, captured off the east coast of Ceylon at Station 199, 800-637

Family **Axiidæ.**

Calastacus, Faxon.

32. *Calastacus investigatoris*, n. sp.

Female. This species very closely resembles *Calastacus stilirostris*, xon, only differing in the following points. The carapace is covered th small granules, and dorsally markedly carinate. The carina extends om the base of the rostrum to within a short distance of the sterior border of the carapace, where it ends in a small denticle. A milar denticle is found on the carina in the centre of the gastric area. The rostrum is triangular and dorsally flattened, its lateral margins extending a short distance back on the sides of the carapace as a pair f elevated ridges each bearing a couple of acute anteriorly directed eth, the posterior of which is considerably larger than the anterior.

The eyestalks are short and conical without any trace of a cornea.

Both the fixed and movable spines of the second joint of the second antennae are very short, only reaching about one-quarter the length of the third joint.

The upper border of the merus of the great chelipeds is armed

with one large distal and 3 or 4 small spines; those on the lower margin of this joint are subequal. On the infero-external margin of the hand is a row of spinules.

The borders of the suture in the outer plate of the swimmer destitute of spinules; the outer margin of this plate is arm 3 small spines, the smallest near the centre, the largest on th of the suture, and the third midway between these two. The border of the inner plate of the swimmeret is not furnishe spine.

Length of carapace exclusive of rostrum 18·5 millim 3·75 millim., abdomen 32·4 millim., cheliped 27 millim., cheliped 9·75 millim., dactylus of cheliped 11 millim. Colo abdomen light brown, carapace very pale pink dorsally fa slate colour on the sides.

Station 184; 947 fms., 2 females.

Tribe *ERYONTIDEA.*

Family **Eryontidæ.**

PENTACHELES, Spence-Bate.

33. *Pentacheles gibba*, Alcock.

Alcock, Ann. Mag. Nat. Hist., Vol. XIII., March 1894, p. 234; and Ill R. I. M. S. 'Investigator,' Crustacea, pt. ii., pl. viii., fig 4.

A male, measuring 135 millims., from tip of rostral spine t of telson, only differs from the description of the female in having first abdominal appendages well developed; the fifth pair of thor legs are chelate.

Arabian sea, Stations 192 and 193; 912–931 and 931 fms.

34. *Pentacheles phosphorus*, Alcock.

Alcock, Ann. Mag. Nat. Hist., Vol. XIII., March 1894, p. 240; Alcock a Anderson, J. A. S. B., Vol. LXIII., pt. ii., 1894, p. 165; and Ill. Zool. R. I. M. 'Investigator,' Crustacea, pt. ii., pl. viii., fig. 2.

Off the Cochin coast, Station 197; 406 fms.

Tribe *SCYLLARIDEA.*

Family **Scyllaridæ.**

ARCTUS, Dana.

35. *Arctus rubens*, Alcock and Anderson.

Alcock and Anderson, J. A. S. B., Vol. LXIII., pt. ii., 1894, pp. 25 and 26.

Indian Ocean, Station 204; 180–217 fms.

Tribe *ANOMOLA.*

Family **Lithodidæ.**

LITHODES, Latreille.

36. *Lithodes agassizii*, S. I. Smith.

S. I. Smith, Bull. Mus. Comp. Zool., Vol. X. No. 1, 1882, pp. 8-11, pl. i.

A single small specimen, measuring only 9 millim. in length, exclusive of the rostral and posterior spines, was trawled off the Cochin coast at Station 197, 406 fms. The colour in life was pale pink, similar to the colour of the American examples as described in the 'Three voyages of the Blake.'

New to the Indian fauna.

Family **Galatheidæ.**

MUNIDA, Leach.

37. *Munida microps*, Alcock.

lcock, Ann. Mag. Nat. Hist., April 1894, p. 326.

One small immature specimen was trawled at Station 197; ms.

MUNIDOPSIS, Whiteaves.

38. *Munidopsis trifida*, Henderson.

enderson, 'Challenger' Anomura, p. 156, pl. xvi., fig. 2; and Alcock and rson, J. A. S. B., Vol. LXIII., pt. ii., 1894, p. 168.

One small specimen from Station 201, 296–320 fms.

39. *Munidopsis stylirostris*, Wood-Mason.

Wood-Mason, Ann. Mag. Nat. Hist., February 1891, p. 201; Alcock, Ann. Mag. t. Hist., April 1894, p. 328; Alcock and Anderson, J. A. S. B., Vol. LXIII., pt. ii., 94, p. 166; and Ill. Zool. R. I. M. S. 'Investigator,' Crustacea, pt. iii., pl. xiii., . 6.

Three ovigerous females and two males from the Arabian Sea, Station 184; 947 fms.

40. *Munidopsis wardeni*, n. sp.

This species is very closely related to *M. stylirostris*, W. M., but differs in the following particulars. 1. The carapace is hairier, flatter and broader. 2. The rostrum is relatively shorter and slopes gently downwards, its curve being nearly continuous with that of the anterior part of the carapace; its extreme tip is upturned. 3. The cornea are cylindrical and slightly curved. 4. The spine at the antero-lateral

angle of the carapace is much smaller and directed forwards and not obliquely outwards at an angle of about 45°. 5. The cervical groove is bounded posteriorly by a small spine; in *M. stylirostris* both groove and spine are very inconspicuous. 6. The merus of the cheliped has two rows of spines on its upper surface, one on the inner the other on the outer margin. 7. All the joints of the 2nd, 3rd and 4th thoracic legs are hairy. 8. The ridges bounding the transverse furrows of the 2nd–4th abdominal terga are spinulous not ctenate.

Colours in life were the same as those of *M. stylirostris;* milky orange dorsally, white ventrally, cornea yellow.

The length of the largest specimen, an egg-laden female, from tip of rostrum to end of telson is 50 millims.

Station 197; 406 fms., 2 egg-laden females and one male. There is also in the Indian Museum an ovigerous female from 30 miles W. of Middle Andaman Island, depth 480–500 fms.

41. *Munidopsis*, sp.

One small specimen, 9 millim. in total length, resembling *M. margarita*, Faxon, more closely than any other described species obtained at Station 201; 320–296.

ELASMONOTUS, A. Milne-Edwards.

42. *Elasmonotus cylindrophthalmus*, Alcock.

Alcock, Ann. Mag. Nat. Hist., Vol. XIII., April 1894, p. 333; and Ill. Zool. M. S. 'Investigator,' Crustacea, pt. iii., pl. xiii., fig. 4.

The single specimen obtained this year is a male. The chelipeds are unequal, the larger measuring 56 while the smaller measures millims. The palm of the larger cheliped is 16·75 millims. and the fingers 6 millims. in length. From tip of rostrum to end of telson 25·5 millims.

Station 197; 806 fms.

GALACANTHA, A. Milne-Edwards.

43. *Galacantha trachynotus*, n. sp.

This species is closely allied to *G. investigatoris*, Alc. and And., *bella*, Hend., and *rostrata*, A. M. E.

From the first it differs in the following points: 1. The carapace is covered with short sharp spiniform tubercles the tips of which are bent forwards. Anteriorly these tubercles are somewhat sparsely scattered but posteriorly they are more densely crowded together. 2. Slightly in front of the pair of gastric spinules is a small median

gastric spinule. 3. Immediately posterior to the cardiac is a small median spine resembling it in shape but only about one-quarter its length. 4. The posterior margin of the carapace is armed with a row of spiniform tubercles as also are both carinae of the 2nd, 3rd and 4th and the anterior margin of the 5th abdominal segments; the terga of the 5th and 6th abdominal segments are irregularly covered with small sharp granules while their pleura are almost smooth. 5. The upper surface of the meri and carpi of the 2nd–4th thoracic legs are covered with tubercles similar to those on the carapace. 6. The posterior margin of the dactyli of the 2nd–4th thoracic legs are 10–12 dentate. 7. The 1st, 2nd and 3rd antennal joints terminate in short sharp spinules.

From *G. bella* it differs: 1. In the distribution of tubercles on the abdominal segments and on the upper surfaces of the meri and carpi of the 2nd–4th thoracic appendages. 2. In the presence of spinules on the antennal joints. 3. In the presence of two median gastric and two median cardiac spines. 4. In the number of dentations in the posterior margin of the dactyli of the 2nd–4th thoracic legs. 5. In the cutting edges of the fingers of the chelipeds being straight.

From *G. rostrata* it differs: 1. In the presence of two gastric and two cardiac median spines. 2. In the two spines on the lateral margins of the carapace being subequal. 3. In the spinature of the natatory legs.

Colour in life milky orange.

A female specimen was obtained from each of the three Stations 192 and 193 at depths of 947, 912–931 and 931 fms. respectively.

Will be figured in the Illustrations of the Zoology of the R. I. S. 'Investigator,' Crustacea, Pt. iv., pl. xxv., figs. 3, 3*a*. (to be issued 1896).

Uroptychus (A. Milne-Edwards), Henderson.

44. *Uroptychus nitidus*, A. Milne-Edwards.

A. Milne-Edwards, Bull. Mus. Comp. Zool., Vol. VIII., 1880, p. 62; Henderson, Challenger,' Anomura, p. 174, pl. xxi., fig. 6; and Alcock and Anderson, J. A. S. B., pl. LXIII., pt. ii., 1894, p. 173.

An ovigerous female, coloured in life bright pink and with milk-white eggs was obtained from Station 201; 320–296 fms.

Sub-Order, BRACHYURA.

Tribe *ANOMOLA.*

Family **Raninidæ.**

LYREIDUS, de Haan.

45. *Lyreidus gracilis*, Wood-Mason.

Wood-Mason, J. A. S. B., Vol. LVI., pt. ii., 1887, p. 376; Alcock and Anderson J. A. S. B., Vol. LXIII., pt. ii., 1894, p. 175.

Twelve specimens from Station 197, 406 fms.; and four specimens from Station 201, 320–296 fms.

Family **Homolidæ.**

PAROMOLOPSIS, Wood-Mason.

46. *Paromolopsis boasi*, Wood-Mason.

Wood-Mason, Ann. Mag. Nat. Hist., March 1891, p. 268, fig. 5.

The largest specimen obtained this season measures from tip to tip of 4th thoracic legs (the longest) 314 millims.; breadth of carapace 50, length 52 millims.

The type of this species was dredged in the Andaman Sea in fms. The present specimens were obtained off the Cochin coast Station 197; 406 fms.

HYPSOPHRYS, Wood-Mason.

47. *Hypsophrys superciliosa*, Wood-Mason.

Wood-Mason, Ann. Mag. Nat. Hist., March 1891, p. 269; Alcock, J. A. S. Vol. LXII., pt. 2, 1893, p. 177; and Ill. Zool. R. I. M. S. 'Investigator,' Crust. pt. 3, pl. xiv., figs. 4, 4*a*.

Numerous specimens in all stages of growth and of both sexes were obtained from the Arabian Sea at Stations 183, 184, 192, 193, and 194 at depths of 890, 947, 912–931, 931 and 891 fms. respectively.

Tribe *OXYSTOMATA.*

Family **Dorippidæ.**

ETHUSA, Roux.

48. *Ethusa indica*, Alcock.

Alcock, Ann. Mag. Nat. Hist., Ser. 6, Vol. XIII., May 1894, pp. 405, 406; Alcock and Anderson, J. A. S. B., Vol. LXIII., pt. ii., 1894, p. 176; and Ill. Zool. R. I. M. S. 'Investigator,' Crustacea, pt. iii., pl. xiv., fig. 2.

In the males the chelæ are very unequal, one being very much stouter although not much longer than the other.

Colours in life—body French gray, legs pink.
Station 197; 406 fms.; 6 males, 8 females.
Station 201; 320–296 fms.; 1 male.

ETHUSINA, Smith.

49. *Ethusina gracilipes*, Miers.

Miers, 'Challenger' Brachyura, p. 332, pl. xxviii., fig. 3; and Alcock and Anderson, J. A. S. B., Vol. LXIII., pt. ii., 1894, p. 177.

Station 192; 912–931 fms.

Family **Leucosidæ**.

RANDALLIA, Stimpson.

50. *Randallia pustulosa*, Wood-Mason.

Wood-Mason, Ann. Mag. Nat. Hist., March 1891, p. 266.

The specimens captured this year are two immature females and small male. The abdominal segments of the former resemble those the male both in width and in forming a concavity. They differ h from the abdominal segments of the adult female which form a ked convex protuberance and extend nearly to the bases of the legs.
Station 197; 406 fms.

Family **Calappidæ**.

MURSIA, Desmarest.

51. *Mursia bicristimana*, Alcock and Anderson.

lcock and Anderson, J. A. S. B., Vol. LXIII., pt. ii., 1894, p. 197; and Ill. R. I. M. S. 'Investigator,' Crustacea, pt. iv., pl. xxiv., fig. 5, (to be issued 896).

The colours of this crab in life were: upper surface of leg and rapace pale bluish-white studded with orange red granules, lower rface white; fingers of chelipeds white, inner surface of merus of helipeds deep orange.

A large male, measuring 88 millim. from tip to tip of lateral spines and 47·8 millim. antero-posteriorly, was trawled at Station 204, off Colombo, 180–217 fms.

Tribe *CYCLOMETOPA*.

Family **Corystoidæ**.

TRICHOPELTARION, A. Milne-Edwards.

52. *Trichopeltarion ovale*, n. sp.

As unfortunately no male of this species has hitherto been obtained,

it is with some doubt that I assign it a place in the genus *Trichopeltarion*. The enlargement of the first joint of the antennal base, the production of the antero-internal angle of the ischium of the external maxillipeds, the absence of spines from the extremity of the merus, and the obliquity of the antero-internal angle of the same joint of the external maxilliped serve to separate it from *Hypopeltarion* at the same time showing its affinity to *Trichopeltarion*.

The carapace is egg-shaped, truncated posteriorly and slightly flattened dorsally, where it is covered with short stiff hairs and short tubercles the free extremities of which split into from 2–6 small teeth; in places the bases of two or more of these tubercles are confluent. Towards the margin of the carapace these multidentate tubercles are gradually replaced by conical, short, sharp spines. On the under surface of the carapace these diminish greatly in size and on the antero-internal part of the pterygostomian region become mere granules. The regions are defined by sulci.

A diamond-shaped sulcus, with its anterior extremity prolonged to the base of the rostrum and its posterior extremity ending in the [illegible] separating the median from the lateral regions, encloses about the [illegible] dle two-thirds of the dorsum. The rostrum is similar to that of *T. nobile*, but the tip of the central spine is broken off. It appears to have been not shorter than the lateral spines. External to these three spines a deep notch, in which the base of the external antenna is visible above, separates the three central from another large spine carrying a small spinule on its outer side.

From between this spine and the basal joint of the antenna protrudes the eye peduncle. The external maxillipeds resemble those of *T. nobile* except that the antero-internal border of the merus is not concave, but straight although oblique. The basal joints of the 2nd antennæ are relatively longer than those of *T. nobile*. The 2nd joint nearly reaches the tip of the 3 rostral spines and the 3rd joint much surpasses it. The ocular peduncle is long slender and slightly curved. Both corneæ have been accidentally destroyed. The orbit is bounded above by a large multicuspidate tubercle, separated by wide notches both from the tubercle from beneath which the eye emerges and from another multicuspidate tubercle which limits the orbit externally.

A very broad notch again separates this latter tubercle from the large spine-bearing tubercle which forms the floor of the orbit. The inner margin of this tubercle is straight and almost parallel with the outer margin of the first basal joint of the external antenna from which it is separated by a deep notch.

All the legs are covered with long coarse hairs.

The chelipeds (in the female) are sub-equal. The merus and ischium are curved to correspond with the much inflated branchiostomial region. The former is triangular in section and bears sharp spines on its upper and a few small spines on its lower external margins. The outer and upper surfaces of the carpus are covered with short sharp tubercles, of which one at the distal extremity is pre-eminent in size. The hand is vertically elongated and studded with four rows of small tubercles on its outer side and some scattered larger sharp tubercles on its upper margin. The fingers are placed somewhat obliquely, leave a slight hiatus at the base when closed, are 5- or 6-dentate on the cutting edges and the movable one bears a few small tubercles on its upper margin near its base.

The upper margin of the meri of the 2nd, 3rd, 4th and the upper margin and posterior surface of the merus of the 5th thoracic legs are armed with sharp spines some 2 millims. in length. The carpi and propodi also carry a few acuminate tubercles. The dactyli are long and styliform.

The abdomen is covered with coarse yellow hairs and is seven jointed; a median ridge on all the segments except the last bears a few tubercles; those on the 1st and 2nd segments resemble the tubercles on the posterior part of the carapace, but on the other segments they gradually diminish in size to mere granules on the 6th, and on the 7th they are absent.

Length of carapace including rostrum	64·0	millim.
Breadth „ „	55·5	„
Depth „ „ including thickness of abdominal segments	35·0	„
Greatest span tip to tip of 3rd legs	210·0	„
Length of chelipeds (along chord from tip of dactylus to basis)	55·0	„

Colour in life pale bluish yellow.

Station 204; 180–217 fms.

This species will be figured in the Illustrations of the Zoology of the R. I. M. S. 'Investigator,' Crustacea, pt. iv., pl. xxv., figs. 4, 4*a*.

Tribe *OXYRHYNCHA*.

Family **Maiidæ**.

Scyramathia, A. Milne-Edwards.

53. *Scyramathia rivers-andersoni*, Alcock.

Alcock, Carcinological Fauna of India, J. A. S. B., Vol. LXIV., pt. ii., 1895, p. 203
Ill. Zool. R. I. M. S. 'Investigator,' Crustacea, pt. iv., pl. xxii., figs. 2 and 4.

Colour in life pale pink, deeper on chelipeds.

Station 197; 406 fms.

Oxypleurodon, Miers.

54. *Oxypleurodon stimpsoni*, Miers.

Miers, 'Challenger,' Brachyura, pp. 38, 39, pl. vi., fig. 1.

A small male, only 4 millim. in total length, was trawled near Colombo, Station 204; 180–217 fms.

Colour in life orange.

New to the Indian fauna.

Physachæus, Alcock.

55. *Physachæus ctenurus*, Alcock.

Alcock, Carcinological Fauna of India, J. A. S. B., Vol. LXIV., pt. ii., 1894, p. 175, pl. iii., figs. 2, 2*a*. and *b*., Ill. Zool. R. I. M. S. 'Investigator,' Crustacea, pt. iv., pl. xviii., fig. 1.

Colour in life pale salmon.

Off the Cochin coast. Station 197; 406 fms.

Order ISOPODA.

Family **Ægidæ**.

56. *Æga*, Leach.

A single specimen of an *Æga*, closely allied to *Æga ventrosa*, Sars, and measuring 32 millim. in total length, was obtained at Station 184, 947 fms. When caught it was not adherent to any host. Colours in life, white and brown in patches.

Noviciæ Indicæ XII.—*Description of a new genus of* Orchidaceæ.—*By* D. Prain.

[Read. 28th April, Read 6th May.]

Among the Orchids of Sikkim sent to Calcutta by Mr. Pantling during 1895, one of the most interesting was a singular little member of the tribe *Neottieæ*,—and within that tribe apparently most satisfactorily referable to the subtribe *Limodoreæ*—that did not seem to fit into any hitherto described genus. Mr. Pantling's specimens, with a figure made from a fresh plant, were sent to Dr. King, then absent in Europe, for comparison with the material preserved in the national herbarium at Kew. The result of this comparison was to confirm the writer's conclusion. A definition of the new genus that it is necessary to propose in order to accommodate the plant, with a description of the plant itself, are now given. The genus is named in honour of Mr. R. Pantling whose devotion to the study of this natural order is so well-known, and whose exertions have so largely extended our knowledge of the Sikkim Orchid-flora.

NAT. ORD. ORCHIDACEÆ.

Tribe NEOTTIEÆ; *Subtribe* Limodoreæ.

PANTLINGIA *Prain*, gen. nov. *Sepala* subæqualia, libera, linearia vel lineari-oblonga. *Petala* linearia patentia vel reflexa. *Labellum* in basi columnæ sessile, transverse ellipticum, parum concavum, margine integro incurvum, facie superiore lineis 2 parallelis callosis prope basin orientibus, versus medium tamen obsolescentibus notatum. *Columna* parum incurva, apud antheram utrinque auriculata, ceterum exalata; facie anteriore medio laminâ breve transversâ horizontali, margine subtruncatâ vel parum emarginatâ, basique processu linguæformi carnosâ quam columnam ipsam dimidio breviore suberectâ transverse et inæqualiter 2-lobâ ornata. *Pollinia* paribus 2 basi cum rostello angusto ligulato confluentia.

Species singula, sikkimensis.

PANTLINGIA PARADOXA *Prain*. *Rhizome* short, about half as thick as a goose quill, pubescent. *Stems* 1-2, from 3-4 in. long, pubescent near base, otherwise glabrous, bearing about the middle a single ovate acute leaf ·25 in. long. *Flowers* 2-3, racemose, ·15 in., or with the ovaries ·4-·6 in. long; *bracts* ovate-acute about as long as the slender pedicels. Lateral *sepals* linear lying under and adpressed to the lip, dorsal longer than lateral linear-oblong slightly shorter than and adpressed to the column. *Petals* linear reflexed or spreading. *Lip* sessile on the base of the column, transversely elliptic, entire, slightly concave, the margins somewhat incurved; the upper surface with 2 elongated parallel calli beginning near the base and becoming obsolete about the middle. *Column* slightly bent forwards, with a rounded auricle on each side of the anther, otherwise wingless; its anterior surface bearing about the middle a short transverse horizontal subtruncate emarginate plate and, at its base just above the insertion of the lip, a sub-erect rigid transversely and unequally 2-lobed fleshy tongue-like process half as long as itself. *Anther* with a vertical suture; *pollinia* in two pairs, confluent by their bases with the narrow strap-shaped rostellum.

SIKKIM HIMALAYA: at Choongtong, elev. 6,000 feet.

The pollen masses are attached by their bases to the strap-shaped rostellum which is not detachable from the top of the stigma. They appear to fertilize the latter by the gradual absorption and disappearance of the rostellum. The nearest alliance of the genus is with *Limodorum* some of the species of which have small processes on the column in the situation of those that are so highly developed in this singular plant: the lip in *Limodorum* is however altogether different.

Notes on the Indian Species of Vitis, Linn.—*By* GEORGE KING, M.B., LL.D., F.R.S., C.I.E. *Superintendent of the Royal Botanic Garden, Calcutta.*

[Read. 28th April, Read 6th May].

In working out the species of *Vitis* of the Malay Peninsula for my "Materials" for a Flora of that region, I had occasion to examine, as critically as I could, the species indigenous to British India; and on some of these I made notes for my own use. With the idea that perhaps these notes, made in a large Herbarium, may possibly be of some use to Indian Botanists less fortunately situated as regards access to good suites of specimens, I offer them to the Society this evening. The numbers — where numbers are given — are those of the species described in Sir Joseph Hooker's Flora of British India, by the late Mr. M. A. Lawson, whose recent death at Ootacamund, his many friends deplore.

3. V. SAGITTIFOLIA, Laws. This is exactly *V. hastata*, Miq. (Ann. Mus. Lugd. Bat. I, 85) and *V. diffusa*, Laws. l. c. 646; and is probably the same plant that was named *V. cerifera* by T. and B. It is part of what was issued by Wallich as his *V. glaberrima* (Wall. Cat. 5991): and it is that part of it which Wallich described in Carey's edition of Roxburgh's Flora Indica, and consequently that part of 5991 to which the name *V. glaberrima* must be attached. The exact state of the synonymy is given in the following note from my Materials for a Flora of the Malay Peninsula, No. 8.

"Under the name *V. glaberrima* and the number 5991, Wallich distributed two species of *Vitis* gathered partly in Penang and partly in Singapore. These two gatherings are not, as is usual with Wallich's plants in similar cases, distinguished by letters. On two of the four sheets of No. 5991 which are now present in the Calcutta Herbarium, "Penang" is given as the locality; and these agree with the description of the species *V. glaberrima* (ex Penang) published by Wallich in Carey's abortive edition of Roxburgh's Flora Indica (Vol. II, 476.) This Penang plant agrees absolutely with type specimens of *Vitis hastata*, Miquel, and of *V. sagittifolia*, Lawson. On the third sheet of No. 5991, in the Calcutta Herbarium, no locality is noted: on this sheet is glued down a specimen of a different species which I have identified as a variety of the one named *V. cerasiformis* by Teysmann and Binnindyk many years after the issue of Wallich's plants. The fourth sheet of No. 5991 at Calcutta is occupied by stems of the latter and a collection of leaves of both the former and latter. The *V. glaberrima* of Wallich is thus a mixed species; and, as such, would have had to be dropped, had not Wallich published a description of his Penang

No. 5991 under that name in Carey's edition of Roxburgh's Flora Indica." This plant is distributed from Assam southwards to the Malay Peninsula, and there are specimens of it in the Calcutta Herbarium from Siam and Timor.

5. V. PENTAGONA, Roxb. Fl. Ind. I, 408. A species described by Roxburgh in seventeen words, and stated by him to be common in the forests of Chittagong. Roxburgh has left no figure of this species in the Calcutta Herbarium. Amongst the considerable collections which have been made within recent years by men sent to Chittagong from the Botanic Garden Calcutta, the only *Vitis* which might possibly be identified with *V. pentagona* is *V. repens*, W. and A. Dr. Prain collected in the Great Coco island a leaf specimen which may possibly belong to *V. pentagona*. The name has indeed been given by Kurz to four specimens in the Calcutta Herbarium brought from different parts of Burma, but the whole material is, in my opinion, too incomplete to form a sound opinion upon; and I think that for the present *V. pentagona*, Roxb., should be considered as a doubtful species, allied to and perhaps identical with, *V. repens*, W. and A.

. V. GLABERRIMA, Wall. This, as accepted by Mr. Lawson, (see note under *V. sagittifolia*) covers the two species issued by Wallich under his No. 5991; *viz.*, *V. glaberrima* proper, and *V. cerasiformis*, T. and B.

11. V. HEYNEANA, Wall. Cat. 5988 A This sheet A appears to me to be one of several species included by Wallich in the seven gatherings which, (distinguished by Roman capital letters) he distributed under the common name *V. Heyneana*. And, if the name is kept up at all, this is the form which should be called *V. Heyneana*. It is, however, to my eyes, exactly the plant to which Wight and Arnott gave the name *V. pallida*; and, as their description is a good one, and one which can refer to only a single species, their name ought, in my opinion, to be adopted, and Wallich's should be abandoned.

13. V. GLAUCA, W. and A. Prod. Following Wight and Arnott, Mr. Lawson has reduced to this *V. Kleiniana*, Wall. Cat. 6008 *a* and *b*. In the Calcutta Herbarium these letters are represented by specimens, one of which I should refer to *V. adnata*; the other I do not recognise. Nt neither is *V. glauca*, Roxburgh, as described by that author in his Flora Indica, and as figured by him in the Calcutta Herbarium. In fact the only specimens which I have seen which appear to me to agree with Roxburgh's description and figure are Wall. Cat. 6819, which he issued as *Leea cordata*, Wall., and Thwaites C. P. No. 2939, which was issued by Thwaites as *V. latifolia*, Roxb. ?

14. V. ASSAMICA, Laws. is an excellent species, widely distributed

along the base of the Eastern Himalaya, Assam, Cachar, Chittagong and Upper Burma. It was collected, so long ago as 1802, by Buchanan-Hamilton in Assam, and occurs in the Calcutta set of Wallich's plants as No. 6001 A, under the name *V. costata*, Wall. There is a sheet of it also from Sylhet under the number 5998 F, and the general name *V. adnata*, and the particular name being *Cissus vitaginea*, Herb. Ham.

15. V. GIGANTEA, Bedd. I have seen no authentic specimen of this. There is not one at Kew.

16. V. REPANDA, W. and A. A scandent species with pink flowers and narrowly oblong fruit, the oldest name of which appears to be *Cissus repanda*, Vahl. To this Mr. Lawson has reduced, and I believe rightly, the most of the specimens issued by Wallich under the following names and numbers—*V. aquosa*, Wall. Cat. 6000 B; *V. Wightiana*, Wall. 6003 C; and *V. riparia*, Wall. 6038. To this species Kurz (As. Soc. Beng. for 1875, pt. 2, p. 176) gave the name *V. Linnaei*. He did so under the impression that the species is the one to which Linnaeus gave the name *Cissus vitiginea*, (Sp. Pl. 117.) Wallich, on the other hand, identifies *Cissus vitiginea*, L. with the semi-erect shrub which Lamarck and De Candolle (Prod. I, 629) name *Cissus angulata*. Planchon, the latest writer on this family and who has consulted the type specimens involved, states (DC. Mon. Phan. V, 473) that there is not the slightest doubt that Wallich, Wight and Arnot, and Lawson are right. In my opinion the Burmese specimens issued by Wallich as *V. laeta* Cat. No. 6002 should also be reduced to *V. repanda*.

17. V. ADNATA, Wall. Cat. 5998. Most of the letters of Wallich's 5998 (they run up to I.) belong to the species which Roxburgh described (Fl. Ind. I, 405) as *Cissus adnata*. But, amongst Wallich's other numbers, some certainly belong to this species. Of these are No. 5999 B issued as *V. repens*, Wall.; No. 6000 C issued as *V. aquosa*; and No. 5990 G issued as *V. glauca*, Wall. The species is really a very easily recognised one, and the confusion made by Wallich is surprising. The plant is found over almost the whole of India, and it runs down into Burma and the Malayan Peninsula. In the latter country its pubescence is rufous. A plant undistinguishable from this was collected in Sumatra by Diepenhorst whose specimens (there is one in the Calcutta Herbarium) were named *Vitis pyrrhodasys*, by Miquel.

19. V. LINNAEI, Wall. Cat. 5987 appears to be the *Cissus vitiginea* of Linnaeus and also *C. angulata* of Lamarck. It would probably be more correct to name this *Vitis vitiginea*. Kurz, disbelieving the identity of *C. vitiginea* L. and *C. angulata* Lamk., suggested that this should be called *V. angulata*.

26. V. BARBATA, Wall. is a very distinct species. The type of it is Wall. Cat. No. 5997; but to it also belong (in the Calcutta set at

least) Wallich's No. 5995 C. and D. The species is admitted by Sir Dietrich Brandis in his excellent Forest Flora of North-Western India. It is distinguished by the mixture of soft pale hairs and dark subulate bristles with which the young stems petioles and tendrils are covered. The species is really a very distinct one; but it has been misunderstood owing, I believe, mainly to a mistake of its author Wallich who mixed under the name *V. barbata* specimens which bore the same number (5994) as his species *V. rugosa*, and which really belong to *V. rugosa*. As a rule the pubescence of *V. barbata*, is pale brown and not rufescent. But in specimens from Perak the pubescence is pale ferrugineous and the leaves are moreover slightly three-lobed. In other respects the Perak plant agrees with specimens from Burma, the Andamans and Sylhet. *V. rugosa*, Wall. to which this species is undoubtedly allied, appears, however, to be quite separable. It has not the characteristic bristles of *V. barbata*, and its pubescence is always rufescent. *V. rugosa* has really little affinity with *V. lanata*, Roxb. to which it has been reduced by Mr. Lawson and others.

27. Vitis lanata Roxb. Very few species have been so misunderstood as this. The plant described by Roxburgh, and of which he left a beautiful coloured figure in the Calcutta Herbarium, was found by him in the Circars, and it has since been collected in the N.-W. Himalaya, Sikkim, Khasia, Assam and Upper Burma. It has broadly-cordate acuminate exserted-serrate leaves both surfaces of which, when young, have a scanty coating of white woolly hair. It is at once distinguished by its bifurcate inflorescence, which consists really of two divaricating thyrses springing from the apex of a common peduncle. A glabrous variety of this is very common, and by that variety the species so closely approaches *V. parvifolia*, Roxb., that I do not think the latter can be maintained as a species. The only differences that I can find between the two are that in the latter the leaves are sometimes 3-lobed, and the inflorescence is always much smaller and shorter; it is, however, bifurcate. The chief cause of the misunderstanding of this species was no doubt the issue by Wallich, under the name *V. lanata*, Roxb., of his No. 5995 B,—a species with a coating of felted rufous tomentum on the young stems and tendrils and on the under surfaces of the leaves. This (the *Vitis lanata* of Wallich) is the plant figured under Roxburgh's name by Decaisne in Jacquemont's Voyage dans l'Inde, Atlas, II. Pl. 36. The oldest name for the plant appears to me to be *Vitis cordifolia*, Roth (Nov. Spec. Pl. 158) a name which, owing to its pre-occupation by an American species of Michaux's, Roemer and Schultes (Vol. V, 318) changed to *Vitis Heyneana*. This species has tendril-bearing thyrses which do not bifur-

cate, and its pubescence is felted and of a bright rufous colour, while that of *V. lanata* is lax and of a pale colour. To *V. lanata*, Roxb. Lawson (following Wight and Arnott) reduces *V. rugosa*, Wall., a plant which (as I have mentioned in my remarks under *C. barbata*, Wall.) is a perfectly distinct good species. In fact *V. lanata*, as understood by W. and A. and Lawson, is not Roxburgh's plant at all; it is, however, the *V. lanata* of Wallich, and of Decaisne.

30. Vitis montana, Laws. is only a form of *V. latifolia*, Roxb. The author of the species relies on the more corymiform shape of the inflorescence to distinguish it from *V. latifolia*, and also on the presence of long white hairs on the younger parts of the stem. But these are characters of scarcely sufficient importance, even did they go together, which they do not. Planchon also was of opinion (DC. Mon. Phan. V. 371), that *V. montana*, Laws., cannot be kept up.

32. Vitis parvifolia, Roxb., cannot be kept distinct from *V. lanata*, Roxb. (see notes on the latter).

33. Vitis indica, Linn. As Trimen has pointed out in his Flora of Ceylon (Vol. I., 288), the plant described under the name *V. erioclada* by Wight and Arnott (Prod. 130), is exactly this plant, *viz.*, the *Schembra Valli* of Rheede (Hort. Malab. VII, t. 6). Wight and Arnott, however, cite as their *V. erioclada*, the species with deeply-lobed leaves figured by Rheede on his succeeding plate 7—an obvious slip. Trimen's opinion on to the identity of *V. erioclada*, W. and A. with *V. indica*, Linn, rests on the solid foundation of actual inspection of Hermann's specimen. Planchon (l. c. 379) gives the name *Ampelocissus Arnottiana* to the plant which he identifies with that named *V. indica*, L. by Lawson; but what Planchon's plant may really be I have not yet discovered.

Vitis Wightiana, Wall. Cat. 6003 has not been accounted for in the Flora of British India. There are three gatherings of it in Wallich's Catalogue, distinguished by the letters A. B. C. That marked A. may, it appears to me, be treated either as a very tomentose form of *V. repanda* with more globular fruit than usual, or as a distinct species.

Vitis costata, Wall. Cat. 6011 A and B, from Burma, is doubtfully referred by Lawson, (l. c. 647) to either *V. discolor* Dalz or *V. repens*, W. and A. In my opinion it is a good distinct species near the former.

Vitis Himalayana, Brandis For. Flora 100. This is the name given by Sir D. Brandis to *Ampelopsis Himalayana*, Royle (Illust. Him. Plants 149) *Cissus himalayana*, Walp. Rep. I, 441 and *Vitis neilgherrensis*, Wight Ic. t. 965. Lawson treats as his variety *semicordata* of this species the plant issued by Wallich as No. 6020 of his catalogue under the name *Vitis semicordata*. But Wallich's name, being older than either Royle's or Wight's, the position of the variety and

species adopted by Lawson must be reversed. As amended, the matter would, therefore, stand thus;

Vitis semicordata, Wall. Cat. 6020; in Roxb. Fl. Ind. Ed. Carey and Wall. I. 481; *V. Himalayana*, Brandis var. *semicordata*, Lawson. *Parthenocissus semicordata* Planch. DC. Mon. Phan. V. 451. Flowers 4-or 5-merous in subcorymbose dichotomous cymes; style short, stout. Fruit 4-seeded. Young branches petioles and the nerves of the under surfaces of the leaves hispid-pubescent, leaves 3-foliolate; leaflets obliquely elliptic, the lateral pair with the base rounded on the outer side and narrowed on the inner, the odd leaflet with a cuneate base, all shortly cuspidate and with crenate-serrate edges; *fruit* pisiform, black; *seeds* obovoid-globular, nearly smooth, black.

Var. *Roylei*, King; *Vitis Himalayana*, Brandis For. Flora 100; Laws. in Hook fil. Fl. Br. Ind. I, 655; *Ampelopsis Himalayana*, Royle and *Neilgherrensis*, Wight Ic. t. 965; *Cissus himalayana*, Wall. Rep. I. 441; *Parthenocissus cuspidifera*, Planch. DC. Mon. Phan. V. 451 and *C. Neilgherrensis*, Planch. l. c. 450.

All parts quite glabrous.

Vitis semicordata is by no means confined to the Himalaya. On the contrary, both the typical form and its variety are found in Sikkim, Khasia, the Neilgherries and Upper Burma. Another form, (*viz.*, var. *Scortechinii*, King) occurs in the Malayan Peninsula and in Java. The variety has thicker leaves and larger flowers.

49. Vitis campylocarpa, Kurz. To this must be referred the plant issued by Wallich under the name *Panax micranthum* (Cat. No. 4938).

Vitis pycnantha, Coll. and Hemsl. Journ. Linn. Soc., Vol. XXVIII, 34. This species is not included in the Flora of British India, having being discovered long subsequently to the publication of the *Ampelideæ* in that work. Its authors do not describe the fruit, which was unknown when they published the species. The Collectors of the Calcutta Bot. Garden having recently sent fruit from the Shan hills, I am enabled to give the following description of it. *Fruit* globular, slightly rugulose when dry, ·35 in. in diam., with 2 or 3 seeds and scanty pulp; seeds ·35 in. long, pale, oblong, compressed, obscurely rugulose and with a shallow vertical groove on the anterior face.

65. Vitis assimilis Kurz in Journ. As. Soc. Bengal for 1872, pt. ii., p. 302, has been reduced to a variety of *Vitis lanceolaria* by Lawson in F. B. India I. 660. It is in my opinion a very distinct form, well worthy of specific rank.

66. Vitis dubia, Laws. This is a good species, and is exactly *V. oxyphylla*, Wall. Cat. 6035, which name should supplant Lawson's.

The species is near *V. bracteolata*, Wall., but has cymes with longer peduncles and larger flowers. To this belong Wall. Cat. 6034 issued by Wallich as *V. serrulata*.

There are in the Calcutta Herbm. many specimens of a *Vitis* from the N.-W. Himalaya, Sikkim, the Khasia Hills, Assam and Upper Burma, for which I can find no name. It comes very near to *V. pedicellata*, Laws., but differs in the character of the hair on the lower surface of the leaves being shorter and more uniformly spread over the intercostal spaces; whereas in *V. pedicellata*, it is confined to the nerves and veins, and the hairs are longer. This plant may be a variety of *V. Heyneana*, R. and S., less hairy than typical form.

Descriptions of some New Indian Trees.—*By* GEORGE KING, M.B., LL.D., F.R.S., C.I.E., *Superintendent of the Royal Botanic Garden, Calcutta.*

[Recd. 28th April, Read 6th May.]

NAT. ORD. **Meliaceæ.**

DYSOXYLUM RETICULATUM, n. spec. A tree 50 feet high; young branches stout, striate, puberulous. *Leaves* 9 to 18 in. long, equally pinnate; the petiole flattened in front, the rachis angled, both puberulous; leaflets 4 to 7 pairs, opposite or alternate, thinly coriaceous, oblong, slightly unequal-sided, shortly acuminate, the base cuneate and often oblique; both surfaces glabrous and minutely reticulate, the lower glaucous when young, both pale when dry; length 3 to 7 in., breadth 1 to 2·25 in., petiolules ·2 to ·3 in. long. *Racemes* solitary, axillary, 6 to 8 in. long, tawny-puberulous, bearing flowers from near the base. *Flowers* broadly ovoid in bud, about ·25 in. long, rather remote, their pedicels about ·2 in. long, each with a subulate basal bracteole. *Calyx* cupular, with 4 remote teeth, glabrous, fleshy. *Petals* 4, three or four times as long as the calyx, elliptic, sub-acute, concave, hoary-puberulous on both surfaces. *Staminal tube cylindric*, shorter than the petals, slightly inflated about the middle, the mouth with 8 shallow emarginate teeth; hoary-puberulous externally, glabrescent internally; anthers 8, oblong, their apices much below the mouth of the tube. *Disc* tubular, short, fleshy, glandular-pubescent, the mouth incurved and irregularly toothed. *Ovary* depressed-hemispheric, 3-angled, 3-celled with 2 ovules in each cell, pubescent, tapering into the stout sub-glabrous style; stigma slightly exserted, cylindric with a narrow basal annulus. *Ripe fruit* broadly pyriform, the apex depressed, 3 in. long, and 2·5 in. in diam., rugulose when young, glabrous and smooth when adult; the pericarp crustaceous,

·15 in. thick. *Seeds* 3-angled, the posterior surface concave, 1·25 in. long.

On the banks of the Teesta in Sikkim, King. Cachar, Prazer.

The nearest ally of this is *D. binectariforum*, Bedd. from which however, it differs conspicuously in its much smaller flowers, totally different disc, and minutely reticulate leaflets.

Nat. Ord. **Sapindaceæ.**

Acer Papilio, n. spec. A small tree; the young branches rusty-tomentose at first but afterwards glabrous and with cinereous exfoliating bark. *Leaves* simple, 5-lobed, the lobes caudate-acuminate and unequally serrate-lobulate; the base in adult leaves sub-truncate to sub-cordate, in the young leaves deeply cordate; the upper surface glabrous except the puberulous middle nerve; the lower when young densely covered with flexuose hairs deciduous with age except on the nerves, the secondary nerves rather prominent beneath; length 4 to 6 in., breadth 4 to 4·5 in., petiole 3 to 4 in. *Inflorescence* a raceme-like terminal or axillary rusty-tomentose panicle 3 or 4 in. long; the branchlets cymose, 2-flowered, and about ·35 in. long. *Flowers* ·2 in. in diam., on pedicels slightly longer than themselves. *Sepals* 5, oblong, sub-obtuse, pubescent on the nerves and edges. *Petals* 5, oblanceolate-linear, glabrous except the pubescent claw. *Disk* fleshy with 8 large and 2 small quadrate lobes. *Stamens* 8, inserted inside and between the lobes of the disc; *anthers* oblong, minutely warted; the filaments slightly flattened, glabrous. *Ovary* rusty-tomentose; *styles* glabrous, bifid. *Fruit* 1·25 in. in length and the same in breadth at the apex, the wings obliquely and broadly rhomboid-triangular, the outer side of each the longest and the inner the shortest, slightly puberulous and with bold forking veins, the nucule about ·3 in. in diam.

Sikkim Himalaya: Sir J. D. Hooker, at elevations of 11,000 to 12,500 ft.; Phalut at 11,500 ft. and Lachong Valley, elevat. 12,500 ft., G. A. Gammie. Jongri, R. Pantling.

A species which has hitherto been confused with *A. caudatum* Wall. and *A. pectinatum*, Wall. from both of which it is at once distinguished by its paniculate inflorescence—that of *A. caudatum* being fasciculate, while that of *A. pectinatum* is a few-flowered simple raceme. The wings of the samara of this are also broader than those of the other two. The disc of the flower in this species has 8 large square lobes, but at two points which stand opposite to each other the disc has a fold in it, and hidden in each of these folds there lies a small lobe. The disc is thus really 10-lobed, although at a superficial glance only 8 lobes are visible.

Nat. Ord. **Sabiaceæ.**

Meliosma Collettiana, n. spec. A tree; young branches deciduously rusty-puberulous, lenticellate. *Leaves* unequally pinnate, the rachises coarsely puberulous; leaflets about 7, coriaceous, oblong or elliptic-oblong, shortly acuminate, the edges coarsely remotely and sharply serrate, the bases oblique, cuneate; upper surface glabrous except the rusty, pubescent midrib, when dry minutely pitted; lower surface much reticulate, pale brown when dry, sparsely puberulous, the midrib and 7 to 9 pairs of rather prominent ascending main nerves rusty-pubescent, length 2·5 to 4 in., breadth 1·2 to 1·8 in.; petiolules ·35, the terminal one about ·6 in. *Panicles* terminal, pedunculate, about as long as the leaves while in flower, longer while in fruit, many-branched, spreading. *Flowers* minute, (less than ·05 in. diam.) solitary or in pairs, shortly pedicellate; bracteole single. *Sepals* 4, broadly ovate, concave, puberulous externally. *Petals* and stamens not seen. *Ovary* broadly ovoid, tomentose, not so long as the cylindric glabrous style. *Young fruit* sub-globular, compressed, keeled, subglabrous except at the gibbous pubescent base.

Burma: Maymyo Hill, 40 miles from Mandalay; native collectors.

This has, so far as I know, been collected only by the native collectors of the Botanic Garden, Calcutta, whose work was kindly supervised by Major-General Sir Henry Collett, K. C. B., who commanded the troops in Upper Burma during 1888.

Meliosma ferruginea, Kurz MSS. in Herb. Calc. A large tree; the young branches petioles under surfaces of the leaves and the inflorescence densely and minutely rusty-tomentose. *Leaves* simple, coriaceous, elliptic-oblong to oblanceolate-elliptic, shortly and abruptly acuminate, the edges with a short tooth at the end of each of the main nerves, the base cuneate: upper surface glabrous except the minutely tomentose midrib and nerves; the lower rusty-pubescent except on the midrib nerves and veins, conspicuously reticulate; main nerves 18 to 24 pairs, spreading, prominent on the lower surface; length 7 to 12 in., breadth 2·25 to 4·25 in., petiole ·8 to 1·5 in. *Panicle* terminal, erect, longer than the leaves, much-branched, many-flowered. *Flowers* ·05 in. in diam., sessile in the short ultimate spicules; bracteoles 2 to 4, oblong, concave, unequal, the larger about the size of the sepals. *Sepals* 5, concave, sub-orbicular, larger than the petals, pubescent outside. *Petals* 5, the outer three sub-orbicular, valvate, glabrous; the inner two small and irregular, each with a stamen opposite to it. *Perfect stamens* 2 or 3, the anthers broad and hooded, the filament short. *Fruit* sub-orbicular, slightly compressed, sub-gibbous at the base, keeled, ·35 in. in diam.

Sikkim: at Lebong T. Thomson: at Ging, Gamble No. 320; Phubsering, Gamble No. 9704: Ryang Valley at 2,000 feet, King.

This species approaches more closely to *M. Wightii*, Planch. than to any other; but its pubescence is much denser and more rusty, its flowers are much smaller and less crowded than in that plant, and its leaves have many more main nerves. It also resembles *M. pungens*, but is a much larger and more robust plant with larger, less deeply serrate, leaves and larger fruit. It was collected so long ago as 1857 by the late Dr. T. Thomson, F. R. S. at that time Superintendent of the Botanic Garden, and has been sparingly collected since.

Nat. Ord. **Anacardiaceæ.**

Semecarpus subspathulatus, n. spec. A small tree; young branches as thick as a goose-quill, glabrous, their bark brown when dry. *Leaves* membranous, entire, sub-spathulate, obovate-lanceolate or obovate-elliptic; the apex broad and rounded or sub-acute, narrowed in the lower two-thirds to the short petiole; upper surface shining, and with a few short scattered adpressed hairs; lower surface pale brown when dry, distinctly reticulate, the prominent midrib and main nerves and also the veins with spreading stiff scattered hairs; main nerves 18 to 20 pairs, spreading, interarching freely within the edge; length 5 to 11 in. breadth (at the widest part) 2 to 5 in.; petiole ·25 to ·4 in., channelled on the upper surface, sparsely pubescent. *Inflorescence* consisting of slender axillary mixed racemes shorter than the leaves, or of a slender terminal panicle of racemes longer than the leaves, minutely and coarsely pubescent. *Male flowers* about ·1 in. in diam., in little distant cymulose fascicles on the racemes or panicles and on pedicels shorter than themselves. *Calyx* cupular, deeply divided into 5 slightly unequal oblong-rotund blunt segments, pubescent outside, glabrous inside. *Petals* 5, valvate, longer than the calyx-segments, ovate, sub-acute, glabrous. *Stamens* 5, all perfect; the anthers cordate and the filaments thickened at the base; disk fleshy, convex, glabrous; ovary 0. *Female flowers* unknown. *Drupe* (when young) ovoid, glabrous, crowned by the remains of 3 short deflected styles bearing large transversely oblong capitate stigmas.

Upper Burmah; exact locality unknown. Calcutta Botanic Garden Collectors.

This is a very distinct species of *Semecarpus*, the nearest ally of which is *S. subracemosa*, Kurz.

A second series of New Orchids from Sikkim.—*By* G. King & R. Pantling.

[Read. 28th April, Read 6th May.]

In the third number of the Society's *Journal* for last year we printed descriptions of thirty-three new species of orchids recently discovered in Sikkim. Subsequent study of these, and a more careful comparison of them with the forms most closely allied to them, have since led us to believe that two of them cannot be upheld as good species. These two are *Bulbophyllum cylindricum*, which we now believe to be *B. leptanthum*, Hook. fil.; and *Cirrhopetalum Dyerianum*, which should, as we now think, be reduced to *B. parvulum*, Hook. fil. This evening we submit to the Society descriptions of a further instalment of novelties amounting to thirty. A large proportion of these have been collected in the Lachoong and Lachen valleys, at elevations varying from 7,000 to 12,000 feet. Amongst these Alpine forms there are no less than three new species of *Listera*—a genus of which only four species were previously known to inhabit British India. There is also a new species of *Corysanthes*—a genus not hitherto found farther north than the mountains of the province of Perak in the Malay Peninsula; and a new genus which forms a connecting link between *Tipularia* and *Corallorhiza*, for which we have proposed the name *Didiceia*.

Epidendreæ.

Microstylis saprophyta, n. spec. Terrestrial, leafless, saprophytic; the whole plant 3 to 6 in. high, glabrous. *Stem* bulbous at the base, with a few short crowded sheaths just above the bulb and 2 or 3 scattered lanceolate bracts ·35 in. long. *Raceme* 1 to 2 in. long, lax; floral bract lanceolate, equalling or exceeding the sub-sessile ovary. *Flowers* ·12 in. long, inverted. *Sepals* ovate, blunt. *Petals* linear; the dorsal sepal reflexed and adpressed to the ovary, the lateral sepals and the petals revolute. *Lip* rotund-reniform, entire, with a semi-lunar convex fold in the middle of the upper surface; the basal auricles erect, rather short and broad, sub-acute.

Sikkim Himalaya, at Choongthang, elevation 6,000 feet. R. Pantling, No. 394.

The flowers, which are greenish, open about July.

A singular plant, quite unlike any other species in the genus. The bulb at the base of the stem is about ·35 in. in diameter.

DIDICIEA, King and Prain.

(Epidendrearum *novum genus*).

Sepals free, spreading, subequal, narrow. *Petals* like the sepals.

Lip sessile on the base of the column and parallel to it, equal in length to the sepals, fleshy, ovate-oblong, concave, blunt, without lobes or teeth; spur minute. *Column* half as long as the sepals and lip, wingless. *Anther* terminal, two-celled, convex, rather broad. *Pollinia* 4, free, waxy, and without appendages, unequal in size, obovoid.

As regards habit and external appearance this genus very closely resembles *Tipularia*, to which it is indeed allied. It differs however from that genus notably in its pollinia having no appendages. The column in this is shorter than in *Tipularia*, and the lip has no lobes of any kind and only a minute straight pouch, scarcely amounting to a spur; whereas in *Tipularia* the spur is much longer than the ovary and much curved; the lip is also different in the two. The pollinia of this are in fact like those of the aphyllous genus *Corallorhiza* in form. In both genera the masses are unequal: the anterior pair being the larger. The column in this is also like that of *Corallorhiza*, except in the absence of any trace of wings: the lip of this is however sessile on the column, whereas in *Corallorhiza* the lip is clawed at the base. In *Tipularia* the inflorescence is a scape rising from the base of the leaf-bearing pseudo-bulb, whereas in *Didiceia* the inflorescence proceeds from the apex of the pseudo-bulb.

The genus is dedicated to its original Collector Dr. D. D. Cunningham, F. R. S., C. I. E., and the consonants in the name proposed for it, are derived from his initials.

Didiciea Cunninghami, King and Prain. Terrestrial, with a small pseudo-bulb bearing from its side a single leaf and from its summit a scape 5 to 9 in. long about one-third of which is spike. *Leaf* broadly ovate, 3-nerved, sub-acute the edges undulate, slightly narrowed at the base to the narrow channelled petiole; length 1·5 in., breadth ·85 in.; petiole ·5 in., slightly expanded at the base. *Scape* with two or three distinct blunt convolute sheaths; *spike* 1 to 1·5 in. long, laxly-flowered, elongating in fruit. Flowers ·1 in. long: floral bract minute, triangular, shorter than the pedicel of the ovary. *Sepals* and *petals* sub-equal, narrowly oblong, blunt; spur of the lip very short, pointed.

Sikkim: in the Lachen Valley; the exact elevation unknown, but probably about 12,000 feet; in flower in July. Cunningham (without note of locality or elevation); Pantling No. 396.

This was originally collected by Dr. D. D. Cunningham, F.R.S., C.I.E., in the Sikkim Himalaya in 1889. It has more recently been brought in by the collectors of the Botanic Garden, Calcutta.

BULBOPHYLLUM, Thouars.

Bulbophyllum gracilipes, n. spec. *Rhizome* ·15 in. thick, with the remains of sheathing bracts at the joints and with leaves at intervals of

from 1·25 to 1·75 in. Pseudo-bulbs none. *Leaves* sub-coriaceous, oblanceolate or oblanceolate-elliptic, blunt and minutely bifid at the apex (sometimes obliquely so) much narrowed to the base; length 2-2·25 in. breadth ·75 in. *Scapes* erect, filiform, slightly exceeding the leaves and bearing one or two small sheathing bracts, the flowers in a terminal capitulum ·35 in. in diam. *Floral bract* one half as long as the shortly-stalked ovary. *Flowers* ·1 in. in diam., dorsally flattened, fleshy, and of a dull purple throughout. *Sepals* 3-nerved; the dorsal broadly triangular, acute, concave and covering the column; the laterals ovate, acute, spreading. *Petals* oblong, oblique, acute, 1-nerved. *Lip* tumid, broadly ovate, convex, papillose, the basal portion rectangular and deeply grooved; *column* with broad falcate arms having a short soft tooth at the end of each. *Anther* flattened, pollinia in ovoid pairs.

Sikkim Himalaya: at an elevation of 1,500 feet, flowering in September and October. R. Pantling No. 242.

This species, although quite distinct from *B. xylophyllum*, Reichb. fil. is allied to it. The latter has more coriaceous leaves with broad bl[illegible] emarginate apices.

IONE, Lindl.

IONE INTERMEDIA, n. spec. *Rhizome* less than ·1 in. thick, smooth. *Pseudo-bulbs* ·5 in. long, ovoid, semi-transparent, less than 1 in. apart, each bearing a single sessile linear leaf notched at the apex 2 to 4 in. long and ·25 in. broad. *Scape* slightly longer than the pseudo-bulb, zig-zagged, enclosed at the base by two or three sheaths and bearing 1 to 3 flowers. *Floral bracts* lanceolate, equalling or longer than the shortly-stalked ovary. *Flowers* pale green, ·5 in. long. *Sepals* lanceolate, spreading, ·25 in. long, the laterals lying under the lip and cohering by their tips. *Petals* linear, more or less twisted and with broad dilated serrate bases. *Lip* sessile, slightly shorter than the sepals, lanceolate-acuminate; the base dilated, slightly concave and with small rounded lobes. *Column* rather broad, with narrow wings near the middle. *Rostellum* elongated, deflexed. *Pollinia* 4, attached in pairs to two strap-shaped caudicles; gland reniform.

Sikkim: at Tendong, elevation 6,000 feet; flowering in June. Pantling No. 161.

The attachment of the pollinia in pairs to the large, stiff, strap-shaped caudicles—so different from the arrangement in *Bulbophyllum*—appears to us a character of sufficient importance to warrant the retention of *Ione* as a genus. In *Bulbophyllum* (to which *Ione* has been reduced) there is no caudicle. This is not, however, the only distinctive character; for, in *Ione*, the lip is sessile and firmly attached to the

very slightly produced base of the column; whereas in *Bulbophyllum* it is jointed to the produced foot of the column and is more or less mobile. In spite therefore of the great authority of Mr. Bentham and Sir Joseph Hooker, we venture to restore the genus *Ione* as it was understood by Lindley.

ERIA, Lindl.

Eria clausa, n. spec. *Rhizome* ·15 in. thick, jointed, smooth, with a few short membranous sheaths. *Pseudo-bulbs* about 2 in. apart, 1·25 to 1·5 long and ·75 in. in diam, ovoid-ellipsoid, blunt at the apex, the bases clothed with the fibrous remains of sheaths. *Leaves* membranous, in pairs, narrowly lanceolate, tapering to each end, sessile, 4 to 6 in. long and ·8 to 1 in. broad. *Scapes* rather shorter than the leaves, one or two from the summit of the pseudo-bulb, each enveloped for more than half its length by a narrow convolute sheath; raceme stout, erect; *flower bracts* nearly obsolete, and represented by slightly thickened rings at the bases of the stalked ovaries. *Flowers* from 15 to 20, about ·3 in. long, slightly shorter than the ovaries, the buds often not expanding. *Sepals* and *petals* oblong, blunt. *Lip* oblong, with two rounded oblique lateral lobes near the apex, the short caruncled rounded midlobe with 5 to 7 vertical lines, the edges entire, the disc with 3 parallel raised slightly sinuous vertical lines. *Column* long; rostellum flattened against the back of the clinandrium. *Stigma* small, with two sub-globular convexities inside its lower margin.

Sikkim; not uncommon at elevations of 3,000 to 5,000 feet; flowering during February and March.

This species is closely allied to *E. vittata* Lindl., but is a much smaller plant. The flowers of both are, however, alike in form and colouration, with the exception that the lip of this has lateral lobes while in *E. vittata* the lip is entire; and that the lip of this has 3 elevated vertical lines on its surface, whereas the lip in *E. vittata* has 5 crenulate wavy ridges. The time of flowering of the two species is the same, and they are found in similar situations. In many cases the flowers of this do not open; nevertheless the ovaries set seeds, and capsules form and ripen, self-fertilization being effected by the rostellum being removed from its normal position and pressed against the body of the clinandrium, thus permitting the pollinia to come into direct contact with the stigma.

CALANTHE, R. Br.

Calanthe Whiteana, n. spec. *Leaves* linear-lanceolate, acuminate, much narrowed towards the sessile base, 2 to 3 feet long, and 1·5 in.

broad at the widest part. *Scape* stout, together with the dense-flowered raceme 2 to 4 feet long, puberulous, with a few short scattered sheaths. *Flower bracts* 1 in. or more in length, linear, acuminate, deflexed, about as long as the ovaries. *Flowers* 1 in. across, yellow. *Sepals* ·4 in. long, ovate, sub-acute, 5-nerved, reflexed, and resting upon the stalked ovary. *Petals* elliptic-lanceolate, acute, narrowed towards the base, erect. *Lip* very short, sessile, inserted at the top of the column, transversely elliptic or quadrate, 2-lobed; the lobes reflexed, their margins entire or sub-crenate, with 5 crested lines running along the centre from base to apex. *Column* short and stout: stigmatic surface on each side of the entrance to the spur. *Spur* exceeding the stalked ovary, sub-clavate, slightly curved, sparsely pubescent, the inner wall with hair-like papillae in the upper half. *Pollinia* clavate, in 4 pairs, attached to an oblong gland.

Sikkim; at Choongthang, elevation 6,000 feet; flowering in May, the flowers sweet-scented. R. Pantling No. 365.

This species comes nearest to *C. Mannii*, Hook. fil. which has, however, a very short spur. This is as yet a little known plant, only a few specimens having hitherto been gathered.

Vandeæ.

SACCOLABIUM, Blume.

SACCOLABIUM LANCIFOLIUM, n. spec. *Stem* pendulous, 8 to 12 in. long. *Leaves* fleshy, linear, acuminate, aristate at the apex, slightly keeled, 3 to 5 in. long and ·25 to ·3 in. broad. *Racemes* axillary, densely-flowered, pendulous, 1·5 to 2 in. long, their peduncles as long as themselves and bearing a few membranous lanceolate scattered bracts. *Flowers* yellow, ·25 in. long; floral bracts minute, triangular, much shorter than the sessile ovary. *Dorsal sepal* broadly ovate, very concave, the apex broad and slightly emarginate, the laterals obliquely obovate, blunt, all three connivent. *Petals* oblong, blunt. *Lip* boat-shaped, its limb about as long as the sepals, the apex with a large callus behind it. *Spur* funnel-shaped, longer than the ovary, much curved forwards, its apex not thickened. *Column* very short, the rostellum beaked. *Pollinia* 2 pairs, small, globular-ovoid, attached to the inflexed beak of the caudicle; *caudicle* broad below the beak, much narrowed to the base; gland elongate, notched at its base.

Sikkim: at Rissisoom, elevation 6,000 feet; flowering in June.

Allied to the Khasia species *S. acuminatum* Hook. fil., but with smaller flowers, longer, narrower, and more sparsely arranged leaves and also with shorter stems.

Neottieæ.

PHYSURUS, Richard.

PHYSURUS HERPYSMOIDES, n. spec. Whole plant 8 to 10 in. high; the stem about ·25 in. thick at the base, the lower part leafy and glabrous, the upper or flower-bearing part pubescent and bracteolate. *Leaves* 3 or 4, obliquely ovate, acute, tapering below to the channelled sheathing petiole, 5- to 7-nerved; length 2·5 to 4 in., breadth 1·25 to 1·75 in., petiole 1·25 in. Bracts of the upper part of the stem nearly 1 in. long, lanceolate, acuminate, adpressed. *Raceme* abrupt, 2 in. or less in length; floral bracts finely acuminate, slightly longer than the ovaries. *Flowers* (to the tip of the spur) about ·75 in. long. *Sepals* oolong-lanceolate, 3-nerved, sparsely pubescent, spreading, ·4 in long. *Petals* linear, dilated towards their cohering apices, 1-nerved. *Lip* adpressed to the column, oblong, 5-nerved; the terminal lobe small, transversely oblong entire, deflexed; the side lobes erect, sub-truncate; the spur shorter than the ovary, wide, slightly inflated below and bifid at the apex. *Anther* lanceolate, with a deep clinandrium which extends to the base of the column. *Pollinia* clavate; the gland linear.

British Bhotan, above Engo; elevation 5,000 feet, in flower during April; Pantling, No. 255.

This somewhat resembles *P. Blumei*, Lindl. but has a shorter and less pubescent inflorescence, longer bracts and larger flowers. The leaves have also twice as many nerves. The sepals and petals of this are of a pale reddish-brown and the lip is white just as in *P. Blumei*.

ANŒCTOCHILUS, Blume.

ANŒCTOCHILUS SIKKIMENSIS, n. spec. Whole plant 6 to 9 in. high. *Stem* procumbent and about ·25 in. thick near the base, with 4 or 5 leaves, glabrous. *Leaves* elliptic-ovate, acute, narrowed to the broad sheathing petiole; the upper surface very dark red with a velvety sheen and veined with golden yellow; length 2 to 2·5 in., breadth 1 to 1·35 in., petiole ·65 in.; peduncle of the raceme with several distant sheathing acuminate bracts ·5 in. long. *Raceme* 1·75 to 2·25 in. long, puberulous. Flower bracts lanceolate, shorter than the glandular-pubescent ovaries. *Flowers* ·6 in. long. *Dorsal sepal* oblong, blunt, concave; laterals oblong, acute, spreading. *Petals* dimidiate, straight along the inner margin, dilated upwards along the outer, and broadly beaked near the apex. *Lip* with two terminal divergent cuneate lobes, the claw with 4 pairs of short forward-pointing teeth. *Spur* short, pouch-like, bifid, the calli within it ovoid. *Column* with two parallel raised lines below the large ovate rostellum resting on a large forcipate process,

b[illegible]th which again are two flat converging calli. *Gland* embraced by t[illegible] united bases of the caudicles; *pollinia* flattened curved, oblong, [illegible]b-equal in length.

Sikkim: at 3,000 to 5,000 feet elevation, not uncommon; flowering in September. Pantling No. 285.

The sepals are olive green and white; the lip is white, the teeth of the claw being green, as are also the column and spur.

This differs from *A. Roxburghii* (which it resembles in leaves) in its smaller flowers, differently shaped petals and pollinia, also in the terminal lobes of the lip and in the teeth of the claw which in this are much smaller. Its nearest ally is however *A. Griffithii*, Hook. fil., a species of the Naga Hills, which has green leaves without reticulations and a more distinctly winged claw with larger teeth and a longer spur.

ODONTOCHILUS, Blume.

Odontochilus tortus, n. spec. Whole plant 6 or 7 in. high. Stem [illegible]ecumbent at the base, stout, bearing 4 or 5 leaves, glabrous. *Leaves* grè[illegible]y in colour, 3-nerved, ovate to ovate-lanceolate, acute, slightly oblique, narrowed at the base into the channelled sheathing petiole; length about 2 in., breadth ·75 to 1 in., petiole ·75 in. Peduncle of the raceme pubescent and bearing a solitary acuminate pubescent bract. *Raceme* about 1·5 in. long, 3- to 6-flowered; floral bract lanceolate, acuminate, thinly pubescent, equalling the ovary. *Flowers* ·75 in. long. *Dorsal sepal* broadly ovate, concave, forming with the petals a hood over the column; the laterals oblong, blunt and spreading, all pubescent outside. *Petals* falcately rhomboid, sub-acuminate, mottled with pale green. *Lip* with a short sub-globose saccate base, a long toothed claw, and a much twisted limb deeply divided into two sub-quadrate slightly divergent irregularly crenate end-lobes the upper margins of which are connivent, the sac containing two approximate stout up-turned teeth; the claw with nine unequal teeth on each margin. *Column* with two small approximate up-turned teeth below the entire stigma; arms of the rostellum large, winged, bidentate. *Pollinia* in sub-equal pairs, united midway into a pseudo-caudicle; the gland small, ovate, lateral.

Bhotan: at Kumai near the Jaldaca river, elevation about 4,000 [illegible]et; flowering in December. Pantling No. 354.

The nearest ally of this species is undoubtedly, *O. Elwesii*, Clarke; [illegible]t that species has very dark purple leaves smaller than those of this and thicker in texture. *O. Elwesii* besides has a longer more pubescent scape than this, and it never bears more than three flowers. Moreover the lip of *O. Elwesii* is not twisted, and its claw has only seven pairs of teeth, while the sac of the lip is bilobed and the column has large processes.

LISTERA, R. Brown.

LISTERA BREVICAULIS, n. spec. Whole plant 6 to 9 in. high; [illegible] very stout *stem* bearing quite close to the ground a pair of unequal ovat[illegible] rotund acute leaves ·8 to 1 in. long; the peduncle of the inflorescence sparsely puberulous and with two distant linear-lanceolate bracts ·5 in. long. *Raceme* 2 to 4 in. long, puberulous, with 12 to 16 scattered dull green flowers ·25 in. long; floral bracts ovate-lanceolate, acute, longer than the pedicel of the ovary. *Sepals* and *petals* sub-equal, shorter than the lip, lanceolate, acute, sub-connivent. *Lip* obcordate and with a thickened mesial line throughout its entire length; the apical lobes broad and blunt, their edges recurved and meeting underneath, the base much narrowed and with 2 conical forward-pointing teeth at its junction with the short column.

SIKKIM: in the Lachen Valley, elevation 9,000 feet; flowering in July. Pantling No. 392.

LISTERA ALTERNIFOLIA, n. spec. Height of entire plant 8 to 10 i[illegible] *Stem* glabrous, 6 in. long, sheathed at the base by a blunt oblanceolat[illegible] bract nearly 2 in. long, and bearing near its apex 2 alternate [illegible] sub-opposite, more or less obovate or elliptic leaves ·5 to ·6 in. long. *Raceme* pedunculate, puberulous, bearing 7 to 9 distant nodding olive-green flowers nearly ·25 in. across; floral bract lanceolate, about as long as the slender pedicel of the ovary. *Sepals* lanceolate, spreading, acute. *Petals* narrowly oblong, blunt. *Lip* rather longer than the sepals, oblanceolate-oblong, with a thickened central line from base to apex, the apex blunt and shortly 2-lobed, with the margins ciliolate, the base broad and with a wart-like callus at each side. *Column* short, stout, curved.

SIKKIM: Lachen Valley, elevation about 10,000 feet, in flower in July; Pantling No. 390.

A species of which the leaves are usually alternate, whereas in all other species of the genus they are opposite.

LISTERA LONGICAULIS, n. spec. Length of the whole plant 6 to 14 in., of which half is the raceme and its peduncle. *Stem* rather stout, glabrous. *Leaves* at the apex of the stem, orbicular-ovate to reniform, sub-acute or blunt, about 1·25 in. long and 1·5 in. broad. *Raceme* pedunculate, puberulous, with 8 to 14 distant olive green flowers ·6 i[illegible] long. *Ovary* with its pedicel ·4 in. long; floral bract lanceolate, ab[illegible] as long as the slender pedicel. *Dorsal sepal* ovate-lanceolate, erec[illegible] lateral sepals and petals linear-lanceolate, sub-falcate, all slightly reflexed. *Lip* large, three times as long as the lateral sepals, flat, ovate-elliptic, the apex blunt and rather deeply bifid, the margins minutely ciliolate; the upper surface with a thickened mesial line from base to

apex from which radiate glandular-pubescent branching nerves. *Column* rather long.

Lachen Valley, elevation about 7,000 feet, in flower in July; Pantling No. 391.

A species resembling *L. japonica*, Bl., which however is a smaller more slender plant with a much more deeply bifid lip.

ZEUXINE, Lindl.

ZEUXINE PULCHRA, n. spec. Height of the whole plant about 6 inches. *Stem* glabrous. *Leaves* 3 or 4, rather crowded, ovate, subacute, coriaceous; the upper surface blackish-purple, the midrib white; the petiole short, broad and sheathing at the base, length about 1 in., breadth ·66 to ·75 in. Peduncle of the spike 3 in. long, covered with sparse flexuous white hairs and bearing 2 sheathing bracts. *Spike* under 1 in. long, 2-3-flowered; floral *bracts* lanceolate, membranous, sparsely pubescent, shorter than the pubescent ovaries. *Flowers* about ·35 in. long. *Sepals* ovate-lanceolate, all free, spreading and pubescent outside. *Petals* obliquely lanceolate, curved, spreading. *Lip* longer than the sepals, the basal part cymbiformly saccate, having two unequal pairs of teeth situated at the margin near the base, the terminal part deeply divided into 2 large divergent cuneate-subquadrate lobes crose on the outer margin. *Column* with 8 tooth-like erect processes; stigmatic lobes anticous, confluent.

SIKKIM: Lachoong Valley, 7,500 feet elevation; flowering in August. Pantling No. 412.

Only two specimens have as yet been gathered of this plant. The dorsal sepal does not cohere with the petals, and the stigma is anticous and undivided; but in all other respects this has the character of the genus to which we have referred it. It is near *Z. goodyeroides*, Lindl., of which it may subsequently prove to be a malformation.

GOODYERA, R. Brown.

GOODYERA ANDERSONII, n. spec. Entire plant 6 to 9 in. high. *Stem* glabrous, leafy. *Leaves* ·8 to 1·15 in. long and ·4 to ·5 in. broad, ovate-lanceolate, with very short petioles and large wide membranous sheaths; petioles about ·2 in., the sheaths ·5 in. *Spike* 1 to 2 in long, peduncled, glandular-pubescent. *Flowers* ·5 in. long; floral bracts lanceolate, glandular-pubescent externally like the sepals petals and ovary, longer than the ovary. *Dorsal sepal* elliptic, the laterals obliquely elliptic, all blunt. *Petals* as long as the sepals, linear, slightly falcate, sub-acute. *Lip* cymbiform, ventricose in its basal half and setose within; the anterior half ovate, acuminate, concave, entire.

Sikkim: at Bucheem, elevation 8,000 feet, in flower in November. Dr. T. Anderson No. 1228.

A little-known species allied to *O. cordata*, Benth.

APHYLLORCHIS, Blume.

Aphyllorchis parviflora, n. spec. Height of entire plant about 10 inches, glabrous. *Rhizome* short with fibrous fascicled rootlets. *Stem* erect, about ·1 in. thick, leafless, but with 4 or 5 sheathing bracts ·5 to 2·5 in. long. *Raceme* about 2 in. long, many-flowered, the rachis stout. *Flowers* ·15 in. across, the labellum superior; flower bracts lanceolate, shorter than the straight untwisted tumid ovary. *Sepals* and *petals* sub-equal, linear, acuminate, spreading, their apices recurved, all keeled externally. *Lip* ovate with a broad obscurely-lobed base, sub-acute, concave. *Column* very short, rostellum prominent, anther with reflexed margins. *Pollinia* 2, the grains loosely cohering.

Sikkim: In the Lachoong Valley; at an elevation of 10,000 feet; flowering time July. Pantling No. 383.

This has smaller flowers than any Indian species of *Aphyllorchis* hitherto described. The ovary not having the usual half-twist, the labellum becomes superior.

CORYSANTHES, R. Brown.

Corysanthes himalaica, n. spec. Height of the entire plant 2 or 3 inches; the tuber ·25 to ·35 in. in diam., depressed-globose, hairy. *Stem* glabrous, with a single convolute sheath near its base. *Leaf* solitary, ·3 to ·5 in. long, sessile just under the flower, concave cordate, acute, sometimes apiculate, green in colour, the midrib and nerves white. *Flower* solitary, ·6 in. long, the bract linear-lanceolate, slightly longer than the thick sessile ovary. *Dorsal sepal* oblanceolate, blunt, concave, arching over the column and the basal half of the lip; laterals short, filiform, bifurcate, lying between the two spurs of the lip. *Petals* none. *Lip* oblong, longer than the dorsal sepal, deflexed from about the middle; the basal portion convolute, with 2 short cylindric straight spurs; the anterior half with unequally denticulate margins, its apex blunt. *Column* short, stout; stigma orbicular; anther erect.

Sikkim: At Lamteng in the Lachen Valley, at an elevation of 9,000 feet, on a moist vertical rock, in flower in July. Pantling No. 3[illegible].

The dorsal sepal and lip are transparent and have rich dark purple markings. Its nearest ally is *Corysanthes fornicata*, Blume, a native of high mountains in Java.

This is a most interesting addition to the British Indian Flora, no species of *Corysanthes* having hitherto been known to grow farther

north than the mountains of Perak. The genus is mainly Australasian; thirteen species being natives of Australia, New Zealand and Samoa, while five are Malayan. The flower is remarkable for the great development of the dorsal sepal, the lateral sepals being filiform; the petals also are either very small or, as in the present instance, altogether absent.

POGONIA, Griff.

Pogonia Prainiana, n. spec. Tubers globular, warted, ·5 to ·6 in. in diam. produced at the ends of runners 2 in. long. *Scape* 3 to 6 in. high, 1-flowered, bearing 5 or 6 bracts, the lower 4 or 5 being unequal, sheathing, blunt, the uppermost acuminate and about 1 in. long. *Leaf* from a separate tuber, orbicular, reniform and plicate, 2·5 in. broad, its petiole 1 in. long. *Floral bract* triangular, minute, very much shorter than the ovary. *Flower* 1 in. in diam., nodding. *Sepals* narrowly oblong, blunt, ·75 in. long. *Petals* linear-lanceolate, blunt. *Lip* longer than the sepals, convolute on the column; the side lobes short, triangular; the terminal lobe shortly suborbicular, its margins fimbriate and its disc with about 7 densely glandular-pubescent vertical lines. *Column* clavate.

Sikkim: Lachoong Valley at an elevation of about 6,500 feet, flowering in June. Pantling No. 372.

Pogonia Hookeriana, n. spec. *Stem* 2 in. long, glabrous, with one or two sheathing bracts near the base. *Leaf* 2 in. broad, appearing with the flowers, reniform-orbicular, the margins undulate, the nerves subscaberulous near the base; petiole nearly as long as the stem, subscaberulous-striate. *Flowers* two, about 1 in. long; the flower bract linear-lanceolate, half as long as the pedicellate ovary. *Sepals* and *petals* sub-equal, linear-lanceolate. *Lip* oblong, with 2 short blunt sub-triangular side-lobes, and an ovate sub-acute terminal lobe, the upper surface with 3 parallel ridges extending from its base to the end of the side lobes.

Sikkim: At an elevation of 3,000 feet; in flower in August. G. King No. 2153.

Collected only once, and the exact locality unknown. The leaf and flower are contemporaneous, and in this respect unique amongst the Indian species of the genus.

Pogonia falcata, n. spec. Tubers globular, warted, ·25 to ·35 in in diam. *Scape* from the apex of the tuber, 1·75 to 2·5 in. high, glabrous, 1-flowered, bearing several oblong sheathing thin membranous bracts at intervals. *Flower* ·4 to ·6 in. long including the ovary; the floral bract lanceolate, longer than the ovary. *Sepals* and *petals* sub-

equal, linear, acute, ·3 to ·4 in. long. *Lip* oblong, convolute and embracing the column, the upper surface with a single broad thickened glandular-pubescent line from the non-saccate base to nearly the apex, the disc pubescent, the lateral lobes falcate acute, the terminal lobe obovate, very blunt. *Column* clavate, its anterior surface puberulous; the anther large and fleshy; the pollinia narrowly clavate-ellipsoid.

Western Dooar or Bhotan, East of the Jaldacca River; flowering in April. Pantling No. 439.

A species near *P. velutina*, Par. and Reichb. fil. and *P. macroglossa*, Hook fil. Only three plants of it have as yet been collected, and the leaf is still unknown.

Ophrydeæ.

HERMINIUM, Linn.

Herminium quinquelobum, n. spec. Entire height of the plant 10 to 12 in. of which about two-thirds are stem; tubers oblong, undivided, about 1 in. long. Lower part of stem enveloped in two long convolute sheaths. *Leaves* two, 6 or 7 in. long by ·5 to ·6 in. broad, arising from about the middle of the stem, linear-oblong, sub-acute, sheathing at the base; peduncle of the spike with a single linear bract ·5 in. long. *Spike* 3 or 4 in. long, rather laxly-flowered. *Flowers* ·25 in. long, green, the floral bract as long as the ovary. *Sepals* sub-equal, free ovate-oblong, sub-acute, spreading. *Petals* linear, acute, spreading, and like the the sepals, 1-nerved. *Lip* longer than the sepals, oblong with small triangular basal and lateral lobes, and a contracted triangular acuminate terminal lobe. *Pollinia* globular-oblong, on short caudicles.

Sikkim: At Tendong, elevation 7,000 feet: in flower in August. Pantling No. 339.

A species like *H. angustifolium*, Benth. in general appearance, but the flowers have a totally different lip and the sepals are spreading and free, those of *H. angustifolium* being connivent. This has been named from its 5-lobed lip.

Herminium Jaffreyanum, n. spec. Entire plant 6 to 8 in. high; the tuber ellipsoidal. *Stem* with one or two short convolute sheaths near the base. *Leaves* two, about an inch apart, from near the middle of the stem, narrowly oblong, acute, sheathing at the base, 4 to 4·5 in. long and ·3 to ·5 in broad, the peduncle of the spike with a linear acuminate bract 1·5 in. long. *Spike* 3 in. long, densely flowered; the floral bracts lanceolate, about as long as the ovaries. *Flowers* ·15 in. long, green. *Sepals* ovate-elliptic, blunt, concave, spreading slightly. *Petals* narrowly oblong, obtuse, longer than the sepals, 1-nerved. *Lip* flat, triangular from a broad base; basal lobes very small, short, rounded; the terminal

Sikkim: at Lingtu; elevation, 11,000 feet, flowering in Ju[ne]. Pantling No. 375.

A curious little species, with a linear undivided entire lip and very small flowers.

HABENARIA, Linn.

Habenaria juncea, n. spec. A slender plant about 12 in. high. *Leaf* solitary from near the base of the stem, from 1·5 to 2·5 in. long and ·65 in. broad, narrowly oblong, acute, tapering from below the middle to the narrowed sheathing base, the stem above the leaf (peduncle of the spike) with two distant lanceolate bracts about ·75 in. long. *Spike* 2 to 4 in. long, few-flowered. *Flowers* ·1 in. long; the floral bract equalling or exceeding the slender shortly stalked and slightly beaked ovary. *Sepals* ovate-lanceolate, acute, the dorsal broader than the lateral pair. *Petals* narrowly oblong, tapering to the rather blunt and slightly incurved apex. *Limb* of lip as long as the sepals, ovate-lanceolate, sub-acute, quite entire; the spur shorter than the limb, vertically compressed, slightly incurved and sub-clavate. *Column* with its summit beaked and overhanging the stigma: anther-cells on each side of the stigma, and immediately above the mouth of the spur; *staminodes* large, situated near the mouth of the spur.

Sikkim: Lachen Valley at an elevation of 11,000 feet; in flower in August. Pantling No. 406.

This belongs to the section *Hologlossa* and is near *H. nematocaulon*, Hook fil., but that species has the lip superior, the ovary being twisted to the extent of one complete spiral.

Habenaria Bakeriana, n. spec. Height of the whole plant 9 to 18 inches. *Stem* about ·25 in thick at the base, and with one or more sub-acute convolute sheaths. *Leaves* several, scattered, sessile; the lower one oblong, sub-acute, with the base broad and sheathing, 3 to 5 in. long; the upper three or four linear-lanceolate, diminishing in size upwards. *Spike* 4 to 7 in. long, laxly-flowered; floral bracts entire, linear-lanceolate, much longer than the slender sessile ovaries. *Flowers* ·8 or ·9 in. long to the tip of the spur. *Sepals* oblong-lanceolate, the dorsal conniving with the petals and forming a hood over the column, the laterals reflexed. *Petals* about as long as the sepals, broadly ova[te], oblique, sub-acute, the bases broad. *Lip* fleshy, oblong, blunt, slightly broader towards the base, entire, equalling the lateral sepals in length; *spur* long, slender, twice as long as the ovary and curved forwards. *Column* stout; the cohering stigmas narrowly reniform and situated immediately below the opening into the spur. *Anther cells* parallel; *staminodes* transversely sub-obovate, lying above the stigmas and outside

the mouth of the spur. *Pollinia* narrowly obovate, tapering much to the base and without caudicles; *gland* narrow, oblong.

Sikkim: in the Lachen Valley, at an elevation of 9,000 feet: in flower in July. Pantling No. 401.

This species resembles *H. leptocaulon*, Hook. fil., but has a broader lip, a longer more curved spur, and coherent stigmas. It has also larger floral bracts and broader leaves. We have dedicated the species to Mr. J. G. Baker, F. R. S., Conservator of the Herbarium of the Royal Gardens, Kew.

Habenaria Dyeriana, n. spec. A slender plant not exceeding 12 inches in height. *Stem* at its base with a sheathing blunt oblanceolate bract 1 in. long. *Leaves* 3 or 4, sessile, 1 to 1·75 in. long, scattered along the stem at distant intervals and becoming smaller upwards, the uppermost bract-like, all more or less oblong-lanceolate with sub-acute apices and broad sheathing bases. *Spike* 3 to 4 in. long, laxly flowered. *Flower* (including the spur), ·5 to ·6 in. long; bract ovate-lanceolate, as long as or exceeding the sessile scabrid slenderly-beaked ovary. *Dorsal sepal* ovate-lanceolate; the laterals narrowly oblong, blunt, reflexed. *Petals* erect, lanceolate, with very oblique bases, slightly undulate on their inner margins. *Lip* rather fleshy, straight, deflexed, a little longer than the lateral sepals, narrowly triangular, with two small rounded lobes near its base, the margins in its lower half obscurely waved and with a short abrupt bend quite at the apex. *Spur* slender, incurved, equal to or slightly longer than the ovary, slightly compressed laterally. *Column* short and very broad. *Stigma* large, transversely elongated, lying above the opening of the spur between the distant anther cells, the arms of the rostellum incurved. *Pollinia* ovoid, their caudicles long, slender; the glands small, discoid. *Staminodes* large, cylindric, half as long as the caudicles and situated vertically on the sides of the anther cells.

Sikkim: In the Lachen Valley, elevation 12,000 feet; in flower in August. Pantling No. 407.

A very distinct species belonging to the Section *Hologlossa*. The floral bracts are leaf-like and gradually decrease in size upwards. The size and position of the very large stigma stretching across the wide column almost to its edges, and situated above the opening of the spur, are good distinguishing marks of this species.

Habenaria pseudophrys, n. spec. Height of entire plant 18 to 28 inches. *Tubers* irregularly oblong, hairy. *Stem* with 3 or 4 long convolute acuminate sheaths in its lower part, each from 1 to 1·5 in. long. *Leaves* about 4 in number, scattered, distant, the lower from 1 to 2 in. long, the upper 3 in. long; all ovate-oblong, acute, with broad sheathing

bases; the upper part of the stem with 3 or 4 scattered lanceolate acuminate bracts ·5 or ·6 in. long. *Spike* 3 or 4 in. long, the bracts lanceolate, equalling or longer than the sessile shortly beaked ovaries. *Sepals, petals* and *lip* connivent. *Dorsal sepal* broadly elliptic, oblong; the laterals oblong; all sub-acute. *Petals* shorter than the sepals, broadly elliptic, sub-acute, the bases oblique. *Lip* equalling the sepals in length, oblong, concave, 3-lobed, the margins entire; side lobes narrowly triangular, pointed forwards, very near the small triangular blunt terminal lobe. *Spur* small, globular, slightly compressed vertically. *Column* broad, with 2 unequal triangular incurved wings along its outer edges. *Anther-cells* close together, parallel; the pollinia broadly ovoid, each with a short caudicle and a discoid gland lodged in a pouch. *Stigma* large, extending on each side of the pouches and concealed by the incurved wings of the column.

Sikkim: at Chong-thang, elevation 5,500 feet, in flower during July. Pantling No. 424.

In externals this species resembles *H. Prainii*, Hook. fil., with which it was at first confused. It is, however, perfectly distinct from that species. This plant has the facies of a *Habenaria*, but the glands and the bases of the caudicles of the pollinia rest in twin pouches, after the manner of *Ophrys*. In fact it forms a connecting link between *Habenaria* and *Ophrys*—hence the specific name which we have proposed for it.

Materials for a Carcinological Fauna of India. No. 2. *The Brachyura Oxystoma.*—*By* A. Alcock, M.B., C.M.Z.S., *Superintendent of the Indian Museum.*

Plates VI—VIII.

Received 7th May. Read 3rd June.

The limits of the Tribe of Oxystoma here adopted are those originally established by De Haan in the Fauna Japonica, and since recognized by Ortmann in his account of the Decapod Crustacea of the Strasburg Museum.

I can hardly, however, go as far as Ortmann in uniting the *Leucosiidæ* and *Raninidæ* in one section, Leucosiinea, co-ordinate in value with the Dorippinea and Calappinea. Rather, it seems to me, the affinities of the *Raninidæ* are, through *Cyclodorippe*, with the *Dorippidæ*. But on the whole it seems enough to recognize the *Raninidæ* as true Oxystomes of equal rank with the *Calappidæ*, *Leucosiidæ* and *Dorippidæ*, just as De Haan practically does.

No one who has examined any of the deep-sea Dorippoids can, I think, find any difficulty in accepting De Haan's comprehensive views of the relations of the Oxystoma.

For instance, in the Indian genus *Cymonomops** (which differs but little from *Cyclodorippe*), although the general external form is as plainly as possible that of *Dorippe*, yet a detailed examination shows a number of Raninoid characters:—The chelipeds are Raninoid, so are the external maxillipeds (especially in their long narrow merus and short narrow exognath), so are the antennules: the fact also that the afferent branchial openings are not in front of the bases of the chelipeds is suggestive. In *Cyclodorippe*, moreover, the oviducts open, as in the *Raninidæ*, on the bases of the third pair of legs.

We have, in fact, in some of these deep-sea forms the clearest evidence of the close relation of the *Ranina* type to the *Dorippe* type, and quite sufficient justification for accepting De Haan's scheme of the Oxystoma almost without modification.

The following is a list of the known Indian genera of Oxystomes:—

Calappidæ Calappinæ:—*Calappa, Mursia, Cryptosoma.*

Calappidæ Matutinæ:—*Matuta.*

Leucosiidæ Leucosiinæ:—*Actæomorpha, Oreophorus, Tlos, Heteronucia (nov.), Ebalia, Nursia, Nucia, Parilia, Randallia, Myra, Leucosia, Onychomorpha, Philyra, Pseudophilyra.*

Leucosiidæ Iliinæ:—*Myrodes, Iphiculus, Pariphiculus (nov.), Nursilia, Heterolithadia, Arcania, Ixa.*

Dorippidæ Dorippinæ:—*Dorippe, Ethusa.*

Dorippidæ Tymolinæ:—*Cymonomops.*

Raninidæ:—*Notopus, Raninoides, Lyreidus.*

Tribe OXYSTOMA or LEUCOSOIDEA.

Oxystomes, Milne-Edwards, Hist. Nat. Crust. II. 96 (*partim*), and *Raniniens* Milne-Edwards *op. cit.* II. 190.

Oxystomata, De Haan, Faun. Japon. Crust. pp. 111–119.

Leucosioidea vel *Oxystomata*, Dana, U. S. Expl. Exp. Crust. I. 389, and *Raninidea* vel *Anomura Leucosiidica*, Dana, *op. cit.* pp. 400, 403.

Oxystomata or *Leucosiidea*, Miers, Challenger Brachyura, p. 337, and *Raninidea*, Henderson, Challenger Anomura, p. 26.

Oxystomata, Ortmann, Zool. Jahrbuch., Syst., VI. 1892, pp. 550, 551.

Epistome reduced or absent. The efferent branchial channels terminate in the middle of the buccal area, the buccal cavern is therefore produced forwards and is generally of an elongate triangular shape; and the efferent channels themselves, whether covered by the external maxillipeds or not, are immediately closed in by an elongate lamellar process of the exopodites of the first maxillipeds.

* Illustrations of the Zoology of the 'Investigator,' Crustacea pl. xiv. fig. 9.

The afferent branchial openings are found either in the usual place in front of the bases of the chelipeds, or at the sides of the endostome.

Branchiæ from six to nine on either side.

The antennules fold either longitudinally or obliquely, very rarely transversely.

In the male the genital ducts protrude either through the bases of the fifth pair of legs or through the fifth thoracic sternum close by.

The Oxystoma may be divided into four families as follows:—

Family I. *Calappidæ*. Carapace of the ordinary brachyurous shape. The afferent branchial openings are found in front of the bases of the chelipeds. The antennæ are small. The legs are normal in position. The vasa deferentia perforate the bases of the fifth pair of legs. The branchiæ are nine in number on either side. The external maxillipeds either completely cover the buccal cavern and have their palp hidden in repose (*Matutinæ*), or do not close the buccal cavern and have their palp always exposed (*Calappinæ*).

Family II. *Leucosiidæ*. The carapace is of the ordinary brachyurous shape. The afferent branchial channels are found on either side of the endostome. The vasa deferentia perforate the sternum near the bases of the fifth pair of legs. The legs are normal in position. The antennæ are small, sometimes obsolete. The external maxillipeds completely close the buccal cavern and have the palp completely hidden in repose. The branchiæ are less than nine (six in many forms) in number on either side.

Family III. *Dorippidæ*. The carapace is short, so that the first two or three abdominal terga, instead of being tucked up beneath it, are completely exposed in the dorsal plane of the body. The last two pairs of legs are much reduced in size and have a peculiar position in the dorsal plane of the body. The antennæ are large. The antennules are usually too large to fold into their fossettes. The vasa deferentia emerge through the sternum near the bases of the fifth pair of legs. The afferent branchial openings are found either in front of the bases of the chelipeds or not. The external maxillipeds either do cover the buccal frame (*Tymolinæ*), or do not (*Dorippinæ*). The branchiæ are less than nine in number on either side.

Family IV. *Raninidæ*. Carapace remarkably elongate, but not covering the abdominal terga, the first 4 or 5 of which lie exposed in the dorsal plane of the body. The last pair of legs also is raised in the dorsal plane of the body. The antennæ are large. The antennules also are large, and do not fold into fossettes. The vasa deferentia protrude through the bases of the fifth pair of legs: *the oviducts pierce the bases*

of the third pair of legs. The sternum is broad anteriorly, very narrow or linear posteriorly. The afferent branchial openings are not found in front of the bases of the chelipeds, and afferent currents probably reach the branchial chamber between the posterior border of the carapace and the bases of the last pair of legs. The external maxillipeds completely cover the buccal cavern, and their palp is concealed in repose; their exopodite is but little longer than the ischium. The branchiæ are less than nine in number on either side.

Family CALAPPIDÆ.

Calappiens, Milne-Edwards, Hist. Nat. Crust. II. 100.
Calappidea and *Matutoidea*, De Haan, Faun. Japon. Crust. pp. 124, 126.
Calappidæ and *Matutidæ*, Dana, U. S. Expl. Exp., Crust. I. pp. 390, 391.
Calappidæ and *Matutidæ*, Miers, 'Challenger' Brachyura, pp. 282, 293.

Carapace more or less oval or subcircular, commonly with either (1) a single denticle or a heavy spine at the junction of the antero-lateral and postero-lateral borders, or (2) a postero-lateral vault-like expansion over the ambulatory legs (*Calappa*). Front generally about as wide as the orbit. The antennules generally fold obliquely. The antennæ are generally small.

The external maxillipeds may (*Matutinæ*) or may not (*Calappinæ*) completely close the buccal cavern, and their palp may (*Matutinæ*) or may not (*Calappinæ*) be concealed in repose.

The efferent branchial channels together form a deep channel in the endostome the channel being covered in below by a long lamellar process of the internal (first) maxillipeds. The afferent branchial openings have the normal position in front of the bases of the chelipeds.

The chelipeds are ponderous and greatly enlarged, and are practically symmetrical (except sometimes as to the fingers)*: the hands especially are of great size—forming often the most conspicuous part of the chelipeds, and are so curved as to shut closely against the pterygostomian regions of the carapace, thus acting as a sort of buckler.

The abdomen usually (always in Indian forms) consists in the adult male of 5 segments, the 3rd–5th terga being fused together, and 7 separate segments in the female (and young male). The branchiæ in all Indian forms are nine in number on either side.

In the male the vasa deferentia perforate the bases of the fifth pair of legs.

In the following list of genera belonging to the family *Calappidæ*

* In the exotic genus *Platymera* one cheliped is larger than the other.

those belonging to the Indian fauna are printed in Roman type, and those known to me by autopsy are marked with an asterisk.

Family **Calappidæ.**

Subfamily I. *Calappinæ.*

Alliance I. Calappoida.

* Calappa.

Paracyclois, Miers, 'Challenger' Brachyura, p. 288, pl. xxiv. figs. 1, 1*a*–1*c*.

* *Platymera*, Milne-Edwards, Hist. Nat. Crust. II. 107; and Milne-Edwards and Lucas, Voy. Amer. Merid. Crust. pl. xiii.

* Mursia.

Acanthocarpus, Stimpson, Bull. Mus. Comp. Zool. II. 1870-71, p. 352; and A. Milne-Edwards, Bull. Mus. Comp. Zool. VIII. 1880-8[illegible] pl. i.

* Cryptosoma.

Alliance II. Orithyioida.

Orithyia, Fabr., Milne-Edwards, Hist. Nat. Crust. II. 110, and in Cuvier, Règne Animal, Crust., pl. viii. figs. 1, 1*a*–1*c*.

Subfamily II. *Matutinæ.*

Alliance I. Matutoida.

* Matuta.

Alliance II. Hepatoida.

Osachila, Stimpson, Bull. Mus. Comp. Zool., II. 1870-71, p. 154; and Faxon, 'Albatross' Stalk-eyed Crustacea, pl. v. figs. 2, 2*a*, 2*b*.

* *Hepatus*, Latr., Milne-Edwards, Hist. Nat. Crust. II. 116, and in Cuvier Règne Animal, Crust. pl. xiii. figs. 2, 2*a*–*i*.

Subfamily CALAPPINÆ.

Calappidæ, Dana *loc. cit.*, and Miers *loc. cit.*

Merus of external maxillipeds not elongate and acute (except in the exotic and somewhat aberrant genus *Orithyia*), and never concealing the palp in repose. Legs gressorial (except in the exotic genus *Orithyia*.)

Subfamily MATUTINÆ.

Matutidæ, Dana, *loc. cit.*, and Miers, *loc. cit.*

Merus of external maxillipeds elongate and acute, entirely concealing the palp in repose. Legs natatorial.

Key to the Indian genera of Calappidæ.

I. *Calappinæ* :—Merus of external maxillipeds not elongate or acute, and never concealing the flagellum in repose: ambulatory legs gressorial:—

1. Carapace with a postero-lateral shield-like expansion or series of broad serrations, forming a vault beneath which the four ambulatory legs can be completely or largely concealed in flexion: basal joint of antennæ much dilated ... ... CALAPPA.
2. Carapace without any trace of a postero-lateral shield-like expansion: basal joint of antennæ slender:—
   i. Carapace transversely oval, with a large spine at the junction of the antero-lateral and postero-lateral borders ... MURSIA.
   ii. Carapace sub-circular or longitudinally suboval, with a small denticle at the junction of the antero-lateral and postero-lateral borders ... ... CRYPTOSOMA.

II. *Matutinæ* :—Merus of external maxillipeds elongate and acute, and completely concealing the flagellum in repose: ambulatory legs in the form of swimming paddles. (Carapace sub-circular, with a large spine at the junction of the antero-lateral and postero-lateral borders: antennæ rudimentary) ... ... MATUTA.

CALAPPA, Fabricius, Edw.

Calappa, Fabricius, Ent. Syst., Suppl. p. 345.
Calappa, Milne-Edwards, Hist. Nat. Crust. II. 102.
Calappa, Lophos, Camara, Gallus, De Haan, Fauna Japonica, Crust. pp. 69, 70, 125.
Calappa, Miers, 'Challenger' Brachyura, p. 283.

Carapace strongly convex, rounded in front, much broadened behind by a pair of clypeiform expansions, or wings, beneath which the four pairs of ambulatory legs are concealed in flexion.

Front small, somewhat triangular, projecting little or not at all beyond the level of the orbits, bilobed.

Orbits small, circular: eyestalks short and thick.

The antennules fold nearly vertically beneath the front.

The basal joint of the antennæ is very broad, and fills a wide hiatus at the inner angle of the orbit: the flagellum is short usually.

There is no distinct epistome; but the endostome is prolonged, as far as the antennulary fossæ, in the form of a canal, which is divided longitudinally by a deep vertical septum into two channels, each channel being completed below by a lamellar process from the first pair of maxillipeds.

The external maxillipeds do not meet across the mouth, but leave exposed between them the mandibles, and, in front of them, the aforementioned plate-like prolongations from the first pair of maxillipeds.

The chelipeds are very large, and in flexion are closely apposed to the front half of the carapace, so as to form a sort of buckler: the meropodite, or "arm," has near its distal end, externally, a transverse wing-like expansion, complementary to the wing-like expansion of the carapace: the propodite, or "hand," is strongly compressed, its upper border forming a high, sharply dentate or crenulate, crest. Except for the fingers, the chelipeds are equal and symmetrical; both the fingers, namely, of one hand have on their outer aspect, near the base, a stout projecting lobule.

The abdomen in the adult male* consists of only five separate pieces, owing to the fusion of the 3rd, 4th and 5th somites. In the young male, as in the adult female, it consists of seven separate somites.

Key to the Indian species of Calappa.

I. Extreme length of the carapace either quite or nearly equal to its extreme breadth:—
  1. Carapace as long as broad: clypeiform expansions ill developed:—
    i. Carapace sub-circular, with 7 longitudinal parallel lines of bullous tubercles ... ... *C. pustulosa.*
    ii. Carapace sub-quadrangular, without regular lines of tubercles ... *C. wood-masoni.*
  2. Carapace a little broader than long: clypeiform expansions well-developed ... *C. gallus.*

* ? *C. gallus*, of which species I have not seen adult males.

II. Extreme length of the carapace about two-thirds of its extreme breadth: free margin of clypeiform expansions strongly laciniate:—

1. Carapace, in the adult, nearly smooth: clypeiform expansions well-developed. [*Inhabitants of shallow water*]:—

i. Anterior border of endostomial septum deeply concave: no spine in the middle line, on the posterior border ... ... *C. lophos.*

ii. Anterior border of endostomial septum strongly convex: a spine in the middle line, on the posterior border ... ... *C. philargius.*

2. Carapace, in the adult, more or less covered with pustular tubercles: clypeiform expansions little developed. [*Habitat deep water*] ... ... *C. exanthematosa.*

III. Extreme length of the carapace very much less than two-thirds of its extreme breadth: free margin of clypeiform expansions either smooth throughout, or broadly dentate:—

1. Extreme length of carapace rather more than half its extreme breadth: surface of carapace with numerous sharpish tubercles: antero-lateral border of clypeiform expansions with broad teeth the points of which are either acute or have the form of up-curved spines:—

i. Antero-lateral border of carapace coarsely serrate ... ... *C. hepatica.*

ii. Antero-lateral border of carapace, and of clypeiform expansions, with strongly up-curved spines ... *C. spinosissima.*

2. Extreme length of carapace rather less than half its extreme breadth: surface of carapace with wavy beaded lines only: free edge of clypeiform expansions smoothly moulded and entire ... *C. fornicata.*

1. *Calappa fornicata*, Fabr.

Cancer calappoides, Rumph, Amboinsche Rariteitkamer I. 21, pl. xi. figs. 2, 3.
Cancer heracleoticus, Seba, Thesaurus III. 51, pl. xx. figs. 7, 8.
Cancer calappa, Linn., Mus. Lud. Ulr. p. 449, and Syst. Nat., 12th ed. I. ii. 1048: Herbst, Krabben I. ii. 196, pl. xii. figs. 73, 74: Fabricius, Ent. Syst. II. 454.
Calappa fornicata, Fabricius, Ent. Syst. Suppl. p. 345: Bosc, Hist. Nat. Crust. I. 183 (*nec* pl. iii. fig. 3): Latreille, Hist. Nat. Crust. et. Ins. V. 394: Desmarest, Consid. Gen. Crust. p. 109: Milne-Edwards, Hist. Nat. Crust., II. 106: Dana, U. S. Expl. Exped., Crust. pt. I. p. 394, pl. xxv. fig. 1: A. Milne-Edwards, Nouv. Archiv. du Mus. IV. 1868, p. 72, and X. 1874, p. 56: Hilgendorf in Von Der Decken's Reisen in Ost.-Afr. III. i. p. 92: Brito Capello, Jorn. Sci. Lisboa, III. 1870-71, p. 133, pl. ii. fig. 5: E. Nauck, Zeits. Wiss. Zool. xxxiv. 1880, p. 46 (*gastric teeth*): A. Ortmann, Zool. Jahrbucher, Syst. etc. VI. 1892, p. 569.

Carapace in length less than half the extreme breadth; its surface nearly smooth anteriorly, marked with transverse wavy beaded lines posteriorly; its antero-lateral borders crenulated.

Clypeiform expansions very large, their breadth (transverse measurement) equal to their length (oblique antero-posterior measurement); their edge smoothly moulded, and in unbroken continuity with the smoothly moulded posterior border of the carapace. Outer part of the pterygostomian regions densely hairy.

Front slightly projecting beyond the level of the orbits, bilobed, its breadth at the tip rather less than the breadth of the orbit.

Endostomial septum extending vertically from the level of the front to the level of the mouth; its anterior border strongly convex and projecting.

Transverse wing-like expansion near the distal end of the arm with its edge smooth and entire.

Outer surface of palm with squamiform tubercles and transverse wavy beaded ridges: upper margin, or crest, of palm bluntly dentate.

Three specimens, including a male and ovigerous female of remarkable size, are in the Museum collection, from the Andamans.

The eggs are singularly minute.

2. *Calappa hepatica* (Linn.)

Cancer hepaticus, Linn., Mus. Lud. Ulr., p. 448, and Syst. Nat. ed. xii. I. ii. 1048.
Calappa hepatica, De Haan, Faun. Japon. Crust., p. 70: Miers, Cat. Crust. N. Zealand, p. 55, and Phil. Trans. Roy Soc. Vol. 168, 1879, p. 491, and Zool. H. M. S. 'Alert' pp. 185, 257, 518, 550, and 'Challenger' Brachyura, p. 285: Haswell, Cat. Austral. Crust., p. 136: Filhol, Crust. Nouvelle Zélande, p. 406: [Cano, Boll. Soc. Nat. Napoli, III. 1889, p. 249]: A. Ortmann, Zool. Jahrbuch., Syst. etc., VI. 1892, p. 568: J. R. Henderson, Trans. Linn. Soc., Zool. (2) V. 1893, p. 395.
Cancer tuberculatus, Herbst. Krabben, I. ii. 204, pl. xiii. fig. 78: Fabricius, Ent. Syst. II. 454.

Calappa tuberculata, Fabricius, Ent. Syst., Suppl., p. 345; Bosc, Hist. Nat. Crust. 183: Latreille, Hist. Nat. Crust. et. Ins., V. 393: Desmarest, Consid. Gen. Crust., p. 109, pl. 10, fig. 1: Milne-Edwards, Hist. Nat Crust., II. 106: Owen, Zool. Beechey's Voy. "Blossom," Crust. p. 80: Krauss, Südafr. Crust., p. 52: Dana, U. S. Expl. Exp., Crust. pt. I. p. 393: Stimpson, Proc. Ac. Nat. Sci. Philad., 1858, p. 162: Heller, Crust. Roth. Meer. in SB. Ak. Wien, 1861, XLIII. p. 372, and 'Novara' Crust. p. 69: Hess, Archiv. fur Naturges. XXXI. 1865, pp. 157 and 172: E. Martens, Verh. zool.-bot. Ges. Wien, XVI. 1866, p. 381: A. Milne-Edwards, Nouv. Archiv. du Mus. IV. 1868, p. 72, and X. 1874, p. 55: Hilgendorf in Von Der Decken's Reisen in Ost.-Afr. III. i. 92: Brito Capello, Jorn. Sci. Nat. Lisboa, III. 1870-71, p. 133, pl. ii fig. 8: Hoffman in Pollen and Van Dam, Faun. Madagasc. V. 2. 1874, Crustacea, p. 25 (*part*), pl. vi. figs. 39, 41, 42: Brocchi, Ann. Sci. Nat. (6) II. 1875, Art. 2, p. 101, pl. xviii. figs. 160, 161, (*male appendages*): Kossmann, Reise Roth. Meer., Crust., p. 63: Streets, Bull. U. S. Nat. Mus. VII. 1877, p. 116: Hilgendorf, MB. Ak. Berl. 1878, p. 809: Richters, in Möbius, Meeresf. Maurit. p. 157: de Man, Notes Leyden Mus. II. 1880, p. 184, and Archiv. fur Naturges. LIII. i. 1887, p. 388: E. Nauck, Zeits. Wiss. Zool. XXXIV. 1880, p. 46 (*gastric teeth*): Lenz and Richters, Abh. Senck. Ges. XII. 1881, p. 425: Muller, Verh. Ges. Basel VIII. 1886, p. 473.

Calappa tuberculosa, Guérin Méneville, Icon. R. A., Crust. pl. 12, figs. 2, 2*a*, 2*b*.

Calappa sandwichica (*Calappa tuberculata* var.) Eydoux and Souleyet Voy. 'Bonite,' Vol. I., Zool., p. 245, pl. iii., figs. 9, 10.

Length of carapace a little more than half the extreme breadth. In the anterior two-thirds the surface of the carapace is tuberculate and granular, in the posterior third it is marked with squamiform tubercles and beaded ridges: the antero-lateral borders are coarsely dentate or serrate.

Clypeiform expansions greatly developed, their breadth being equal to their length: their anterior border shows the points of four teeth, but the postero-lateral border forms a continuous curve, broken only on the under surface by three or four faint sutures.

Posterior border of the carapace beaded, unarmed.

Outer part of the pterygostomian regions densely hairy.

Front emarginate, not projecting beyond the level of the orbits, its breadth at the tip markedly less than the breadth of the orbit.

The endostomial septum extends vertically from the level of the front to the level of the mouth; its anterior border strongly convex and projecting.

Transverse wing-like expansion of the distal end of the arm with its edge four-lobed. Outer surface of palm with numerous sharp tubercles: upper surface of wrist tuberculate: anterior end of arm with some sharp granules: crest of palm crenulate, not sharply dentate.

Andamans, Nicobars, Maldives, Laccadives, Persian Gulf.

In the very *young*, the extreme length of the carapace is not much

less than three-fourths of the extreme breadth, owing not only to le development of the clypeiform expansions, but to the relative le breadth of the body.

3. *Calappa spinosissima*, Edw.

Calappa spinosissima, Milne Edwards, Hist. Nat. Crust. II. 106: A. Milne Edwards, Nouv. Archiv. du Mus. X. 1874, p. 55: Richters, in Möbius Meeresf. Maurit., p. 157.

Calappa tuberculata (part) Hoffmann in Pollen and Van Dam, Faun. Madagasc. V. ii. Crustacea, p. 25, pl. vi. figs. 40, 43, 44.

Differs from *C. hepatica* only in the following characters:—

(1) the serrations on the antero-lateral border of the carapace, as also the teeth on the antero-lateral border of the clypeiform expansions, are in the form of sharp up-curved spines:

(2) the postero-lateral border of either clypeiform expansion has three spines where, in *C. hepatica*, there are only sutures on the under surface:

(3) some of the tubercles on the outer surface of the palm have sharp spinous points.

From a single small specimen, which is all that the Indian Museum at present possesses, it is impossible to express any opinion as to whether this species is, as Hoffmann appears to have regarded it, a variety of *C. hepatica*, or not.

4. *Calappa lophos*, (Herbst).

Cancer lophos, Herbst, Krabben, I. ii. 201, pl. xiii. fig. 77.

Calappa lophos, Fabricius, Ent. Syst. Suppl., p. 346: Bosc, Hist. Nat. Crust. I. 184: Latreille, Hist. Nat. Crust. et Ins. V. 394: Milne Edwards, Hist. Nat. Crust. II. 104: De Haan, Faun. Japon. Crust. p. 72, pl. xx fig. 1: Heller, 'Novara' Crust. p. 69: Miers, Ann. Mag. Nat. Hist. (5) V. 1880, p. 315, and 'Challenger' Brachyura, p. 286: E. Nanck, Zeits. Wiss. Zool. XXXIV. 1880, p. 46, (*gastric teeth*): de Man, Archiv. fur Naturges. LIII. 1887, i. p. 389: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 395.

? *Calappa guerini*, Brito-Capello, Jorn. Sci. Nat. Lisb. III. 1870-71, pp. 128, 133 pl. ii. fig. 2.

The length of the carapace is not quite two-thirds the extreme breadth.

Carapace smooth, except for a few lumps anteriorly and a fe scattered granules posteriorly: its antero-lateral borders beaded and finely festooned: its posterior border beaded, and bounded on either side by a tooth.

Clypeiform expansions nearly as broad (transverse measurement) as long (oblique antero-posterior measurement), and formed of about 6 large laciniated teeth.

Outer part of the pterygostomian regions densely hairy.

Front bifid, its least breadth equal to the breadth of the orbit, beyond the level of which it does not project.

Endostomial septum extending, posteriorly, from the level of the front to the level of the mouth, but deeply excised anteriorly.

Margin of the transverse wing-like expansion of the distal end of the arm four-lobed, the two anterior lobes each with a spine: upper surface of wrist and outer surface of palm nearly smooth: crest of palm deeply 6- or 7-toothed.

Andamans; the whole of the east coast of India, from the Ganges Delta to Pondicherry; Ceylon, Persian Gulf.

In the *young* the carapace is traversed longitudinally in its anterior three-fourths, by 7 or 8 lines of sharpish tubercles, and is marked in its posterior third by a pair of large ocelli, one in each epibranchial region.

From an examination of a very large series of these young I feel nearly sure that Capello's *C. guerini* is to be referred to this species.

5. *Calappa philargius* (L.)

Cancer philargius, Linn. Mus. Lud. Ulr. p. 432, and Syst. Nat. ed. xii. I. ii. 1042: Herbst, Krabben, I. ii. 203.

Cancer inconspectus, Herbst, Krabben, II. ii. 162, pl. xl. fig. 3.

Calappa cristata, Fabricius, Ent. Syst. Suppl. p. 346: Latreille, Hist. Nat. Crust. et Ins. V. 393: Milne-Edwards, Hist. Nat. Crust. II. 105, pl. xx. figs. 1, 2: Stimpson, Proc. Ac. Nat. Sci. Philad., 1858, p. 62: Ortmann, Zool. Jahrb., Syst. etc., VI., 1892, p. 565.

Calappa inconspecta, Bosc, Hist. Nat. Crust. I. 185.

Calappa philargius, De Haan, Faun. Japon. Crust. p. 71, pl. xix. fig. 1: E. Nauck, Zeits. Wiss. Zool., XXXIV. 1880, p. 46 (*gastric teeth*): de Man, Archiv. fur Naturges., LIII. 1887, i. p. 388, and Journ. Linn. Soc., Zool., Vol. XXII. 1888, p. 196: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 396.

The extreme length of the carapace is two-thirds the extreme breadth.

Differs from *C. lophos* only in the following characters:—

(1) there is a large tooth in the middle of the posterior border, and the tooth bounding that border on either side is more salient:

(2) the endostomial septum, instead of being deeply excised anteriorly, has its anterior border strongly convex and projecting.

Mergui, Andamans, Ceylon, Persian Gulf.

In the *young* the teeth of the posterior and postero-lateral borders are more prominent and less oblique; and the carapace is traversed fore and aft by 7 or 8 rows of sharp tubercles.

6. *Calappa exanthematosa*, Alcock and Anderson.

Calappa exanthematosa, Alcock and Anderson, Journal Asiatic Soc. Bengal, V LXIII. pt. 2, 1894, p. 177, and Illustrations of the Zoology of the R. I. M. S. 'Investigator,' Crustacea, pl. xv. figs., 1, 1a.

Extreme length of carapace a little more than two-thirds the extreme breadth.

The carapace is greatly inflated, especially in the branchial regions: its surface in rather more than its anterior half is covered with large round, or oval, smooth mamillary tubercles having a red base and a shining yellow apex, and exactly resembling smallpox pustules; and is covered posteriorly with smaller round, or oval, slightly elevated patches, which exactly resemble smallpox papules. The antero-lateral borders of the carapace are quite smooth in their anterior half, and have 4 or 5 coarse serrations in their posterior half: the posterior border is beaded, and is bounded on either side by a tooth.

The clypeiform expansions are little developed, their extreme transverse dimension being less than one-third their extreme dimension in an inwardly oblique antero-posterior direction: they consist of about seven serrated teeth.

The pterygostomian regions have only a few scanty hairs.

The front is bifid, the breadth of its tip is half again that of the orbit, beyond which it does not project.

The flagellum of the antenna is nearly twice the breadth of the orbit in length.

The endostomial septum is narrow, not extending vertically to the level of the mouth, and quite plainly shows its origin out of a fold of the endostome: its anterior border is cut straight, and projects obliquely.

The wing-like expansion at the end of the arm has its edge finely serrate and 4-dentate. The upper surface of the wrist and the outer surface of the palm are more or less covered with pustules similar to those on the carapace. The palm has its crest sharply 6- or 7-dentate and its lower surface uniformly covered with beadlike granules.

The sterna corresponding to the 2nd, 3rd and 4th pairs of legs are much inflated.

Bay of Bengal, off the Madras coast, 91–112 fms.

In the *young* the tubercles on the carapace are sharper, and extend further backwards.

7. *Calappa gallus*, (Herbst.)

Cancer gallus, Herbst, Krabben, III. iii. 46, pl. lviii. fig. 1.
Calappa gallus, Milne Edwards, Hist. Nat. Crust. II. 105: De Haan, Faun.

Japon. Crust. p. 70: Dana, U. S. Expl. Exp. Crust. pt. I. p. 393: A. Milne Edwards in Maillard's 'Ile Réunion, Annexe F. p. 10, and Nouv. Archiv. du Mus. X. 1874, [illegible]5: Brito Capello, Jorn. Sci. Nat. Lisb. III. 1870-71, p. 133, pl. ii. fig. 4: F. Müller, Verh. Ges. Basel, VIII. 1886, p. 473: Miers, 'Challenger' Brachyura, p. 286: Ozorio, Jorn. Sci. Nat. Lisb., XI. 1885-87, p. 227: de Man, Arch. für Naturges., LIII. 1887, i. p. 388, and Journ. Linn. Soc., Zool. XXII. 1888, p. 197: Ortmann, Zool. Jahrbuch., Syst., &c., VI. 1892, p. 567: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 395.

The extreme length of the carapace is nearly five-sixths the extreme breadth.

The carapace, the outer surface of the wing-like expansion of the arm, the upper surface of the wrist, and the outer surface of the palm, are covered with coarse tubercles, which become squamiform on the posterior part of the carapace.

The antero-lateral border of the carapace is crenulate, and the posterior border is finely beaded and quite unarmed.

The clypeiform expansions are well developed, their extreme transverse dimension being about two-thirds their extreme antero-posterior dimension: the free edge of each has about six strong teeth with beaded edges.

The pterygostomian regions have only a few scanty hairs.

The front is emarginate, and projects well beyond the orbits, forming a laminar rostrum.

The endostomial septum extends vertically from the level of the front to the level of the mouth: its anterior border is angularly convex.

The wing-like expansion of the end of the arm is conspicuously four-lobed: the crest of the palm is 6- or 7-dentate.

Mergui, Andamans, Ceylon, Persian Gulf.

In the *young* the tubercles of the carapace and chelipeds are sharper and crisper, and the antero-lateral borders of the carapace are sharply serrate.

8. *Calappa pustulosa*, n. sp. Plate VI. fig. 1.

Carapace subcircular, the clypeiform expansions consisting of five short broad teeth, the last of which is in advance of the level of the [illegible]terior border: its surface is covered with large bullous tubercles arranged in seven parallel longitudinal rows: the antero-lateral borders are smooth in their anterior half, crenulated in their posterior half: the posterior border is bounded on either side by a faint prominence.

The pterygostomian regions have a few scanty hairs.

The front is sharply bilobed, its tip is not quite so broad as the orbit, beyond the level of which it projects.

The endostomial septum does not extend vertically from the level of the front to the level of the mouth, except at its posterior limit.

The crest at the distal end of the arm is four-lobed: the upper surface of the wrist and the outer surface of the palm have numerous bullous tubercles like those on the carapace: the crest of the palm is serrate.

The abdomen is as in *C. lophos.*

The sterna corresponding to the 2nd, 3rd and 4th legs are inflated.

Off Ganjam and Orissa Coasts, 25 fathoms.

9. *Calappa wood-masoni*, n. sp. Plate VI. fig. 2.

Very closely allied to *C. depressa*, Miers, 'Challenger' Brachyura, p. 287, pl. xxiii. fig. 2.

The extreme length of the carapace is a little greater than the extreme breadth.

Carapace depressed; its surface crisply tuberculate, except between the eyes, the tubercles becoming squamiform posteriorly: the anterior lateral borders crisply crenulate, the posterior border entire and unarmed.

The clypeiform expansions are slightly developed, and plainly consist of about 7 convex carinate teeth fused together except at the tip.

Pterygostomian region with few scanty hairs.

Rostrum sharply and deeply bilobed, each lobe being again subdivided at tip; projecting well beyond the level of the orbits, and rather broader than them.

Flagellum of antenna nearly half the length of the carapace.

Endostomial septum extending vertically from the level of the front to the level of the mouth; its free edge greatly thickened, its anterior edge sharply excised.

Crest at the distal end of the arm broadly and faintly four-partite: upper surface of wrist and outer surface of palm crisply tuberculate: crest of palm sharply serrate.

Penultimate segment of the male abdomen the shortest of all except the first.

Off south coast of Ceylon, 34 fathoms.

The above description applies to the *young*, no adults having been obtained.

MURSIA, Desmarest, Edw.

Mursia, Desmarest, Consid. Gen. Crust., p. 108, pl. 9, fig. 3.

Mursia, [Latreille, in Cuvier, Règne Animal, ed. 2, p. 39] and Milne-Edwards in Cuvier, Règne Animal, ed. 3, p. 54.

Mursia, Milne-Edwards, Hist. Nat. Crust. II. 109.
Mursia, De Haan, Faun. Japon. Crust. p. 68 and p. 125.
Mursia, Miers, Challenger Brachyura, p. 290, (*ubi synon.*).
Thealia, Lucas, Ann. Soc. Entomol. France (1) VIII. 1839, p. 577.

Carapace oval, moderately convex, rounded in front, rather suddenly contracted behind, the evenly-arched antero-lateral margins ending in a large lateral epibranchial spine.

Front with a small acuminate tip.

Orbits rather large, oval, with at least one closed but distinct fissure in the upper margin, and with two wide gaps in the lower margin, in one of which the basal joint of the antenna is lodged. Eyes large, eyestalks short and thick.

The antennules fold obliquely. The basal joint of the antennæ is not dilated.

There is no distinct epistome, but, as in *Calappa*, the endostome is prolonged into a canal, which however is but incompletely divided longitudinally, the septum being little more than a ridge anteriorly, though well developed posteriorly. As in *Calappa* the first pair of maxillipeds give off each a lamellar process to complete this efferent canal below.

The external maxillipeds do not meet across the mouth, but, as in *Calappa*, leave exposed between them the mandibles, and, in front, the plate like prolongations of the first maxillipeds.

The chelipeds are enlarged, much as in *Calappa*; but the meropodite, or "arm," instead of a transverse crest near the distal end of its outer surface, has merely a ridge with one or two spines: the palm is compressed and its upper border forms a dentate crest, but not such a high one as that of *Calappa*. As in *Calappa* the chelipeds are only asymmetrical as regards the fingers, which on one hand have on their outer aspect, near the base, a stout lobule.* The legs are large, the first two pairs being at least as long as the chelipeds.

The abdomen in the male is as broad in the proximal half as it is in the female: in the adult male it consists of five segments, the 3rd, 4th and 5th being intimately fused, the sutures even being hardly distinguishable: in both sexes the tergum of the 1st somite is almost entirely concealed, and that of the 2nd somite strongly carinate transversely.

Mursia is practically *Calappa* without the wings to the carapace, and with large strong legs: the widely fissured orbital floor, the less

* In *Mursia hawaiiensis*, Mary J. Rathbun, Proc. United States National Museum, xvi. 1893, p. 252, the chelipeds are described as very unequal.

pronounced endostomial septum, and the slender basal-antennary joint are the other important points of difference.

10. *Mursia bicristimana*, Alcock and Anderson.

Mursia bicristimana, Alcock and Anderson, Journ. Asiatic Soc. Bengal, Vol. LXIII. 1894, pt. 2, p. 179; and Ill. Zool. 'Investigator' Crust. pl. xxiv. fig. 5 (*in the press*).

The length of the carapace is about seven-ninths of the breadth immediately in front of the lateral epibranchial spine; and the length of the epibranchial spine is from one-third (in the young) to less than one-fourth (in the adult) the length of the carapace.

The surface of the carapace is closely granular, and in addition there are *seven rows of tubercles*, one in the middle line, and three on each side radiating over the branchial regions: the antero-lateral margins are finely beaded and evenly and sharply festooned: the postero-lateral margins are without the angular bend inwards seen in M. armata: *the posterior margin is bounded on either side by a lamina denticle, not by a great projecting lobule as in* M. armata.

The outer parts of the pterygostomian and subhepatic regions are covered with a dense felt of long hairs.

The rostrum is trilobed, its breadth at the level of the lobes being about one half more than the greatest breadth of the orbit.

The transverse ridge near the distal end of the arm is very hairy, and is armed distally with two spines, the outer and larger of which is more than half the length of the lateral epibranchial spine. *This ridge is continued along the palm as a sharp longitudinal crest* (more prominent even than that of *Platymera*) which is unevenly trilobed, the proximal lobe being spiniform, the middle lobe broad and obtuse, and the distal lobe narrow and obtuse. The upper surface of the wrist, and the outer surface of the palm and fingers, are closely and sharply granular: the upper edge, or crest, of the palm is 7- serrate.

The ambulatory legs are large stout and compressed, those of the first three pairs being a little longer than the chelipeds. In these three pairs the *meropodite is lamellar, its greatest breadth being considerably more than a third its length*: the carpus has its outer surface traversed longitudinally by three beaded carinæ, the middle one of which ends in a spine; and the propodite is lamellar with the outer (anterior) edge subcarinate and the upper surface traversed longitudinally by two or three raised lines of fine beading.

The second abdominal tergum in both sexes is raised into a stout carina, the height of which is more than a third the transverse diameter of the tergum: this carina is three lobed, the lobes being separated only

by fissures. In the female, as in the male, the 3rd–5th terga are fused, though the lines of fusion are quite distinct in the former sex.

Colours in life salmon pink.

Off Ceylon, 142–400 fms., and 180–217 fms.

In the form of the legs, in the ornamentation of the chelipeds, and in the shape of the carapace, this species bears a strong resemblance to *Platymera*. Even in the articulation of the flagellum with the merus of the external maxillipeds the appearances are somewhat those of *Platymera*.

On the other hand the form of the endostomial channels, and of the processes of the first maxillipeds which close those channels ventrally, as well as the practical symmetry of the chelipeds, are all as in *Mursia*.

But a comparison of this species with specimens of *Mursia armata* and *Platymera gaudichaudii* leads to the belief that all three are congeneric.

The dimensions of an adult male are as follows :—

breadth of carapace 67 millim., excluding the lateral epibranchial spines;
length of carapace 47 millim.
length of first pair of ambulatory legs about 90 millim.

Cryptosoma, Brullé.

Cryptosoma, Brullé in Webb and Berthelot's Hist. Nat. des îles Canaries, Crustacés, p. 16.

Cryptosoma, Milne-Edwards, Hist. Nat. Crust., II. 110.

Cryptosoma, Miers, Challenger 'Brachyura,' p. 292.

Cycloes, De Haan, Faun. Japon. Crust., p. 68, and p. 125.

Carapace heart-shaped or subcircular.

Front rather narrow, and often emarginate.

Orbits, as in *Mursia*, large, oval, with a distinct suture or a fissure in the roof, and with two gaps in the floor, in one of which the slender basal-antennary joint is lodged. Eyes large, eyestalks short and thick.

The antennules fold obliquely.

The external maxillipeds meet sufficiently to conceal all the underlying (*i.e.*, really overlying) parts, and to completely close the buccal frame as far as the front. Concealed by the external maxillipeds there is, however, an endostomial efferent branchial channel closed by lamellar processes from the 1st pair of maxillipeds.

The antero-internal angle of the merus of the external maxillipeds is prolonged obliquely forwards to form a prominent lobule above the articulation of the palp.

The chelipeds are as in *Calappa* and *Mursia*: the meropodite, or "arm" has the same transverse ridge or crest near its distal end, external; the palm is strongly compressed, with its upper border raised into a sharp serrated crest; and the chelipeds as a whole are symmetrical, except that on one hand the fingers have each, at the base, on their outer surface, a coarse tooth or lobule.

The legs are compressed and are of moderate size: none of them approach the chelipeds in length.

The abdomen in both sexes is much as in *Calappa*: in the male the 3rd, 4th and 5th terga are intimately fused together, and with almost complete obliteration of sutures; in the female all seven segments are perfectly distinct. In the majority of species the second abdominal tergum, in both sexes, is strongly carinate transversely, as in *Mursia*.

11. *Cryptosoma granulosum*, (De Haan).

Cycloes granulosa, De Haan, Faun. Japon. Crust. p. 71, pl. xix. fig. 3.

Cryptosoma granulosum, Miers, 'Challenger' Brachyura, p. 293: Alcock and Anderson, J. A. S. B., Vol. LXIII. 1894, pt. 2, pp. 198 and 203.

Carapace conspicuously longer than broad, its surface, like the exposed surfaces of the chelipeds, finely and very closely granular: in its anterior half there are also some small tubercles, most of which fall into seven nearly longitudinal rows, one row being in the middle line. The antero-lateral borders are very finely crenulate, and end at a tiny lateral-epibranchial denticle. The convergent postero-lateral borders, and the posterior border, are very finely and closely beaded. The outer parts of the pterygostomian and subhepatic regions are covered with a felt of fine short hairs.

The front is bidentate and projects beyond the level of the orbits: the latter occupy all the rest of the anterior border.

The antennary flagella are very short.

The transverse ridge at the distal end of the arm is granular, and is armed with three spines gradually increasing in size from within outwards: the upper surface of the wrist has several small tubercles: the outer surface of the hand has, at its base, an oblique crest, which ends acutely and is continued obliquely upwards as a line of small tubercles; a second line of tubercles runs parallel with this, obliquely across the middle of the hand: the crest of the hand is 8-dentate.

The last pair of legs has its four terminal joints distinctly lamellar.

The carina of the second abdominal tergum is in both sexes trilobed, the middle lobe being much smaller than the lateral lobes.

Andamans, depth not recorded: Maldives, 20–30 fms.

MATUTA, Fabr., Edw.

Matuta, Fabricius, Ent. Syst., Suppl. p. 369.

Matuta, Milne-Edwards, Hist. Nat. Crust. II. 113.

Matuta, Miers, Trans. Linn. Soc. Zool. (2) I. 1875–79 (1877) p. 243, and 'Challenger' Brachyura, p. 294.

Matuta, de Man, Notes Leyden Mus. III. 1881, p. 109.

Carapace somewhat depressed, usually subcircular, with the postero-lateral borders sharply convergent, and usually with a great horizontal spike at the lateral epibranchial angle, on either side.

There are usually six more or less distinct tubercles, disposed quite symmetrically, in the middle of the carapace, and there is commonly an eminence, or even an acute tubercle, in the front half of the postero-lateral border.

The front is about as wide as the orbit, and consists of three nearly equal lobes, the middle one of which projects as a laminar rostrum with the end usually bifid or emarginate.

The orbits are large and roughly reniform: in the middle of the upper border are two short sutures, placed close together; at the external angle is a wide gap communicating with a deep groove in the pterygostomian region; while at the internal angle is a fissure communicating with the antennulary fossa. The eyestalks are stout but somewhat elongate.

The antennules fold nearly longitudinally. The antennæ are almost rudimentary, and occupy a space between the basal-antennulary joint and the lower wall of the orbit.

The external maxillipeds completely cover the mouth and all the mouth-parts, up to the level of the front, the patulous efferent branchial orifice being visible only from above. In repose the palp of the external maxillipeds lies completely concealed within a deep groove in the dorsal face of the long subacute meropodite.

On removal of the external maxillipeds a deep undivided efferent canal is seen in the roof of the endostome, which groove is closed below by an elongate lamellar process of the first pair of maxillipeds.

The chelipeds are shaped on the *Calappa* plan, but are quite singular in having, on the inner face, near the crest of the palm, two raised obliquely-striated areas—one linear, the other broadly oval—which in two species at any rate, and probably in all, are used as stridulating organs. The meropodite, or "arm," has the transverse distal crest low, and only well-pronounced at the outer angle, where there is a prominent lobule. The propodite or "hand" is compressed, but not so much so as in *Calappa*, and has its upper border cristate, and its outer surface definitely sculptured. The fingers, as well as the rest of the chelipeds, are quite symmetrical.

The four ambulatory legs have the form of swimming-paddles, the two terminal joints being broadened and compressed—in the first and last pairs of legs enormously so.

The abdomen in the adult male consists of 5 segments, owing to the intimate fusion of the 3rd, 4th and 5th terga: in the female and young male all 7 terga are distinctly separate. In both sexes the first tergum is almost entirely concealed beneath the carapace.

In the adult male the *third* tergum is very strongly carinate transversely, and the second moderately so. In the female and young male both the *second* and *third* terga are strongly carinate, and if there is any inequality it is the *second* that is most prominent.

Owing partly to their great similarity, and partly to the insufficient descriptions of earlier authors, the discrimination of the species of *Matuta* has always been a matter of difficulty.*

The first species described and figured is the *Cancer lunaris* of Rumph (Amboinsche Rariteitkamer p. 11, pl. vii., fig. S. 1705), a species characterized by the possession of an entire (*i.e.*, not bifid) rostrum and of a very sharply defined tubercle near the middle of either posterior border.

This species must, I believe, be (1) the species called *M. banksii* by Leach, Miers, and subsequent authors, (2) the *M. picta* of Hess and Miers, (3) the *M. distinguenda* of Hoffmann, and (4) the *M. obtusifrons* of Miers. I think also that the *M. granulosa* of Miers and de Man is only a slightly abnormal form of Rumph's species.

Rumph's name having unfortunately been accepted for a quite different post-Linnæan species, cannot now be used; and Rumph's species must therefore bear the earliest applicable post-Linnæan name—namely *M. banksii*, Leach.

M. banksii according to Leach can be recognized by a very strong tubercle behind the lateral spine.

The second known species of *Matuta* is the *Cancer americanus* of Seba (Thesaurus III. 52, pl. xx., figs. 10, 11. 1758), of which it is impossible to say more than that it roughly represents the form of the genus *Matuta*.

Herbst (Krabben, etc., 1790–1799) described and figured two species of *Matuta*. One (Krabben, I. ii. 140, pl. vi. fig. 44), he called *C. lunaris*, and this he says is Rumph's species, quoting Rumph's Latin and vernacular names: the other (I. ii. 143) he called *C. victor* of Fabricius. Subsequently, however (III. ii. 43) he renamed *C. victor* *C. lunaris*, figured it on pl. xlviii. fig. 6, and stated that his *C. victor* and *C. lunaris* are the same species.

Herbst's two figures—pl. vi. fig. 44 and pl. xlviii. fig. 6—are so different, however, that doubts must still remain as to whether they both really do refer to the same species, and it does not seem to me that Hilgendorf's observations, to be presently referred to, clear these doubts up. I believe myself that Herbst's pl. vi. fig. 44 might still be regarded, as Herbst at first seems to have regarded it, as representing Rumph's *Cancer lunaris*.

Fabricius who (Entomol. Syst., Suppl. p. 369, 1798) instituted the genus *Matuta*, included in it two species—*M. victor* and *M. planipes*. We know, from Hilgendorf's paper to be presently considered, to what species of modern authors these refer.

* Unfortunately I have not been able to see Latreille's article on the genus Matuta in the *Encyclopédie Méthodique*, Vol. X.

Leach (Zool. Miscellany III. pp. 12-14, 1817), gave brief diagnoses of four species of *Matuta*. One of these—*M. banksii*—I believe to apply to Rumph's *Cancer lunaris*.

A second—*M. leseurii*—is referred by Miers, and I think with justice, to the *M. victor* of Fabricius.

A third—*M. peronii*—is also, and I think rightly, referred by Miers to *M. victor*, Fabr.

The fourth—*M. lunaris*—is regarded by Miers, whose paper will be considered in the sequel, as applicable to *M. picta* of Hess, a species characterized by having a simple rostrum and a tubercle in the postero-lateral border. Now Leach's figure shows a distinctly bilobed rostrum, and has no tubercle on the postero-lateral border, so that I do not see how the name *M. picta* can apply to it. Leach's *M. lunaris* seems to me rather to agree with the species described by Henderson as *M. miersii*.

To sum up, it seems to me that three species were known to Leach, namely *M. banksii*, Leach, (Rumph's species), *M. victor* Fabr. and perhaps the species now known as *M. miersii*, Henders.

The great naturalist Milne-Edwards only admitted two species of *Matuta*, namely *M. lunaris* and *M. victor*, and it is only because I have been able to examine over 400 specimens from all parts of the Indian coasts, that I venture to disagree from him.

I can reconcile his description of *M. lunaris* with the *M. lunaris* of Leach and with Guérin's figure of *M. peronii* (not Leach's); but on the strength of Hilgendorf's statements I do not see how it can be reconciled with Herbst's *Cancer lunaris*. Milne-Edwards italicizes the fact that the carpus of the penultimate pair of legs is *bicarinate*: now the only species known to me that agrees with his description in other respects, and has also the carpus of the penultimate legs full and indistinctly bicarinate, is Henderson's *M. miersii*.

The *M. victor* of Milne-Edwards seems to be Fabricius' species, although I do not think that the whole of the synonomy can be accepted.

Miers' classical attempt (Trans. Linn. Soc. Zool. (2) I. 1875-79 [1877] p. 243) to simplify the confusion existing in this group, although forming a careful critical and extremely valuable paper, yet fails for the reason that the character selected by Miers for the primary subdivision of the genus—namely the sculpture of the hands and fingers—varies not only according to sex (as Miers indeed fully recognized), but also according to age.

In Miers' system the adult males of *M. victor*, Fabr. and of *M. lunaris* Hbst. Hilgendorf, belong to one section of the genus, and the young males to the other section.

One has, of course, to be very careful in deciding that any given small specimen of *Matuta* corresponds with the young of any given large specimen; but when one finds, for example, that a small male individual, taken on the same spot with a large male and female, exactly resembles the adults in all important characters, and differs from the adult male, and agrees with the adult female, just in those very characters where the adult female differs from the adult male; when, therefore, such a young one can be confused with no other known species; and when moreover these agreements and differences are found to have a general correspondence throughout the whole genus; then one can with some confidence assign that young individual to its place.

One of the most constant differences, throughout the genus, between the adult

male on the one hand, and the female and young male on the other hand, is found in the second and third abdominal terga: in all adult males the third abdominal tergum is very strongly carinated transversely, and the second is carinated also, but not nearly so strongly: in all adult females both the second and the third terga are either equally strongly carinate, or, if one is more prominent than the other, it is the second.

The other differences between the sexes are those (emphasized by Miers) that occur in the sculpture of the hand and fingers; and these differences also apply between the adult male and the young male, which Miers does not appear to have taken into consideration.

The nine species separated by Miers can, in my opinion, be reduced to three, namely, *M. banksii* Leach (Rumph's species), *M. victor*, Fabr., and *M. lunaris* Hbst. Hilgendorf.

The next paper to be referred to is that by Hilgendorf (Monatsber. Ak. Berl. 1878 [1879] p. 810), which is a most authoritative contribution, since the writer had been able to examine Fabricius' types of *M. victor* and *M. planipes*, and apparently also Herbst's specimens. Dr. Hilgendorf states definitely (1) that *M. victor* Fabr. is the species carefully described and figured as *M. victrix* by Miers (*loc. cit.*); (2) that the species figured by Herbst. *on pl. xlviii. fig.* 6 is the unequivocally recognizable *M. rubro-lineata* of Miers (*loc. cit.*); and (3) that the *M. planipes* of Fabricius is *M. lunaris* of Herbst. It is most unfortunate that Dr. Hilgendorf does not tell us whether *both* of Herbst's figures refer to the same species, or not. We now know, without any ambiguity, what Herbst's pl. xlviii. fig. 6 is; but we are still in doubt as to the meaning of pl. vi. fig. 44.

The last reference necessary is to de Man's paper (Notes Leyden Mus. III. 1881, p. 109), on the species of *Matuta* in the Leyden Museum, a paper that embodies the results of an examination of no less than 270 specimens. With most of Dr. de Man's synonomy I entirely agree, although I am unable to follow him in the acceptance of *M. granulosa*, *M. maculata* and *M. picta* as distinct species.

Dr. de Man rightly recognizes the value of the sculpture of the hand and fingers in the descrimination of the species; but, equally with Mr. Miers, he takes no due notice of the fact that this character varies with age, at any rate in the male sex. He considers that the development of the tubercles on the surface and lateral margins of the carapace furnishes a character of only secondary importance, in which opinion I cannot quite agree with him if he includes the tubercle on the postero-lateral border.

It remains only to refer to the opinions of those who, like M. A. Milne-Edwards and Dr Ortmann, regard all the forms of *Matuta* as varieties of a single species. This view would seem to imply that the characters by which the species are usually recognized are variable,—either indefinitely so, or in response to some local peculiarities of the environment. Of this I can find no evidence.

Certain of the characters that I have used in separating the species in the Indian Museum Collection are, as far as an examination of over 400 specimens goes, perfectly well defined, whether in the young or in the adult, and whether from the same locality or not.

The characters of the first importance in the separation of the species are those emphasized by Milne Edwards, namely (1) the form of the carpus of the penultimate pair of legs—whether full and

carinate," or compressed and unicarinate, and (2) the extent of the raised postero-lateral border—whether stopping short of the great lateral spine, or prolonged into the border of that spine. With regard to the first of these characters, it may be remarked that the distinction drawn is between a distinctly compressed carpus, and a distinctly inflated carpus. With regard to the second, the distinction drawn is between a sharply-raised border that (in any position of the carapace and in any light) can be plainly seen to form a considerable part of the hinder border of the great lateral spine, and a border that stops at the base of the spine or even further behind. The sculpture of the lower part of the outer surface of the hand is also very definite in all the species, and—if age and sex be taken into due consideration—the sculpture of the median ridge of the hand and of the dactylus. The presence or absence of a tubercle on the postero-lateral border is also of importance.

Key to the species of Matuta.

I. Carapace pentagonal, lateral epibranchial spine rudimentary ... ... *M. inermis.**]

II. Carapace more subcircular than pentagonal, lateral epibranchial spine greatly developed (*Indian species*) :—

1. Front just equal to the orbit in width, rostrum simple or faintly emarginate: a sharply defined acute tubercle near the middle of the posterolateral border *M. banksii.*

2. Front distinctly wider than the orbit, rostrum distinctly bilobed: postero-lateral border with or without an obscurely defined eminence near its middle :—

i. Postero-lateral border elevated throughout, forming a considerable part of the hinder border of the great lateral spine, and without any trace of a tubercle or eminence: lower surface of hand very rough in the adults of both sexes ... ... *M. miersii.*

* *M. inermis*, Miers, Zoology H. M. S. 'Alert,' p. 256, pl. xxvi. fig. C. Known only from the Melanesian part of the Indo-Pacific area.

ii. Postero-lateral border elevated posteriorly, gradually subsiding at or behind the great lateral spine, and with an obscurely defined eminence: lower surface of hand quite smooth in the adult male, a little rough in the female and young:—

a. A distinct spine at the angle of the hand where it comes in contact with the external angle of the arm: carapace covered with minute red dots ... ... *M. victor.*

b. Only a tubercle at the angle of the hand where it touches the external angle of the arm: carapace covered with spots, rings, and vermicular lines... ... ... *M. lunaris.* (*M. planipes.*)

12. *Matuta banksii*, Leach.

Cancer lunaris, Rumph, Amboinsche Rariteitkamer, I. p. 11, pl. vii. fig. S. (1705).

?? Cancer lunaris, Herbst, Krabben I. ii. 140, pl. vi. fig. 4 (*nec* III. i. 43, pl. xlviii. fig. 6).

?? Matuta victor, Bosc, Hist. Nat. Crust. I. 225, pl. iv. fig. 3, (*nec* Fabr.)

Matuta banksii, Leach, Zool. Miscell III. p. 14. (1817).

Matuta victor, Desmarest, Consid. Crust. p. 101, pl. vii. fig. 2 (*nec* Fabr.)

Matuta victor var. *quinta* et *sexta*, De Haan, Faun. Japon. Crust. p. 128.

Matuta banksii, Miers, Trans. Linn. Soc. Zool. (2) I. 1875–79 (1876) p. 245, pl. xl. figs. 1, 2, and Ann. Mag. Nat. Hist. (5) V. 1880, p. 315, and 'Challenger' Brachyura, p. 295: de Man, Notes Leyden Mus. III. 1881, p. 115, and Archiv für Naturgesch. LIII. 1887, i. p. 389, and in Weber's Zool. Ergeb. Niederl. Ost.-Ind. II. 1892, p. 351: A. O. Walker, Journ. Linn. Soc. Zool. XX. 1890, p. 111: Zehntner, Rev. Suisse de Zool. II. 1894, p. 183, pl. viii. fig. 15.

Matuta picta, Hess, Arch. für Naturges. XXXI. i. 1865, pp. 158, 172, pl. vi. fig. 13: Miers, Trans. Linn. Soc. Zool. (2) I. 1875-79, (1876) p. 246, pl. xl. figs. 5–7, and 'Challenger' Brachyura, p. 295: E. Nauck, Zeits. Wiss. Zool. XXXIV. 1880, p. 46 (*gastric teeth*): de Man, Notes Leyden Mus. III. 1881, p. 118, and Zool. Jahrbucher, II. 1887, p. 703: Haswell, Cat. Austr. Crust. p. 135.

Matuta distinguenda, Hoffmann in Pollen and Van Dam's Fauna Madagasc., Crust. p. 27, pl. vi. figs. 49–52, pl. vii. figs. 53–57 (1874): Lenz and Richters, Abh. Senk. Ges. XII. 1881, p. 425.

Matuta obtusifrons, Miers, Trans. Linn. Soc. Zool. (2) I. 1875–79 (1876), p. 247, pl. xl. figs. 8 and 9, and Ann. Mag. Nat. Hist. (5) V. 1880, p. 316.

? *Matuta granulosa*, Miers, Trans. Linn. Soc. Zool. (2) I. 1875–79 (1876) p. 245, pl. xxxix. figs. 8, 9, and 'Challenger' Brachyura, p. 295: de Man, Notes Leyden Mus. III. 1881, p. 114: Haswell, Cat. Austral. Crust. p. 134.

Matuta victor, varr. 5 and 6, and ? 4, Ortmann, Zool. Jahrbucher, Syst., &c., VI., 1891-92, pp. 572, 573.

Carapace coarsely granular in the epibranchial, post-gastric and cardiac regions. All six tubercles are almost always very distinct, both in the young and adult.

The antero-lateral borders are crenulate, the last three crenulations forming three large blunt teeth. The posterior and postero-lateral borders form a continuous granular slightly-elevated ridge, which stops at a sharply-defined tubercle, or tooth, situated considerably in rear of the lateral epibranchial spine. The length of this lateral spine (measured along its front border) is always less than one-fourth the breadth of the carapace.

Front just equal in width to the orbit: rostrum either entire, or faintly emarginate.

Hand with the upper border, or crest, trilobed, and the lower border dentate as far as the base of the immobile finger. Below the crest are two obliquely-longitudinal rows of tubercles, the lower somewhat broken and irregular. Below these, the hand is traversed longitudinally, as far as the finger-cleft, by a row of 5 teeth, of which the 2nd (counting from the proximal end) is enlarged and acute, and the 4th is also somewhat enlarged and acute, but less so in the adult male than in the female and young male. The surface of the hand, below the ridge, is roughened, and is traversed—from the angle where the hand touches the arm, to the immobile finger—by a row of molariform tubercles, which is continued to the tip of the immobile finger as a ridge and furrow: the first of these tubercles, at the angle where the hand touches the arm, is enlarged and acute. The dactylus in the female and young male is convex and smooth: in the adult male it is longitudinally traversed by a sharp ridge, which becomes milled at the distal end.

The carpus of the penultimate pair of legs is full and even inflated, and shows more or less distinct traces of a second dorsal longitudinal carina.

Colour in spirit bright yellow, with a fine close discontinuous reticulum of red markings, which give to the whole, when viewed from a distance, a rich chestnut-brown appearance. The legs are also of the

same bright yellow colour, with copious chestnut-brown marki
Under surface light yellow.

In the Indian Seas only at the Andamans and Nicobars.

The branchial cavity in this species is often occupied by a Bopyrid.

I have examined 63 specimens in the Indian Museum collection, comprising 19 adult males, 28 females, and 16 young males.

13. * *Matuta victor*, Fabr., Hilgendorf.†

Cancer victor, Fabricius, Ent. Syst. II. 449 (*fide* Hilgendorf). 1793.

Matuta victor, Fabricius, Ent. Syst. Suppl., p. 369 (*fide* Hilgendorf).

Matuta victor, Milne Edwards in Cuvier, Règne Animal, Crust. pl. vii. and Hist. Nat. Crust. II. 115.

Matuta victor, var. *prima* et *secunda*, De Haan, Faun. Japon. Crust. p. 127.

Matuta victor, Hilgendorf in Von der Decken's Reisen in Ost.-Afr. III. i. Crust. p. 93, pl. iii. fig. 2: Hoffmann in Pollen and Van Dam's Faun. Madagasc., Crust., p. 27, pl. vi. figs. 45–48: Hilgendorf, MB. AK. BERL. 1878, p. 810.

Matuta victrix, Miers, Trans. Linn. Soc. Zool. (2) I. 1875–79 (1876) p. 24 pl. xxxix. figs. 1–3, and Ann. Mag. Nat. Hist. (5) V. 1880, p. 315, and Zool. H. M. 'Alert' pp. 185, 256, and 'Challenger' Brachyura, p. 295: de Man, Note Leyden Mus. III. 1881, p. 110, and Archiv für Naturges. LIII. 1887, i. p. 389: Haswell, Cat. Austral. Crust. p. 133: J. R. Henderson, Madras Journ. L. Sci. 1886-87, p. 65, and Trans. Linn. Soc. Zool. (2) V. 1893, p. 396: Ortmann, Zool. Jahrbucher, Syst. etc. VI. 1891-92, varr. 1 and 2 pp. 571-572.

Matuta victrix var. *crebrepunctata*, Miers, Trans. Linn. Soc. Zool. (2) I. 1875–79 (1876), p. 244, pl. xxxix. fig 4, and 'Challenger' Brachyura, p. 295: de Man in Weber's Zool. Ergeb. Niederl. Ost.-Ind. II. p. 351.

Matuta peronii, Leach (*nec* Guérin), Zool. Miscell. III. p. 13, pl. 127, figs. 1, 2.

Matuta lesueurii, Leach, Zool. Miscell. III. p. 14.

Matuta maculata, Miers, Trans. Linn. Soc. Zool. (2) I. 1875–79 (1876) p. 246, pl. xl. figs. 3, 4, and 'Challenger' Brachyura, p. 295: de Man, Notes Leyden Mus. III. 1881, p. 116.

Carapace finely granular in the epibranchial, post-gastric and cardiac regions. The two anterior tubercles are obsolescent; the other four are visible, but are not conspicuous in the adult.

The antero-lateral borders are crenulate, two—sometimes three—of the crenulations being somewhat enlarged, but never forming stout teeth. The posterior and postero-lateral borders form a continuous finely-beaded slightly-elevated ridge, which ends on a faintly-marked elevation situated considerably in rear of the lateral spine. The length of t

* The specific name *victor* is here regarded as a noun substantive in apposition to *Matuta*, just as in the name *Felis leo*, the masculine noun *leo* is in apposition to the feminine noun *felis*. It seems unnecessary to change the old established name *M. victor* for a name based on the personal claims of the goddess *Matuta*.

† No references are given, except such as appear to be unequivocally applicable to *M. victor* as re-defined by Miers and confirmed by Hilgendorf.

lateral spine is always very much more than one-fourth—often more than one-third—the breadth of the carapace.

The front is wider than the orbit: the rostrum is sharply bilobed.

Hand with the crest trilobed—the proximal lobe broad, the others acute, and with the lower border dentate (female and young male) or bluntly crenulate (adult male) as far as the base of the immobile finger. Below the crest, on the upper aspect of the hand, are two obliquely-longitudinal rows of tubercles, the lower of which is somewhat broken and irregular. Below these the hand is traversed longitudinally by a ridge, which varies according to age and sex: in the adult male it is strongly salient and is continued nearly to the tip of the immobile finger, and has at its proximal end a tubercle followed by a spine: in the female and younger male it becomes nearly obsolete at the base of the immobile finger, and is broken up into five lobes, of which the second (counting from the proximal end) and the fourth are spines—the second being very large. The surface of the hand below this ridge is smooth in the adult male, except for a strongish spine at the angle where the hand touches the arm; but in the female and younger male it is traversed just above the lower border by a raised but broken ridge, which is most distinct on the immobile finger. The dactylus varies also according to sex and age: in the adult male its external surface is traversed from base to tip by a strongly-milled ridge: in the adult female and youngest males there is little trace of ridge, and none of milling: and the ridge and milling gradually appear in the male with growth, often showing on one hand before the other.

The carpus of the penultimate pair of legs is compressed, and is surmounted dorsally by a single carina.

Colours of carapace, in spirit, dull yellowish-brown to dull olive-green, with a multitude of speckles.

Indian coasts—Penang, Tavoy, Arakan, Andamans, Ganges Delta, Máhánaddi Delta, Madras, Ceylon, Malabar coast, Karáchi.

I have examined 41 adult males, 120 females, and 49 young males in the Indian Museum collection.

This grows to a larger size than any other species of *Matuta*.

14. *Matuta lunaris* (Herbst) Hilgendorf.[1]

? Cancer lunaris, Herbst, Krabben I, ii. 140, pl. vi. fig. 44, (1790).

Matuta planipes, Fabricius, Ent. Syst. Suppl. p. 369 (*fide* Hilgendorf), 1798.

Matuta lunaris, Herbst (*nec* Rumph) Krabben, III. i. 43, pl. xlviii. fig. 6 (*fide* Hilgendorf), 1799.

[1] No references are given except such as appear to be unequivocally applicable to the *M. lunaris* of Hilgendorf.

Matuta appendiculata, Bosc, Hist. Nat. Crust. I. 225.

Matuta victor, var. *tertia* et *quarta*, Dellaan, Faun. Japon. Crust. pp. 127 and 128.

Matuta lunaris, Miers, Trans. Linn. Soc. Zool. (2) I. 1875–79 (1876) p. 24[illegible] pl. xl. figs. 10-11 (♀ and young ♂), and 'Challenger' Brachyura, p. 295: Hilgendorf MB. Ak. Berl. 1878, p. 810: de Man, Notes Leyden Museum, III. 1881, p. 112: Henderson, Madras Journ. Lit. Sci. 1886-87, p. 66, fig. 6, and Trans. Linn. Soc. Zool. (2) V. 1893, p. 396.

Matuta rubrolineata, Miers, Trans. Linn. Soc. Zool. (2) I. 1875–79 (1876), p. 244, pl. xxxix. figs. 5, 6.

Matuta lineifera, Miers, *op. cit.*, p. 245, pl. xxxix. fig. 7: Haswell Cat. Austral. Crust. p. 134.

Matuta circulifera, Miers, Ann. Mag. Nat. Hist. (5) V. 1880, p. 315, pl. xiv. fig. 5, and Challenger Brachyura, p. 295.

Matuta laevidactyla, Miers, Ann. Mag. Nat. Hist. (5) V. 1880, p. 316 (footnote), and 'Challenger' Brachyura, p. 296 (♀ and young ♂).

Matuta victor, var. 3, Ortmann, Zool. Jahrbucher, Syst. &c. VI. 1891–92, p. 572.

Except in colour this species resembles *Matuta victor* very closely, differing only in the following characters:—

(1) the carapace is almost smooth, and the tubercles in the adult, but not in the young, are *all* indistinct:

(2) instead of a spine at the angle where the hand comes in contact with the distal lobule of the arm, there is only a tubercle, or a pair of tubercles:

(3) the fourth lobe of the median longitudinal ridge on the outer surface of the hand is not enlarged or acute: so that, in both sexes, and at all ages, there is only one large spine on the outer surface of the hand. Apart from this, exactly the same sexual and growth-differences occur in the hand as in *M. victor*:

(4) the colour of the carapace, in spirit, is bright yellow with vermicular red lines, which usually form spots or incomplete rings on the anterior half of the carapace and narrow longitudinal loops posteriorly.

I have heard this species stridulate.

Indian coasts—Mergui, Andamans, Burma, Sunderbunds and Gangetic Delta, Máhánaddi Delta, Madras, Bombay, Karáchi.

In the Indian Museum collection are 5 adult males, 55 females (many ovigerous), and fifteen young males.

The question of uniting this species with *M. victor*, as a variet[illegible] has to be carefully considered. After examining 210 specimens of *M. victor* and 75 of *M. lunaris* I find that the differences between them hold good irrespective of age or sex, and I would therefore regard the two species as perfectly distinct. I acquiesce in the name *M. lunaris* only on the supposition that Hilgendorf's remarks apply to *both* of Herbst's figures. If they do not apply to Herbst's pl. vi. fig. 44, then the Fabrician name *M. planipes* would have the priority.

15. *Matuta miersii*, Henderson.

? *Matuta peronii*, Guérin Méneville, Icon. Règne Animal, pl. i. fig. 1 (*nec* Leach).

?? *Matuta lunaris*, Leach, Zool. Miscell. III. p. 13, pl. 127, figs. 3–5.

? *Matuta lunaris*, Milne-Edwards, Hist. Nat. Crust. II. 114 (*nec* Rumph, *nec* Herbst).

Matuta miersii, Henderson, Madras Journ. Lit. Sci. 1886–87, p. 66, figs. 1–4, and Trans. Linn. Soc. Zool. (2) V. 1893, p. 396.

Carapace granular upon the eminences that support the tubercles, and towards the lateral epibranchial spines. All six tubercles of the carapace almost always distinct, both in the young and adult.

The antero-lateral borders are crenulate, the last three crenulations forming three large blunt teeth. The posterior and postero-lateral borders form a continuous, beaded, strongly-elevated ridge, which runs about half way along the edge of the lateral epibranchial spine and has in its course no trace of a tubercle or eminence. The length of the lateral spine is always, even in the young, less—often much less—than three-fourth the breadth of the carapace.

The front is wider than the orbit: the rostrum is distinctly bilobed.

Hand with the upper-border trilobed,—the lobes being almost always equal and acute, and with the lower border dentate, in both sexes and at all ages, as far as the base of the immobile finger. Below the crest, on the upper aspect of the hand, are two obliquely longitudinal, regular, unbroken rows of close-set teeth. Below these the hand is traversed longitudinally, as far as the finger-cleft, by a row of 5 teeth, the second of which (counting from the proximal end) is enlarged and acute. The surface of the hand below this ridge, as well as the surface of the immobile finger, is roughened, and is traversed longitudinally, at least as far as the middle of the finger, by a row of molariform tubercles, which row is sometimes incompletely double; but none of the tubercles are acute.

The characteristic sculpture of the hand is the same in the young and adult, in both sexes.

The carpus of the penultimate pair of legs is full, not compressed, and shows more or less distinct traces of a second dorsal carina.

Colour of carapace in spirit: olive yellow with red dots which are arranged in broadish vermicular lines and rings.

This is the smallest of all the species of *Matuta*: the largest male in the collection of the Indian Museum has a carapace-breadth of only 29 millim., and the largest ovigerous female a carapace-breadth of only 20 millim., although there is a single female—non-ovigerous—as large as the largest male.

It can be at once distinguished from *M. banksii*—which it most nearly resembles—by the complete absence of a tubercle on the postero-

lateral border; and by this border being elegantly beaded, raised in very strong relief, and continued far along the edge of the lateral spine.

In the Indian Seas this species has only been found on the Madras coast.

Although I have frequently dredged it, I have never done so in less than nine fathoms. I have on more than one occasion heard it make a musical noise audible at several yards distance.

As Henderson has remarked, a *Sacculina* is often found parasitic on the male.

In the Museum collection are 14 adult males, 40 females, and 15 young males.

Family LEUCOSIIDÆ.

Leucosiens, Milne-Edwards, Hist. Nat. Crust. II. 118.
Leucosiidea, De Haan, Faun. Japon. Crust. p. 129.
Leucosiidæ, Dana, U. S. Expl. Exp. Crust. pt. I. p. 390.
Leucosiadæ, Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 277.
Leucosiidæ, Miers, 'Challenger' Brachyura, p. 297.

Carapace circular or oval or polygonal. Eyes and orbits very small: front narrow but many times wider than the orbit. The antennules fold more or less obliquely. The antennæ are small, sometimes obsolete. The external maxillipeds completely close the buccal cavern, except that very commonly there is a crevice in front: their palp or flagellum springs from a groove in their dorsad surface near the inner edge, and is completely concealed when the maxillipeds are in repose: the exognath is broad, sometimes remarkably broad.

The afferent branchial channels occupy the sides of the endostome on either side of the deep median endostomial groove which, as in the *Calappidæ*, serves as an efferent branchial channel. The afferent channels are covered in by the exognaths of the external maxillipeds; the efferent channel is covered in immediately, as in the *Calappidæ*, by a pair of lamellar processes from the first maxillipeds.

The chelipeds are symmetrical and have no remarkable peculiarity of form.

The abdominal terga are very rarely distinctly separate: commonly in both sexes the 3rd–6th are intimately fused with obliteration of sutures, sometimes however the 6th also is independent, and in a few forms the sutures are not obliterated.

The vasa deferentia emerge through the 5th thoracic sternum on either side, near the bases of the 5th legs.

The *Leucosiidæ* are such a natural group, and the various forms of which it is composed show so many intergradations, that any attempt to split it up into "sub-families" must be received with caution.

Among the genera known to me by autopsy, however, two extremes of form are plainly recognizable, and I propose to use these two extremes as the bases of two natural alliances or sub-families.

The first alliance is typified by *Leucosia* and *Philyra*, the second by *Ilia* and *Iphiculus*.

In *Leucosia* and *Philyra* the merus of the external maxillipeds is as long as the ischium measured along the inner border; the fingers are stout and compressed, taper gradually from a broad base, and are usually shorter than the hand; the hand is stout, compressed, and if anything a little broader at its distal end than at its base; and when the specimen is laid face downwards on the table, with the chelipeds resting on the table in a semi-flexed position, the fingers open and close in a horizontal plane.

In *Ilia* and *Iphiculus*, on the other hand, the merus of the external maxillipeds is only half the length of the ischium measured along the inner border; the fingers are slender and of almost the same diameter from the base to near the hook-like tip, and are very much longer than the hand; the hand is either subglobular, or tapering-cylindrical with a swollen base; and when the specimen is placed in the position above described, the fingers open and close in either a vertical or oblique plane, and in *Iphiculus* the dactylus can, without any breakage or unnatural dislocation of parts, be moved through an arc of about 120°.

Speaking only of the genera known to me by autopsy, the following, though they differ a good deal from *Leucosia* in the characters under consideration, do not differ nearly so much as they do from *Ilia*:—*Pseudophilyra*, *Myra*, *Parilia*, *Randallia*, *Ebalia*, *Nursia*, *Merocryptus*, *Onychomorpha*. *Tlos* and *Oreophorus* also, although their fingers move in a nearly vertical plane, yet in other respects show no close affinities with the *Ilia* type, but rather, through *Nursia*, with the *Leucosia* type; and *Actæomorpha* goes with *Oreophorus*.

On the other hand, the following Indian genera belong to the *Ilia* alliance:—*Myrodes*, *Iphiculus*, *Nursilia*, *Arcania*. *Ixa* also, although its fingers are much shorter than the hand, clearly in other respects belongs to this alliance.

I would define these two subfamilies as follows:—

1. Subfamily *Leucosiinæ*. Merus of external maxillipeds more, often much more, than half the length of the ischium measured along the inner border: fingers stout, gradually narrowing from base to tip, seldom much longer, commonly shorter, and often very much shorter than the hand, either opening in a horizontal plane or if in a vertical plane then the immobile finger is markedly more massive than the dactylus, the tip of the dactylus hardly ever movable through an arc

of over 60°: hands stout, generally longer than broad, and compressed, hardly ever broader at the base than at the distal end—when short broad and swollen (as often occurs in the Oreophoroid alliance) then the immobile finger is markedly more massive than the dactylus.

2. Subfamily *Iliinæ*. Merus of external maxillipeds half or less than half the length of the ischium measured along the inner border: fingers slender, almost of the same diameter from base to near tip, either very much longer than the hand, or if shorter than the hand then of filiform slenderness; either opening and closing in a vertical plane, or if in a nearly horizontal plane then the tip of the dactylus is movable through an arc of about 120°: hands either short swollen and subglobular, or tapering-cylindrical with a swollen base, always much broader at the base than at the point of origin of the fingers.

The following is a list of the genera of Leucosoid Crabs, so far as known to me, arranged in accordance with the classification here proposed. Indian genera are printed in Roman type, and all genera known to me by autopsy are marked with an asterisk:—

Family **Leucosiidæ**.

Sub-family I. *Leucosiinæ*.

Alliance I. Oreophoroida.

* Actæomorpha.

? *Carcinaspis*, Stimpson, Proc. Acad. Nat. Sci. Philad. 1858, p. 161.

Cryptocnemus, Stimpson, Proc. Acad. Nat. Sci. Philad. 1858, p. 161.

* Heteronucia, *n. gen.*

* *Merocryptus*, A. Milne-Edwards, Journ. Mus. Godeff. I. iv. p. 84 (260). 1873. [Transition towards *Nursia*].

* Oreophorus.

Spelæophorus, A. Milne-Edwards, Ann. Soc. Ent. Franc. (4) V. 1865, p. 148.

* Tlos.

Uhlias, Stimpson, Ann. Lyc. Nat. Hist., New York, X. 1874, p. 117.

Alliance II. Nursioida.

* Ebalia.

Lithadia, Bell, Trans. Linn. Soc. XXI. 1855, p. 305.

* Nursia.

Phlyxia, Bell, Trans. Linn. Soc. XXI. 1855, p. 303.

[*Bellidilia*, Kinahan, Journ. Roy. Dub. Soc. I. 1858, p. 128: regarded by Miers, 'Challenger' Brachyura, as synonomous with (*Phlyxia* and) *Ebalia*.]

ALLIANCE III. NUCIOIDA.

* Nucia.
* Parilia.
* Raudallia.

ALLIANCE IV. MYROIDA.

Leucosilia, Bell, Trans. Linn. Soc. XXI. 1855, p. 295.
* Myra (= *Myropsis*, Stimpson).
Persephona, Leach, Zool. Miscell. III. 22 (1817) [= *Guaia*, Milne-Edwards, vide Bell, Trans. Linn. Soc. XXI. 1855, p. 292.

ALLIANCE V. LEUCOSIOIDA.

* Leucosia.
* Onychomorpha (perhaps the only known representative of a distinct alliance).
* Philyra.
* Pseudophilyra.

Sub-family II. *Iliinæ.*

ALLIANCE I. MYRODOIDA.

Callidactylus, Stimpson, Bull. Mus. Comp. Zool. II. 1870-71, p. 157.
* Myrodes.

ALLIANCE II. IPHICULOIDA.

* Iphiculus.
* Pariphiculus, *n. gen.*

ALLIANCE III. NURSILIOIDA.

* Heterolithadia.
* Nursilia.

ALLIANCE IV. ILIOIDA.

* Arcania (= Iphis, Leach).
* *Ilia*, Leach, Zool. Miscell. III. 19: Milne-Edwards, Hist. Nat. Crust. II. 123.
Iliacantha, Stimpson, Bull. Mus. Comp. Zool. II. 1870-71, p. 155: Miers 'Challenger' Brachyura, p. 301.
* Ixa.

I. *Key to the Indian genera of the sub-family* Leucosiinæ.

I. Carapace convex or subglobular; subcircular, oval, or hexagonal in outline; its surface may sometimes be more or less covered with bead-like or vesiculous granules, but it is generally quite smooth and often polished to the naked eye; the hepatic regions may sometimes form independent convexities, and the intestinal region may sometimes be delimited by a groove or by creases, but as a rule the regions are merged in the general convexity of the carapace. The eyes are very small; and the orbits are complete—the edge of the roof being not, or little, emarginate, and the outer wall, though marked by closed sutures, not being fissured: there is little or no space between the edge of the floor of the orbit and the free edge of the buccal cavern—the two practically coinciding: antennæ distinct:—

1. Chelipeds massive: posterior margin of carapace smooth, although sometimes, especially in the young, its extreme ends may be dentiform: intestinal region never tumid and acuminate: merus of external maxillipeds nearly as long as, or sometimes even longer than, the ischium measured along the inner border:—

   i. Front narrow, prominent, forming a distinct snout projecting beyond the subhepatic or pterygostomian regions which are never puffed out: buccal cavern elongate: the exopodite of external maxillipeds narrow and elongate, with the outer margin straight:—

      a. Either a circumscribed cavity or a deep depression in the ventrad surface of the carapace above the base of the chelipeds ..... LEUCOSIA.

      b. No cavity in the carapace above the base of the chelipeds..... .... PSEUDOPHILYRA.

   ii. Front broad and remarkably truncated, the whole or the greater part of the edge of the buccal cavern being seen beyond it in a dorsal view: buccal cavern broad: exopodite of external maxillipeds broad (often remarkably expanded), its outer and anterior borders forming a continuous nearly semicircular curve ..... PHILYRA.

2. Chelipeds only moderately stout, or even rather slender: three spines or long petaloid processes on the posterior border, the middle one of which belongs to the tumid intestinal region: merus of external maxillipeds not quite two-thirds the length of the ischium measured along the inner border: pterygostomian regions always puffed out beyond the level of the true antero-lateral margin of the carapace..... .... MYRA.

II. Carapace strongly convex, or globular; circular or oval in outline, the regions usually, but not always, defined by distinct grooves: orbits rather incomplete, the roof being markedly emarginate, and the outer wall being often cleft by fissures (which are sometimes quite closed sutures): *a space of remarkable depth between the edge of the lower wall of the orbit and the free edge of the buccal cavern*: posterior margin of carapace most commonly, but not always, armed with spines or tubercles: front truncated, narrow, almost always sunk behind the level of the edge of the buccal frame: *pterygostomian regions remarkably puffed out, often convex beyond the front*: merus of external maxillipeds not much shorter than the ischium measured along the inner border: antennæ very distinct:—

1. Buccal cavern transversely oblong, much broader than long, owing to the enormous width of the afferent branchial canal and of the exognath, the latter foliaceous with the outer and anterior borders forming a continuous semicircular curve: carapace ovoidal, finely scabrous: chelipeds slender—in the adult male more than four times the length of the carapace..... PARILIA.

2. Buccal cavern triangular, exognath not expanded: surface of carapace pustulous or densely vesiculous (if smooth to the naked eye the vesiculous appearance can be detected under a lens):—

   i. Carapace almost circular and globular: legs slender: chelipeds from once and a half to twice and a half the length of the carapace..... RANDALLIA.

   ii. Carapace transversely oval, manifestly broader than long, its lateral margins coarsely spinate: legs remarkably stout: chelipeds very short and stout ..... NUCIA.

III. Carapace consisting of two parts namely (1) a low convex subcircular perfectly smooth crown, formed by the carapace proper, and (2) a thin broad unbroken brim formed by the front and the confluent lateral and posterior margins: merus of external maxillipeds considerably longer than the ischium: eyes and orbits as in I: antennæ obsolete..... ONYCHOMORPHA.

IV. Carapace very rarely approaching a subcircular or ovoidal shape, commonly broad and polygonal; its surface always broken, nodular, tuberculous, wrinkled, or eroded; most commonly the regions are well delimited by grooves or by inequalities of level: almost always a distinct space between the edge of the floor of the orbit and the free edge of the buccal cavern: antennæ often indistinct, sometimes obsolete:—

1. Edge of roof of orbit markedly emarginate, so that the retracted eye is a good deal exposed to dorsal view: antennulary fossæ in open communication with orbits: space between floor of orbit and free edge of buccal cavern rather narrow: fingers opening in a horizontal plane, and of normal shape: antennæ minute, but distinguishable:—

   i. Carapace pentagonal or hexagonal, little or not at all broader than long, its lateral borders not expanded, its regions usually tumid and well defined by grooves or in-

equalities of surface: antennary flagella minute but distinct: merus of external maxillipeds a great deal more than half the length of the ischium measured along the inner border..... EBALIA.

ii. Carapace usually much broader than long, broadly and irregularly pentagonal, its margins thin depressed and expanded, with the edges often jagged; its posterior margin being on a well-defined plane, distinct from, and much lower than, the general plane of the carapace; its surface usually traversed by ridges radiating from the centre, which do not define the regions: antennary flagella minute and difficult to detect: merus of external maxillipeds not much more than half the length of the ischium measured along the inner border ..... NURSIA.

2. Orbits very complete, and not in open communication with the antennulary fossæ: a broad space between edge of floor of orbit and free edge of buccal cavern: antennary flagella obsolete or very minute: carapace very markedly broader than long, its surface remarkably nodular, or eroded, or both; expanded laterally so as sometimes to partly or entirely conceal the legs in flexion: merus of external maxillipeds a good deal more than half the length of the ischium: immobile finger markedly more massive than the dactylus:—

i. Lateral expansions of carapace entirely concealing the legs in flexion: basal antennal joint though tightly filling the gap at the inner canthus of the orbit, yet quite independent: fingers clumsy, cupped on the inner face, closing in a vertical plane, the immobile finger monstrous:—

a. Carapace enormously convex, honeycombed by large symmetrically-disposed undermined caverns and channels..... ORETOPHORUS.

b. Carapace humped behind, flattened and cupped at the sides, the lateral margins formed each of three broad foliaceous lobes which are fused but still display the sutures..... TLOS.

ii. Sides of carapace only partly or slightly concealing the legs in flexion: basal antennal joint fused with the orbit, which except for a narrow fissure in the lower wall forms an unbroken ring:—

a. Antennæ quite obsolete: fingers shorter than palm, opening obliquely: abdomen in both sexes with all the segments separate: meropodites of legs somewhat concealed, in flexion, by the carapace..... ACTÆOMORPHA.

b. Antennary flagella present, very minute: fingers longer than palm, opening vertically: abdomen of female (male unknown) with the 3rd–6th terga indistinguishably fused: legs hardly at all concealed even in flexion, by the carapace HETERONUCIA.

II. *Key to the Indian genera of the sub-family* Iliinæ.

I. Hands not much longer than broad, short squat swollen or subglobular: fingers always much longer than the hand, opening either in an obliquely vertical or sometimes in a nearly horizontal plane:—

1. The whole body and appendages covered with a close spongy pubescence:—

i. Carapace much broader than long, its antero-lateral margins armed with large spines increasing in size from before backwards: tip of dactylus movable through an arc of about 120° ..... IPHICULUS.

ii. Carapace oval (longitudinally) or globular, its margins with small dentiform tubercles: tip of dactylus movable through an arc of about 70° ..... PARIPHICULUS.

2. Carapace practically free of pubescence:—

i. Carapace longer than broad, elongate-oval, smooth, shaped almost exactly as in *Myra*: tip of dactylus movable through an arc of about 120° ..... MYRODES.

ii. Carapace broader than long, not smooth:—

a. Carapace polygonal, with the lateral margin laminar and sinuous or jagged, and with some definite ridges and spines on the surface—shaped, in fact, much as in *Nursia*: tip of dactylus movable through an arc of about 130° ..... NURSILIA.

b. Carapace oval, its surface closely granular and nodular, the hepatic regions much sunken: tip of dactylus movable through an arc of about 70° ..... HETEROLITHADIA.

II. Hands much longer than broad, tapering from a swollen base: fingers opening in a nearly vertical plane, the tip of the dactylus movable through an arc of 60° to 70°:—

1. Carapace more or less globular, its margins with definitely-disposed large spines or tubercles: fingers either longer or not very much shorter than the hand ..... ARCANIA.

2. Sides of the carapace produced into two huge cylindrical sausage-shaped processes: median regions of the carapace separated from the lateral regions by broad channels or grooves: figures not half the length of the hand ..... IXA.

Actæomorpha, Miers.

Actæomorpha, Miers, Journ. Linn. Soc. Zool., Vol. XIII. 1878, p. 184.

Carapace Cancroid, convex, granular. Front broad, not projecting much. Orbits quite complete. *Antennary flagella absent, basal joint present and fused with the orbit to form its inner wall.* The antennules fold obliquely.

The external maxillipeds close the buccal cavern completely: their exopodite is narrow, with the outer edge almost straight: the triangular merus is about two-thirds the length of the ischium measured along the inner border.

Chelipeds massive, not, or hardly, longer than the carapace: hand short and broad, and about the same length as the stout compressed fingers.

True legs short and stout: the meropodites, in flexion, are somewhat hidden beneath the carapace.

The abdomen in both sexes has all seven terga distinctly separate, and in the male is narrow-ovate.

In general appearance *Actæomorpha*, as Miers states, much resembles the Cancroid *Actæa granulata*: it is, however, a true Leucosid, and closely related to *Oreophorus*, as Miers has stated.

Key to the Indian species of Actæomorpha.

1. Regions of carapace separated by deep clean cut channels ... ... *A. morum.*
2. Regions of carapace separated by shallow shelving grooves ... ... *A. lapillulus.*

16. *Actæomorpha morum*, n. sp. Plate VIII. fig. 3.

Carapace broader than long, somewhat oval, strongly convex, closely covered—like the whole body—with large smooth crowded vesiculous granules. The regions of the carapace as a whole are completely isolated from a broad marginal ring by a broad sculptured circumferential groove, a very narrow bridge alone connecting the front with the gastric region: and the regions are again most elegantly isolated from each other (1) by two obliquely-longitudinal channels that cut off the acutely-triangular gastro-cardiac region from the somewhat reniform branchial regions, and (2) by a transverse channel that cuts off the semi-ovate intestinal region—the channels being all in communication with the marginal channel. The isolated marginal ring consists of the front, which is thickened, broad, and slightly prominent; of the posterior margin, which is thickened, slightly curved, and slightly prominent; and of four sharp-cut lateral lobes on either side.

The eyes and orbits are visible in a dorsal view.

The chelipeds and legs are closely crowded with large granules, which on the under surface are smooth and vesiculous, and on the upper surface are spiniform. The chelipeds in the female are about as long as the carapace: the hands are about as long as the fingers: the fingers are traversed by close rows of tiny granules nearly to the tip. The legs are stout and short, with very slender hairy dactyli: in flexion they are somewhat hidden by the carapace.

Orange colour in spirit.

Two females from a bottom of sand and shells, off the Ganjam Coast, 28 to 30 fathoms. They do not seem to be quite adult, and the carapace is 10 millim. long and 12 millim. broad.

17. *Actaeomorpha lapillulus*, n. sp.

Carapace broader than long, strongly convex, crowdedly pustulous: its regions are all well-defined by shallow grooves, and the branchial and intestinal regions are also separated from the margin by shallow grooves. The front is somewhat prominent, and is obscurely bilobed; the hepatic regions though dorsally sunken are angularly convex in the antero-lateral margin, the lateral margins are coarsely and bluntly three-lobed, and the posterior margin is thickened and somewhat prominent. The eyes are hardly visible in a dorsal view. The under surface of the body is closely granular.

The chelipeds are everywhere nodular and pustulous, and the legs are more or less granular on the under surface, and are covered on the dorsal surface with crowded spiniform granules. The chelipeds in the female are about as long as the carapace, and the hands are about as long as broad and not much longer than the fingers. The legs are stout and short, and are somewhat hidden by the carapace in flexion,—that surface of the carapace being somewhat grooved by the pressure of the meropodites.

Colours in spirit: yellowish white, mottled with orange.

Two males and a female from off Ceylon, 34 fms., and a female from off Ceylon 32 fms., the bottom in both cases consisting of broken coral and shells.

The largest specimen—a female not quite adult—has a carapace 9 millim. long and 11 millim. broad.

Oreophorus, Rüppell.

Oreophorus, Rüppell, Beschreibung, etc., Kurzschwänzigen Krabben des rothen Meeres, p. 18 (1830).

Oreophorus, Milne-Edwards, Hist. Nat. Crust. II. 130.

Oreophorus, Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 306, and Cat. Leucos. Brit. Mus. p. 18.

Carapace broadly semi-elliptical or subpentagonal, so that its postero-lateral margins overhang and completely conceal the legs in flexion (much as in *Calappa*); strongly convex, nodose, and often symmetrically eroded or honey-combed. The front forms a distinct, slightly upturned, triangular projection, with the orbits almost on its under surface.

Eyes small; orbits quite complete, the inner canthus being completely closed by the tight-fitting basal antennal joint. No antennary flagella. Antennules folding obliquely.

The external maxillipeds close the buccal cavern completely: their exopodite is narrow, with the outer edge almost straight: the triangular merus is nearly two-thirds the length of the ischium, measured along the inner border.

Chelipeds massive, not very much longer than the carapace: hand short and broad: fingers about twice as long as the hand, their inner surface hollowed like a spoon: the immobile finger enormously massive.

True legs small, and hidden, when flexed, by the lateral expansions of the carapace.

The abdomen of the male consists of three pieces, and is acutely triangular; that of the female consists of four pieces.

In India these little crabs are found only on bottoms of dead coral shingle, to the eroded fragments of which the crabs themselves have a most extraordinary likeness, the likeness being increased by an encrusting growth of *Foraminifera*, *Polyzoa*, etc., to which the crabs like the shingle, are subject.

18. *Oreophorus reticulatus*, Adams & White.

Oreophorus reticulatus, Adams and White, 'Samarang' Crustacea, p. 54, pl. vi. fig. 1 (1850): Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 307, and Cat. Leucos. Brit. Mus. p. 19: A. Milne-Edwards, Ann. Soc. Ent. Franc. (4) V. 1865, p. 151: Miers, Zool. H. M. S. 'Alert,' pp. 185, 254: A. O. Walker, Journ. Linn. Soc., Zool., XX. 1890, p. 111.

Carapace with three caverns, diminishing in size from before backwards, excavated just inside the front and lateral margins on either side. The caverns have undermined edges, and the first communicates with the second by a tunnel, while the second may sometimes (young) have an open communication with the third, and sometimes (adults) only the remains of a communication.

The intestinal region and the true posterior margin are insolated from the rest of the carapace by an undermined channel, which sends forwards a short branch on either side of the cardiac region. The

branchial regions are remarkably tumid, and their surface, like that of the non-excavated parts of the carapace, is reticulate-punctate: the floors of the caverns are either smooth or granular; the floor of the channel has bead-like granules scattered over it.

The whole under surface of the body is rough and granular.

The chelipeds are not quite $1\frac{1}{2}$ times the length of the carapace, and are nodular and granular: the hand is rather broader than long, and not much more than half the length of the fingers: along the outer surface of both fingers is a row of pits. The legs are slender, and are covered up to the tips of the dactyli with crisp, clavate, spiniform, or arborescent granules.

An adult (ovigerous) female has the carapace nearly 11 millim. long, and 14 millim. broad.

In the Indian Museum are 12 females and a young male from off Ceylon, 34 fms., off the Malabar coast, 28 fms., and from the Persian Gulf.

The abdomen of the young male is sunk below the level of the sternum.

18*a*. *Oreophorus reticulatus*, var. *alcicornis*, nov.

Differs from the common form in the following particulars:—

(1) The caverns are much larger, the two just behind the front being separated by a very narrow bridge.

(2) On either branchial region are three coarse spines—one on the summit and two on the lateral border: the spine on the summit is vertical and has a bifid tip.

(3) The eyes are not at all visible in a dorsal view.

A single adult female from off the Ganjam Coast, 28 fms.

Carapace 14 millim. long, 19 millim. broad.

Tlos, Adams and White.

Tlos, Adams and White, 'Samarang' Crustacea, p. 57.
Tlos, A. Milne-Edwards, Nouv. Archiv. du Mus. X. 1874, p. 51.

Tlos differs from *Oreophorus* chiefly in having the anterior and lateral parts of the carapace flat and the margin of the carapace turned up, so that although the cardiac and parts of the branchial regions are convex, the carapace as a whole is cupped. This is in marked contrast with the inflated form of *Oreophorus*, and constitutes the only difference between the two forms.

19. *Tlos petræus*, A. Milne-Edwards.

Tlos petræus, A. Milne-Edwards, Nouv. Archiv. du Mus. X. 1874, p. 51, pl. iii. fig. 1.

Carapace broadly pentagonal; with the front somewhat produced, bluntly triangular, and slightly emarginate. The margins of the carapace are thickened, roughened, and somewhat upturned. Each wing of the carapace shows a division into three broad lobes, but the divisions are only sutures, not gaps. Except for a ridge running from the front to the cardiac region, and except for a granular node just external to the cardiac region on either side and for a little thickening between each node and the postero-lateral angle, the surface of the carapace is smooth and concave. The under surface of the body is granular. The orbits are almost ventral in position, and the eyes are not visible in a dorsal view.

The chelipeds in the female are not quite as long as the carapace: the arm is trigonal with enlarged granules along all its borders, the wrist and hand are rough, and the dactylus is fluted. The hand is as broad as long, and is continued without any sort of constriction into the great shovel-shaped immobile finger, which is about as long as the hand and vastly more massive than the dactylus. The legs are compressed, and have their dorsal and ventral surfaces granular: in flexion they are hidden beneath the wings of the carapace.

In the abdomen of the male the terga although a good deal fused are all separately recognizable, and there is a denticle in the middle line on the 4th and 6th.

An adult (ovigerous) female has the carapace 7 millim. long, and 10 millim. broad.

Andamans, Off Ceylon 34 fms., Pedro Shoal 20 fms. Eight specimens.

20. *Tlos patella*, n. sp. Plate VIII. fig. 4.

Carapace transversely oval, and closely covered with granules which under the lens are fungiform: the carapace is traversed by a longitudinal ridge, and the branchial regions are convex in their posterior part; but the wings of the carapace are cupped dorsally, much as in *T. petræus*, and are divided by closed sutures into three broad lobes.

The front hardly breaks beyond the general outline of the carapace, and has its edge thickened. The eyes can just be seen in a dorsal view.

The intestinal region is convex backwards, and the bilobed (true) posterior margin still more so.

The under surface of the body is granular, much like the upper surface.

The chelipeds in the female are about one-fourth longer than the carapace, and are closely covered with small flat smooth granules: the arm is trigonal, with larger granules along the edges: the hand is somewhat inflated, a little longer than broad, and not much more than half the length of the fingers: the fingers are curved and are hollowed on the inner face: the immobile finger is distinctly constricted off from the hand, and is not vastly more massive than the mobile finger.

The legs are as in *T. petræus*.

The largest adult (ovigerous) female has the carapace 9 millim. long and 11 millim. broad.

Loc. Andamans. Seven females.

Heteronucia, n. gen.

Carapace strongly convex, broader than long, its surface both granular and tubercular (or coarsely spinous): the regions distinct.

Front bidentate, sunk behind the edge of the mouth-parts and of the puffed out pterygostomian regions.

Orbits complete but shallow, not concealing the rather large eyes in flexion. The basal antennal joint is fused with the orbit and with the front, and the extremely minute antennary flagellum is entirely inside the orbital wall. The antennules fold obliquely.

The epistome is exceptionally broad.

The external maxillipeds completely close the buccal cavern; the exopodite is narrow, with the outer edge straight; the merus is about two-thirds the length of the ischium measured along the inner border.

The chelipeds are massive and are about half again as long as the carapace: the hand is short, broad and swollen: fingers a good deal longer than the hand, stout, closely meeting throughout their extent, curved and concave on their inner face, opening vertically: the immobile finger is a good deal more massive than the dactylus.

Legs stout, the meropodites slightly hidden in flexion.

This species has, at first sight, a general resemblance to *Nucia speciosa*, but is at once distinguished by the form of the orbits, antennæ and chelipeds.

21. *Heteronucia vesiculosa*, n. sp. Plate VIII. fig. 1.

The whole surface of the body and of the appendages (except the fingers and dactyli) is covered with crowded vesiculous granules without any space between them.

Carapace a good deal broader than long, strongly convex: on either lateral margin are eight coarse spines or acute tubercles, the first of which is at the antero-external angle of the buccal cavern, the last of which is at the junction with the posterior border: in addition the

whole dorsum of the carapace is occupied by a "pyramid" (as on the billiard table) of 8 or 9 similar coarse spines or acute tubercles—the apex of the pyramid being on the intestinal region—and there is, further, a coarse denticle on either hepatic region: the surface of all these is densely vesiculous.

The front is broadly bidentate, and the whole of the front edge of the buccal cavern and of the tips of the external maxillipeds can be seen beyond it in a dorsal view. There is a tubercle near the base of the distal piece of the exognath.

The chelipeds are stout, and are rather more than half again as long as the carapace: the hand is subglobular: the fingers are somewhat longer than the hand, are elegantly grooved, meet in all their extent, open nearly vertically, and are hollowed and curved inwards; the dactylus is less massive than the immobile finger: at the base of the dactylus, on the upper surface of the hand is a small tubercle.

The abdomen of the female consists of 4 pieces—the 3rd to 5th terga being fused.

Colours in spirit light orange yellow.

An ovigerous female has the carapace 5 millim. long and 6 millim. broad.

Loc. Off Ceylon, 34 fms.

Nursia, Leach.

Nursia, Leach, Zool. Miscell. III. p. 18.

Nursia, Milne-Edwards, Hist. Nat. Crust. II. 137.

Nursia, Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 307, and Cat. Leucos. Brit. Mus. p. 19.

Carapace with a broad, usually depressed, symmetrically-wrinkled surface, and with expanded, foliaceous, sinuous, scallopped, or jagged lateral and posterior margins,—the lateral margins somewhat concealing the true legs in flexion. Front projecting beyond the epistome and usually well beyond the eyes.

Orbits with two sutures in the roof, and a gap at the inner canthus, and with the upper-outer wall so emarginate as to leave the fully-retracted eye exposed to dorsal view.

Antennules folding obliquely. Antennæ, minute, situated in the inner canthus of the orbit.

Buccal cavern about as long as it is broad at base, and somewhat narrowed anteriorly; the exognath not dilated, its outer edge a little curved: the triangular merus is a little over half the length of the ischium, measured along the inner edge.

The chelipeds relatively to the legs are very massive: in the male they vary from $1\frac{1}{2}$ times to over twice the length of the carapace:

arms sharply trigonal; hands a good deal compressed; fingers stout and compressed, about half or two-thirds the length of the hand.

The abdomen of the male consists, usually, of 3 pieces, that of the female of 4.

Key to the Indian species of Nursia.

I. An oblique ridge crossing either hepatic region, in addition to the longitudinal, transverse, and epibranchial ridges: upper surface of hand convex, but without a conspicuous median ridge:—

1. The posterior margin of the carapace has the form of two blunt semicircular lobes: the lateral margins are sinuous, or only bluntly jagged: chelipeds in the adult male less than twice the length of the carapace:—

i. Lateral margins jagged: front with a coarse thickened granular edge, and not projecting much beyond the eyes: carapace much broader than long ... ... *N. plicata.*

ii. Lateral margins sinuous: front in the form of a large ovate snout, projecting far beyond the eyes: carapace nearly as long as broad:—

a. Outer surface of wrist and hand bluntly and inconspicuously carinate: ridges of carapace coarse and granular: snout semicircularly rounded ... *N. blanfordi.*

b. Outer surface of wrist and hand sharply and conspicuously cristate: ridges of carapace clean-cut: snout ovate-pointed *N. nasuta.*

2. The posterior margin of the carapace has the form of two sharp laminar teeth: the lateral margins are sharply jagged: front sharply 4-denticulate:

chelipeds, in the adult male, more than twice the length of the carapace *N. hardwickii.*

II. No trace of an oblique ridge on the hepatic regions or of a transverse ridge behind the branchial regions, the longitudinal and epibranchial ridges alone present: posterior margin not manifestly bilobed: upper surface of hand traversed from base to finger-cleft by a distinct ridge:—

1. Carapace convex: front broadly bidentate ... ... *N. persica.*
2. Carapace almost laminar: front broadly pointed ... ... *N. abbreviata.*

III. No ridges at all on the carapace: margins not manifestly sinuous ... ... *N. rubifera.*

22. *Nursia plicata*, (Herbst) *nec auctorum.*

Cancer plicatus, Herbst, Krabben III. iv. 2, pl. lix. fig. 2.

Carapace about three-quarters as long as broad, *with the posterior margin in the form of two semi-circular dorsally-concave lobes.* The foliaceous lateral margins are scallopped, each into four blunt teeth: in front of the first of these (which is rounded off), on either side, is a thickened marginal nodule; and the last, on either side, are united by a coarse granular ridge running across the carapace parallel with the posterior margin, which it cuts off from the rest of the carapace. This ridge culminates, in the middle line, in a coarse granular tubercle.

The middle of the carapace forms a coarsely-granular eminence surmounted by 3 tubercles in a triangle. From it six blunt coarsely-granular ridges radiate, as follows:—one forwards, in the middle line, to the front; one backwards, in the middle line, to the transverse ridge; one obliquely forwards, across the hepatic region on either side, to the nodule on the hepatic margin; and one obliquely backwards to the penultimate lateral tooth on either side. The spaces between the ridges are markedly concave, and are usually smooth.

The front hardly projects beyond the eyes, and has a coarse thickened granular edge: *it is usually obscurely bilobed, and never quadridentate.*

The surfaces of the external maxillipeds, of the pterygostomian regions, of the thoracic sterna, and of the proximal part of the male abdomen are distinctly granular.

The chelipeds in the adult male are $1\frac{3}{4}$ *times, in the adult female about* $1\frac{1}{4}$ *times the length of the carapace:* the arm has only its outer border

carinate,—the carina being coarse and granular; the base of its upper surface, the inner border, and the base of the under surface and the under border are also granular to the naked eye: the outer edges of the wrist and hand are coarsely and inconspicuously carinate: the fingers are stout, are rather strongly bent inwards, and have the opposed edges almost edentulous: *the dactylus is more than three-quarters the length of the outer border of the hand*, in both sexes.

The true legs are not much longer than the arm, and are compressed: in all the merus and propodite are sharply carinate dorsally and ventrally, the carpus has two sharp dorsal crests, and the dactylus is closely pubescent.

The abdomen of the male consists of two linear basal pieces and a small triangular apical piece, and between the two a long triangular plate with a median sub-terminal tooth.

Length of carapace of the largest male, 15 millim., breadth 20 millim.: length of carapace of largest female 16 millim., breadth 22 millim.

Old spirit specimens are uniform flesh-colour: but fresh spirit specimens are a bright brick red, with the wings of the carapace, and a medium longitudinal band including the front, yellowish white.

In the Indian Museum are 8 adult males, 6 adult and egg-laden females, and one young, from the Orissa Coast, Tinnevelly coast, Palk Straits, Bombay, Karáchi, and the Persian Gulf. [Besides these there are 4 adult females and a male from Hongkong].

23. *Nursia hardwickii*, Leach.

Nursia hardwickii, Leach, Zool. Miscell. III., p. 20: Desmarest, Consid. Crust. p. 166: Milne-Edwards, Hist. Nat. Crust. II. 137.

Nursia plicata, Bell, Trans. Linn. Soc. Vol. XXI. 1855. p. 307, pl. xxxiv. fig. 4, and Cat. Leucos. Brit. Mus., p. 19 (*nec* Herbst): Stimpson, Proc. Ac. Nat. Sci. Philad. 1858. p. 161 (?): Miers, Trans. Linn. Soc. Zool., (2) I. p 240, pl. xxxviii. fig. 28: Haswell, Cat. Austral. Crust. p. 127 (?): de Man, Notes Leyden Mus. III. 1881, p. 129: A. O. Walker, Journ. Linn. Soc., Zool., Vol. XX. p. 111 (?): J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 404.

The general form is that of *N. plicata* Herbst, but much finer and cleaner cut; and with the anterior part of the carapace narrower and the front projecting.

The posterior margin of the carapace has the form of two sharp-cut laminar teeth; and the three last teeth on either lateral margin are thin and sharp.

The crests on the carapace are thin and sharp, and very finely granular; and the elevation from which they radiate is defined by three sharp denticles: the transverse ridge that unites the two last marginal teeth across the carapace culminates, in the middle line, in a denticle.

The front distinctly projects beyond the eyes; *its margin is thin and sharp and is cut into four teeth*: the antero-lateral margins do not run up to the level of the tip of the front, involving the orbits, as they do in *N. plicata*.

The granulation on the ventral surfaces, unlike that of *N. plicata*, is hardly visible to the naked eye.

The chelipeds in the adult male are $2\frac{1}{3}$ *times, in not-quite-half-grown males* $1\frac{7}{8}$ *times, and in adult females* $1\frac{1}{2}$ *times the length of the carapace*: to the naked eye they are perfectly smooth: the outer edges of the arm, wrist and hand are *sharply* carinate: *the dactylus in the male is little more than half the length of the outer edge of the hand.*

Uniform flesh-colour in spirit.

Length of carapace in the adult male 14 to 15 millim., breadth about 19 millim.; in the adult female length 12 to 13 millim., breadth about 16 millim.

In the Indian Museum collection are 18 adult males, 8 adult females, and 2 young males taken at various places along the Coromandel coast, from Ganjam to Pondicherry.

24. *Nursia blanfordi*, n. sp. Plate VII. fig. 5.

Carapace, except that it is nearly as long as broad, of the same general appearance as in *N. plicata*, Herbst, with the same two semicircular lobes on the posterior margin, and the same number of *blunt* teeth on the lateral margin,—the teeth, however, being blunter, and the first two on either side nearly confluent.

The ridges that radiate from the centre of the carapace, though of the same coarse and coarsely-granular form as in *N. plicata*, differ somewhat in arrangement: the median longitudinal ridge, the ridges that run obliquely outwards to the hepatic margin on either side, and the transverse ridge that unites the last lateral teeth across the carapace, are the same; but the epibranchial ridges that run to the penultimate lateral tooth on either side are so little oblique in the greater part of their extent as to form an almost transverse crest across the carapace, parallel with the first-mentioned transverse ridge and with the posterior margin. The triangle of denticles on the mid-gastric region, and the denticle on the second transverse crest are as distinct and sharp, especially in the male, as they are in *N. hardwickii*.

The front has the form of a semi-circular foliaceous snout, projecting far beyond the eyes, and somewhat recurved upwards.

Both the exopodite and the endopodite of the external maxillipeds are traversed longitudinally by a raised line of enlarged granules.

The chelipeds in the male are about $1\frac{7}{8}$ times, in the female about

$1\frac{1}{3}$ times, the length of the carapace, and their surface is everywhere finely granular, except on the fingers, which are of the same form and proportions as in *N. plicata*: the arm is trigonal, with all the edges sharp, and the outer edges of the wrist and hand are coarsely, but distinctly, carinate.

The legs have the merus, carpus and propodite faintly carinate dorsally.

The abdomen of the male consists of 3 pieces, the large middle piece having a subterminal denticle.

Colours in spirit, uniform light brownish.

The ovigerous female has the carapace 8 millim. long and 8·5 millim. broad: the male is slightly smaller.

Persian Gulf, 52 fathoms, dredged by Mr. W. T. Blanford, F. R. S., to whom the Indian Museum collections owe so many valuable additions. Also from the Mekrán coast. Six specimens are in the Indian Museum.

25. *Nursia nasuta*, n. sp. Plate VII. fig. 6.

Resembles *N. blanfordi* in almost all its characters, especially in having the carapace nearly as long as broad, and the front in the form of a large curved foliaceous snout; but differs in the following particulars:—

(1) the front is sharper and even longer, and in shape is pointed-ovate:

(2) the ridges of the carapace are little granular, and the oblique ridges that cross the hepatic regions are obsolescent:

(3) the outer edge of the wrist and of the hand are raised each into a thin sharp high crest:

(4) the size is even more minute, the largest specimens (ovigerous females) having the carapace from 5 to 6 millim. long and from 5·25 to 6·25 millim. broad.

Loc. Off the Malabar coast, 28 fathoms. Two adult males and 6 adult females.

26. *Nursia persica*, n. sp. Plate VII. fig. 7.

Carapace about nine-tenths as long as broad, its lateral margins expanded and cristiform, but not scallopped, only sinuous (much as in *N. abbreviata*), forming three shallow lobules on either side: posterior margin laminar, perfectly straight, with a spot of dark red (in spirit) pigment in the middle line.

The carapace, which is rather strongly convex, is traversed longitudinally, in the middle line, by a broad sharp-edged ridge that ends

at a tubercle in the intestinal region, and is again crossed transversely by a similar ridge, which is strongly convex forwards: these are the only ridges on the carapace.

The front has the form of two broad sharp-cut teeth which are prominent beyond the eyes.

The outer margins both of the endopodite and of the exopodite of the external maxillipeds are granular and somewhat raised.

The exposed surfaces of the thoracic sterna, and of the carapace round the bases of the chelipeds, are covered with large granules (in the female—male unknown).

The chelipeds in the female are very little longer than the carapace: the arm is sharply trigonal, with the edges coarsely granular: the wrist and hand have the upper surface rough: the edges of the hand are sharp, and the upper surface of the hand is traversed, from its base to the finger-cleft, by a sharp finely-beaded ridge, as in *N. abbreviata*: the fingers (in the female) are about two-thirds as long as the hand, and are finely denticulate.

The legs are slender and compressed, with the merus, carpus and propodite sharply carinate dorsally.

Colours in spirit: mottled like Castile soap.

Length of carapace 9 millim., breadth 10·5 millim.

A single ovigerous female from the Persian Gulf.

This species well illustrates the close relation between *Nursia* and *Tlos*.

27. *Nursia abbreviata*, Bell.

Nursia abbreviata, Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 308, pl. xxxiv. fig. 5, and Cat. Leucos. Brit. Mus. p. 20: Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 404.

Carapace about eight-ninths as long as broad, abnormally depressed—almost laminar—except in the mid-gastric region, which is somewhat angularly elevated: its borders, behind the front, are thin, foliaceously expanded and sinuous, forming 7 shallow lobules, the least distinct of which is the posterior border, which again is very inconspicuously subdivided by a faint emargination in the middle line: the whole of the free edge of the carapace is finely beaded, and slightly upturned, so as to emphasize the depressed appearance of the carapace.

An anteriorly-convex milled carina crosses the carapace from one lateral margin to the other, and is met in the middle line by a milled ridge running from the front: these are the only ridges on the carapace. There is granular elevation in the cardiac region, otherwise the carapace is smooth. The front is broad and prominent with the edge a little convex.

The pterygostomian region is traversed by a sharp ridge that runs parallel with the antero-lateral border.

The external maxillipeds, the edge of the sternum, and the entire edge of the fossa that receives the abdomen, are ornamented with beadlike granules, in the male.

The chelipeds in the male are a little more than half again as long as the carapace and in the female are not one-fourth longer than the carapace: the arm is sharply trigonal, with all the edges granular and the surfaces smooth: the upper surface of the wrist and hand are traversed, up to the finger cleft, by a sharply-raised beaded ridge: the fingers are about two-thirds the length of the hand, and meet only at tip.

The abdomen of the male consists of three pieces, the long middle piece having a sub-terminal denticle.

Colours in spirit: yellowish-brown mottled with greenish-brown, which on the arm, on the base of the hand, on the base of the fingers, and on the legs, forms cross-bands.

Eight males and five adult females, from Karáchi, the carapace of the largest male and female being 9 millim. long, and 10 millim. broad. Three very young specimens from the Coromandel coast are almost certainly this species.

28. *Nursia rubifera*, Müller.

Nursia rubifera, Müller, Verhandl. Naturforsch. Ges. Basel, VIII. 1886, p. 480, pl. iv. figs. 4, 4*a*, 4*b*.

Carapace broader than long, outline oval,—very inconspicuously polyhedral, edge cockled and finely granular. Front prominent, *bilobed*. Two isolated granular tubercles in the middle line—one in the gastric, one (smaller) in the cardiac region; but *no ridges*. Outer border of exognath strongly curved. Chelipeds in the male about half again as long as the carapace: arm sharply trigonal, with all three edges granular: a sharp longitudinal ridge on upper surface of hand: fingers meeting throughout their extent.

Irregular lilac stripes on the carapace and cross-bands on legs.

Loc. Trincomalee.

Not in the Indian Museum collection. Known here only from Müller's description and figures.

The species, as Müller says, is nearest allied to *N. abbreviata*, and is also closely related to *N. persica*.

Ebalia, Leach.

Ebalia, Leach, Malac. Pod. Brit. text of pl. xxv. and Zool. Miscell. III. p. 18.
Ebalia, Milne Edwards, Hist. Nat. Crust. II. 128.

Ebalia, Bell, Brit. Stalk-eyed Crust. p. 139, and Trans. Linn. Soc. Vol. XXI. 1855, p. 303, and Cat. Leucos. Brit. Mus. p. 16.

Ebalia, Miers 'Challenger' Brachyura p. 303 (part).

Carapace rhomboidal or pentagonal or hexagonal; commonly, but not always, a little broader than long; its regions generally well defined and tumid, the tumid portions nodular or granular: its posterior margin is generally a little prominent and either bilobed, or with its extreme ends dentiform.

The front is not much produced in Indian species, except in *Ebalia* (*Phlyxia*) *erosa*.

In the orbital wall, as usual, there are three sutures, and a gap at the inner canthus: the edge of the roof of the orbit is considerably emarginate. The antennules fold obliquely or nearly transversely. The antennæ are minute but distinct.

The buccal cavern is moderately elongate: the exopodite of the external maxillipeds is not dilated, its outer edge is a little curved: the triangular merus of the external maxillipeds is about $\frac{3}{4}$ the length of the ischium measured along the inner border.

The chelipeds are variable: they are usually massive. In the typical *Ebalia* forms they are short—not much more than half again as long as the carapace—and stout, with short broad hands not much differing in length from the stout compressed fingers.

The abdomen of the male consists of 3 or 4 pieces.

Key to the Indian species of Ebalia.

I. Front much produced: carapace markedly longer than broad ..... *E. erosa.*

II. Front not produced: carapace either a little broader than long or a very little longer than broad:—

1. Edge of buccal cavern projecting a little beyond the front: posterior border of the carapace with three rounded teeth in the male and two (much less distinct) in the female: a large granular "broad arrow" on the carapace the ends of the wings of which project beyond the postero-lateral margin... *E. sagittifera.*
2. Edge of front projecting beyond the epistome: ends of posterior margin thickened and obscurely dentiform.

i. Dorsum of carapace deeply and very elegantly trilobed longitudinally..... *E. diadumena.*

ii. Carapace hexagonal, dorsum with 4 granular swellings arranged in a "cross"... *E. wood-masoni.*

I have not included the species referred to by Dr. Henderson as *Ebalia pfefferi* and *Ebalia fallax* in this key, because the first appears to belong to Dana's genus *Nucia*, which in my opinion has no close affinity with Leach's genus, while the second is quite clearly a form belonging to the *Ilia* alliance, as it has the *Ilia* fingers hands and external maxillipeds.

29. *Ebalia diadumena*, n. sp. Plate VII. fig. 4.

Carapace rhomboidal, a little broader than long, its dorsal surface divided into three tumid crisply granular and most elegantly shaped lobes (a gastro-cardiaco-intestinal and two branchial—forming a sort of *fleur de lys*) by two extremely deep smooth longitudinal furrows. On the middle lobe the gastric and cardiac regions are separated by a shallow groove, and the cardiac and intestinal by a deep furrow. The hepatic regions are also distinctly circumscribed, but are altogether on a much lower plane than the rest of the carapace, and like the front are only indistinctly granular.

The front is divided, from its hardly emarginate edge down to the gastric region, by a narrow deepish longitudinal groove. Behind the front the angular pterygostomian ridge is somewhat prominent. The lateral margins are finely crenulate: the posterior margin is almost straight, with the ends somewhat dentiform.

The surfaces of both branches of the external maxillipeds are tumid and granular.

The chelipeds in the female (male unknown) are not very much longer than the carapace: the arm is trigonal and the greater part of all its surfaces is crisply granular, as also are large parts of the surfaces of the wrists and hands: the fingers are not much shorter than the hand and are elegantly striate-granular: the hand is not very much longer than broad.

The carapace of the adult female is 4 millim. long and 4·5 millim. broad.

A single ovigerous female from Palk Straits.

Colours in spirit lilac brown, the furrows on the carapace dark violet brown.

30. *Ebalia woodmasoni*, n. sp. Plate VII. fig. 3.

Carapace sharply hexagonal, its length just exceeds its breadth in the male, its breadth is equal to its length in the female.

Four large well-defined (especially in the male) granule-capped swellings or tubercles mark, respectively, the cardiac, intestinal, and branchial regions, and two small indistinct swellings mark the hepatic regions: the hollows between the larger swellings are elegantly punctulate.

Antero-lateral borders finely and inconspicuously, postero-lateral and posterior borders finely and distinctly beaded; the posterior border prominent and straight, with its ends more prominent—giving it a bilobed appearance.

Front angularly emarginate or broadly bidentate. Eyes rather large and not well concealed by the orbits.

Exposed parts of sternum granular, the first segment, in the male, with a strong longitudinal ridge or boss near the base of either chelipe[illegible].

Chelipeds in both sexes half again as long as the carapace: arm trigonal, its upper surface with some rows of enlarged beadlike granules along both borders, its under surface with a broad tapering band of similar granules: hand nearly twice as long as broad, and from $\frac{1}{4}$ to $\frac{1}{3}$ longer than the fingers.

Abdomen of male with a very strong terminal tooth on its penultimate segment.

In the male the carapace is 5 millim. long and 4·8 millim. broad, in the adult female it is 5 millim. in both dimensions.

Loc. Andamans.

This species appears to be near *Ebalia quadrata*, A. M.-E., from Bass' Straits, and to Miers' *Ebalia rhomboidalis*, *minor* and *bituberculata*, from Japan.

31. *Ebalia sagittifera*, n. sp.

Carapace hexagonal, although hardly longer than broad yet of an elongate appearance, owing to the unusual length and very gradual convergence of the postero-lateral borders: the whole antero-lateral margin is sharp, slightly curled and elegantly striated or milled: the edge of the subhepatic regions, or pterygostomian ridges, are extremely prominent, standing out on either side like a pair of little wings. In the male the posterior margin bears a petaloid tubercle at either end and a denticle in the middle line: in the adult female the lateral tubercles are indistinct and the median tubercle absent.

The front is emarginate, and part of the edge of the buccal cavern can be seen beyond it in a dorsal view.

On the carapace are three broad granular ribs which unite to form a "broad-arrow," point forwards: the middle ridge begins about the middle of the gastric and ends in the middle of the intestinal region, the lateral ribs run obliquely backwards and outwards, parallel with the antero-lateral margins, across the branchial regions, their ends projecting well beyond the postero-lateral borders in the male, but not so much in the female.

The chelipeds are about half again as long as the carapace: the arm is trigonal with the edges raised and granular: the wrist and hand have a raised row of granules along the inner edge of their upper surface: the hand is about two-thirds as broad as long, and the fingers are about two-thirds the length of the hand.

The abdomen of the male consists of only two pieces, and is without a denticle.

Colours in spirit: mottled dark green and greenish brown, legs and chelipeds with black-speckled cross-bands.

Length of carapace of male 5 millim. long, 4·5 millim. broad; of ovigerous female 6 millim. long, 5·75 millim. broad.

Loc. Karáchi.

As in *Ebalia erosa* the space between the lower edge of the orbit and the edge of the buccal frame is much reduced. This species appears to be closely related to *Ebalia hypsilon*, Ortmann, in Semon's Zool. Forschungreisen Austral. u. Malay. Arch., Crust. p. 36, pl. ii. fig. 7.

32. *Ebalia erosa*, (A. Milne Edwards).

Phlyxia erosa, A. Milne Edwards, Journ. Mus. Godeff. I. iv. 1873, p. 262, and Nouv. Archiv. du Mus. X. p. 47, pl. iii. fig. 2: Haswell, P. L. S. N. S. Wales, IV. 1879, p. 54, and Cat. Austral. Crust. p. 125: Miers, P. Z. S. 1884, pp. 10, 13.

Ebalia erosa, Miers, 'Challenger' Brachyura p. 305: Ortmann, Zool. Jahrbuch. Syst., etc., VI. 1892, p. 580.

Carapace longer than broad, somewhat piriform, with a produced narrow bidentate front from which a prominent ridge runs straight back to the cardiac region, with the hepatic and subhepatic regions angularly prominent, and with three dentiform projections—one of which is the acuminate tip of the tumid intestinal region—on the prominent posterior margin. On the posterior half of the carapace there are some large symmetrically disposed tubercles, usually about 9 in number (3 on either branchial region and 3 on the cardiac region) and sometimes more or less confluent: the three on the cardiac region are always very distinct and are so connected as to form an elegant V, or with the ridge from the front an "anchor," and however much the branchial tubercles may be confluent one on either side of the V is

always enlarged and acuminate. The tubercles, the tumid intestinal region, and sometimes also the intervening hollows, are crisply granular.

The buccal cavern is elongate.

The chelipeds in both sexes are little longer than the carapace, and are rather slender: they are finely granular, especially the arms. The hand is a little broader at its proximal than at its distal end, where it is about half as long as broad: the fingers are little more than half the length of the hand.

Colours in spirit ivory white.

The carapace of the male is about 6 millim. long and 5 millim. broad: that of the adult female is 9 millim. long and 7 millim. broad.

Numerous specimens are in the Indian Museum, from the Maldives and Andamans.

Nucia, Dana.

Nucia, Dana, U. S. Expl. Exped., Crust. pt. I. p. 397.
Nucia, Bell, Cat. Leucos. Brit. Mus. p. 24.

Carapace strongly convex, broad, transversely somewhat ovoidal in shape, its surface uneven and densely covered with vesiculous or pustulous granules, and with the regions usually well demarcated.

The front is narrow, broadly bidentate, and somewhat sunk behind the level of the front edge of the buccal cavern. The pterygostomian regions are puffed out so as to increase the squat and sunken appearance of the front. There is a remarkably broad interval between the orbits and the edge of the buccal cavern.

The eyes are large, and the orbits have the upper edge deeply emarginate so that the retracted eye is hardly at all concealed. The antennules fold obliquely, and the antennæ have the basal joint rather closely filling the gap at the inner canthus of the orbit and the flagellum small but distinct.

The buccal cavern is moderately elongate: the exognath is not dilated and has the outer border almost straight: the triangular merus of the endognath is not much shorter than the ischium measured along its inner edge.

The chelipeds are very short and stout: the legs also are rema[illegible]ably stout.

In the Indian Museum Collection, the only representative of this genus is a male specimen of *Nucia speciosa*, Dana, from Upolu. This is, quite clearly, closely allied to the species named *Randallia pustulosa* and *Randallia lamellidentata* by Wood-Mason. [Whether these are really *Randallia* as defined by Stimpson it is difficult to say; but they are certainly congeneric with Miers' *Randallia granulata* ('Challenger' Brachyura, p. 317, pl. xxvi. fig. 1)].

33. *Nucia pfefferi*, (de Man).

Ebalia pfefferi, de Man, Archiv. für Naturges. LIII. 1887, i. p. 390, pl. xvii. fig. 4: Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 402.

As there seems to be some doubt whether this species is really distinct from *Nucia speciosa*, Dana, U. S. Expl. Exp. Crust. pt. I. p. 397, pl. xxv. fig. 5*a* I must here be content to give only the references. It is included in the Indian fauna on the authority of Dr. J. R. Henderson.

Randallia, Stimpson.

Randallia, Stimpson, Journal Boston Soc. Nat. Hist. Vol. VI. 1857, p. 471.
Randallia, Miers, 'Challenger' Brachyura, p. 316.

Carapace circular and convex, almost globular; with the front narrow, usually broadly bidentate, and somewhat sunk behind the level of the front edge of the buccal cavern. The subhepatic or pterygostomian regions are convex and puffed out, so as to increase the squat and sunken appearance of the front. There is a remarkably broad vertical interval between the orbits and the edge of the buccal cavern.

The surface of the carapace is, typically, covered with vesicular or pustulous granules, but these are sometimes visible only with a lens: the regions are usually, but not always, distinctly demarcated by grooves.

The posterior margin is generally, but not always, armed with spines or petaloid lobules or tubercles.

The orbits are almost as imperfect as they are in *Parilia*: their upper edge is deeply emarginate, there is a wide gap at the inner canthus, and there are three very distinct sutures, or sometimes actual fissures, in the upper-outer wall.

The antennules fold obliquely: in one Indian species their basal joint forms a close-fitting operculum to the antennulary fossa. The antennæ are very distinct, and are loosely lodged in the inner canthus of the orbits.

The buccal cavern is triangular and somewhat elongate: the exognath is not dilated and its outer margin is almost straight: the triangular merus of the endognath is about $\frac{2}{3}$ the length of the ischium measured along its inner edge.

Chelipeds either massive or moderately stout, of moderate length; fingers stout, about as long as the hand, which is not more—but is usually much less—than half the length of the carapace.

Although there is, as usual, some fusion among the abdominal terga, yet the sutures are never wholly obliterated as they are in most other Leucosines.

Key to the Indian species of Randallia.

I. The basal joint of the antennules forms a close-fitting operculum to the antennulary fossa: the whole body and appendages are covered with a dense velvety pubescence: front very indistinctly emarginate ..... *R. lanata.*

II. The antennules fold loosely in their fossæ: body and appendages devoid of pubescence: front distinctly bidentate:—

1. Carapace granulous or pustulous, the regions defined by grooves:—

i. Front separated from the carapace by a conspicuous transverse groove: intestinal region tumid but not culminating in a spine: tip of exognaths (and often of adjoining points) blister-like ..... *R. pustulilabris.*

ii. No deep groove at the base of the front: intestinal region culminating in a spine, the tip of which overhangs the posterior margin of the carapace: end of exognaths sharp:—

(*a*) Chelipeds rather elongate and slender, twice the length of the carapace: hand subcylindrical and rather elongate: antero-later margins of carapace with simple tubercles or spines ..... *R. pustulosa.*

(*b*) Chelipeds short and stout, less than twice the length of the carapace: hand short and stout, its outer border, like that of the fingers, very sharply cristiform: antero-lateral margins of carapace with laminiform teeth ..... *R. lamellidentata.*

2. Carapace smooth and polished to the naked eye, the regions not or hardly defined:—

i. Chelipeds rather elongate and slender, more than twice the length of the

carapace: three round laminiform lobes on the posterior margin of the carapace ..... *R. eburnea.*

ii. Chelipeds short and stout, less than twice the length of the carapace: posterior margin of carapace differing from that of all the other species in being quite smooth ..... *R. glans.*

34. *Randallia lanata*, n. sp.

The whole of the body and its appendages covered with a close, short, light-coloured, velvety pubescence.

Carapace circular, globular, with all the regions well defined by grooves; its surface covered, beneath the pubescence, with rather distant pustulous granules. Behind the front all the margins of the denuded carapace are armed with blunt dentiform tubercles or granules. There is a not very distinct notch between the hepatic and branchial regions.

The front has an almost straight edge, and although it is for the genus rather prominent, the ends of the external maxillipeds can be seen beyond it in a dorsal view.

The orbits are so emarginate above as to afford little concealment to the retracted eye, which is rather large.

The antennules fold obliquely, their basal joint forming a close-fitting operculum to the antennulary fossæ.

The chelipeds are similar in both sexes, being stout and about half again as long as the carapace: the hand is very stout, is not much longer than broad, and is about one-third the length of the carapace: the fingers are stout and are about three-fourths the length of the hand. The legs are stoutish.

In both sexes all seven abdominal terga are plainly and independently recognizable though not all independently movable: in the female (even in the ovigerous adult) the abdomen is somewhat narrow.

In the adult male the carapace is 7 millim. long and 6·5 millim. broad, in the adult female it is 8·5 millim. in both diameters.

Andaman Sea usually at over 30 fathoms.

35. *Randallia pustulilabris*, n. sp.

Leucosilia granulosa, Alcock and Anderson, J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 207, and Ill. Zool. Investigator, Crustacea, pl. xxiv. fig. 3 (*in the press*).

Carapace slightly broader than long, globular: truncated anteriorly,

so that the external maxillipeds are visible beyond the front: very densely covered, as are also the chelipeds, with bead-like granulations: the regions delimited by shallow yet distinct furrows. The rostrum consists of two divergent hollow lobes, the tips of which are curved slightly outwards, beneath which the antennules are lodged, as in the other species of this genus: *immediately behind the rostrum the carapace is traversed from side to side by a deep groove.* The antero-lateral margin is interrupted by a deep notch, in front of which is a coarse blunt hepatic tooth, while behind it is a stronger epibranchial tooth. The lateral angle is also marked by a prominent granule. The posterior margin is almost straight and bears three dentiform tubercles, of which the median is hardly conspicuous. The hepatic regions are inflated, as are also the sides of the gastric region. The intestinal region forms a tumid boss, on the summit of which the granulations are obsolescent.

The tips of both rami of the densely granular external maxillipeds are strongly bent upwards, as in all the other species of this genus that of the exognath ending in a large blister-like tubercle. [Sometimes also the outer angles of the buccal cavern, the tips of the frontal teeth, and the edges of the orbit end in similar, but smaller, blister-like swellings].

The chelipeds in the male are a little less than twice the length of the carapace, and are stout: the fingers are stout, and are about as long as the hand, which is rather more than two-fifths the length of the carapace. Legs smooth: dactyli with a few hairs.

The 3rd to the 5th abdominal terga are fused in the male, but are independently recognizable, and the 6th has a terminal denticle—not very conspicuous: in the female the 3rd to the 6th are fused.

	Male.	Female.
Length of carapace.....	6·5 millim.	7·5 millim.
Breadth of carapace.....	7·0 millim.	9·0 millim.
Greatest span (of chelipeds).....	24·0 millim.	26·5 millim.

Besides being smaller, and having the chelipeds of slightly greater relative length, the male differs from the female in being much more sharply granular.

Numerous males and egg-laden females, from different parts of the Malabar Coast in 26–30 fathoms, from the North Maldive Atoll in 15–30 fms., and from Mergui in 40 fms.

I have thought it justifiable to change the name of this species from *granulosa* to *pustulilabris*, as Miers, 'Challenger' Brachyura (1886) p. 317 has already used the very similar name *granulata* for a species belonging to this genus as here defined.

36. *Randallia glans*, n. sp.

Carapace globular, usually in the male smooth and polished to the naked eye though closely punctate-granular under the lens, in the female densely covered with vesicular granules that are often visible without any magnification: all its borders smooth and full, and except for a broad and shallow notch in the antero-lateral border, between the branchial and hepatic regions, its regions are not in any way defined.

Front narrow, broadly bidentate, the tips of the teeth somewhat produced and bent outwards: its base is separated from the rest of the carapace by an indistinct groove.

External maxillipeds smooth and polished to the naked eye in the male, somewhat more granular in the female—just like the carapace.

Chelipeds stout: in the male a little less than twice the length of the carapace, everywhere very densely granular, the granules being vesicular and being plainly visible without a lens on the arm at any rate: fingers stout, as long as the hand, which is between $\frac{1}{2}$ and $\frac{2}{3}$ the length of the carapace. Legs smooth: dactyli with a few hairs.

In the male the 3rd–5th abdominal terga are fused but are independently recognizable, and the 6th has a strong terminal denticle; in the female the 3rd–6th are fused.

The carapace of the adult male is 6 millim. in either diameter, that of the ovigerous female is 7·5 millim. long and 8 millim. broad.

Andaman Sea, about 50 fms.

This species is closely related to *R. pustulilabris*.

37. *Randallia lamellidentata*, Wood-Mason.

Randallia lamellidentata, Wood-Mason, Illustrations of the Zoology of the 'Investigator' Crustacea, pl. v. figs. 5, 5*a*, 5*b*: Alcock, Ann. Mag. Nat. Hist. May, 1894, p. 404.

Carapace rhomboidal with the angles rounded off—subcircular; its surface behind the front covered with unequal-sized rather scattered pustulous tubercles; its regions well defined by grooves of some depth.

Front bluntly bidentate. On the antero-lateral margin are three broad lamelliform teeth, the front one of which is on the pterygostomian ridge (which as usual forms the front part of the antero-lateral margin), and there is a fourth similar tooth at the junction of the antero-lateral and postero-lateral margins. The postero-lateral margins are full and the pustulous tubercles extend on to them.

The short posterior margin is elegantly bilobed, with a few pearly granules round the lobes, and is overhung by the tip of the horizontal spine in which the intestinal region culminates.

The ventral surface of the carapace, the thoracic sterna, abdominal

terga (in the male) and external maxillipeds are all granular, the granules above the base of the chelipeds being enlarged and pearly.

The chelipeds in the male are about two-thirds as long again as the carapace, and are massive and granular: at the distal end of the outer edge of the somewhat trigonal arm the granules are enlarged and almost spiniform, as are also one or two at the distal end of the outer surface of the wrist. The hand is not much longer than broad and hardly one-third the length of the carapace; its outer edge is in the form of a remarkably thin and deep crest: the fingers are stout and rather longer than the hand, their outer (non-opposed) edges are cristiform.

The legs are granular, the granules on the dorsum of the propodites carpopodites and distal end of the meropodites being spiniform, as also on the outer surface of the ischium and merus of the last pair: the dactyli are hairy.

The 3rd–6th abdominal terga of the male are fused but are all very distinctly and independently recognizable, the 6th has a terminal denticle.

The largest male, dredged in the Andaman Sea at 350 fms., has the carapace between 16 and 17 millim. long and 18 millim. broad (without spines).

38. *Randallia pustulosa*, Wood-Mason.

Randallia pustulosa, Wood-Mason, Ann. Mag. Nat. Hist. March, 1891, pp. 266 and 267, and Illustrations of the Zoology of the 'Investigator' Crustacea, pl. v. fig. 4.

Carapace subcircular, subspherical; covered with unequally large pustulous tubercles the surface of which, like the surface between them, is finely and closely granular under the lens; all the regions are well defined by broad grooves.

The front is narrow and broadly bidentate. The lateral margins are full and inflated, and carry in the adult a series of tubercles, in the young a series of blunt spines: in the antero-lateral margin, between the hepatic and branchial regions, is a conspicuous notch, which corresponds with a groove or depression in the pterygostomian face of the carapace.

The short posterior border has a spine or dentiform lobe at either end, and is overhung by the long spine in which the tumid intestinal region culminates.

The whole under surface is densely granular in the young male, but in the female the fused 4th–6th abdominal terga and the inner half of the ischium of the external maxillipeds are smooth.

The chelipeds in the adult female and young male (adult male unknown) are twice the length of the carapace and are everywhere

finely granular. The hand is subcylindrical and elongate, being half as long as the carapace; the fingers are stout and about as long as the hand, they are finely denticulate, with enlarged denticles at regular distant intervals.

The legs are stoutish and, to the naked eye, smooth: the dactyli are fringed with hairs.

In the (young) male the 3rd–6th abdominal terga are fused but without any obliteration of sutures: in the adult female the 4th–6th are fused and the sutures obliterated.

Carapace of an adult female about 31 millim. in either diameter.

Loc. Andaman Sea, 240–220 fms., and 250 fms., Laccadive Sea, 406 fms.

In the young the carapace is quite spherical, with its edges spiny and its surface closely and crisply granular—the young, in short, has a very strong general resemblance to the adult of *R. pustulilabris*.

In the adult female the brood-pouch communicates with the branchial chambers on either side by means of a foramen, as in *Parilia*.

39. *Randallia eburnea*, n. sp.

Carapace subcircular, convex, subspherical, perfectly smooth to the naked eye though closely covered with vesicular granules under the lens; its regions, except the intestinal, hardly defined.

The front is narrow, and is broadly bidentate; the edge of the buccal cavern is more prominent beyond it than in any of the other species. Between the convex subhepatic border and the branchial border is a broad notch: near the middle of the branchial border is a rounded deflexed tooth: the antero-lateral margin from the front to this tooth is finely denticulate.

The fissures in the outer wall of the orbit are very distinct.

The posterior margin is elegantly three lobed, the lateral lobes being broad and semicircular, the middle lobe being narrower: all three are laminar.

The external maxillipeds are granular and pubescent distally.

The chelipeds are longer and more slender than in any of the other species, being a little more than $2\frac{1}{2}$ times the length of the carapace: they are perfectly smooth to the naked eye though closely granular under the lens, the granules on the arms being vesicular. The hands are subcylindrical and about two-thirds the length of the carapace: the fingers are stout and between $\frac{3}{4}$ and $\frac{5}{4}$ the length of the hand, their opposed edges are finely denticulate, with enlarged denticles at distant regular intervals. Legs smooth, the dactyli with a few fine hairs at tip only.

Although the 3rd–5th abdominal terga are fused they are all three independently recognizable.

Carapace of (apparently adult) male 14 millim. in either diameter.

Loc. Off Laccadive Islands, 30 fms.

Parilia, Wood-Mason.

Parilia, Wood-Mason, Ann. Mag. Nat. Hist., March 1891, p. 264.

Carapace strongly convex, especially posteriorly, somewhat oval transversely, with three spines on the posterior margin; the surface finely granular, the regions fairly well-defined.

The front is narrow and bidentate, and the epistome projects well beyond it,—the epistome being, for an Oxystome, deep—as in *Randallia* and *Nucia*.

The eyes are small, and the orbits imperfect, for not only have they two fissures (not mere sutures) in the roof, and a broad fissure in the outer wall, and a broad gap communicating with the antennary and antennulary fossæ, but their upper-outer wall is deeply emarginate.

The antennules fold a little obliquely. The antennæ are distinct, and stand in the gap at the inner canthus of the orbit, which they do not nearly fill.

The buccal cavern is considerably broader than long, owing to the enormous width of the afferent branchial channels and of the foliaceous expansion of the exopodite that covers them: the outer edge of the latter is strongly curved: the triangular merus of the endognath is very nearly as long as the ischium, measured along the inner edge.

The chelipeds in the adult male are several times the length of the carapace, and are slender, though more massive than the legs: the hands are several times the length of the stoutish fingers.

The abdomen in the male consists of five distinct pieces: in the female it consists of seven, but the 4th, 5th and 6th are not separately movable.

Branchial chambers greatly inflated, especially posteriorly: branchiæ large, and six in number on either side. [Brood-pouch of the female very large and communicating with the branchial chamber on either side, at base, by a foramen.]

40. *Parilia alcocki*, Wood-Mason.

Parilia alcocki, Wood-Mason, Ann. Mag. Nat. Hist., March 1891, p. 264, and Ill. Zool. 'Investigator,' Crust. pl. v. figs. 3, 3a ♀: Alcock and Anderson, J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 177.

Carapace about seven-eights as long as broad, transversely oval,

but with the anterior margin—between the outer angles of the afferent branchial channels—perfectly straight.

The antero-lateral margin is broadly indented at the junction of the hepatic and branchial regions, and bears four denticles; and there are three denticles on the posterior margin, the middle one of which is the smallest: just above the posterior margin is another transverse row of three denticles,—one in the middle of the intestinal region and one on the posterior wall of the branchial region on either side.

The carapace is strongly convex, the convexity gradually increasing from before backwards and then suddenly dropping, like a simian cranium, which in profile it much resembles: the surface is everywhere finely granular.

The regions of the carapace are well delimited by broad shallow grooves and lines of dimples, the branchial regions each forming an enormous tumid expanse. A slightly raised ridge traverses the carapace, in the middle line, from the base of the front to the intestinal denticle.

The front is broadly bilobed, each lobe being convex dorsally and acuminate: beyond it in a dorsal view is seen the epistome and the whole length of the edge of the buccal cavern.

The surface of the external maxillipeds and the ventral surface of the carapace are finely granular, but the sternum and the greater part of the abdomen are smooth. In the middle of the sternum of the female, between the genital openings, is an erect spine.

The external maxillipeds have a narrow triangular endopodite, the merus of which is strongly curved upwards towards the front; and a foliaceous exopodite, which is much shorter than the endopodite, and which is semicircular in shape and two-thirds as broad as long—broader even than in *Philyra globosa*, Fabr.

The chelipeds as in *Myra fugax*, vary according to age and sex: in the adult male they are $4\frac{1}{2}$ times, in the female and young male $2\frac{1}{2}$ times, the length of the carapace, and are only about twice as massive as the legs: their surface up to nearly the end of the hand is finely scabrous. The arm is cylindrical: the hand in the female is cylindrical, but in the male somewhat clavate. The hand in the male is more than 3 times, in the female only twice the length of the fingers: the fingers are stout, gently curved in the female, somewhat sinuous in the adult male, and their opposed edges are almost edentulous.

The legs in the male are shorter than the arm; in the female they are a little longer than the arm: they are cylindrical, and finely scabrous on the dorsal surface: the dactyli are obtusely pointed, and have both their edges closely fringed with longish stiff hairs.

Colours in spirit rusty reddish.

The carapace of the average adult male is 50 millim. long and 56 millim. broad, of the adult female 40 millim. long and 48 millim. broad.

Fairly common on soft muddy bottoms along the east coast of India between 70 and 250 fathoms.

In the Indian Museum collection are 96 specimens of both sexes and all ages.

Myra, Leach.

Myra, Leach, Zool. Miscell. III. p. 23.

Myra, Milne-Edwards, Hist. Nat. Crust. II. 125.

Myra, Bell, Trans. Linn. Soc. Vol. XXI, 1855, p. 296, and Cat. Leucos. Brit. Mus. p. 12.

Myra, Miers, 'Challenger' Brachyura, p. 312.

? *Myropsis*, Stimpson, Bull. Mus. Comp. Zool. Vol. II. p. 156.

Carapace ovoid (or globular in *Myropsis* and in the *young* of most Indian species of *Myra*), terminating posteriorly in three spines,—two on, and one in the middle line immediately above, the posterior border. (But in *Myropsis* and in the young of several species of *Myra* there is a pair of additional spines,—one on either postero-lateral border just above the last pair of legs). The surface of the carapace is either smooth or granular, never nodular or eroded, and resembles that of *Leucosia* in not having all the regions demarcated, at any rate in the adult.

The front is well delimited from the carapace, and although the dentiform prolongations of the septa of the branchial channels may sometimes project beyond it, yet the whole of the edge of the buccal cavern is never in the adult seen beyond it in a dorsal view.

The hepatic region—the side-wall of which commonly forms a distinct facet—is generally separated from the branchial region by a broad notch in the antero-lateral margin, this being continuous with a depression in the pterygostomian face of the carapace and with a longitudinal groove in the side-wall of the carapace,—the whole foreshadowing the thoracic sinus of *Leucosia* (? in *Myropsis*).

The orbits are deep, and although the upper edge is a little emarginate, the retracted eye is completely concealed: the three sutures in the roof and outer wall are very distinct: as in *Leucosia* the floor practically coincides with the roof of the buccal cavern, as regards its edge at any rate.

The antennæ are loosely lodged in a gap at the inner canthus of the orbit. The antennules fold obliquely.

The buccal cavern is elongate: the acutely-triangular merus of

the external maxillipeds is not much more than half the length of the ischium measured along the inner edge: the 2nd segment of the exognath generally has the outer edge elegantly curved, but is not dilated except a little at the base.

The chelipeds though much more massive than the legs, and rather more massive than those of *Ilia*, *Arcania* and their immediate allies, are not nearly so massive as those of *Leucosia*, *Philyra*, etc. In some species at any rate they vary much in length according to age and sex, but they are seldom less, and are often more, than twice the length of the carapace. The fingers are stout and vary in length, being sometimes a little longer than, but in the adult males of one species only half the length of, the hand.

The abdomen of the male usually consists of 4 pieces, that of the female of 5.

The species of this genus are often difficult to discriminate owing to the changes that they undergo in growth. The following key will, it is believed, serve for the determination of adult forms.

Key to the Indian species of Myra.

I. Carapace broadly oval (longitudinally), with a broad notch in the antero-lateral margin between the hepatic and branchial regions:—

1. Side-wall of hepatic region forming a distinct facet, behind which the lateral margins of the carapace are defined by a beaded line: spines of the posterior margin more or less acute: fingers either shorter or hardly longer than the hand:—

i. Spines of the posterior margin long and acute: carapace finely granular—the granules hardly visible to the naked eye: chelipeds slender (in the adult male nearly thrice the length of the carapace): hand long (in the adult male often nearly twice the length of the fingers, and about two-thirds the length of the carapace) ... *M. fugax.*

ii. Spines of the posterior margin short, the middle one acute,

those on either side dentiform: carapace crisply granular, the granules of good size: chelipeds stoutish, not quite twice the length of the carapace even in the adult male: hand short:—

a. Front not projecting beyond the dentiform ends of the walls of the branchial channels: hand about half length of carapace: fingers about two-thirds length of hand ..... *M. affinis.*

b. Front shaped much as in *Leucosia*, projecting well beyond the free edge of the branchial channels: hand hardly two-fifths the length of the carapace: fingers as long as the hand ..... *M. brevimana.*

2. Side wall of hepatic regions convex, not distinctly facetted in the adult: lateral margins of the carapace full, and not defined by any beaded line: armature of the posterior margin consisting of three petaloid lobules: fingers longer than the hand ..... *M. darwinensis.*

[II. Carapace subcircular, with five marginal spines and spinules at its posterior end ..... *M. pentacantha.* (probably the young of *M. fugax*)].

III. Carapace narrowly and acutely oval (longitudinally) its shape recalling that of *Raninoides*, without any marked notch between the hepatic and branchial regions ..... *M. elegans.*

41. *Myra fugax*, (Fabr.)

Cancellus anatum tertius, Rumph, Amboin. Rariteitk. I. 27, pl. x. fig. C.
Cancer punctatus, Herbst, Krabben, I. ii. 89, pl. ii. figs. 15, 16.

Leucosia fugax, Fabricius, Ent. Syst. Suppl. p. 351: Bosc, Hist. Nat. Crust. I. 236: Latreille, Hist. Nat. Crust. et Ins. VI. 119, pl. *l.* figs. 1, 2.

Myra fugax, Leach, Zool. Miscell. III. p. 24: Desmarest, Consid. Crust. p. 169, pl. xxviii. fig. 2: Milne Edwards, in Cuvier, Règne Animal, Crust. pl. xxv. fig. 3, and Hist. Nat. Crust. II. 126: De Haan, Faun. Japon. Crust. p. 134, pl. xxxiii. fig. 1: Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 295, and Cat. Leucos. Brit. Mus. p. 12: Stimpson, Proc. Acad. Nat. Sci. Philad. 1858, p. 160: A. Milne Edwards, Nouv. Archiv. du Mus. X. 1874. p. 45: Hilgendorf, MB. Ak. Berl. 1878, p. 811: E. Nauck, Zeits. Wiss. Zool. XXXIV. 1880, p. 48 (*gastric teeth*): Richters, in Möbius Meeresf. Maurit. p. 157: Miers, P. Z. S. 1884, pp. 10, 13, and 'Challenger' Brachyura p. 313: [Cano, Boll. Soc. Nat. Napoli, III. 1889, p. 253]: Müller, Verh. Ges. Basel, VIII. 1886, p 472: Ortmann, Zool. Jahrbuch., Syst., &c., VI. 1892, p. 581: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 402. (Adult).

Myra carinata, Bell, Trans. Linn. Soc. Vol. XXI. 1855. p. 297, pl. xxxii. fig. 3, and Cat. Leucos. Brit. Mus. p. 13: Haswell, P. L. S., N. S. Wales, IV. 1879, p. 50, and Cat. Austral. Crust. p. 121: Miers, Ann. Mag. Nat. Hist. (5) V. 1880, p. 316, and Zoology H. M. S. 'Alert' pp. 184, 250: Slaiter, Tijds. Nederl. Ind. XL. 1881, p. 160: Müller, Verh. Ges. Basel, VIII. 1886, p. 472: A. O. Walker, Journ. Linn. Soc., Zool., XX. p. 111. (Non-adult).

Myra coalita, Hilgendorf, MB. Ak. Berl. 1878, p. 812, pl. i. figs. 6 and 7: [Cano, Boll. Soc. Nat. Napol. III. 1889, p. 253]. (Non-adult).

Myra dubia, Miers, P. Z. S. 1879, pp. 20, 42.

Myra fugax, var. *coalita*, Ortmann, Zool. Jahrbuch., Syst., &c., VI. 1892, p. 582.

Carapace, in the adult, ovoidal, with 3 sharp, usually recurved, spines—one at either extremity of the posterior margin, and one very long one in the middle line just above the posterior margin. On the surface of the carapace are (1) some scattered punctiform granules, almost invisible to the naked eye in the adult (except on the basal half of the median posterior spine where they are always large and numerous), and (2) a longitudinal median carina, almost or quite obsolete in the adult. The regions of the carapace are not well defined.

The front is broadly bidentate, and is prominently convex dorsally, but projects so little beyond the edge of the buccal cavern that the spiniform angles of the branchial channels and the tips of the external maxillipeds can be seen beyond it in a dorsal view: it and the neighbouring parts are usually somewhat pubescent.

Behind the tip of the front the antero-lateral boundary of the carapace is formed by the obliquely-facetted side-wall of the sub-hepatic region, the facet being bounded above and below by beaded lines on both of which, near their posterior end, is a tubercle or tooth: the surface of the facet is quite smooth.

Behind the hepatic facet, between it and the branchial region, is a very well defined notch corresponding with a depression on the pterygostomian face, this again being in continuity with a well-cut longitudinal groove (quite independent of the epimeral suture) that traverses

the side-wall of the carapace just above the somewhat thickened epimeral edge,—the whole foreshadowing the thoracic sinus of *Leucosia*.

Behind this notch the lateral border of the carapace is defined by a finely beaded line, the first few beads being sometimes, in non-adults, somewhat dentiform.

The external maxillipeds are granular and hairy distally, and in the female are hairy all along their apposed edges.

The chelipeds vary a good deal according to age and sex, but are always rather slender. In the adult male they are from $2\frac{3}{4}$ to $3\frac{1}{4}$ times the length of the carapace (without spine), in the adult female a little over twice. The cylindrical arm has the proximal half to three-quarters closely covered on all but its under surface with enlarged vesicular granules. The hand though slightly broadened at base, is of an elongate rather slender form: in the adult male it is about $\frac{3}{4}$ the length of the carapace (without spine), in the adult female half or a little more than half. The fingers in the adult male are from $\frac{5}{8}$ to $\frac{1}{2}$, in the adult female about $\frac{2}{3}$, the length of the hand: they are gently curved, a little bent inwards, and somewhat slender, and their opposed edges meet throughout and are finely denticulate, with larger denticles at regular rather distant intervals.

The legs are slender and not, or hardly, longer than the arm; their dactylus is narrowly lanceolate and fringed with longish stiffish hairs, as is also the dorsal edge of the propodite.

On the long penultimate piece of the male abdomen is a terminal granule.

Colours in spirit: pinkish flesh-colour, the chelipeds and legs coppery, the front and branchial regions often with a bluish tinge.

The largest adult male in the Indian Museum collection has the carapace 28 millim. long (without spine) and 23 millim. broad.

Found on both coasts of the Peninsula, at the Andamans, and in the Persian Gulf.

In the Indian Museum there are 57 specimens, including numerous adults of both sexes.

[*Myra pentacantha*, n. sp. ?

Most probably the young of M. fugax.

Differs from *Myra fugax* Fabr. in the following characters:—

(1) the carapace is almost circular, and is somewhat depressed, except in the middle line where it is strongly carinated:

(2) the front is thickly pubescent, and the whole of the free edge of the buccal cavern is visible beyond it in a dorsal view:

(3) the intestinal region is well defined and rather tumid, and is

surmounted in the middle line by a raised cluster of granules, terminating, but discontinuous with, the carina of the carapace:

(4) in addition to the 3 spines on the posterior margin of the carapace there is a spine or spinule on either postero-lateral margin above the last pair of legs:

(5) on the antero-lateral margin, immediately behind the branchio-hepatic notch, are several denticles.

The chelipeds are not quite twice the length of the carapace: they are slender, and their constituent pieces have the same proportions as in the adult female of *M. fugax*.

The carapace of an average specimen is 8·5 millim. long and 8 millim. broad.

In the Indian Museum are 29 specimens from both coasts of the peninsula. Commonest at about 25 fathoms.

I regard these as the very young of *M. fugax* first because among 57 specimens of that species in the Indian Museum there is not a single very young one, and secondly because a fine large adult male of that species in our collection has the additional spine well developed on one side. Again it is suggestive that although *M. pentacantha* appears to be a common enough form, it is never found as an adult.]

42. *Myra affinis*, Bell.

Myra affinis, Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 296, pl. xxxii. fig. 2, and Cat. Leucos. Brit. Mus., p. 12: Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 160: Haswell, P. L. S. N. S. Wales, IV. 1879, p. 50, and Cat. Austral. Crust., p 121: Miers, Zool. H. M. S. 'Alert' pp. 184, 150, and 'Challenger' Brachyura, p. 315: A. O. Walker, Journ. Linn. Soc., Zool., XX. 1890, p. 111.

Myra mamillaris, Miers (*nec* Bell), Miers, Trans. Linn. Soc. (2) I. 1875–79 (1877) p. 239, pl. xxxviii. figs. 25–27, and 'Challenger' Brachyura, p. 315.

Myra subgranulata, Kossmann, Reise roth. Meer. Crust., p. 65, pl. i. fig. 7, and Archiv. für Naturg. XLIV. 1878, p. 256.

? *Myra australis*, Haswell, Proc. Linn. Soc. N. S. Wales, IV. 1879, pp 50 and 404, pl. v. fig. 3, and Cat. Austral. Crust., p. 122: Miers, Zool. H. M. S. 'Alert' pp. 184, 251, and 'Challenger' Brachyura, p. 315: A. O. Walker, Journ. Linn. Soc. Zool., XX. 1890, p. 111: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 402.

Myra punctata, de Man, Journ. Linn. Soc., Zool., XXII. 1878, p. 205 (*nec synon*).

Differs from *Myra fugax*, adult males being compared, in the following characters:—

(1) the carapace, including the surface of the sub-hepatic facet, is covered with crisp granules, all very plainly visible to the naked eye; its longitudinal median carina is persistent and granular; its posterior marginal spines are shorter and blunter, the middle one being sharp and recurved, the lateral ones dentiform:

(2) the chelipeds are stouter and shorter, being a little less than twice the length of the carapace (without spine); the hand especially is stouter and shorter, being hardly half the length of the carapace; the fingers are about $\frac{2}{3}$ the length of the hand:

(3) the long penultimate piece of the male abdomen carries a strong terminal tooth.

Colours in spirit: some reddish or orange markings on the carapace, and some broad orange-reddish cross-bands on the chelipeds.

The largest adult male in the Indian Museum collection has the carapace 17 millim. long and 15 millim. broad.

In the young the intestinal region is distinctly delimited, rather tumid, and is surmounted by a raised cluster of granules terminating, but discontinuous with, the median carina of the carapace.

In the Indian Museum collection are 16 specimens from Arakan, Mergui, Andamans, Ganjam coast, and the Persian Gulf.

The specimens here included comprise (1) adult forms that answer to Bell's descriptions and figures of *M. affinis* and are readily distinguishable from *M. fugax* (*a*) by the relative stoutness and shortness of the chelipeds and hands and (*b*) by the shortness and coarseness of the spines, and (2) half-grown forms that correspond with Haswell's figure of *M. australis*, and Miers' figures of *M. mamillaris* (*loc. cit.*) which Miers in his work on the 'Challenger' Brachyura refers to *M. australis*. Although Haswell's figure and description hardly correspond—*e.g.*, the fingers are described as being about half the length of the hand, but are figured as nearly equal to the hand in length—I cannot but think that his species represents the immature form of *M. affinis*.

In very young specimens there is a denticle or enlarged granule on either postero-lateral margin above the last pair of legs.

43. *Myra brevimana*, n. sp.

Differs from *M. fugax*, a large series of fully adult males and ovigerous females being compared, in the following characters:—

(1) the carapace is much more convex, being ovoid in the male, subglobular in the female; its surface, including the surface of the subhepatic facet, is crisply granular and its longitudinal median carina is persistent and granular, as in *M. affinis*; the posterior marginal spines are as in *M. affinis*, the middle one being short stout acute and recurved, the lateral ones being dentiform:

(2) the front is much more deeply and acutely bidentate, and otherwise is shaped much as in *Leucosia*, being strongly convex, being delimited from the hepatic regions on either side by a hollow, being well recurved upwards, and projecting so far that no part whatever of

e buccal frame or of the external maxillipeds can be seen in a dorsal iew even in the deep incision between the frontal teeth:

(3) the tooth on the posterior part of the upper of the two lines that defines the hepatic facet is almost as large and prominent as that on the lower:

(4) the chelipeds are quite similar in both sexes, and are stout, especially the hand; they are just under twice the length of the carapace (without spine). The hand is hardly two-fifths the length of the carapace (without spine), is more than half as broad as long, and is somewhat inflated; the fingers are as long as the hand, the dactylus being plainly longer than the outer border of the hand:

(5) on the long penultimate piece of the male abdomen is a strong terminal tooth.

Colours in spirit: regions of carapace defined by broad orange-red markings, some broad orange-red cross-bands on chelipeds, one of which occupies the basal half or three-fourths of the fingers.

Carapace in the adult male 16 millim. long and 14 millim. broad, in the adult female 20 millim. long and 18 millim. broad.

In the Indian Museum are 34 specimens from Arakan, Mergui, Ganjam, and Ceylon, usually at depths of about 30 fathoms.

In the young the intestinal region is well defined and tumid, and is surmounted by a raised cluster of granules in a line with the median longitudinal carina.

The prominent front, the stout chelipeds, and the short inflated hands are characters by which this species is easily recognized.

44. *Myra darnleyensis*, Haswell.

Myra darnleyensis, Haswell, Proc. Linn. Soc., N. S. Wales, IV. 1879, p. 52, pl. v. fig. 4, and Cat. Austral. Crust. p. 122: Miers, 'Challenger' Brachyura, p. 316.

Carapace sub-piriform, globous dorsally, the lateral margins full and inflated and not defined by any beaded line; the surface very finely and closely granular (under the lens); the intestinal region fairly well defined, as are also the branchial regions posteriorly.

The three processes on the posterior margin are not spines, but broadly-laminar petaloid lobes.

The front is prominent, but the dentiform ends of the walls of the branchial canals can be seen beyond it in a dorsal view: it is deeply channelled in the middle line, dorsally, and has a fluted appearance: the outer wall of the orbit has the same elegantly fluted appearance, owing to the depth of the sutures and the convexity of the surfaces between the sutures.

Behind the front the side-wall of the hepatic regions is full and

convex, not flattened and distinctly facetted as it is in other species; bears, however, a strong mammillary tubercle. As in the other species there is a well-defined notch in the antero-lateral margin between the hepatic and branchial regions—the notch as usual being in continuity with a crease in the pterygostomian face, and this with a groove in the lateral wall of the carapace.

The external maxillipeds are granular and hairy distally, being alike in both sexes.

The chelipeds are alike in both sexes and are about twice the length of the carapace: all the surfaces of the arm in the greater part of its extent are vesicular-granular, but the granules are only just visible to the naked eye. The hand is short, about one-third the length of the carapace (without spine), and is somewhat inflated. The fingers are markedly longer than the hand, the dactylus being about half again as long as the outer border of the hand.

The long penultimate piece of the abdomen of the male carries a stout terminal denticle.

Colours in spirit much as in *M. brevimana*, the regions of the carapace being defined by broadish orange-red markings, and the chelipeds having some broad cross-bands of the same colour, but these never involve the fingers, which are white.

In the male the carapace is 13 millim. long (without spine) and 11 millim. broad, in the female 15 millim. long and 13 millim. broad.

In the Indian Museum are 52 specimens, including adult males and ovigerous females, from the Andamans, Maldives, Palk Straits, and from off Ceylon 34 fms.

In many adult females, as in most young, there is in the middle of the carapace a cruciform constellation of 5 enlarged bead-like granules or denticles. In the young also the side wall of the hepatic region is not so much inflated and even shows traces of flattening, while the tumid intestinal region is surmounted by an enlarged granule, and on either postero-lateral margin (in the very young), just above the last pair of legs, is a denticle or enlarged granule.

45. *Myra elegans*, Bell.

Myra elegans, Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 297, pl. xxxii. fig. 4, and Cat. Leucos. Brit. Mus. p. 13.

Carapace elongate-oval tapering to a long acute spine at the posterior margin, half again as long as broad without the spine, nearly twice as long as broad with the spine. On either side of the spine is a spinule situated at either extreme of the short posterior margin, and a little in advance of these, on either postero-lateral margin, just above the last pair of legs, is sometimes a sharp denticle.

The carapace is traversed longitudinally, from the middle of the gastric region, by a broadish granular carina, and there is an elongate patch of granules along the middle of either branchial region and a patch round and on the big posterior spine; otherwise the carapace is smooth.

The front is broadly bilobulate, each semi-circular lobule having a knife-edge, and although it projects beyond the margin of all parts of the buccal cavern, yet the hairy tips of the external maxillipeds can be seen beyond it in a dorsal view.

Behind the front the side wall of either sub-hepatic region forms a not very well marked hairy facet, behind which there is no well marked marginal notch as there is in the other species. The lateral margins of the carapace are well defined and beaded throughout.

The chelipeds are nearly similar in both sexes, being slender and short—only about 1½ times the length of the carapace (without spine): the upper surfaces of the cylindrical arm are covered with enlarged fasicular granules in the greater part of their extent, and the under surface at base only: the hand is short, hardly a quarter the length of the carapace (without spine): the fingers are almost one-fourth longer than the hand.

The legs are compressed, especially the carpopodites and propodites, the latter and the dactyli having hairy edges.

The long penultimate piece of the abdomen of the male has a terminal denticle.

The largest male in the Indian Museum has the carapace 12 millim. long and 8 millim. broad: in an apparently adult female the carapace is 15·5 millim. long and 10·5 millim. broad.

A young and two apparently adult males and an adult female from a muddy bottom, in 12 fms., off the Madras coast, and a young male from off the Arakan coast 13 fms., are in the Indian Museum. In the last mentioned the wrist and hand are elegantly fluted with lines of raised granules.

Although our female is not laden with eggs, I conclude that it is adult because it has the wide deep brood-chamber with the broad convex abdominal lid so familiarly found in the adult females of the *Leucosidæ*. Moreover the carapace is stained and worn as if it had not been renewed for a long time. *Myra elegans* is certainly not the young of any other Indian species.

Leucosia, Fabr.

Leucosia, Fabricius, Ent. Syst. Suppl., p. 349.
Leucosia, Milne Edwards, Hist. Nat. Crust. II. 121.

Leucosia, Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 281, and Cat. Leucos. Brit. Mus., p. 5.

Leucosia, A. Milne Edwards, Nouv. Archiv. du Mus. X. 1874, p. 39.

Leucosia, Miers, 'Challenger' Brachyura, p. 322.

The whole exo-skeleton is of the consistence and appearance of glazed porcelain.

Carapace extremely convex, sub-circular or subrhomboidal to hexagonal in outline, perfectly smooth, with none of the regions—except sometimes the hepatic—defined: in front of the hepatic regions it is produced to form a sort of upturned snout, underneath the tip of which are found the minute eyes sunk in deep round complete orbits, the obliquely-folding antennules, and the minute antennæ lying below the antennules.

The lateral epibranchial angles of the carapace form on either side a distinct lobe, which is bent downwards towards the base of the chelipeds to form the cave of a deep sinuous depression in the side-wall of the carapace, known as the thoracic sinus.

The true postero-lateral margin of the carapace is ill-defined posteriorly, and the epimeral edge of the carapace—which practically takes the place of most of the postero-lateral margin—is greatly thickened and elegantly milled. These epimeral edges on either side are continuous with a finely-beaded crest that forms the posterior margin of the dorsum of the carapace; and below this posterior margin the carapace ends in a deflexed posterior wall.

The buccal cavern is elongate-triangular, and the front part of its side walls are coincident with the sides of the snout-like front of the carapace: the acutely-triangular merus of the external maxillipeds is about as long as the ischium, and the outer margin of the exognath is almost straight.

The chelipeds are symmetrical and, relatively to the legs, very massive; they are a little longer in the male than in the female, but are very rarely more than half again as long as the carapace: the margins and certain parts of the surfaces of the arms are ornamented with large polished pearly tubercles: the hands are usually short and broad and little longer than the fingers. The true legs are small.

The abdomen of the male consists usually of 4 pieces, but the two large middle pieces (which are formed of 5 terga) are sometimes fused, into one: the abdomen of the female also consists of 4 pieces usually, but the large oval third piece (which is formed of 4 terga) is sometimes fused with the second piece.

The so-called thoracic sinus of *Leucosia* is simply an invagination of the after part of the pterygostomian region and of the side-wall of the carapace, as may be seen by comparing cleaned carapaces with those of other Leucosines.

The invagination seems to be chiefly due to the pushing up of the epimeral margin against the resistance of the vault of the carapace—a pushing up which may be inferred from the position of what remains of the "epimeral suture."

The origin of the thoracic sinus from such a simple invagination is very apparent in the isolated carapace of *Leucosia unidentata*. Here, viewed from the inside of the carapace, the thoracic sinus is seen as the convexity of a pocket; and, viewed from the outside, the mouth of the sinus shows as a ring of large granules or puckers resulting from invagination.

Key to the Indian species of Leucosia.

A. NORMAL GENERA: free edge of front projecting beyond the epistome: hands not foliaceous:—

I. Carapace conspicuously longer than broad, bluntly rhomboidal, quite devoid of definite pubescence, the thickened epimeral edge never visible in all its extent, dorsally, when the carapace is held, without any inclination, straight in front of the observer's eyes: front never ending in three sharp horizontal prongs: the thoracic sinus always defined in some part of its extent by large granules visible to the naked eye: no extensive growth of hair, or definite patches of spongy pubescence at the base of the upper surface of the arm: meropodites of legs subcylindrical: abdomen in both sexes consisting of 4 pieces:—

1. Outer edge of hand never carinate: front dorsally convex in all its extent: posterior margin of carapace, in the adult, usually gently convex, with its external angles not defined:—

i. True postero-lateral margin of carapace beaded as far as the level of the base of the last pair of legs: ventral surface of ischium of external maxillipeds of female almost flat—never broadly carinate:—

a. A loop of large granules between the base of the chelipeds and the margin of the carapace: two small red and white ocelli on either side of the gastric region ..... *L. unidentata.*

b. A single row of large granules between the base of the chelipeds and the margin of the carapace, and above it a second row of very small granules running into the puckered edge of an almost circular bight in the pterygostomian region: no ocelli *L. obtusifrons.*

ii. True postero-lateral margin of carapace beaded only up to the level of the base of the first pair of true legs: a single row of large granules between the base of the chelipeds and the margin of the carapace:—

a. Carapace, excluding the whole front, broader than long, its posterior margin gently convex:—

aa. Thoracic sinus deep, the convex edge of the pterygostomian region, which defines the sinus

anteriorly, being finely granular: front ending in a triangular projecting beak: ventral surface of ischium of external maxillipeds of female broadly carinate up to a stout terminal tooth:—

a. Hepatic regions each forming a strong mammary bulge, dorsally, quite independent of the general convexity of the carapace: meropodites of true ambulatory legs perfectly smooth ..... *L. longifrons.*

β. Convexities of hepatic regions hardly distinguishable, dorsally, from the general convexity of the carapace: meropodites of true ambulatory legs with some longitudinal granulation:—

*a*1. Meropodites of legs with 3 rows of granules: inner edge of hand with several rows of granules: size under 25 millim..... *L. neocaledonica.*

*a*2. Meropodites of legs with a single row of granules: inner edge of hand with a single row of granules: size over 35 millim. *L. urania.*

bb. Thoracic sinus shallow, the convex edge of the pterygostomian region, which defines the sinus anteriorly, smooth and entire: edge of front sharply transverse, and sinuous: ventral surface of ischium of external maxillipeds of female non-carinate ..... *L. hancelli.*

b. Carapace, excluding the front, as long as broad, its posterior margin almost straight..... *L. marmorea.*

2. Outer edge of hand raised into a sharp carina: posterior margin of carapace, in the adult, straight, with its external angles pronounced:—

i. Front dorsally concave in the middle line anteriorly:—

a. Size medium (carapace over 20 millim. long): thoracic sinus defined ventrally by a row of granules of which 3 or 4 are pearl-like ..... *L. pallida.*

b. Size small (carapace under 15 millim. long): thoracic sinus with at most three granules, two of which are very large and reniform or fungiform ... *L. whitmeei.*

ii. Front convex dorsally in all its extent, produced beyond the orbits into a broadly triangular point as in *L. longifrons* .... *L. corallicola.*

II. Carapace conspicuously longer than broad, sharply hexagonal, devoid of definite pubescence outside of the thoracic sinus, the thickened epimeral edge visible, dorsally, in all its extent when the carapace is held without any inclination straight in front of the observer's eyes: front ending in three sharp horizontal prongs: the thoracic sinus is filled with hair, and is not defined in any part of

its extent by granules visible to the naked eye: a definite patch of encrusting spongy pubescence at the basal end of the upper surface of the arm: meropodites of legs compressed: abdomen of the male consisting of 3 pieces, of the female of 4 pieces:—

1. Front much broader than long, distinctly trigonal, its sides merging in the antero-lateral borders of the carapace without any very abrupt transition: thoracic sinus deep, the edge of the pterygostomian region, which forms the anterior boundary of the sinus, convex and granular or milled: surface below the posterior margin of the dorsum of the carapace sharply granular:—

   i. Outer limb of the thoracic sinus not invading the antero-lateral margin of the carapace ..... *L. craniolaris.*

   ii. Outer limb of the thoracic sinus invading, and causing a marked emargination of, the antero-lateral border of the carapace ..... *L. vittata.*

2. Front about as long as broad, with the sides subparallel or, at any rate, forming an abrupt junction with the antero-lateral borders of the carapace: thoracic sinus shallow, the edge of the pterygostomian region, which forms the anterior boundary of the sinus, not strongly convex and not granular or milled:—

   i. The edge of the pterygostomian region that bounds the thoracic sinus almost straight: surface of carapace below the posterior margin of dorsum granular: inner surface of hand with two prominent sharp-cut rows of granules: size about 14 millim. ..... *L. rhomboidalis.*

   ii. Edge of the pterygostomian region a little convex: surface of carapace below posterior margin smooth: inner surface of hand smooth, or with a single row of obsolescent granules: size about 18 millim..... *L. pubescens.*

III. Carapace as broad as long, urn-shaped or broadly hexagonal, often with a strip of thick fur along the postero-lateral border, the thickened epimeral edge visible, dorsally, in all its extent when the carapace is held without any inclination straight in front of the observer's eyes: front obtuse: the thoracic sinus with or without granules: either a definite patch of spongy pubescence or a good deal of coarse hair at the basal end of the upper surface of the arm: meropodites of legs compressed: [abdomen of male consisting of 4 pieces, that of the female of 3, or if of 4, then the 3rd piece is again incompletely subdivided]: size very small, rarely 14 millim.:—

1. Lateral epibranchial angle and true postero-lateral border of the carapace with a sharply defined edging of thick fur:—

i. Outer edge of hand, if sharp, never distinctly carinate: front with the dorsal surface uniformly convex :—

a. Thoracic sinus defined ventrally by relatively large granules: hepatic region culminating, dorsally, in a granular eminence: arms covered with tubercles: hands subglobular: abdomen of female of 4 pieces, the large third piece incompletely subdivided into three ..... *L. whitei.*

b. Thoracic sinus not defined by granules: hepatic regions smooth and ill-defined: surfaces of arms not everywhere invested with tubercles, a definite patch of spongy pubescence at the basal end of the upper surface: hands of the ordinary form: abdomen of female formed of 3 pieces :—

aa. Four rows of tubercles—including those on the inner and outer margins—along the upper surface of the arm: fur and pubescence on carapace and chelipeds black (in spirit): carapace (in spirit) reticulated with bright brown ..... *L. margaritata.*

bb. Upper surface of arm with only a few tubercles besides those on the margins: fur and pubescence yellowish white: carapace covered with crimson spots ..... *L. hæmatosticta.*

ii. Outer edge of hand strongly carinate: front with the dorsal surface concave in the middle line giving a bilobed appearance ..... *L. elata.*

2. Lateral epibranchial angle and true postero-lateral border of the carapace devoid of fur :—

i. Front prominent beyond the hepatic regions: posterior border of the carapace not equal in length to half the greatest breadth of the carapace: thoracic sinus deep and sharply defined in front: hand hardly longer than the fingers..... *L. cumingii.*

ii. Front hardly prominent beyond the unusually strong convexity of the hepatic borders: length of the posterior border of the carapace more than half the greatest breadth of the carapace: hand about twice as long as the fingers ..... *L. sima.*

B. Peculiar genera :—

I. Free edge of front not projecting beyond the level of the epistome. Otherwise belonging to the *craniolaris* group ..... *L. truncata.*

II. Hands foliaceous: chelipeds shorter than the carapace: thoracic sinus ill defined. Otherwise belonging to the *longifrons* and *marmorea* group..... *L. phyllochira.*

46. *Leucosia unidentata*, De Haan.

Leucosia unidentata, DeHaan, Faun. Japon., Crust., p. 133, pl. xxxiii, fig. 3: Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 284, and Cat. Leucos. Brit. Mus. p. 6: Haswell, P. L. S., N. S. Wales, Vol. IV. 1879, p. 44, and Cat. Austral. Crust. p. 118.

Leucosia obtusifrons var. *unidentata*, Ortmann, Zool. Jahrbucher, Syst. etc., VI. 1892, p. 585.

Carapace bluntly hexagonal or subcircular, about nine-tenths as long as broad: its surface perfectly smooth and devoid of hair: its antero-lateral borders sinuous, convex, faintly beaded anteriorly, strongly beaded posteriorly: its *true* postero-lateral border distinctly beaded or crenulate up to the level of the base of the *last* pair of legs: its thickened milled epimeral edge, which is continuous with the posterior margin and ends at a sharp tooth just behind the base of the chelipeds, is not visible, dorsally, when the carapace is held, without any inclination, straight in front of the observer's eyes: its posterior margin short, gently curved, finely beaded, with the deflexed surface below it quite smooth.

The puckered mouth of the pterygostomian invagination—the thoracic sinus of Bell and subsequent authors—shows as a roughly 9-shaped loop of equal-sized large pearly granules situated between the base of the chelipeds and the strongly-pronounced lateral angle, or cave, of the carapace: the pterygostomian plate is deeply indented, transversely, in front of this loop of granules.

The convexities of the hepatic regions are an almost indistinguishable part of the general convexity of the carapace.

The front is prominent, dorsally convex, and truncate-triangular; its length is less than its breadth; its front edge is strongly deflexed and very faintly trilobed, the middle lobe being mucronate.

The ventral surface of the ischium of the external maxillipeds in the female, as in the male, is flat and smooth.

The chelipeds in the adult male are considerably more than half again as long as the carapace. The upper surface of the arm has two divergent longitudinal rows of pearly tubercles in addition to those that bound its inner and outer borders: these two rows start from a basal eminence formed of 7 or 8 smaller coalescent tubercles, and end near the distal quarter of the arm. The inner surface of the arm is completely covered with pearly tubercles of unequal size: the under surface is smooth except in its basal third, or half. The wrist is smooth except for two lines of bead-like granules bounding its inner surface,—one line dorsal in position, the other ventral. The hand and fingers together are as long as the arm. The hand is half again as long as broad, its narrow inner surface bears several rows of small bead-like granules the upper and lower of which are sharply defined and converge

elegantly to the immobile finger, along which they are usually continued for some distance. The fingers are as long as the hand, and have their opposed edges crenulate throughout their extent.

The legs have stout subcylindrical meropodites (the trigonal origin of which, however, is shown by three longitudinal rows of fine granulation), inflated carpopodites, stout dorsally-sharp-edged propodites, and broadly lanceolate, or palmulate, dactyli.

The abdomen in both sexes consists of 4 distinct pieces, the third piece in the male bearing a strong tooth in the middle line.

Colours in spirit: carapace slate-grey with four small ocelli—two on either side of the gastric region: the ocelli have broad red circumferences and small white centres: the pearly tubercles of the upper surface of the arm have the base orange-red and the apex white: the fingers have a yellowish red base, and the legs are indefinitely banded with yellowish red.

The carapace of an adult of average size, of either sex, is about 30 millim. long and 27 millim. broad.

In India this species has been found only off the Malabar Coast at 45 fathoms. In the Museum collection are an adult male and female, and three half-grown females from the Malabar Coast, (and four adult females from Hongkong.)

47. *Leucosia obtusifrons*, De Haan.

Leucosia obtusifrons, De Haan, Faun. Japon. Crust. p. 133, pl. xxxiii. fig. 2: Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 284, and Cat. Leucos. Brit. Mus. p. 6: A. Ortmann, Zool. Jahrbucher, Syst. etc. VI. 1892, p. 585.

Differs from *L. unidentata*, De Haan, *only* in the following characters, adults of both sexes being compared:—

1. The puckered mouth of the pterygostomian invagination—or thoracic sinus—is still visible in all its extent as a long loop of granules lying between the base of the chelipeds and the eave of the carapace; but the granules of the dorsal limb of the loop are so small as to be only visible with a lens; those of the front convexity of the loop have—by a further infolding of the pterygostomian region—become partly welded together and cut off to form an almost isolated ring; while only those that form the ventral limb of the loop remain as large separate granules.

2. The two rows of tubercles on the upper surface of the arm are shorter, ending within the proximal half of the arm.

3. The chelipeds, in the adult male, are less than half again as long as the carapace.

4. The dactyli of the legs are narrowly lanceolate, not palmulate.

5. On either side of the gastric region are two white spots, instead of two red and white ocelli.

6. The body is somewhat smaller, the carapace in the average adult male measuring 25 by 23 millim., and in the average adult female 26 by 24 millim.

In the Museum Collection are 2 adult males, 4 egg-laden females, 2 young males, and a young female, from the Coromandel Coast.

The structural and colour differences hold good irrespective of age or sex, and I therefore think that De Haan's separation of this species from the preceding is justified.

48. *Leucosia longifrons*, De Haan.

? *Cancellus anatum secundus*, Rumph, Amboin. Rariteitkamer, I. 27, pl. x. fig. B.

? *Araneus marinus*, Seba, Thesaurus, III. 46, pl. xix. figs. 4, 5.

Leucosia longifrons, De Haan, Faun. Japon. Crust. p. 132, pl. xxxiii, fig. 4: ell, Trans. Linn. Soc. Vol. XXI. 1855, p. 284, and Cat. Leucos. Brit. Mus. p. 6: . Ortmann, Zool. Jahrbüch., Syst. etc., VI. 1892, p. 585.

? *Leucosia urania*, Guérin, Icon. R. A. Crust., pl. vi. fig. 4 (*nec* Herbst).

Leucosia polita, Hess, Archiv für Naturges. XXXI. i. 1865, pp. 155 and 172, pl. vi. fig. 14; (and ? Haswell, Cat. Austral Crust. p. 120); *fide* de Man, Zool. Jahrbüch. Syst. etc., II. 1892, p. 585.

Leucosia ornata, Miers, Trans. Linn. Soc., Zool., (2) I. 1875–79, p. 236, pl. xxxviii. figs. 7–9.

Leucosia urania, de Man, Journ. Linn. Soc., Zool., Vol. XXII. 1888, p. 197 (*nec* Herbst).

Carapace bluntly rhomboidal, about nine-tenths as long as broad: its surface perfectly smooth and devoid of hair: its antero-lateral borders finely beaded, and strongly sinuous, owing to the prominence of the edge of the well-defined hepatic region: its *true* postero-lateral border beaded only as far as the level of the first pair of legs (2nd pereiopods): its thickened milled epimeral border is visible, dorsally, only in its posterior third when the carapace is held, without any inclination, straight in front of the observer's eyes: its posterior margin short, gently curved, and finely beaded, with the deflexed surface below it quite smooth.

The thoracic sinus is no longer recognizable as the puckered mouth of a simple pterygostomian invagination: it is now a roughly Y-shaped cavity, the tail of the Y being defined by a line of 6 or 7 large pearly granules continuous with the milled epimeral edge of the carapace, the concavity of the fork of the Y being defined by the convex crenulated edge of the pterygostomian region, and the outer limb of the Y being a good deal longer than the inner.

The hepatic regions are strongly convex dorsally, their convexities being quite independent of the general convexity of the carapace.

The front is prominent, triangular, and dorsally convex; its length is at least equal to its breadth, and it ends in a projecting laminar triangular tip.

The ventral surface of the ischium of the external maxillipeds of the female is strongly convex up to a stout terminal tooth.

The chelipeds, in the adult male, are less than one-third longer than the carapace. The upper surface of the arm has both its anterior and posterior borders defined by a distally-incomplete row of tubercles, and, besides the basal eminence formed of 6 to 8 coalescent granules, has four—rarely five or more—large tubercles disposed in an irregular square just beyond the basal eminence: the inner surface of the arm has a few tubercles in its proximal half, as has also the under surface in its proximal fourth. The wrist is quite smooth. The hand is very little longer than broad, its inner edge bears a single row of granules which are often indistinct. The fingers are not much shorter than t hand, and their opposed edges are crenulate—and that but indistinctly only in their distal two-thirds.

The legs have stout, subcylindrical, perfectly smooth meropodites, inflated carpopodites, propodites with a sharpish dorsal edge, and, in the case of the last pair, with the ventral edge sharp also, and narrowly lanceolate dactyli which are more than half again as long as their propodites.

The abdomen in both sexes consists of 4 distinct pieces, the third piece, in the male, having a denticle in the middle line.

Colours in spirit: carapace light yellowish-brown, with a horseshoe of six impressed white spots in the gastric region, and with a narrowly defined red ring in either branchial region posteriorly; legs broadly banded with yellowish red; fingers with reddish base and white tip; tubercles on upper surface of arm with red base, sharply defined, and white apex.

The carapace of an average adult male is 22 millim. long and 18 millim. broad, of an adult female 25 millim. long and 22 millim. broad.

Over 80 specimens of all ages, from the Andamans, Mergui, Ceylon, and the Persian Gulf.

48*a*. **Leucosia longifrons*, var. *neocaledonica*, A. Milne Edwards.

Leucosia neocaledonica, A. Milne Edwards, Nouv. Archiv. du Mus. X. 1874, p. 40, pl. ii. fig. 1; and? Haswell, P. L. S., N. S. Wales, Vol. IV. 1879, p. 46; and? de Man, Notes Leyden Mus. III. 1881, p. 123.

? *Leucosia urania*, de Man, Notes Leyden Mus. III. 1881, p. 256.

This is certainly a well-marked variety, and perhaps a distinct

species. It differs from *L. longifrons*, De Haan, only in the following characters, adults of both sexes being compared:—

1. The carapace is closely punctate.
2. The antero-lateral border is *sharply* crenulate.
3. The hepatic regions although equally convex in the antero-lateral margins, have their dorsal convexity hardly distinguishable from the general convexity of the carapace.
4. The terminal tooth on the ventral surface of the ischium of the external maxillipeds of the female is extremely acute and prominent.
5. Along the inner edge of the hand, below the upper row of granules, which are very distinct, are several indefinite rows of granules.
6. Along the inner edge of the upper surface of the wrist is a line of 3 or 4 granules.
7. The meropodites of the ambulatory legs have three distinct ngitudinal lines of granules,—one dorsal, two ventral.
8. The propodites of the ambulatory legs have their dorsal edges ot merely sharp, but highly carinate, and have also their ventral edges carinate.
9. The colours, when good fresh spirit specimens are compared, are very different. On the gastric region is a pair of large ocelli with small white centres and very broad red outer rings. In faded specimens the colours are much those of *L. longifrons*, but even then, instead of two round spots or rings in the posterior half of the carapace, there are from 4 to 6 large spots round the posterior half of the circumference of the carapace.

Its average size is a little less than that of *L. longifrons*.

In the Museum collection are 35 adult males and females from Palk Straits, from Karáchi, and from the Persian Gulf.

48*b*. *Leucosia longifrons*, var. *pulcherrima*, Miers.

? *Cancellus anatum primus*, Rumph, Amboin. Rariteitkamer, I. 27, pl. x. fig. A.

Leucosia pulcherrima, Miers, Trans. Linn. Soc., Zool., (2) I. 1875–79, (1877) p. 236, pl. xxxviii. figs. 4–6: Haswell, P. L. S., N. S. Wales, Vol. IV. 1879, p. 46, and Cat. Austral. Crust. p. 119.

Leucosia splendida, Haswell, P. L. S., N. S. Wales, Vol. IV. 1879, p. 47, pl. v. fig. 1, and Cat. Austral. Crust. p. 119.

This is certainly only a variety of *L. longifrons*, De Haan, from which it differs chiefly in the colouration, which is altogether richer and more brilliant. Adult females compared, the only apparent differences from *L. longifrons* are as follows:—

1. The surface of the carapace is slightly punctate.
2. The propodites of the ambulatory legs are highly carinate dorsally, and have also their ventral edges carinate, as in var. *neocaledonica*.

3. The two red rings on the posterior half of the carapace are often, but not always, much larger, and the six white spots on the anterior part of the carapace are enclosed in six red circles, which often partly coalesce to form a double trefoil pattern.

In the Museum collection are an adult female, two half-grown females, and a half-grown male, all from the Persian Gulf; and the characteristic trefoil pattern occurs only in the adult female.

49. *Leucosia urania*, Herbst.

Leucosia urania, Herbst, Krabben, III. ii. 17, pl. liii. fig. 3: Leach, Zool. Miscell. III. p. 21: Desmarest, Consid. Gen. Crust., p. 167: Milne Edwards, Cuv. Règne An., Crust. pl. xxv. fig. 1, and ? Hist. Nat. Crust. II. 122: Bell, Trans Linn. Soc. XXI. 1855, p. 283, and Cat. Leucos. Brit. Mus. p. 6: Hilgendorf, MB. Ak. Berl. 1878, p. 811.

This species, although closely resembling *L. longifrons*, and espe ally the variety (or species) *neocaledonica*, is at once distinguished fr these, and from all other species, by its comparatively great size. It is giant in the genus *Leucosia*, the carapace of an adult female in the Indian Museum collection being 38 millim. long and 34 millim. broad, dimensions almost equalled by Herbst's figure.

It differs from *L. longifrons* only in the following particulars, adult females being compared:—

1. It is very much larger.

2. The antero-lateral border is but slightly sinuous, owing to the slight prominence of the hepatic regions, of which also the dorsal convexities are an almost indistinguishable part of the general convexity of the carapace.

3. The hand is as broad as long, and the fingers have their opposed edges crenulate throughout.

4. The meropodites of the legs are traversed ventrally by a line of granules.

5. The propodites of the legs are foliaceous.

6. The dactyli are broadly lanceolate, and are only equal in length to their propodites.

7. Colours (of a thoroughly well-preserved specimen that has been eight years in spirit) olive green, with a broad white median band, forked posteriorly, extending from the tip of the front to the after end of the gastric region; four dusky red blotches round the posterior half of the circumference of the carapace: legs yellow, banded with red; basal half of fingers red.

Loc. Andamans.

The single female specimen in the Indian Museum collection is the exact counterpart of Herbst's figure.

50. *Leucosia marmorea*, Bell.

Leucosia marmorea, Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 286, pl. xxx. fig. 4: E. Nauck, Zeits. Wiss. Zool. XXXIV. 1880, p. 49 (*gastric teeth*): A. O. Walker, Journ. Linn. Soc., Zool., Vol. XX. 1890, p. 111.

Carapace highly polished, piriform, *longer than broad by the whole extent of the front*: its antero-lateral borders finely beaded, *slightly* sinuous, and *gradually* convergent: its true postero-lateral border beaded only as far as the level of the first pair of legs (2nd pereiopods): its epimeral edge not visible in a dorsal view: its finely-beaded posterior margin *almost straight*, with the surface below it quite smooth.

The thoracic sinus is a roughly Y-shaped cavity, the tail of the Y being defined by a line of 5 or 6 small pearly granules continuous with the milled epimeral edge, the concavity of the Y being defined by the convex, *very finely* crenulated edge of the pterygostomian region, and both limbs of the Y being very short.

The hepatic regions are hardly defined posteriorly by a faint crease.

The front is prominent, dorsally convex, and truncate-triangular, ending in three minute teeth, of which the middle one is the largest.

The ventral surface of the ischium of the external maxillipeds of the female is smooth, *and not strongly convex*.

Chelipeds little longer than the carapace. The arm has its three borders tuberculate; its upper surface with 5 to 7 pearly tubercles, in two short rows, in its basal half, just beyond a basal eminence formed of 6 to 8 coalescent granules; its inner surface granular or tubercular in rather more than its basal half, and its under surface in rather more than its basal third. The wrist and hand both have a row of sharp-cut granules along their inner edge. The fingers, which meet only at their tips, have the opposed edges distantly crenulate.

The legs are slender: their meropodites are subcylindrical with longitudinal rows of microscopic granulation, dorsally and ventrally: their propodites have sharpish edges, but are not dilated: their dactyli, which are somewhat longer than the propodites, are very narrowly lanceolate.

Colours in spirit: rich warm yellowish-brown with two pale round spots on either side of the gastric region.

Length of carapace of an adult female 23 millim., breadth 18·5 millim.

A young and four adult females from the Andamans.

Among Indian species of the *L. longifrons* group, this is at once recognized by its elongate piriform carapace, by its truncate front, by its nearly straight posterior margin, by its slender legs, and by its warm cinnamon brown colour.

51. *Leucosia haswelli*, Miers.

Leucosia haswelli, Miers, 'Challenger' Brachyura, p. 324, pl. xxvii. fig. 2.

Carapace with the antero-lateral margins slightly sinuous, owing to the slight convexity of the hepatic regions, which also are defined posteriorly, on the dorsum of the carapace, only by a faint crease. In other respects the carapace almost exactly resembles that of *L. longifrons*, but is a little more convex.

The front ends abruptly in a projecting, sharply transverse, sinuous edge, the edge under a lens being seen to be faintly bilobed with each lobule again faintly emarginate.

The thoracic sinus is a roughly Y-shaped cavity *of no great depth*, the tail of the Y being defined by *four* large pearl-like granules situated above the base of the chelipeds, the concavity of the fork of the Y being defined by the convex *perfectly smooth* edge of the pterygostomian region, and the limbs of the Y being both equally short.

The ventral surface of the ischium of the external maxillipeds of the female is *moderately* convex *without a terminal tooth*.

The chelipeds are almostly exactly like those of *L. longifrons*; but on the upper surface of the arm there are always at least six pearly tubercles, in two short lines, running forwards from the basal eminence formed of coalescent granules, and these tubercles, like some of those on the inner edge of the arm, are of an uniform transparent blood-red colour; the wrist has a row of tiny blood-red granules along its inner edge; and the hand has not only a row of granules along its inner edge, but also, below this, a row of punctuations which become granules on the immobile finger: finally, the fingers are crenulate along the whole extent of their opposed edges.

Except that their propodites are sharply carinate, the legs exactly resemble those of *L. longifrons*.

Colours in spirit: light greenish yellow, mottled with darker, and with a dark greenish brown blotch on the posterior part of either branchial region and two white spots on either side of the gastric region.

Size of carapace of an adult male 21 millim. long and 18 millim. broad, of an adult female 22·5 by 20 millim.

37 specimens, young and adult, of both sexes, from the Andamans, are in the Indian Museum collection. In the smallest young the carapace is more elongate and its posterior border is almost straight, its whole shape being very much like that of *L. marmorea*, Bell.

52. *Leucosia pallida*, Bell.

Leucosia pallida, Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 285. pl. xxx. fig. 2, and Cat. Leucos. Brit. Mus. p. 7: E. Nauck, Zeits. Wiss. Zool. XXXIV. 1880, p. 48. (*gastric teeth*).

Leucosia obscura, Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 285, pl. xxx. fig. 3, and Cat. Leucos. Brit. Mus. p. 7.

Leucosia pallida, var. *obscura*, Miers, Ann. Mag. Nat. Hist. (5) V. 1880, p. 316.

? Leucosia parvimana, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 159.

? Leucosia moresbiensis, Haswell, P. L. S., N. S. Wales, Vol. IV. 1879, p. 49.

? Leucosia perlata, de Man, Notes Leyden Mus. III. 1881, p. 124; Ortmann, Zool. Jahrbüch Syst. etc., VI. 1892, p. 584.

Carapace more nearly circular than in any other species of the genus, owing to the convexity of the antero-lateral margins; its surface perfectly smooth; its antero-lateral margins crenulate: its *true* postero-lateral margins beaded almost up to the level of the 2nd pair of legs (3rd pereiopods); its epimeral edge not visible in a dorsal view; its posterior margin in the adult, as well as in the young, nearly *straight, salient, and having the outer angles dentiform*, the deflexed surface below being quite smooth.

The thoracic sinus is a Y-shaped cavity of no great depth; the tail of the Y being defined by a row of 6 or 7 granules, *three or four of which are large and pearl-like;* the concavity of the fork of the Y being defined by the convex smooth edge of the pterygostomian region; and both limbs of the Y being equally short.

The front is much broader than long *and is distinctly concave in the mid-dorsal line, anteriorly:* it ends in three denticles, the middle one of which is the most prominent.

The ventral surface of the ischium of the external maxillipeds of the female is strongly convex up to a stout terminal tooth.

The upper surface of the arm is traversed, in its proximal half, by 7 to 9 pearly tubercles arranged in two rows running forwards from the basal eminence formed by the usual mass of coalescent granules: the inner edge of the upper surface of the wrist bears a few tiny tubercles: *the hand, which is more than three-fourths as broad as long, has its outer edge strongly carinate*, and its inner edge granular: the fingers meet only at their tips, where alone they are faintly denticulate, their length is four-fifths that of the hand.

Except that they are more slender, and have sharply carinated propodites, and slender very narrow dactyli, the legs are as in *L. longifrons*.

Colours in spirit: delicate lavender grey marbled with darker; a pair of brown spots in the posterior part of the carapace, and two pairs of pale spots in the gastric region.

The carapace of an adult female is 21 millim. long and 18 millim. broad.

In the Indian Museum collection are 3 adult females (one with eggs) from the Andamans, and a young male from the Persian Gulf.

53. *Leucosia corallicola*, n. sp. Plate VI. fig. 4.

Carapace somewhat piriform, longer than broad almost by the whole length of the front: the antero-lateral borders gradually converging, and coarsely crenulate up to the smooth sharp lateral borders of the front: the true postero-lateral border, which is also crenulate, ceases abruptly at the level of the first pair of true legs: the posterior margin is quite straight with the outer angles pronounced: the epimeral edge is only visible dorsally in its posterior part.

The thoracic sinus is deep and distinct, but short and in places ill defined: its longitudinal limb is bounded by 3 or 4 small (small because the species is small) granules above the base of the chelipeds: the edge of the pterygostomian region, which defines it in front, is convex and irregularly wrinkled but not granular.

The front is almost as in *L. longifrons*: it is long, strongly convex dorsally, and ends in a broad triangular somewhat deflexed tip which projects beyond the orbits.

The ventral surface of the ischium of the external maxillipeds is not abnormally convex.

The chelipeds are as in *L. pallida*, as are the legs.

Colours in spirit: light yellow marbled with brownish. The carapace of not quite adult females, and of the males, is 10 millim. long and 8 millim. broad.

Loc. Off Malabar Coast, 29 fathoms on a bottom of "hard flat coral slabs" (Alfred Carpenter).

This species may possibly be Bell's *L. affinis* (Trans. Linn. Soc. Vol. XXI. 1855, p. 287, pl. xxx. fig. 6), but the front and the thoracic sinus are quite different from the figures of that species. It is certainly not the immature form of *L. longifrons*, *L. haswelli*, *L. pallida*, or *L. whitmeei*, to which group it belongs. Among Indian forms its closest relative is *L. pallida* Bell.

54. *Leucosia whitmeei*, Miers.

Leucosia whitmeei, Miers, Ann. Mag. Nat. Hist. (4) XVI. 1875, p. 342, and Trans. Linn. Soc., Zool., (2) I. 1875–79, p. 238, pl. xxxviii. figs. 16–18: J. R. Henderson, Trans. Linn. Soc. Zool., (2) V. 1893, p. 397.

Carapace piriform, longer than broad by the whole length of the front; the antero-lateral borders hardly sinuous, gradually converging and finely milled; the *true* postero-lateral border, which is also finely milled, ceases abruptly at the level of the interval between the chelipeds and the first pair of legs; the posterior margin, in the adult, no less than in the young, almost straight, with the external angles somewhat pronounced, the deflexed surface below being quite smooth; the epimeral edge visible to dorsal view only in its posterior part.

The thoracic sinus is a deep hardly Y-shaped cavity, since the outer limb of the Y is greatly produced and the inner limb is very short: the tail of the Y is defined by *two singularly large fungiform or reniform tubercles* with sometimes a third smaller one behind, and the strongly convex edge of the pterygostomian region, which defines the thoracic sinus in front, is finely milled.

The front is prominent, *almost quadrangular, with a sharply transverse sinuous edge and with its dorsal surface, anteriorly, markedly concave.*

The ventral surface of the ischium of the external maxillipeds of the female is broadly carinate up to a strong terminal tooth.

The chelipeds, in the adult male, are very little longer than the carapace. The arm is slender and is ornamented as in *L. pallida*: the wrist is quite smooth: the hand, which *is nearly twice as long as broad and nearly twice the length of the fingers*, has its outer edge carinate and its inner edge sharp: the short fingers meet only at the tip, where alone they are faintly denticulate. The legs are as in *L. pallida*.

Colours in spirit: fawn colour, the front of the carapace sometimes [illegible]ve-green; four large round brown spots round the circumference of the carapace behind; two pale spots on either side of the gastric [illegible]

The carapace of the adult male is 14 millim. long and 11 millim. broad; that of the adult female is 13 millim. long and 11 millim. broad. [illegible] male and 26 adults of both sexes (many of the females [illegible]) from the Andamans, are in the Indian Museum collection.

55. *Leucosia whitei*, Bell.

Leucosia whitei, Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 289, pl. xxxi. fig. 2, and Cat. Leucos. Brit. Mus. p. 9: Hess, Archiv für Naturges. XXXI. i. 1865, pp. 155, 172: Haswell, P. L. S., N. S. Wales, Vol. IV. 1879, p. 45, and Cat. Austral. Crust. p. 118: Miers, Zool. H. M. S. 'Alert,' pp. 184, 289, and 'Challenger' Brachyura, pp. 322 (footnote), 325: A. O. Walker, Journ. Linn. Soc., Zool., Vol. XX. 1890, p. 111.

? *Leucosia chevertii*, Haswell, P. L. S., N. S. Wales, Vol. IV. 1879, p. 47, pl. v. fig. 2, and Cat. Austral. Crust. p. 120.

Carapace not appreciably longer than broad, elegantly urn-shaped; its surface smooth, except for (1) a narrow strip of thick short fur clothing its postero-lateral border, (2) a sharp angular granule-tipped eminence springing from the vault of either hepatic region, and (3) a patch of granules just dorsad of the lateral epibranchial angle; its antero-lateral border smooth as far as the front end of the thoracic sinus, and then beaded; its *true* postero-lateral border beaded as far as the level of the base of the 2nd pair of legs (3rd pereiopods); its epimeral edge visible in all its extent, dorsally; its posterior margin gently curved,

the inflexed surface below it having numerous punctuations and squamous granules.

The thoracic sinus is a simple cavity defined ventrally by a loop of small somewhat irregular granules, and not very well defined in front.

The front is broader than long, dorsally convex, and its tip, which is truncated pitted and deflexed, ends in 3 broad denticles.

The ventral surface of the ischium of the external maxillipeds of the female is smooth (non-carinate).

The sub-cylindrical arm is closely nodular everywhere except in the middle of the ventral surface; the sub-globular wrist has about half of its upper surface, and a band on the inner edge of its under surface, granular: the hand is inflated, or sub-globular, with its base granular, and its inner edge sharply crenulate: the fingers, which are not much shorter than the hand, meet only at their tips, where alone they are denticulate.

The legs are compressed: the meropodites, which are much compressed, are finely granular along the edges; the carpopodites and propodites are sharply carinate, dorsally; the dactyli, which are nearly as long as their propodites and carpopodites together, are narrowly lanceolate.

The abdomen of the female consists of 4 pieces, and the large third piece is again subdivided into 3 pieces by two deep furrows which, however, are broadly interrupted in the middle line.

A single egg-laden female from the Andamans has the carapace 14 millim. long and 13·5 millim. broad.

The colours, according to Bell, are light brown with small angular red spots on the carapace, and a large red spot on the upper surface of the hand.

Our single specimen, which has been in strongly carbolized spirit for over 20 years, is now an uniform stone grey.

56. *Leucosia cumingii*, Bell.

Leucosia cumingii, Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 290, pl. xxxi. fig. 3, and Cat. Leucos. Brit. Mus. p. 9.

Carapace quite devoid of marginal fur, a little broader than long, the inequality being hardly appreciable in the adult female, elegantly hexagonal as in the preceding species. The antero-lateral border, the main curve of which would be slightly concave, is convex by reason of the strongly marked angular projection of the hepatic region. The antero-lateral margin may be obscurely milled just in front of its junction with the *true* postero-lateral border, *but the latter, as well as the posterior margin, is quite smooth*: the posterior margin is gently curved, and in the male prominent.

The thoracic sinus is a deep obscurely Y-shaped cavity full of hair, the tail of the Y being defined by a row of 5 flat pearly granules situated above the chelipeds, the inner limb of the Y being very short, and the outer limb of the Y being produced up to the antero-lateral border to accent the boundary between the hepatic and branchial regions, the concavity of the fork of the Y being sharply defined by the smooth convex edge of the pterygostomian region.

The front is broader than long, deflexed and obscurely bilobed at tip, and *a little concave in the mid-dorsal line anteriorly.*

The ventral surface of the ischium of the external maxillipeds of the female is perfectly flat.

The edges of the trigonal arm are tuberculate: on the upper surface of the arm two short rows of tubercles arise from a mass of granules and short hairs at the base of the arm, and run, one towards the inner, one to the outer, edge of the arm: the wrist and the hand quite devoid of granules: the fingers are nearly as long as the hand, and meet only at the tips.

The legs have all the joints compressed but not dilated.

The abdomen of the male consists of 4 pieces, that of the female of 3 pieces only.

Colours in spirit: yellowish white with yellowish brown markings, the hand and the fingers each with a brownish cross-band, the abdomen of the female with brownish yellow markings in its anterior (true posterior) third.

A male and an egg-laden female from the Nicobars: the carapace of the male is 11 millim. long and 10 millim. broad, that of the female is 12×11·5 millim.

57. *Leucosia sima*, n. sp. Plate VI. fig. 5.

Very closely related to *L. cumingii*, but differs from it, and from all other species of the genus, in the length of the posterior margin of the carapace, which is considerably more than half the greatest breadth of the carapace. Its form therefore would be broadly hexagonal, but owing to the shortness of the front and to the great convexity of the hepatic regions, it almost forms a pentagon.

Besides in the form of the carapace, which is unique in the genus, it differs from *L. cumingii*, Bell, only in the following characters, adult males being compared:—

1. The front hardly breaks beyond the general convexity of the anterior half of the carapace owing to the still greater angular prominence of the hepatic regions.

2. The antero-lateral margin of the carapace behind the angular

prominence of the hepatic region, and the postero-lateral margin up to the level of the base of the 1st pair of legs, are distinctly beaded.

3. The thoracic sinus has no definite boundary in front, although it is deep and defined ventrally by large pearly granules as in *L. cumingi*.

4. The inner edge of the upper surface of the wrist bears a row of granules, which is continued on to the base of the hand.

5. *The fingers are only half the length of the hand.*

An adult egg-laden female from Bombay has the carapace 13 millim. long and 13 millim. broad.

58. *Leucosia elata*, A. Milne Edwards.

Leucosia elata, A. Milne Edwards, Nouv. Archiv. du Mus. Vol. X. 1874, p. 41, pl. ii. fig. 2.

Carapace as broad as long, hexagonal, with the antero-lateral borders strongly convex and smooth: the *true* postero-lateral bord is clothed with a strip of dense dark-coloured fur: there are also a fe scattered stiff hairs on the posterior part of the epibranchial regions.

The thoracic sinus is a simple cavity, deep, sharply defined anteriorly, containing a good many hairs and a line of tiny granules, besides the row of 2 or 3 larger pearly granules (situated above the base of the chelipeds) which define it ventrally.

The front is prominent, broader than long, concave in the mid-dorsal line and distinctly bilobed.

The arm is markedly trigonal *with the antero-external angle expanded*, its upper surface is bounded internally by a row of pearly tubercles, externally by a row of pearly granules, and is otherwise smooth, except for a few granules almost hidden in hair and a single larger tubercle at its base. The wrist is smooth and subglobular, with obscure traces of carination along its outer surface. The hand is a little longer than broad and has its outer edge strongly carinate, the carina being continued on the mobile finger, where, however, it is less marked: the little lobule at the base of the inner margin of the hand is beaded all round its edge. The fingers, which are not much shorter than the hand, meet only at the tip, and have their opposed edges smooth throughout.

The legs are much compressed, and have the carpopodites strongly carinate dorsally, the propodites strongly carinate dorsally and ventrally, and the dactyli extremely slender and hardly as long as their propodites: the meropodites also of the last pair are carinate dorsally.

Colours in spirit: porcelain white or pale yellow. M. A. Milne Edwards describes the colours as bright greenish grey with numerous specks of orange red.

Besides a specimen from Upolu purchased from the Museum

Godeffroy, there are, in the Indian Museum collection two apparently adult males dredged, one off the south coast of Ceylon in 34 fathoms, and the other from the Persian Gulf.

The carapace of the latter is 8·5 millim. long and 8·5 millim. broad.

59. *Leucosia hæmatosticta*, Adams and White.

Leucosia hæmatosticta, Adams and White, Zool. 'Samarang,' Crust. p. 54, pl. xii. fig. 2; Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 289, and Cat. Leucos. Brit. Mus. p. 8; Stimpson, Proc. Acad. Nat. Sci. Philad. 1858, p. 160; Miers, P. Z. S. 1879, pp. 20 and 49; A. O. Walker, Journ. Linn. Soc., Zool., Vol. XX. 1890, p. 111.

Carapace sharply hexagonal, elegantly urn-shaped, its breadth equal to its length; its surface smooth except for a strip of thick short harsh white fur, which extends from the lateral epibranchial angle along the whole length of the *true* posterior border; its antero-lateral borders slightly concave and smooth, or very faintly milled; its *true* postero-lateral border ending abruptly at the level of the base of the second pair of legs (3rd pereiopods); its thickened milled epimeral edge, which is continuous with the posterior margin and ends at a sharp tooth just behind the base of the chelipeds, is visible, dorsally, in all its extent, when the carapace is held, without any inclination, straight in front of the observer's eyes; its posterior margin perfectly straight, with the outer angles well defined, and with the deflexed surface below it perfectly smooth.

The thoracic sinus is a simple cavity, defined in front by the smooth, very oblique, slightly convex edge of the pterygostomian plate: it is more or less filled with hair and is devoid of granules large enough to be seen with the naked eye.

The front is prominent, dorsally convex, much broader than long, and has its sinuous front margin strongly deflexed.

The chelipeds in the adult male are about one half as long again as the carapace. The upper surface of the trigonal arm has a single line of tubercles along its inner border, and a partly-fused double row along its outer border; at its base are some small tubercles hidden in a well-defined patch of encrusting spongy pubescence, of a whitish colour, from which two or three tubercles run forward to the inner border. The ventral border of the arm is tubercular, the tubercles arising somewhat profusely in a dense patch of spongy pubescence; the inner and under surfaces are quite smooth. The wrist is smooth, except for one or two tiny granules along its inner edge. The hand is a little longer than broad, its inner surface has a single row of granules, which is continued some way along the immobile finger. The fingers are about as long as the hand, and are somewhat hairy: their opposed edges

are crenulate along the distal two-thirds, the crenulation being most marked on the immobile finger.

The legs have the meropodites compressed, and concave on the ventral surface, the concavity being defined by two prominent longitudinal lines of granulation; the carpopodites dorsally subcarinate, but not dilated; the propodites carinate both dorsally and ventrally, but not dilated; and the dactyli narrowly lanceolate, and nearly as long as their carpopodites and propodites combined.

The abdomen of the male consists of 4 pieces, the third piece having a strong tooth in the middle line: that of the female consists of only 3 pieces.

Colours in life and in spirit: front pinkish-grey; the rest of the carapace ivory white covered with roundish crimson spots, which may be scattered, or may form a definite network: thoracic sterna, abdominal terga and external maxillipeds with similar spots; and a few similar but larger spots on the upper surface of all the joints of the chelipeds; legs banded with crimson.

In the Museum collection are two adult males and a half-grown female from the Madras side of Palk Straits, in 12 fms. and upwards.

The carapace of the largest male is 12·5 millim. long and 12·5 millim. broad.

60. *Leucosia margaritata*, A Milne Edwards.

Leucosia margaritata, A. Milne Edwards, Nouv. Archiv. du Mus. X. 1874, p. 42, pl. ii. fig. 3.

Differs from *L. hæmatosticta*, Ad. and Wh., only in the following particulars:—

1. Its size is even smaller, the carapace in the adult of either sex measuring only 8·5 millim. in length and 8·5 millim. in breadth.

2. The spongy pubescence on the base of the chelipeds, and the fur along the postero-lateral edge of the carapace are coal-black.

3. The hepatic regions are indicated by faint bulgings above the antero-lateral border.

4. The thoracic sinus is much shallower, being, in fact, almost obsolete.

5. The upper surface of the arm is bounded both in front and behind by *two* rows of pearly tubercles.

6. On the ventral surface of the basal joint of the external maxillipeds there is a sharp stout tooth, and another on the ventral surface of the ischium joint of the female.

7. Colours in spirit: old ivory white, the carapace and chelipeds elegantly reticulated with bright reddish brown.

In the Indian Museum collection are two adult males and an adult female laden with eggs. All came from an encrusted bottom of shells and shingle; one from the Andamans, one from the Malabar coast at 26–31 fms., and one from the Coromandel coast at 18 fms.

61. *Leucosia craniolaris*, (Herbst.)

?? *Cancer craniolaris*, Linnæus, Mus. Lud. Ulr. p. 431, and Syst. Nat., 12th ed., p. 1041.

Cancer craniolaris, Herbst, Krabben, I. ii. 90, pl. ii. fig. 17; and (?) Fabr. Ent. Syst. II. 441.

Leucosia craniolaris, Fabr. Ent. Syst. Suppl. p. 350: Leach, Zool. Misc. III. p. 21: Milne Edwards, Hist. Nat. Crust. II. 122: Bell, Trans. Linn. Soc. 1855, p. 283, and Cat. Leucos. Brit. Mus. p. 6: Miers, 'Challenger' Brachyura, p. 325, pl. xxvii. fig. 3: A. O. Walker, Journ. Linn. Soc. Zool, Vol. XX. 1890, p. 111: J. R. Henderson, Trans. Linn. Soc. Zool. (2) V. 1893, p. 397.

Leucosia craniolaris, var. *lævimana*, Miers, Zool. H. M. S. Alert, pp. 184 and 250, pl. xxvi. fig. A.

Carapace rather sharply hexagonal, about six-sevenths as long as broad: its surface perfectly smooth and devoid of hair: its antero-lateral borders finely beaded, almost straight, and gradually converging to join the sides of the truncate-triangular front without any abrupt break: its *true* postero-lateral border beaded, the beading ending rather abruptly at the level of the base of the first pair of legs (2nd pereiopods): its thickened milled epimeral edge, which is continuous with the posterior margin and ends at a sharp tooth just behind the base of the chelipeds, is visible, dorsally, in all its extent when the carapace is held, without any inclination, straight in front of the observer's eyes: its posterior margin is almost straight and finely beaded, and the deflexed surface below it is covered with rows of sharp granules.

The thoracic sinus is a deep cavity full of hair, and—when denuded—is devoid of any tubercles or granules visible to the naked eye: it is bounded in front by the finely beaded, or milled, convex edge of the pterygostomian plate, so as to end in two broad notches of nearly equal size. The convexities of the hepatic regions are an indistinguishable part of the general convexity of the carapace.

The front is prominent, dorsally convex, and truncate triangular; its length is less than its breadth; and it ends in five prongs, the outer of which on either side are the sharp external orbital angles, and the middle one of which is by far the most prominent.

The ventral surface of the ischium of the external maxillipeds, in the female, is strongly convex up to a strong terminal tooth.

The chelipeds, in the adult male, are two-thirds longer than the carapace: the trigonal arm has beaded edges, the beading failing at the distal end of the outer border, and being spread out and profuse at the

proximal end of the ventral border: all the surfaces of the arm, however, are practically smooth, for although there are a few small tubercles at their proximal ends, these are covered and almost concealed by a dense adherent encrusting spongy pubescence, which is specially well marked on the upper surface. The surface of the wrist is quite smooth, except for two or three tiny granules along the inner edge of the upper surface. The hand is nearly as broad as long, and its inner surface is bounded by two prominent longitudinal rows of sharp-cut bead-like granules, which are continued some way along the immobile finger. The fingers are nearly as long as the hand, and are stoutly denticulate along the whole extent of their opposed edges.

The legs have the meropodites much compressed, those of the first three pairs being sharply squared, with four sharp longitudinal lines of granules, and those of the last pair being broadened and carinated ventrally as well as dorsally; the carpopodites, in all, are compressed and strongly carinate dorsally; the propodites are compressed and strongly carinate both dorsally and ventrally; and the dactyli are broadly lanceolate.

The abdomen, in the male, to external view, consists of only 3 distinct pieces, the second piece bearing a tiny denticle in the middle line.

Colours in spirit: stone blue with indefinite longitudinal stripes of darker hue; chelipeds, above, livid purplish-blue; legs yellowish.

The carapace of an adult male is 23 millim. long and 20 millim. broad; of an adult female, 21·5 millim. long and 19 millim. broad.

In the Museum collection are 2 adult males and 3 adult females from the mouth of the R. Hooghly.

62. *Leucosia vittata*, Stimpson.

Leucosia vittata, Stimpson, Proc. Acad. Nat. Sci. Philad., 1858, p. 159.

Differs from *L. craniolaris*, adults of both sexes being compared, only in the following particulars:—

1. The antero-lateral borders are distinctly emarginate behind the hepatic regions, the emargination being caused by the encroachment of the outer limb of the thoracic sinus, and being plainly visible, dorsally, when the carapace is held, without any inclination, straight in front of the observer's eyes.

2. The hand is very appreciably longer than broad, and the fingers are every bit as long as the hand.

3. The colours in spirit are: carapace blackish blue, or nearly black, with flame-coloured stripes; chelipeds from the distal fourth of the arm to near the tips of the fingers, smoky flame-coloured on both surfaces, as are also the legs; under surface of body ruddy brown.

In size similar to *L. craniolaris*.

Two adult males, an adult female, and a young female from the Andamans are in the Indian Museum collection.

In the young one the posterior margin of the carapace is perfectly straight, with the outer angles dentiform.

63. *Leucosia pubescens*, Miers.

Leucosia pubescens, Miers, Trans. Linn. Soc., Zool., (2) I. 1875-79 (1877), p. 238, pl. xxxviii figs. 22-24: Haswell, P. L. S., N. S. Wales, Vol. IV. 1879, p. 46, and Cat. Austral. Crust. p. 119: de Man, Archiv. für Naturges. LIII. i. 1887, p. 390.

? *Pseudophilyra hoedtii*, de Man, Notes Leyden Mus. III. 1881, p. 125.

Pseudophilyra hoedtii, de Man, Journ. Linn. Soc. Zool. Vol. XXII. 1888, p. 198.

Differs from *L. craniolaris* Herbst, only in the following particulars:—

1. The front is as long as broad, and its sides meet the antero-lateral borders of the carapace at an angle.

2. The inflexed surface below the posterior margin of the dorsum of the carapace is quite smooth.

3. The thoracic sinus, when denuded of its hair, is a shallow cavity, and the edge of the pterygostomian region which bounds the sinus anteriorly is thickened, smooth, and little convex.

4. The inner edge of the hand is almost devoid of granules.

5. The meropodites of the first three pairs of legs are rounded, not sharply squared, and usually have only a single longitudinal row—ventral in position—of minute granules: those of the last pair, though compressed, are not carinate, except that ventrally, about the middle, they bear a serrated lobule.

6. The carpopodites of the legs are inflated and non-carinate, and the propodites are but slightly carinate.

7. In fresh spirit specimens the carapace is light slate blue, traversed longitudinally by four broken longitudinal stripes of greenish brown which are so far continuous as to form a treble loop something like an incomplete pair of spectacles or a rather fantastic U: the chelipeds and legs with bands of yellowish brown, and the base of the fingers yellowish brown. In old spirit specimens the markings are not found on the carapace.

The carapace of an adult male is 18 millim. long and 15 millim. broad, that of an adult female is 18·5 millim. by 15 millim.

In the Indian Museum collection are 3 adult males and 2 adult females from the Madras Coast, two adult females and a young male from the Persian Gulf, an adult and a half-grown male from the

Andamans, and young males from Palk Straits, Mergui (and Hong-kong).

The young male from Mergui has been named *Pseudophilyra hoedtii* by Dr. de Man.

64. *Leucosia truncata*, n. sp. Plate VI. fig. 6.

Differs from *L. pubescens*, ovigerous females compared, *only* in the following characters :—

1. The front is broad and so extremely short that its free edge does not project beyond, indeed barely projects as far as, the epistome.

2. The thoracic sinus is extremely shallow, but yet is a distinct sinus, with a row of minute granules above the base of the chelipeds.

3. The dactyli are palmulate.

4. A distinct line of sharp cut beads bounds the inner edge of the wrist and of the hand.

Two adult (ovigerous) females from the Orissa coast. The colouration is exactly similar to that of *L. pubescens*, but darker.

The first specimen that I saw I regarded, after careful examination, as either a malformation of *L. pubescens*, or a specimen of *L. pubescens* that had had its front broken and imperfectly repaired. But a second ovigerous female of exactly similar form, from another dredging station, now leads to the conclusion that, instead of being malformations, these two specimens must represent either a new species of the *L. craniolaris* and *rhomboidalis* type, or possibly may belong to the *L. porcellana* of Fabricius, which de Man states definitely is a true *Leucosia*.

At any rate the species here under consideration is a genuine *Leucosia*, and not a *Pseudophilyra* or *Philyra*.

65. *Leucosia rhomboidalis*, De Haan.

Leucosia rhomboidalis, DeHaan, Faun. Japon. Crust. p. 134, pl. xxxiii. fig. 5: Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 284, and Cat. Leucos. Brit. Mus. p. 6: F. Muller, Verh. Ges. Basel, VIII. p. 472: A. Ortmann, Zool. Jahrbüch. Syst. etc., VI. 1892, p. 586.

? *Leucosia craniolaris*, Desmarest, Consid. Gen. Crust., p. 167, pl. xxvii. fig. 2.

Leucosia maculata, Stimpson, Proc. Acad. Nat. Sci. Philad. 1858, p. 159.

Differs from *L. craniolaris* Herbst, only in the following particulars, adults of both sexes being compared :—

1. Its size is very much smaller: the carapace of the adult, in our series of 23 specimens, is never more than 16 millim., and is usually about 14 millim. long.

2. The front, which is as long as broad, has its sides subparallel

and hence forming a very abrupt angle with the antero-lateral borders of the carapace: it ends in 3 teeth, of which the two outer are small and deflexed and only the middle one is large and prominent. As, also, the external orbital angles are inconspicuous, the front, when examined without a lens, seems to end in a single sharp point, as shown in De Haan's figure.

3. The thoracic sinus, when denuded of its hair, is a shallow cavity, and the edge of the pterygostomian region that forms its anterior boundary is thickened, smooth, and almost straight.

4. The chelipeds of the adult male are less than half again as long as the carapace.

5. The inner surface of the wrist is bounded both above and below by a line of granules.

6. Colours in spirit: carapace and dorsal surface of chelipeds blue-black: the carapace with two divergent crescents of dark red spots in its anterior half, following the anterior boundary of the epibranchial regions; tips of arms hands and fingers sometimes nearly white, bases of fingers sometimes yellow.

17 adults of both sexes (including females with eggs) from the Coromandel coast in 13 to 28 fathoms, and an adult male and female from the Andamans (besides 4 adults from Hongkong) are in the Indian Museum collection.

66. *Leucosia phyllochira*, Bell.

Leucosia phyllocheira, Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 291, pl. xxxi. fig. 5, and Cat. Leucos. Brit. Mus. p. 9.

This species has a piriform carapace, and is distinguished from all its congeners by the following characters:—

1. The chelipeds are shorter than the carapace.
2. The arms have their upper surface much expanded.
3. The hands are broader than long, are foliaceous, and have both their inner and outer edges strongly carinate.

A single small specimen from Palk Straits is in the Indian Museum collection.

Onychomorpha, Stimpson.

Onychomorpha, Stimpson, Proc. Acad. Nat. Sci., Philadelphia, 1858, p. 162.

Carapace shaped much like a human nail, depressed, with all its margins, behind the front, forming a continuous laminar brim, increasing in breadth from before backwards and beneath which the true legs are almost entirely concealed in flexion: the expansion of the posterior

margin is particularly broad: the regions of the carapace are not delimited. Front short, hardly projecting beyond the general outline of the carapace, but projecting well beyond the edge of the buccal cavern. Eyes minute: orbits with a long suture in the roof, and a small gap at the inner canthus, but complete and affording complete concealment to the eyes: the floor of the orbit is closely appressed to the roof of the buccal cavern. Antennules folding a little obliquely. Antennæ obsolete.

Buccal cavern longer than broad: the exopodite of the external maxillipeds is elongate, and not much broader than the endognath, and has its outer edge a little curved: the acutely triangular merus of the endognath projects beyond the exognath, and is much longer than the ischium, measured along the inner edge.

The chelipeds, compared with the legs, are very massive: they are depressed and laminar, and are about the same length as the carapace: the fingers are stout, compressed, and very short.

The legs are slender and compressed, and when flexed are almost entirely concealed beneath the expanded edge of the carapace.

67. *Onychomorpha lamelligera*, Stimpson.

Onychomorpha lamelligera, Stimpson, Proc. Acad. Nat. Sci. Philad., 1858. p. 162: A. O. Walker, Journ. Linn. Soc. Zool. XX. 1890 (1887), p. 111, pl. viii. fig. 3.

Carapace triangular with the sides slightly curved, a little longer than broad; depressed, laminar, and unguiform owing to the preponderance of the broad laminar brim, to which the true carapace (the part lodging the viscera) forms a low convex circular crown.

The surface of the carapace is smooth, without any indication of regions: the edge of the brim is elegantly striated. The under surface of the body is also quite smooth, except for the striations all round the edge of the carapace.

The front is a little recurved upwards.

The chelipeds, in the female, are a very little longer than the carapace: the arm is sharply trigonal, with the outer edge cristiform, the edge of the crest being finely striated like the edge of the carapace: the outer edge of the wrist is carinate, and a ridge traverses the upper surface of the wrist: the hand is laminar with the edges sharp and striated beneath a copious spongy pubescence; it is rather more than half again as long as broad, and more than twice as long as the compressed fingers.

The legs are short and slender, with the merus, carpus and propodite carinated, and the dactylus almost filiform.

In the female all the segments of the abdomen except the last appear to be fused together, although the first and second can be recognized.

The carapace of an apparently adult female is 7 millim. long, and 6·5 millim. in greatest breadth.

A single female occurs in the collection of the Indian Museum,—from Palk Straits.

Philyra, Leach.

Philyra, Leach, Zool. Miscell. III. p. 18.

Philyra, Milne Edwards, Hist. Nat. Crust. II. 131.

Philyra, Bell, Trans. Linn. Soc., Vol. XXI. 1855, p. 299, and Cat. Leucos. Brit. Mus. p. 13.

Philyra, Miers, 'Challenger' Brachyura, p. 320.

Philyra can be at once distinguished from *Leucosia* by the absence of a thoracic sinus, and from *Pseudophilyra* by the fact that the front is broad and either not all produced to form a *Leucosia*-like snout, or if so produced (as it is, to some extent, in *Philyra platychira*) then the side-wall of either hepatic region forms an independent marginal facet.

Carapace usually circular and somewhat depressed, with the epistome projecting beyond the broad front; the dorsal surface of the carapace is generally bounded by a continuous beaded line; the hepatic and branchial regions usually fairly well defined by grooves or creases.

Buccal orifice transversely oblong, with the anterior angles broadly rounded: the exognath broadly dilated, usually foliaceous, the outer and anterior borders forming parts of one wide curve: the merus of the endognath narrowly and acutely triangular, the length of its inner border being not less, or not much less, than that of the inner border of the broad ischium.

Orbits small and sunken, with two sutures in the upper and outer wall, and a hiatus at the inner angle, where the minute antennal flagellum stands. The antennules fold transversely.

Chelipeds symmetrical and, relatively to the legs, very massive; longer in the male—about twice the length of the carapace—than in the female: true legs small.

The abdomen of the male consists of 3 or 4 pieces, that of the female of 4.

Key to the Indian species of Philyra.*

I. Carapace circular, never carinate or covered with pubescence dorsally: upper surface of chelipeds never longitudinally carinate:—

1. The epistome and the lower border of the marginal hepatic facet form a lobe that projects far beyond the front, like the lower jaw of a bulldog:—

i. Carapace as long as broad, its surface only partly, and very variably granular: chelipeds of adult male more than twice as long as the carapace ..... *P. scabriuscula.*

ii. Carapace a little broader than long, its surface always completely covered—except sometimes on the tip of the front—with beadlike granules: chelipeds of the adult male much less than twice the length of the carapace..... *P. verrucosa.*

2. The epistome projects either very slightly in all its extent, or not in its entire extent, beyond the front:—

i. The sidewall of the hepatic region forms, on either side, an independent facet on the antero-lateral margin of the carapace: the margin of the epistome is deeply cleft on either side, below the eye; hands between 2 and 3 times as long as broad, fingers with their opposed edges toothless..... *P. platychira.*

ii. The sidewall of the hepatic regions is not flattened to form a facet: the margin of the epistome not cleft below the eye: hands never twice as long as broad, fingers denticulate:—

a. The carapace is almost smooth to the naked eye: the regions of the carapace are hardly defined:—

α. The whole of the epistome projects beyond the front, which is hardly pubescent: the beads on the line that defines the circumference of the carapace are of uniform small size: terminal segment of the exognath roughly semicircular: hands not inflated, fingers not strongly bent inwards in the male: sixth abdominal tergum quite smooth..... *P. globosa*, (Fabr.)

β. Only the internal angles of the afferent branchial orifices project beyond the front, which is hairy: some of the marginal granules of the carapace are enlarged and almost dentiform, at fairly regular intervals: terminal segment of the exognath ovally, and very elegantly, foliaceous: fingers, in the male, strongly bent inwards: sixth abdominal tergum, in the male, with a small median denticle *P. globulosa*, Edw.

b. The regions of the carapace form independent swellings, the convexities of which are closely covered with large vesiculous granules..... *P. corallicola.*

II. Carapace sharply hexagonal, the posterior margin quite straight and the posterior angles dentiform: traversed fore and aft by a median carina, and with an oblique carina on either branchial region: upper surface of chelipeds traversed—from base of arm to finger-cleft—by a sharp ridge..... *P. sexangula.*

* Dr. Henderson includes *Philyra adamsii* Bell (Trans. Linn. Soc. Vol. XXI[illegible], p. 301, pl. xxxiii. fig. 1) in the Indian Fauna. I have not given it a place in this Key because, from the figures and description [illegible] satisfy myself that it is really a *Philyra*. It seems to me to be, [illegible]ther, a *Pseudophilyra*.

68. *Philyra scabriuscula*, (Fabr.)

Seba, III. pl. xix. figs. 10, 11.

? *Cancer cancellus*, Herbst, Krabben, I. ii. 94, pl. ii. fig. 20.

Leucosia scabriuscula, Fabricius, Ent. Syst. Suppl. p. 349: Latreille, Hist. Nat. Crust. et Ins. VI. 116.

Philyra scabriuscula, Leach, Zool. Miscell. III. p. 22: Desmarest, Consid. Crust. p. 167: Milne Edwards, Hist. Nat. Crust. II. 132, pl. xx. figs. 9, 10: Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 299, and Cat. Leucos. Brit. Mus. p. 1: Heller, 'Novara' Crust. p. 70: de Man, Notes Leyden Mus. III. 1881, p. 126: Lenz and Richters, Abh. Senck. Ges. XII. 1881, p. 425: Muller, Verh. Ges. Basel, VIII. 1886, p. 473: de Man, Journ. Linn. Soc., Zool., Vol. XXII. 1888, p. 201: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 399.

The epistome and the subhepatic regions form a dorsally-flattened, marginally-crenulate, rounded lobe, which is separated from the anterior curve of the carapace by a groove and projects far beyond the front, like the lower jaw of a bulldog.

The carapace is discoidal, with the margin beaded and the dorsal surface very variably ornamented with vesicular granules visible to the naked eye: these, however, never completely cover the carapace, and are rarely altogether absent, but are generally confined to the outer part of the branchial regions and to the branchio-cardiac grooves, which are broadly defined. The hepatic regions also are defined, by a slight marginal indentation and by a dorsal wrinkle.

The front is divided into two lobes by a deep broad groove, and the roof of the orbit is deeply fissured, so that the external orbital angle is acutely emphasized.

The edges of the thoracic sterna and the basal edge of the abdomen, as well as the greater part of the pterygostomian regions, are ornamented with polished granules; but the surface of the external maxillipeds is perfectly smooth, except in the female, where there are traces of granulation on the endopodite.

The chelipeds in the adult male are about $2\frac{1}{2}$, in the adult female about $1\frac{4}{5}$, times the length of the carapace: the arms bear rows of beadlike granules running along the upper and inner surfaces but fading away distally; the under surface of the arm is almost smooth: the inner edge of the wrist has a single row, and the inner edge of the hand several rows, of minute vesicular granules, which are hardly visible to the naked eye even in the male, and are obsolescent in the female. The hands are twice as long as broad: the fingers, although they meet only at their extreme tip, are denticulate all along the opposed edges; the mobile finger is nearly as long as the hand.

The legs are slender and smooth, except for a line of microscopic granulation along the under surface of the meropodites.

The abdomen of the adult male consists of two linear and hidden basal pieces, a triangular apical piece, and a long triangular middle piece in which the division of the 6th tergum is marked by a faint transverse groove.

The diameter of the carapace of the adult male is 12 to 14 millim., of the adult female about 10 millim.

Colours in spirit: carapace mottled with dull brown and greenish shades; chelipeds distinctly and legs indistinctly banded with dull brown.

In the Indian Museum collection are 110 specimens from Tavoy, Mergui, Madras coast, Travancore coast, Karáchi, Mekrán coast, and Persian Gulf.

1. A variety from Madras—represented by a single male—has the greater part of the carapace covered with granules, four of which—one in the mid-gastric, one in the mid-cardiac, and one on either branchial region—are much enlarged; and has chelipeds a good deal less than twice the carapace in length.

2. A variety from the Nicobars—also represented by a single male—has the whole carapace, except the front and the anterior limit of the gastric region, very closely covered with large granules much as in the next species.

69. *Philyra verrucosa*, Henderson.

Philyra verrucosa, Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 399, pl. xxxvii. figs. 10–12.

Differs from *P. scabriuscula*, (Fabr.), adults of both sexes being compared, only in the following characters:—

1. The carapace is irregularly oval rather than discoidal, especially in the female, owing to the greater lateral bulging of the branchial regions.

2. The whole dorsal surface of the carapace, except sometimes the front, is closely covered with beadlike granules, which are larger posteriorly, and one of which—somewhere near the middle—is usually enlarged.

3. A slight transverse dorsal indentation separates the hepatic from the branchial region on either side, but there is no independent dorsal bulging of the latter.

4. The branchio-cardiac grooves are narrow and deep.

5. The front is divided into two lobes by a broad shallow groove: the fissure in the roof of the orbit is indistinct, so that the external orbital angle is not sharply pronounced.

6. The whole surface of all the thoracic sterna is closely beaded, and the surface of the exopodite as well as of the outer half of the endopodite of the external maxillipeds is granular.

7. The chelipeds, in the adult male, are less than twice the length of the carapace: the distal end of the upper surface of the arm is covered with granules, and the greater part of the under surface of the arm is granular: the wrist and hand of the male have, along their inner edge, a row of granules quite visible to the naked eye: the hand is only half again as long as broad.

8. The size is a good deal smaller—the carapace of the adult male being about 9 millim. long and 10 millim. broad, that of the adult female being about 8 millim. long and 9 millim. broad.

9. Colours in spirit: dorsum blue-black, with a coppery tinge which is most marked on the chelipeds.

12 adults (male and female) from off Puri, 10 fathoms, from Madras, and from Karáchi, are in the Indian Museum.

70. *Philyra sexangula*, n. sp. Plate VII. fig. 2.

The whole exoskeleton, excluding the tips of the fingers and dactyli, is closely covered with a short close microscopic velvet-like pubescence—both dorsally and ventrally.

Carapace as long as broad, sharply hexagonal, traversed fore and aft by an interrupted median carina: the branchial regions are also traversed obliquely backwards each by a carina which terminates on either postero-lateral margin at a sharp eminence. The straight posterior margin has its outer angles strongly dentiform.

The side wall of either hepatic region forms an independent facet, which also involves the front and thus presents a condition intermediate between that of *P. platychira* and *P. scabriuscula*.

The edge of the front is straight and bilobed, and the straight edge of the epistome projects beyond it. There is a slight notch in the edge of the epistome beneath the eye on either side.

The chelipeds in the adult male are nearly $2\frac{1}{2}$ times as long as the carapace; their upper surface, from the base of the arm to the finger cleft, is traversed by a sharp ridge; they are devoid of any granules visible through the general velvet: the hand is twice as long as broad, and the fingers are rather over two-thirds the length of the hand and have their opposed edges finely denticulate and hairy: the inner edge of the upper surface of the hand is traversed by a second sharp ridge.

The legs are slender and compressed, the under edge of their propodites and dactyli being fringed with long hairs.

The abdomen of the male appears to consist of only two pieces, namely a small apical piece, and a long triangular plate in which the 6th tergum is marked off by a groove and bears a strong median tooth.

The diameter of the carapace of the male is 8 millim.

Colours uniform blackish brown everywhere above and below.

Loc. Godávari coast, Sacramento shoal, 6 fms., a single male: and Persian Gulf, a male.

In the specimen from the Persian Gulf the surface of the carapace beneath the velvet-like pubescence is uniformly punctulate in honeycomb fashion; and the edges of the carapace, the epibranchial carinæ, and the edges of the chelipeds and of their longitudinal ridge, as also of the second ridge along the inner edge of the hand, are all evenly granular. A near ally of this little species appears to be *P. punctata*, Bell.

71. *Philyra platychira*, De Haan.

Philyra platychira De Haan, Faun. Japon. Crust. p. 132, pl. xxxiii. fig. 6: Bell, Trans. Linn Soc. Vol. XXI. 1855, p. 300, and Cat. Leucos. Brit. Mus. p. 15: Stimpson, Proc. Acad. Nat. Sci. Philad. 1858, p. 160: E. Nauck, Zeits. Wiss. Zool. XXXIV. 1880, p. 49 (*gastric teeth*): Miers, 'Challenger' Brachyura, p. 321: de Man, Journ. Linn. Soc., Zool., XXII. 1888, p. 201: J. R. Henderson, Trans. Linn. Soc. Zool., (2) V. 1893, p. 400.

Philyra longimana, A. Milne Edwards, Nouv. Archiv. du Mus. X. 1874, p. 43, pl. ii. fig. 4: Miers, 'Challenger' Brachyura, p. 321.

Carapace convex, subcircular, but pinched in to form an independent marginal facet in either hepatic region: the circumference is beaded, as also—but less distinctly—are the margins of the lateral hepatic facets: the surface of the carapace, to the naked eye, is almost always quite smooth: the branchio-cardiac grooves are distinct.

The edge of the front is almost straight and is broadly bilobed, the whole of the epistome projects beyond it. The edge of the epistome is deeply cleft just below the eye, on either side.

The thoracic sterna have the edges, and the first sternum the surface also, beaded or granular.

The external maxillipeds have the surface smooth, and the edges of certain of their segments finely and inconspicuously fringed as in *P. globosa* (Fabr.), only the hairs on the inner edge of the endogna[th] of the female being conspicuous: the distal segment of the exog[nath] is less dilated than in any other Indian species.

The chelipeds in the adult male are $2\frac{1}{2}$ times, in the adult f[emale] $1\frac{5}{6}$ times, the length of the carapace: the arms have a few rather dis[tant] small vesicular granules on the basal third of, and also along the inner border of, the upper surface, and on the base and along the lower border of the inner surface, besides other tiny granules only visible with a lens: the surfaces of the wrist and hand are smooth. The hand is thin—

almost lamellar—with sharp edges, the inner of which is finely crenulate; in the adult male its length is nearly three times its breadth. The fingers, which are not as long as the hand, are also very thin and lamellar, and are elegantly curved: their opposed edges are sharp and *entire*, the cutting edge of the immobile finger being rather thickly fringed with hair.

The legs are slender and smooth, except for a line of tiny granules along the under surface of the meropodites.

The abdomen of the male consists of a single linear and concealed basal piece and a small triangular terminal piece, and, between the two, a long smooth triangular piece, which is bilobed and granular at base and has the sixth tergum demarcated by a deep groove.

The colour in spirit is uniform coppery.

The carapace of the adult male is 13 or 14 millims. in either diameter, that of the female 12 or 13.

In the Indian Museum collection are 40 specimens, adults and young of both sexes, from the Andamans, Mergui, Karáchi, and the Persian Gulf.

The Persian Gulf specimens, which are quite adult, have the dorsal surface much mottled with green and brown, and the immobile finger denticulate beyond the line of hair.

72. *Philyra globosa*, Fabr., de Man.

Philyra globosa, de Man, Journ. Linn. Soc., Zool., Vol. XXII. 1888, p. 202: *only that part referring to Fabricius' female type and to the Mergui specimens.* This reference is placed first because Dr. de Man has examined Fabricius' types, male and female, of *P. globosa*, and the species here under consideration corresponds with Fabricius' female type as re-described by de Man.

?? Rumph, Amboin. Rariteitk. pl. x. fig. D.

Cancer globosus, Fabr., Sp. Insect. I. 497 and Ent. Syst. II. 441.

? *Cancer globus*, Herbst, Krabben, I. ii. 90.

Leucosia globosa, Fabr. Ent. Syst. Suppl. p. 349: Latreille, Hist. Nat. Crust. et Ins. VI. 117.

? *Philyra globosa*, Leach, Zool. Miscell. III. 22 (reference to male); and (?) Desmarest, Consid. Crust. p. 168.

? *Cancer porcellanus*, Herbst, Krabben I. ii. 92 (*nec syn.*), pl. ii. fig. 18.

Philyra porcellana, Milne Edwards, Hist. Nat. Crust. II. 133: Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 300, and Cat. Leucos. Brit. Mus. p. 14 (*nec syn.*)

Philyra polita, Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 401, pl. xxxviii. figs. 1–3.

The whole exoskeleton (when not incrusted with *Hydrozoa*, &c., as it commonly is) has, to the naked eye, the appearance of glazed porcelain, although when examined with a lens it is minutely punctulate and granular.

The carapace is subcircular, the anterior portion being an arc of a smaller circle than the posterior; its dorsum is defined all round, behind the hardly at all pubescent front, by a line of fine beads all of equal size.

The epistome projects well beyond the edge of the front, which is deflexed, the deflexed portion being slightly acuminate downwards in the middle line.

None of the regions of the carapace are in any way defined.

The thoracic sterna and the base of the abdomen are bordered by granules, which are flattened and depressed.

The *surface* of the external maxillipeds is quite devoid of hair, though the edges of the exopodite have a fringe of exceedingly short hair, and the inner edge of the endopodite is, in the female, fringed with hair that is somewhat longer. The expanded exopodite is very broad anteriorly and has the inner edge quite straight (not curved).

The chelipeds in the adult male are a little more than twice the length, in the adult female about $1\frac{3}{4}$ times the length, of the carapace. The arms are covered with close-set flattened pearly granules on the upper surface except near the tip, on the whole of the inner surface, and on the basal half or third of the under surface. The wrist and hand are quite smooth, and only very occasionally in old males the inner surface of the hand is, under the lens, but not to the naked eye, roughened. The hand in both sexes is a little more than half again as long as broad, and is not inflated.

The fingers have much the same form in both sexes: they are almost in the same straight line with the hand; they meet closely only at tip, although they are faintly denticulate along the greater part of their extent; they do not, in the male, bear any enlarged dentiform tubercle; and the length of the dactylus is hardly greater than that of the outer border of the hand.

The true legs are not much longer than the male arm; their meropodites have every surface quite smooth, their propodites are bluntly carinate, and their dactyli lanceolate.

The abdomen of the male consists of two linear basal pieces and a triangular apical piece, and, between the two, a long narrow triangular plate which has no median denticle and is divided by a transverse groove of no great depth.

Colours in spirit: smoky bluish brown above, the blue deepest on the carapace.

The diameter of the carapace of the adult male does not exceed millim., that of the adult female does not exceed 17 to 18 millim.

In the Indian Museum collection are 110 specimens, both young and adult, of both sexes, from the East coast, from the mouth of the Hooghly to Madras—and also from Karáchi.

Besides these there are 4 specimens (two males more than half-grown, a younger male, and one very young specimen) from Mergui. These have been compared by Dr. de Man with Fabricius' types of *P. globosa* from the Kiel Museum, and are stated by him to agree with Fabricius' female type.

They do not however, as Dr. de Man appears to suspect, agree with Fabricius' male type, and this involves a delicate question of synonymy.

From Dr. de Man's description it is evident that Fabricius' male is a species quite distinct from his female: as a matter of fact it appears to be the species named by Milne Edwards—and named probably with foresight—*P. globulosa*.

It seems therefore preferable to apply Milne Edwards name, *P. globulosa*, to Fabricius' male type, and to leave the name *P. globosa* in possession of Fabricius' female type.

The only other alternative is to make use of Dr. Henderson's name *P. polita* for Fabricius' female, and to let *P. globosa* stand for Fabricius' male. But this, I think, would be a little unjust to Dr. de Man, upon whose prior work the present attempt to clear up the confusion between the two species is based, and a little wanting in respect to the memory of the founder of modern carcinology.

73. *Philyra globulosa*, Edw.

?? *Cancer anatum*, Herbst, Krabben, I. ii. 93, pl. ii. fig. 19.

Philyra globulosa, Milne Edwards, Cuvier Règne An. Crust. pl. xxiv. fig. 4, and Hist. Nat. Crust. II. 132 (*nec syn.*): Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 300, and Cat. Leucos. Brit. Mus. p. 14 (*nec syn.*)

? *Philyra globosa*, Leach, Zool. Miscell. III. p. 22 (female only): ? Desmarest, Consid. Crust. p. 168 (part).

Philyra globosa, de Man, Journ. Linn. Soc., Zool., Vol. XXII. 1888, p. 203: *only that part relating to Fabricius' male type*, and *not* the part relating to Fabricius' female type and to the Mergui specimens.

? *Philyra heterograna*, Ortmann, Zool. Jahrbuch. Syst. etc. VI. 1892, p. 582, pl. xxvi. fig. 17, (half-grown male).

The whole exoskeleton (when not incrusted with *Hydrozoa* &c., as it rarely is) has the somewhat greasy look and feel of unglazed porcelain, except the legs and abdomen, which are polished.

The carapace is circular, its dorsum is defined all round, behind the hairy front, by a line of granules, some of which, at fairly regular intervals, are much enlarged and may even, in young specimens, form distinct denticles.

The epistome can be scarcely said to project beyond the front, since only the inner angles of the afferent branchial canals do so.

The edge of the front is emarginate in the middle line, so as to make the front, when denuded of hair, broadly bilobed.

An indentation of the margin of the carapace separates the hepatic from the branchial regions, and a broad groove separates the branchial regions from the cardiac and intestinal regions, on either side.

A band of granules visible to the naked eye is always found

on either pterygostomian region, bounding the buccal cavern; and almost always in females and young males, and often but by no means always in adult males, the hepatic regions and the outer and posterior parts of the epibranchial regions are distinctly granular to the naked eye.

The exposed parts of the thoracic sterna are more or less covered with granules, and there are granules on the base of the abdomen. But the greater part of the abdomen, in contrast with the sternum, is polished.

The edges of the maxillipeds are hairy in the same manner as, but much more coarsely than, those of *P. globosa* Fabr., and the surface also is in large part covered with hair: the foliaceous exopodite has an elegantly oval shape, owing to the fact that its inner edge is curved and enters the common curve of the outer and anterior edges without any abrupt transition.

The chelipeds in the adult male are a little more than twice the length, in the female only about $1\frac{1}{4}$ times the length, of the carapace. The arms bear numerous sharpish granules (speaking of those visible to the unaided eye alone) on the basal third (male) or basal half (female) of the upper surface, all along both the inner and outer borders of the upper surface, and on the basal third and inner border of the lower surface. The wrist has a row of granules along the upper border of its upper surface, and commonly also along the under border of the same surface; and the inner surface of the hand is defined above by a row of prominent granules, and below by several lines of smaller granules—all continued on to the base of the immobile finger, and all being very much less distinct in the female than in the male. The fingers are fluted, with the outer borders granular at base. The hand in the female is hardly longer, and in the male is only about one-fifth longer, than broad, and is considerably inflated. The fingers differ considerably according to sex, but both sexes agree in having the dactylus very markedly longer than the outer border of the hand, in the male they are bent inwards at an angle of about 145° with the hand, and the edge of the basal half of the dactylus is a good deal hollowed to make room for a strong dentiform tubercle on the opposed edge of the immobile finger; and it is only beyond this tubercle and its corresponding hollow that the fingers are denticulate: in the female the fingers are not bent inwards strongly, and their opposed edges are unbroken, and are denticulate in the greater part of their extent.

The true legs resemble those of *P. globosa*, except that (1) the under surface of the meropodites is granular—a line of granules on

the first pair, in the male only, being much enlarged, and (2) that the dactyli are distinctly palmulate.

The abdomen of the male consists of a single linear basal piece and a triangular apical piece, and, between the two, a long triangular plate which is divided in its distal fourth by a deep transverse groove, the piece so cut off bearing a median denticle in its distal half.

Colours in spirit: light yellowish-pinkish-brown to coppery, with a bluish tinge over a large part of the dorsum of the carapace.

The diameter of the carapace of the adult male is 29 to 30 millim., that of the adult female 22 to 24 millim.

In the Indian Museum collection there are 160 specimens collected all along the East coast, from the mouth of the Hooghly to Point Calimere, and on the coasts of Travancore, the Andamans, and the Persian Gulf.

74. *Philyra corallicola*, n. sp. Plate VII. fig. 1.

Carapace perfectly circular, convex: the hepatic regions form a pair of distinct dorsal swellings, and the branchial regions are separated from the median regions by deepish grooves: the summits of the hepatic regions, the posterior part of the gastric region, and the convexities of all the other regions are closely covered with vesiculous granules like those of *P. verrucosa*, but the grooves and hollows of the carapace are quite smooth. The front is divided longitudinally, from edge to base, into two tumid lobes by a deepish groove: its edge is straight and the tips of the mouth-parts can only just be seen beyond it in a dorsal view. The entire margin of the carapace is finely evenly and sharply crenulate. The sternum and convexities of the pterygostomian regions are finely granular, as are also the outer and distal parts of the external maxillipeds.

The external maxillipeds are shaped as in *P. globulosa*, Edw.

The chelipeds in the male are about $1\frac{1}{4}$ times the length of the carapace: the arm is closely covered, everywhere except on a distal patch of the inner surface, with vesiculous granules, which are largest on the upper surface: the wrist and hand are finely granular; there is a raised row of granules on the outer edge of the wrist, which becomes a granular crest on the outer edge of the hand; and there are two raised rows of granules along the inner surface of the hand: the fingers are about as long as the hand. The abdomen of the male consists of 3 pieces, the broad base of the long triangular second piece being granular: at the distal end of the second piece is a stout denticle.

Diameter of the carapace of an apparently adult male, 6 millim.

Loc. off Malabar Coast, 29 fms. on a bottom of "hard flat coral slabs" (Alfred Carpenter).

At first sight this species resembles *P. verrucosa*, Henderson, from which it is easily distinguished on close examination.

Pseudophilyra, Miers.

Pseudophilyra, Miers, P. Z. S., 1879, p. 40.

Of the small forms grouped together in the genus *Pseudophilyra* some present the greatest resemblance to the smaller species of *Leucosia*, and others to the smaller species of *Philyra*. All, however, may be distinguished from *Leucosia* by the absence of any trace of a "thoracic sinus"; and all may be distinguished from any Indian species of *Philyra* by the following characters:—(1) either the whole free edge of the front, or at least the tip of its median tooth, projects beyond the level of the epistome; (2) the buccal cavity is either longer than broad and shaped as in *Leucosia*, or only a very little broader than long; (3) the exognath of the external maxillipeds is never broadened, and never has the outer and anterior borders forming one unbroken sweep; (4) the front has always the form of a distinct snout, convex, and pinched off, at base, from the hepatic regions. Now in the only Indian species of *Philyra* in which this to some extent occurs, the side wall of either hepatic region forms an independent marginal facet to the carapace—a thing never seen in *Pseudophilyra*.

The whole exoskeleton porcellanous.

Carapace subcircular or subpiriform, convex, with the regions usually not defined; produced in front to form a short upturned snout, similar in all its relations except length to that of *Leucosia*. The carapace is defined all round behind the front by a continuous raised and usually beaded line: its epimeral edge is not appreciably thickened, and is not approximated to the true lateral margin, so that there is no infolding of the lateral wall of the carapace or "thoracic sinus": nor is the epimeral edge of the carapace continuous with the line that defines the dorsum of the carapace posteriorly, as it is in *Leucosia*.

The buccal cavern is truncate-triangular: its length is usually greater than, but sometimes slightly less than its greatest breadth: the outer margin of the exognath meets the anterior margin abruptly, the exognath not being dilated.

The chelipeds are symmetrical and, relatively to the legs, very massive: in the male they are nearly twice the length of the carapace: a large part of the surface of the arms is ornamented with beadlike and vesicular granules: the hands are broad, but usually not so broad as long: the fingers are usually somewhere about the same length as the hand.

The abdomen of the male usually consists of 4 pieces, but the two

basal pieces are usually linear and hidden. The abdomen of the female consists of 3 or 4 pieces.

Key to the Indian species of Pseudophilyra.

I. Front tridentate, the whole of its free edge projecting well beyond the epistome: carapace strongly convex: buccal cavern elongate, truncate-triangular, quite as in *Leucosia*:—

1. Carapace closely and coarsely punctulate: hepatic regions defined: thoracic sterna of male normal ..... *P. tridentata.*
2. Carapace smooth and polished: third thoracic sternum of male with two processes or teeth,—one on either side of the abdomen:—
   i. Hepatic regions defined: hands longer than broad: processes of third thoracic sternum stout, and projecting only on to the second sternum ..... *P. pusilla.*
   ii. Hepatic regions not defined: hands as broad as long: processes of third thoracic sternum laminar, and projecting well on to the first sternum ... *P. wood-masoni.*

II. Front divided almost from the base by a deep longitudinal groove, its free edge straight and projecting just beyond the epistome: carapace strongly convex, with most of the regions well defined and tumid; the branchial, cardiac, post-gastric, and to a less extent the hepatic regions are, at any rate in the male, conspicuously granular in their tumid portion: buccal cavern a little broader than long ..... *P. blanfordi.*

III. Front with a single median tooth, the tip of which alone projects beyond the epistome: carapace moderately convex, with the hepatic regions defined: buccal cavern as long as broad ..... *P. melita.*

75. *Pseudophilyra tridentata*, Miers.

Pseudophilyra tridentata, Miers, P. Z. S. 1879. pp. 20, 41, pl. ii. fig. 4.

Carapace subpiriform, its dorsum coarsely closely and uniformly punctulate everywhere except near the tip of the front, and defined all round behind the antero-lateral margins by a minutely-beaded line.

The front projects well beyond the margin of the buccal cavern and ends in three laminar teeth, the middle one of which is much the largest. The external orbital angles are acute, but do not reach the level of the frontal teeth. Posteriorly the frontal region extends straight backwards, between the hepatic regions, as a ridge, which is particularly conspicuous in the male. On either side of this ridge the hepatic regions are much depressed, but behind the depressions they form distinct mamillary elevations.

In the male the anterior and lateral margins of the sternum are indistinctly punctate, and the edges of the fossa in the first segment that lodges the tip of the abdomen are very finely beaded: in the female only the front border of the sternum is punctulate.

The chelipeds in the adult male are about $1\frac{2}{3}$ times the length of the carapace: the upper surface of the arm is irregularly granular in its basal half, punctulate in its distal half; the inner surface is covered with tiny vesicular granules in its basal half, the under surface is smooth: the wrist and hand are smooth, the hand about half as long again as broad: the fingers, which are as long as the hand is broad, meet only at tip and have the opposed edges almost smooth.

The first pair of true legs exceed the arms in length by almost the last two joints.

The male abdomen is narrow and triangular and consists of 4 pieces, but the two proximal pieces are linear and concealed: the long third piece has a median tooth near the distal end.

The carapace of the male measures 10 by 8 millim., that of the female 11·5 by 10 millim.

Colours in spirit: pinkish grey mottled with reddish and yellowish brown; spotted cross-bands of brown on arms and hands, and a cross-band of reddish brown on the fingers.

In the Indian Museum collection are two adult males and four adult females from the Persian Gulf.

76. *Pseudophilyra wood-masoni*, n. sp. Plate VI. fig. 3.

Carapace subpiriform, perfectly smooth and polished, its dorsum defined all round behind the hepatic regions by a faintly raised, smooth (microscopically granular) line.

The front projects beyond the margin of the buccal cavern and ends in three teeth of nearly equal size, but it is not prolonged backwards as a ridge between the hepatic regions. The external orbital angles are not acute.

The hepatic regions have no convexity distinct from the general convexity of the carapace.

In the male the third thoracic sternal segment is produced, on either side of the abdomen, to form a laminar tooth which projects forwards, across the second segment, well on to the first. And the margins of the fossa in which the tip of the abdomen is lodged are finely beaded.

The chelipeds in the adult male are twice the length of the carapace, and are exceptionally massive—the arm being between a half and a third as broad as long: the arm has its inner border and proximal half of upper surface beaded, its inner surface completely covered with vesicular granules, and its under surface smooth: the wrist and hand are quite smooth, the hand of the adult male being as broad as long: the fingers are stout, as long as the hand, and meet only at tip: the dactylus in the male has one of its teeth—situated near the middle—of very conspicuous size; the fingers in the female are without teeth.

The true legs exceed the arm in length almost by their last two joints.

The male abdomen resembles that of the last species, and its long second piece has a stout tooth at its extreme distal end.

The carapace of the male measures 7·5 by 6·5 millim., that of the female 8 by 7 millim.

Colours in spirit: uniform yellowish pinkish brown.

In the Indian Museum collection are 2 males (one adult) and 6 females (four ovigerous) from the Andamans, and an adult male from off Cape Comorin, 39 fathoms.

77. *Pseudophilyra pusilla*, Henderson.

Pseudophilyra pusilla, Henderson, Trans. Linn. Soc. Zool. (2) V. 1893, p. 398, pl. xxxvii. figs. 13–15.

Differs from *Pseudophilyra wood-masoni* in the following particulars only:—

1. Its size is even more diminutive, the carapace of the largest male in the Indian Museum—an undoubted adult—measuring 6 by 5 millim.

2. The edge of the front is straight, slightly deflexed and concave in the middle line, this deflexed portion being again produced horizon

tally forwards as a median tooth. Posteriorly a faint carina runs straight backwards from the front, separating the hepatic regions, much as in *P. tridentata*.

3. The tooth on the third thoracic sternum, on either side of the abdomen, though more outstanding, is much shorter, projecting forwards only about halfway across the second sternum.

4. The chelipeds of the adult male are not more massive than usual, the arms being only about a quarter as broad as long, and the hands being more than half again as long as broad.

5. The fingers in the adult male, as in the female, are almost smooth, and there is no big tooth near the middle of the mobile finger.

6. There is but the faintest trace of a denticle on the male abdomen, in the middle line.

7. The colours are altogether different, even in a specimen that has been over 20 years in spirit in the same bottle with specimens of *P. wood-masoni*.

In good spirit specimens the dorsal surface is light grey with elegantly speckled markings of various shades of greenish and yellowish brown, as follows:—a band across the tip of the front: a V-shaped collar at base of front: a crescent on either branchial region, joining a stripe down the middle of the postgastric and cardiac regions, the whole looking like a scorpion with extended chelæ: a broad band across middle of arm and a narrow band across distal end of arm: a broad band across middle of hand, and a narrow stripe along both fingers. The ventral surface of the external maxillipeds and the tip of the abdomen closely speckled and mottled with dark brown.

Locality—Andamans, whence the Indian Museum collection has 3 adult males.

The foregoing three species have more the general facies of *Leucosia* than of *Philyra*.

78. *Pseudophilyra blanfordi*, n. sp. Plate VI. fig. 7.

Carapace circular, its dorsal surface defined all round behind the eyes by a finely beaded line; its regions are tumid and well demarcated, the tumid surfaces being very distinctly granular (excepting the front part of the gastric region) in the male, but in the female more punctate than granular. The front is distinctly pinched off at base from the hepatic regions, as in all the species of *Leucosia* except *L. truncata*, and as in all other species of *Pseudophilyra*: it is divided into two rather tumid lobes by a longitudinal groove that extends almost to its base: its anterior edge is straight, and projects just beyond the edge of the epistome.

In the male the whole surface of the sternum, except the segment belonging to the external maxillipeds, as also the pterygostomian region and extreme base of abdomen, is finely beaded, and the surface of the exognath is granular: in the female the outer border of the endognath also is granular, and the basal abdominal terga.

The exognath is not dilated in any part, and the buccal cavern is narrowed in front and is at least as long as broad.

The chelipeds in the male are less than twice, though more than 1½ times, the length of the carapace; in the adult female they are not much longer than the carapace. The arms are cylindrical and are roughly granular everywhere except a very small part of the under and of the inner surface. The upper surfaces of the wrist and hand are slightly granular along the inner half. The hand is not greatly longer than broad. The fingers are as long as the hand, and are strongly bent inwards, much as in *Philyra globulosa*, Edw. On the immobile finger in the male there is a strong tooth, and on the opposed edge of the mobile finger a notch, beyond which the opposed edges are denticulate.

The abdomen of the male consists of 3 pieces, including a linear basal piece and a small apical piece: on the large middle piece the 6th tergum is marked by a shallow groove, and bears a stout median tooth at its distal border.

Diameter of carapace of male between 7 and 8 millim., of female the same.

Two males and four ovigerous females from the Mekrán Coast, 25 fathoms.

This little species bears a considerable resemblance to *Philyra adamsii*, Bell; but may be distinguished by its perfectly circular and strongly convex carapace, by its short chelipeds, and by the stout tooth on the abdomen of the male.

79. *Pseudophilyra melita*, de Man.

Pseudophilyra melita, de Man, Journ. Linn. Soc. Zool., Vol. XXII. 1888, p. 199: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 397.

Carapace in the adult almost circular, moderately convex; its dorsal surface defined all round, behind the front, by an elegantly beaded line; its surface, to the naked eye, smooth and polished.

The hepatic regions are defined by a slight dorsal acuminate bulge, or wrinkle.

The anterior margin of the front, which does not reach the level of the anterior margin of the buccal cavern, is concave and deflexed in the middle line, so as to appear somewhat bilobed, but the deflexed

concave portion is horizontally produced to form an acute tooth, the tip of which projects beyond the margin of the buccal cavern.

In the male the sternum is elegantly beaded along the anterior and lateral borders, and round the line of contact with the tip of the abdomen: in the female only the anterior border is beaded.

The chelipeds in the adult male are nearly twice the length of the carapace: the arms are cylindrical, and have the upper surface in its proximal half or two-thirds beaded in longitudinal lines; the under surface is granular, except at the distal end and along the outer border: wrist smooth: hand half again as long as broad in the adult male, about twice as long as broad in the female; its inner surface, in old males only, with numerous vesicular granules: fingers in both sexes as long as the hand is broad, meeting only at tips, and having the opposed edges distantly and inconspicuously dentate.

The first pair of true legs exceed the arm in length by their dactylus.

The abdomen of the male is narrowly triangular, and is devoid of any median denticle: it consists of 5 pieces, but the joint between the 3rd and 4th pieces is rigid.

The carapace of the male is 11 millim. long and 10 millim. broad; that of the female is slightly larger.

Colours in spirit: pearly grey with numerous darker mottled markings. The confluent gastric and cardiac regions are defined by a brown line, which forms with an ill defined ring of the same colour on either branchial region a pair of spectacles; the hepatic regions edged with brown: broad cross-bands of brown across middle of arm, base of hand, and middle of fingers; wrist brown: legs with yellowish brown cross-bands.

Common along Coromandel coast. Also from Mergui.

This species has more the facies of *Philyra* than of *Leucosia*.

Myrodes, Bell.

Myrodes, Bell, Trans. Linn. Soc. Vol. XXI. 1855 p. 298, and Cat. Leucos. Brit. Mus p. 13.

Myrodes, Miers, 'Challenger' Brachyura, p. 297.

Closely resembles *Myra* in all details of form, but differs conspicuously in the following characters:—

(1) the chelipeds are much shorter, their length being hardly $1\frac{2}{3}$ times that of the carapace:

(2) the hands are not $\frac{1}{4}$ longer than broad and are inflated and subglobular:

(3) the fingers are much longer than the hand, are extremely slender and not much compressed, and are of about the same diameter

from their base to near their hook-like tip: the tip of the dactylus moves through an arc of over 120°.

(4) the merus of the external maxillipeds is hardly more than half the length of the ischium measured along its inner border.

80. *Myrodes eudactylus*, Bell.

Myrodes eudactylus, Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 299, pl. xxxii. fig. 6, and Cat. Leucos. Brit. Mus. p. 13.

Myra eudactyla, A. Milne Edwards, Nouv. Archiv. du Mus. X. 1874, p. 46, pl. iii. fig. 3: Haswell, Cat. Austral. Crust. p. 123.

Myrodes gigas, Haswell, P. L. S., N. S. Wales, Vol. IV. 1880, p. 52, pl. v. fig. 5.

Myrodes eudactylus, Miers, 'Challenger' Brachyura p. 298: A. Ortmann, Zool. Jahrbuch., Syst. etc., VI. 1892, p. 576.

Carapace convex, longitudinally-ovoidal, with a carina—indistinct or obsolete in large adults—down the middle line; its surface generally smooth to the naked eye in large adults, but with numerous scattered bead-like granules in the young; its short posterior margin with a setaloid tooth at either end, and overhung in the middle line by a horizontal recurved spine; its lateral margins defined by a finely-beaded line.

The front is truncated and broadly bidentate, and the subhepatic region forms an independent facet, the raised pterygostomian edge of which ends posteriorly at a sharp tooth. Between the hepatic and branchial regions, on either side, is a shallow notch which is in continuity with a longitudinal groove in the side wall of the carapace.

The external maxillipeds are closely scabrous, especially distally.

The chelipeds are hardly $1\frac{5}{9}$ times the length of the carapace (without spine), and though generally smooth to the naked eye in the adult, have, in the young, the base of the arm, the outer edge of the wrist, hand and dactylus, and the inner two-thirds of the upper surface of the hand finely but distinctly granular: the arm is subtrigonal, and the hand subglobular but much smaller at the distal end than at the base: the fingers are slender and hook-like, much longer than the hand, finely granular, of almost the same diameter from the base to the hook-like tip, and are armed on the opposed edges with fine teeth with larger lancet-like teeth at distant intervals: the movable finger opens in a horizontal plane, but it moves through an arc of between 120° and 130°.

The legs are slender, and have both edges of the dactylus, and the dorsad edge of the propodite, fringed with close shortish stiffish hairs.

The abdomen of the male is four-jointed, the penultimate piece carrying a subterminal denticle: that of the female consists of 5 separate pieces.

Numerous specimens—adults and young of both sexes—from the Andamans.

Iphiculus, Adams and White.

Iphiculus, Adams and White, 'Samarang' Crustacea p. 57.

The whole body and its appendages, except only the fingers, covered with a dense spongy or woolly tomentum, beneath which, when denuded, the surface is rough granulous or pustulous, and beneath which the regions of the carapace—especially the cardiac and intestinal—are demarcated by grooves.

Carapace transversely somewhat oval, its lateral margins spinate.

The front is narrow and is sunk behind the level of the edge of the buccal cavern, and appears still more sunken because the hepatic and sub-hepatic regions are puffed out beyond it at the sides and in front.

The orbits are obliquely elongate and completely conceal the eyes, in the denuded carapace three sutures can be made out in the emarginate roof. There is a gap at the inner canthus in which stands the basal joint of the antenna, the largish flagellum of which appears to be inside the orbit. The antennules fold very obliquely. There is a broad vertical space between the lower edge of the orbit and the edge of the buccal cavern.

The buccal cavern is triangular: the merus of the external maxillipeds is half the length of the ischium measured along the inner border.

The chelipeds are about $1\frac{3}{5}$ the length of the carapace: the hand is short and globular: the fingers are slender and hook-like, much longer than the hand, and open in a somewhat oblique plane, the tip of the mobile finger moving easily through an arc of 120°. Legs rather large.

Abdomen of male with the 3rd and 4th segments fused: that of the female with all the segments distinct.

81. *Iphiculus spongiosus*, Adams and White.

Iphiculus spongiosus, Adams and White, 'Samarang' Crustacea, p. 57, pl. xiii. fig. 5: Stimpson, Proc. Acad. Nat. Sci. Philad. 1858, p. 161: Miers, Zool. H. M. S. 'Alert' pp. 185, 253.

Carapace convex, transversely ovoidal, much broader than long, the surface when denuded of its woolly covering granulous with numerous larger pustulous tubercles, and showing the cardiac and intestinal regions tumid and very well demarcated by grooves. On the antero-lateral margins are four large coarse close spines, increasing in size from before backwards; on the postero-lateral margins are two coarse dentiform tubercles separated by a wide interval.

The broad front is coarsely bilobed: there is a strong tooth at the outer angle of the orbit against which the retracted eye impinges, and another at the outer angle of the buccal cavern, on either side—only visible on the denuded carapace.

Except that they are densely tomentose up to the base of the fingers, and that the fingers are even more slender, the chelipeds are a repetition of those of *Myrodes*.

In the Indian Museum are numerous specimens, from the Andamans, the Mekrán Coast, and from the Bay of Bengal up to 65 fms.

Pariphiculus, n. gen.

Closely allied to *Iphiculus*, but differing in several important characters and in the whole form of the carapace. The appendages are as densely tomentose as in *Iphiculus*, but the carapace is covered with a finer and sparser tomentum which does not quite conceal the texture of the surface.

The carapace is circular and globular, with its margins coarsely [illegible]inate, and its surface vesiculous: the intestinal region is very distinctly isolated, but the other regions are almost lost in the general convexity of the carapace.

The front is narrow: in one species it projects as a distinct snout, in the other the angle of the afferent branchial canal can be seen beyond it in a dorsal view, but the whole mouth can never be seen beyond it as it can in *Iphiculus*.

The orbits are obliquely elongate and completely conceal the eyes: two distinct fissures are plainly visible in the emarginate roof besides a fissure in the lower part, and there is a gap at the inner canthus where the basal joint of the antenna—the flagellum of which is large—stands. The antennules fold very obliquely. There is a space of varying width between the edge of the orbit and the edge of the buccal cavern.

The buccal cavern is rather elongate triangular, and the merus of the external maxillipeds is half the length of the ischium measured along the inner border.

The chelipeds are from $1\frac{1}{4}$ to $1\frac{2}{3}$ times the length of the carapace: the hand is short, cylindrical with the base inflated, or is subglobular, but not nearly so swollen as in *Iphiculus* or *Myrodes*: the fingers are slender, much longer than the hand and somewhat hooked; they open in an obliquely vertical plane, and the tip of the mobile finger moves through the usual arc of about 75°. The legs are moderately stout. The abdomen of the male has the 3rd, 4th and 5th segments fused: that of the female has all the segments distinct.

Key to the Indian species of Pariphiculus.

I. Carapace a little broader than long: front not at all prominent: a spiniform tubercle on the cardiac region between one on either branchial region: chelipeds about $1\frac{2}{3}$ the length of the carapace ..... *P. coronatus.*

II. Carapace longer than broad: front markedly prominent: cardiac region and branchial regions immediately on either side of it unarmed: chelipeds about $1\frac{1}{4}$ the length of the carapace ..... *P. rostratus.*

82. *Pariphiculus coronatus*, Alcock & Anderson.

Randallia coronata, Alcock & Anderson, J. A. S. B., Vol. LXIII. pt. 2, 1894, p. 177.

Pariphiculus coronatus, Alcock & Anderson, Ill. Zool. 'Investigator,' Cri[illegible] pl. xxiv. fig. 2 (*in the press*).

Carapace globular, just broader than long, its surface close[illegible] covered with large vesiculous granules beneath a dense fine-textured pubescence: the intestinal region forms an independent circular swelling, bounded by a deepish groove, and surmounted by two spiniform tubercles, one behind the other: the gastric region is partly defined anteriorly by two creases, and the cardiac region is partly defined posteriorly by two grooves, and a narrow and indistinct groove separates the hepatic from the branchial region on either side: on either lateral margin are 5 spiniform tubercles, not including the dentiform prolongation of the outer angle of the buccal cavern, and at either end of the short posterior margin is a dentiform tubercle: 3 similar tubercles occur, one in the middle of the cardiac region and one on either side of it on the after part of the branchial regions—these three, along with the last on the lateral borders and the two on the posterior margin, forming a ring round the tumid intestinal region: the side-wall of the carapace is grooved longitudinally just above the epimeral edge.

The front is bidentate, its tips just projecting beyond the level of the buccal cavern.

The chelipeds in the female (male unknown) are $1\frac{2}{3}$ times the length of the carapace: the hand is inflated, cylindrical, and about $\frac{3}{4}$ the length of the fingers: the fingers are very slender, almost hairless, hooked at tip, finely denticulate with a few slightly larger denticles at distant intervals, and they open in an obliquely vertical plane.

Length of carapace of female (apparently adult) 16 millim., breadth 17 millim.

Loc. Bay of Bengal, off Coromandel coast, 112 fms.

83. *Pariphiculus rostratus*, n. sp. Plate VIII. fig. 2.

Carapace globular, a little longer than broad, with the front prominent and projecting in the form of a snout; its surface covered with very small, distant vesicles, beneath a dense fine pubescence: the intestinal region exactly resembles that of *P. coronatus*, and the gastric and cardiac regions are incompletely defined in the same way: on either lateral border are six sharpish tubercles, the first of which—situated about the middle of the pterygostomian ridge—and the third—situated near the anterior limit of the branchial region—are enlarged and spiniform: at either end of the short posterior margin is a dentiform tubercle: the side-wall of the carapace is traversed longitudinally by two grooves, one just above the epimeral edge, the other just below the lateral margin, and the surface between the grooves is tumid.

The very prominent front is sharply bidentate, the tips of the teeth being somewhat sharpened and thickened: the space between the edge of the orbit and the edge of the buccal cavern is much reduced.

The chelipeds are similar in both sexes and are about $1\frac{1}{2}$ times the length of the carapace, sometimes less than this: the hand is subglobular but not so swollen as in *Iphiculus* and is only about half the length of the fingers: the fingers are slender, hooked at tip, and finely denticulate, the denticulations, however, being obscured by a thick growth of short colourless hairs; they open in an obliquely vertical plane.

The largest specimen—an apparently adult female—has the carapace 32 millim. long and 27 millim. broad.

Loc. Off Malabar coast 28 to 45 fms., off Coromandel coast 25 to 30 fms., on soft muddy bottoms.

Nursilia, Bell.

Nursilia, Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 308, and Cat. Leucos. Brit. Mus. p. 20.

Carapace broader than long, bluntly polygonal, with the lateral borders sharp, thin, laminar, somewhat turned up, and with the surface broken by some definitely-placed ridges and distant spines. Front prominent, bidentate: orbits with two distinct sutures, their lower edge not distinct from the edge of the buccal cavern. Antennæ with longish flagella, their basal joint occupying the very much restricted space between the eye and the obliquely folding antennules.

Buccal cavern elongate-oval, the hairy tips of the external maxillipeds projecting beyond the edge of the buccal cavern: the merus much hidden in hair (more so than in *Lea*) and considerably less than half the length of the ischium.

Chelipeds somewhat slender, about half again as long as the carapace: hands swollen, especially towards the inner side and the base: fingers much longer than the hand, slender, hook-like; the tip of the dactylus moves through an arc of more than 130°.

In the abdomen of both sexes all but the first and last segments are intimately fused.

As the name indicates, this form has the carapace and front shaped very much as in *Nursia*, though approaching *Ilia*—or rather *Myrodes*—in the form of the chelipeds and mouth-parts.

84. *Nursilia dentata*, Bell.

Nursilia dentata, Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 309, pl. xxxiv. fig. 6, and Cat. Leucos. Brit. Mus. p. 20: Stimpson, Proc. Acad. Nat. Sci. Philad. 1858, p. 161: Haswell, P. L. S., N. S. Wales, IV. 1879, pp. 56, 404, and Cat. Austral. Crust. p. 128: Miers, Zool. H. M. S. 'Alert,' pp. 158, 253, 518, 548: R. I. Pocock: Ann. Mag. Nat. Hist. (6) V. 1890, p. 73.

Carapace broader than long, distinctly polygonal in the male but with the angles more rounded off in the female. The lateral margins are thin, sharp, slightly turned up, and sinuous (laciniate in the young): the ends of the short posterior margin are dentiform in the male, but indistinctly so in the female.

The carapace is traversed by a longitudinal carina, on the posterior half of which are 3 large vertical spines with the tips often curved forwards: an oblique ridge ending in a sharpish tooth separates the gastric from the hepatic region on either side: another oblique ridge, with a sharpish tooth at each end, runs across the after part of the branchial region to the postero-lateral margin on either side: there are always one or two teeth on either side of the longitudinal carina in the gastro-cardiac region. In the young the oblique gastro-hepatic ridge is connected by a longitudinal ridge with the oblique branchial ridge, the branchial ridges more or less meet across the carapace, and the spines are more numerous and more distinct.

The chelipeds have the arm very sharply trigonal: the fingers are slender and hook-like and are twice the length of the much swollen hand: they are finely denticulate with enlarged teeth at distant intervals, and as in *Myrodes*, the dactylus is remarkable for the great range of its mobility.

Adult females have the carapace about 9 millim. long and about 10·5 millim. broad: adult males are a good deal smaller.

A large number of specimens are in the Indian Museum Collection, from the Andamans, from off Ceylon at 32 to 34 fms., from the Madras coast in the neighbourhood of Palk Straits, from off the Malabar coast at 26 to 31 fms., and from off the Maldives at 20 to 30 fms.

85. *Nursilia tonsor*, n. sp.

This species is distinguished (1) by its smaller size,—ovigerous females having the carapace only 7 millim. long and 7·25 millim. broad, and adult males being a good deal smaller: (2) the gastro-cardiac region is defined posteriorly on either side by an oblique dentigerous ridge, which meets the oblique ridge that traverses either branchial region at an obtuse angle—the whole forming a sharply defined W reversed: (3) the hand is less swollen and the outer edge of the fingers is cristiform—the cristiform lamina being of extreme thinness and delicacy: (4) the serrations of the lateral margins and the ridges and spines of the carapace are all much sharper-cut.

Loc. Andaman Sea up to 40 fms., off Ceylon 34 fms.

Heterolithadia, Wood-Mason, (name only).

Carapace broader than long, transversely somewhat oval, its surface nodular, coarsely granular, convex except the hepatic regions which are hollowed; all the regions well delimited by grooves.

Front distinct, moderately prominent, broadly bidentate. Orbits with [illegible] indistinct sutures in the outer wall, and very little space between their lower edge and the edge of the buccal cavern. The antennules fold obliquely. The antennæ have a short flagellum and occupy the much restricted space between the antennules and the eye.

Buccal cavern triangular with the sides curved somewhat as in *Nursilia*: merus of external maxillipeds half the length of the ischium measured along the inner border.

Chelipeds stout, about half again as long as the carapace: hand very short, swollen, half the length of the fingers: fingers slender, of nearly the same diameter from base to near the hook-like tip, opening in a nearly vertical plane, the tip of the dactylus being movable through an arc of about 75°.

The abdomen of the male has the 3rd–6th segments fused.

Heterolithadia has a strong external resemblance to *Lithadia*, but has the *Ilia* fingers and external maxillipeds. Its nearest ally is *Nursilia*.

86. *Heterolithadia fallax*, (Henderson).

Ebalia fallax, J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 402, pl. xxxviii. figs. 4–6.

The posterior half of the carapace is a segment of a broad ellipse, the anterior half is broadly triangular.

The carapace is broader than long, and its surface, like the whole under surface of the body and the whole surface of the arms, is closely covered with large flat-topped pearly granules, except in the deeply-excavated hepatic areas where the granules are small and rather distant.

The regions are well demarcated by grooves, and (except the hepatic regions, which are markedly excavated inside of the rather prominent antero-lateral borders) are tumid. A broadish median ridge extends from the front to near the middle of the cardiac region, where it ends in a stout tubercle, and in continuation of the same line, on the intestinal region, are two similar tubercles: there are also four similar tubercles on the gastric region,—two on either side of the median ridge.

The front is broadly bidentate: behind it the pterygostomian ridge, which ends at a coarse denticle, can be seen in front of the antero-lateral margin in a dorsal view: the hepatic portion of the antero-lateral margin is thickened and ends abruptly at a very prominent granular swelling; behind this the lateral margin is most elegantly curved. The posterior margin is rather prominent and is bilobed, the apex of one of the intestinal tubercles being seen between the lobes in a dorsal view.

The chelipeds are rather more than half again as long as the carapace: the arm is coarsely granular like the carapace, the wrist and hand are granular under the lens: the hand has the outer edge somewhat thickened and raised and the inner side swollen: the fingers are hooked, are twice the length of the hand, and open in a nearly vertical plane; their opposed edges are finely denticulate with larger denticles at distant intervals and with a good many hairs.

The abdomen of the male has a tooth at the penultimate segment.

In the Indian Museum is a specimen from the Andamans and one from the Orissa Coast.

Arcania, Leach.

Arcania and *Iphis*, Leach, Zool. Miscell. III. p. 19.
Arcania and *Iphis*, Milne Edwards, Hist. Nat. Crust. II. 133, 138.
Arcania and *Iphis*, Bell, Trans. Linn. Soc., Vol. XXI. 1859, pp. 309, 311, 312.
Arcania, A. Milne Edwards, Nouv. Archiv. du Mus. X. 1874, p. 48.
Arcania, Miers, 'Challenger' Brachyura, p. 299.

Carapace globular, ovoid, or rhomboidal, with the lateral and posterior margins armed with definitely-situated large spines (except in *Arcania gracilipes* Bell, in which large tubercles take the place of spines, and *A. orientalis* Miers, in which spines are absent), and with

the surface, usually, crisply granular, spiny, or tubercular, but sometimes almost smooth to the naked eye.

Front bilobed and prominent, or if not prominent then distinctly pinched off from the gastric and hepatic regions.

Orbits with three sutures in the upper and outer wall, with a cleft in the inner wall, and usually with the inner canthus prolonged into a spine: eyes small.

The antennules fold very obliquely. The antennæ are small, and their basal joint loosely fills the cleft in the inner wall of the orbit.

The buccal cavern is elongate-triangular: the external maxillipeds have the ischium from $2\frac{1}{2}$ to 3 times the length of the bluntly-triangular merus: their exognath is narrow, with the outer border nearly straight.

The chelipeds are very slender and are usually about twice the length of the carapace—either a little more or a little less; their joints cylindrical, the palm alone being a little swollen at base: the fingers long and very slender, their opposed edges being finely ctenoid, with larger denticles at long intervals; they open in a nearly vertical plane.

The legs are slender.

The abdomen of the male usually consists of 5 pieces, female of 4 or 5.

Key to the Indian species of Arcania.

I. Margins of the carapace with spines, hepatic regions dorsally convex: abdomen of adult male consisting of 5 pieces:—

1. Fingers longer than the hand: surface of carapace either smooth (microscopically granular), or with small granules all of one size:—

i. Lateral median epibranchial spines nearly straight, far longer than any of the other spines, their length often being equal to the breadth of the carapace:—

a. Seven spines on margins of carapace,—3 very large, 4 smaller..... *A. septemspinosa, (Fabr.)*

b. Five spines on margins of carapace,—3 very large, 2 smaller ..... *A. quinquespinosa.*

ii. Median lateral epibranchial spines claw-like, not longer than the spines on the posterior part of the carapace, their length being not a quarter the breadth of the carapace:—

a. Nine spines on margins of carapace,—3 large and 6 smaller: regions of carapace very ill-defined *A. novemspinosa.*

b. Eleven spines on margins of carapace,—none of them very large: regions of carapace well defined ..... *A. undecimspin*

2. Fingers shorter than the hand: surface of carapace covered with spines, or with granules and larger tubercles:—

i. Carapace longer than broad: chelipeds less than twice the length of the carapace:—

a. Carapace densely spiny: eleven large marginal spines..... *A. erinaceus.*

b. Carapace with granules and claviform tubercles: eleven marginal prominences, of which only 4 or 5 can be called spines *A. tuberculata.*

ii. Carapace broader than long: chelipeds a little over twice the length of the carapace: carapace with granules and large tubercles ..... *A. pulcherrima.* (=*A. septemspinosa*, Bell.)

II. Margins of carapace with large tubercles in place of spines, hepatic regions dorsally sunken and flat: abdomen of adult male consisting of 4 pieces, and the second piece sunk almost out of sight ..... *A. gracilipes.*

ii. Median lateral epibranchial spines claw-like, not longer than the spines on the posterior part of the carapace, their length being not a quarter the breadth of the carapace:—

a. Nine spines on margins of carapace,—3 large and 6 smaller: regions of carapace very ill-defined *A. novemspinosa.*

b. Eleven spines on margins of carapace,—none of them very large: regions of carapace well defined ..... *A. undecimspin*

2. Fingers shorter than the hand: surface of carapace covered with spines, or with granules and larger tubercles:—

i. Carapace longer than broad: chelipeds less than twice the length of the carapace:—

a. Carapace densely spiny: eleven large marginal spines ..... *A. erinaceus.*

b. Carapace with granules and claviform tubercles: eleven marginal prominences, of which only 4 or 5 can be called spines *A. tuberculata.*

ii. Carapace broader than long: chelipeds a little over twice the length of the carapace: carapace with granules and large tubercles ..... *A. pulcherrima.* (=*A. septemspinosa*, Bell.)

II. Margins of carapace with large tubercles in place of spines, hepatic regions dorsally sunken and flat: abdomen of adult male consisting of 4 pieces, and the second piece sunk almost out of sight ..... *A. gracilipes.*

87. *Arcania septemspinosa*, (Fabr.), Leach, Edw.

Cancer septemspinosus, Fabr., Mant. Ins. I. 325, and Ent. Syst., II. 463: Herbst, Krabben, I. ii. 259, pl. xx. fig. 112.

Leucosia septemspinosa, Fabr., Ent. Syst. Suppl., p. 351: Bosc, Hist. Nat. Crust. I. 237: Latreille, Hist. Nat. Crust. et Ins. VI. 119.

Iphis septemspinosa, Leach, Zool. Miscell. III. p. 25: Desmarest, Consid. Gen. Crust., p. 170: Milne Edwards in Cuvier Règne Animal, Crust., pl. xxv. fig. 4, and Hist. Nat. Crust. II. 139: Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 311, and Cat. Leucos. Brit. Mus. p. 22: Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 161: Miers, Ann. Mag. Nat. Hist. (5) V. 1880, p. 317: Sluiter, Tijdschr. Nederl. Ind. XL. 1881, p. 159, fig. 1.

Arcania septemspinosa, Miers, 'Challenger' Brachyura, p. 300: Henderson, Trans. Linn. Soc. (2) V. 1893, p. 403.

Carapace pentagonoidal, the anterior blunt angle of the rhomb formed by the bilobed, slightly projecting, front, and the lateral and posterior angles all produced to form huge slightly-curved spines, the lateral pair being the longest. Besides these, there are four other smaller spines on the posterior part of the carapace, namely one on either side at the level of, and one on either side behind, the large posterior spine. The surface of the carapace is [illegible] in irregular patches, the granules being most distinct [illegible] spines. The hepatic regions are separated from the branchial regions on either side by a transverse crease or pucker, but otherwise the regions of the carapace are not clearly demarcated. The summit of the (antero-lateral) convexity of the hepatic region is, usually, faintly acuminate. The chelipeds are symmetrical and slender, and are more than twice the length of the carapace (posterior spine excluded) in both sexes: the long cylindrical arms are very finely and uniformly granular: the almost filiform fingers are a little longer than the slender tapering hand. The true legs are slender and smooth, and the dactyli are thickly fringed with rather long hair: the first pair exceed the arm in length by their dactylus and rather more than half their propodite.

Colours streaky and patchy red.

The carapace of an average adult of either sex is about 20 millim. long, and about 20 millim. broad.

Localities: Andamans, Arakan, Gangetic and Máhánaddi Deltas, Madras coast, Persian Gulf. It is commonest on muddy bottoms at depths of 15–25 fathoms.

Of 92 specimens in the Indian Museum the lateral spines are found to vary a good deal in length: they are usually, in adults, about as long as the arm, and sometimes a good deal longer; but in the young they are usually much shorter than the arm.

88. *Arcania quinquespinosa*, Wood-Mason MS. name, Alcock and Anderson.

Arcania quinquespinosa, Alcock and Anderson, J. A. S. B., Vol. LXIII. pt. 2, 1894, p. 206, and Ill. Zool. R. I. M. S. "Investigator," Crust., pl. xxiv. fig. 6 (*in the press*).

? *Arcania septemspinosa*, var. *gracilis*, Henderson, Trans. Linn. Soc. Zool. (2) V. 1893, pp. 403, 404.

Differs from *A. septemspinosa* (Fabr.) only in the following particulars:—

1. It is a much smaller species, the carapace of the adult being less than 12 millim. long, and less than 14 millim. broad.

2. The outline of the carapace is broadly conical, owing to the bulging, obliquely backwards, of the branchial regions.

3. The front is sharply bidentate, instead of bilobular.

4. The large spines of the margins of the carapace are relatively smaller, and the spine on the postero-lateral border, on either side, either altogether wanting or is represented only by a granule.

5. The regions of the carapace, with the single exception of the boundary between the gastric and cardiac regions, are distinctly delimited by fine grooves.

6. The fingers are nearly twice the length of the hand.

7. The cardiac region in life, and even in fresh spirit specimens, shows as a large bright red milk-white-edged ocellus. The rest of the carapace is delicate pink in life.

In the Indian Museum collection are 27 specimens—chiefly adult males and egg-laden females—from the coasts of Arakan, Ganjam, Vizagapatam, Ceylon, and the Persian Gulf.

89. *Arcania undecimspinosa*, De Haan.

Arcania undecimspinosa, De Haan, Faun. Japon. Crust., p. 135, pl. xxxiii. fig. 8: Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 309, and Cat. Leucos. Brit. Mus. p. 21: Miers, Zool. H. M. S. 'Alert' pp. 518, 548: (?) A. O. Walker, Journ. Linn. Soc., Zool., Vol. XX. 1890, p. 111: Ortmann, Zool. Jahrbüch., Syst. etc., VI. 1892, p. 577: J. R. Henderson, Trans. Linn. Soc., Zool. (2) V. 1893, p. 404.

Arcania granulosa, Miers, Trans. Linn. Soc., Zool., (2) I. 1875–79, p. 240, pl. xxx[illegible] fig. 29 (*fide* Miers, P. Z. S. 1879, p. 44): Haswell, P. L. S., N. S. Wales, IV. p. 58, and Cat. Austral. Crust. p. 131.

? ? *Arcania novemspinosa* var. *aspera*, Miers, Ann. Mag. Nat. Hist. (5) V[illegible] p. 317.

Carapace longitudinally ovoid in the male, nearly globular in the adult female, uniformly covered either with rather distant miliary granules or with close-set short prickles, amid which the fine smooth grooves that define the regions of the carapace are very distinct,—the

only one wanting being that between the gastric and cardiac regions. The margins of the carapace are armed with eleven spines of moderate size, situated as follows:—one, pointing obliquely forwards, in either antero-lateral border, at the culmination of the sub-hepatic region; one on either side just behind the groove that separates the hepatic from the branchial region; one, claw-like, at either (median) lateral epibranchial angle; one, pointing obliquely backwards, just abaft the middle of either postero-lateral border; one at either end of the posterior border; and one, pointing straight backwards, in the middle of the intestinal region. The front ends in two sharp-cut laminar teeth.

The slender chelipeds, in the adult male, are just over twice the length of the carapace (spine excluded); the arm is usually, but not always, covered in all or the greater part of its extent with miliary granules similar to those on the carapace; the almost filiform fingers are as long as the hand and rather more than half the wrist combined. The true legs are slender and smooth; their dactyli are scantily fringed with hair in their distal half: the first pair exceed the arm in length by their last two joints.

The length of the carapace of the adult male is about 16 millim., and the breadth about 14 millim.; of an adult female the dimensions are 18 millim. by 16 millim.

In the Indian Museum collection are young and adults of both sexes, from the Andamans and from the Madras side of Palk Straits.

90. *Arcania novemspinosa*, Adams & White.

Iphis novemspinosa, Adams & White, 'Samarang' Crust. p. 56, pl. xiii. fig. 1.
Arcania novemspinosa, Bell, Trans. Linn. Soc., Vol. XXI. 1855, p. 309, and Cat. Pucos. Brit. Mus. p. 21: Haswell, P. L. S., N. S. Wales, IV. 1879, p. 58, and Cat. Austral. Crust. p. 131: de Man, Archiv für Naturges. LIII. 1887, i. 392.

Differs from *A. undecimspinosa*, De Haan, only in the following characters:—

1. The surface of the carapace, in the adult, is almost smooth—at any rate is without isolated miliary granules or prickles.

2. The marginal spines are very much larger, with the single exception of the spine on either side situated at the junction of the sub-hepatic and branchial regions, which is a mere denticle or granule.

3. With the exception of a faint groove between the hepatic and branchial regions, and of a still more indistinct break of level between the branchial and intestinal regions on either side, the regions of the carapace are not defined.

4. The front is more prominent.

5. The chelipeds in the adult male are $2\frac{1}{2}$ times the length of the carapace, and the arm is only very finely granular, and at the base only.

6. The carapace in the adult male is a little more elongate.

Two adult males and a half-grown female from the Andamans are in the Indian Museum collection.

The differences above noted are plain enough in extreme forms, but their *sum* is not constant, as it is in the case of the differences between *A. 7-spinosa* and *A. 5-spinosa*, so that it seems doubtful whether *A. 9-spinosa* is really distinct from *A. 11-spinosa*.

91. *Arcania erinaceus*, (Fabr.)

Cancer erinaceus, Fabricius, Mantiss. Insect. I. 325, and Ent. Syst. II. 460: Herbst, Krabben, I. ii. 258, pl. xx. fig. 111.

Leucosia erinaceus, Fabr., Ent. Syst. Suppl. p. 352: Latr., Hist. Nat. Crust. et Ins. VI. 119.

Arcania erinaceus, Leach. Zool. Miscell. III. p. 24: Desmarest, Consid. Gen. Crust., p. 170, pl. xxviii. fig. 1: Milne Edwards in Cuvier Règne An., Crust., pl. xxiv. fig. 2, and Hist. Nat. Crust. II. 134: Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 309, and Cat. Leucos. Brit. Mus. p. 20.

Carapace globular, everywhere thickly covered with thorns and spine-like granules, amid which the smooth shallow sulci that define the branchial and hepatic regions are visible. Round the margin of the carapace are eleven large spines, similar in position to but larger in size than those of *A. undecimspinosa*, and covered with secondary spinelets. The ventral surface of the external maxillipeds, the thoracic sterna, and the abdominal terga are all also sharply granular. The front ends in two prominent sharp teeth.

The chelipeds and the true legs have their meropodites covered with thorns, and the other joints—except the dactyli, the distal half of the hand, and the fingers—sharply granular. The chelipeds, even in the adult male, are only about $1\frac{2}{3}$ times the length of the carapace (spine excluded), and the fingers are a little shorter than the palm. The first pair of true legs exceed the arms in length by their last 2 joints.

The carapace of the adult male is 16 millim. long and 14 millim. broad; that of the adult female is 21 millim. long and 19 millim. broad.

Loc. East coast, from the Hooghly to Pondicherry. In the Indian Museum collection are an adult male and a young and three females.

92. *Arcania tuberculata*, Bell.

Arcania tuberculata, Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 310, pl. xxxiv. fig. 8, and Cat. Leucos. Brit. Mus. p. 21.

? *Arcania lacrimana*, Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 310, pl. xxxiv.

fig. 10, and Cat. Leucos. Brit. Mus. p. 22: A. Milne Edwards, Nouv. Archiv. X. 1874, p. 48, pl. iii. fig. 4.

Carapace subglobular with an abruptly prominent bidentate front; closely covered everywhere, except in the anterior half of the front, with elongate granules some of which are large and claviform. The regions of the carapace are fairly well defined. In the position of the marginal spines of *A. undecimspinosa* there are 11 marginal prominences, of which only 4 or 5 in the posterior part of the carapace deserve the name of spines, the others being denticles not vastly larger than the enlarged claviform tubercles of the dorsal surface. These spines and denticles are covered with secondary granules in all or part of their extent.

The chelipeds, even in the adult male, are not $1\frac{2}{3}$ times the length of the carapace: the arms are elegantly granular; the wrists have a few granules and, on their outer surface, a tooth; the hands are nearly smooth: the fingers are little shorter than the hand.

The legs are slender and perfectly smooth.

The carapace of the adult male is 8 millim. long and 6 millim. broad, that of the adult female is 10 millim. long and 9 millim. broad.

Loc. Andamans and Maldives. In the Indian Museum collection are 11 specimens—young and adults of both sexes, including ovigerous females.

93. *Arcania pulcherrima*, Haswell.

Arcania septemspinosa, Bell *nec* Fabricius, Bell, Trans. Linn. Soc., Vol. XXI. 1855, p. 310, pl xxxiv. fig. 7, and Cat. Leucos. Brit. Mus. p. 21.

Arcania pulcherrima, Haswell, P. L. S., N. S. Wales, IV. 1879, p. 58, and Cat. Australl. Crust. p. 131: Miers, Zool. H. M. S. 'Alert' p. 253 (*ubi synon.*), and Challenger' Brachyura, p. 299 (footnote).

Carapace transversely ovoid, the front not breaking beyond the general outline: its surface everywhere covered with miliary granules, amid which stand out 13 or 14 granule-covered tubercles arranged in five incomplete longitudinal rows. Round the margin of the carapace are 10 granule-covered prominences, the first two of which on either side are mere denticles, while the remaining six are broad spines,—those at the lateral epibranchial angle on either side being much the longest. The regions of the carapace are ill defined. The inner canthus of the orbit is not prolonged into a spine as it is in all the preceding species.

The chelipeds are slender even for the genus, and in the adult male are just over twice the length of the carapace: the arm alone is elegantly granular: the fingers are a little shorter than the hand. The true legs are slender and perfectly smooth.

The carapace of the adult male is about 9 millim. long and 10 broad; that of the adult female is about 10 millim. long and 12 broad.

In the Indian Museum collection are 3 adult males and 2 adult females (one egg-laden) from off Ceylon, 34 fms.

94. *Arcania gracilipes*, Bell.

Arcania gracilipes, Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 310, and Cat. Leucos. Brit. Mus. p. 22: (Haswell. P. L. S., N. S. Wales, Vol. IV. 1879, p. 58?)

Carapace globular, just as broad as long, with the hepatic regions dorsally sunken and flat, so as to throw the front—which does not otherwise project much—into strong relief. The circumference, like the dorsum of the carapace, is armed not with spines, but with numerous large tubercles, which, like the general surface between them, are closely covered with flat discoidal granules: there are altogether about 24 of these large tubercles. The regions of the carapace are fairly well defined. The front ends in two blunt teeth: the inner canthus of the orbit is not prolonged into a spine.

The chelipeds, in the adult male, are slightly over twice the length of the carapace: the arm wrist and hand are elegantly granular like the carapace, the granulation in the case of the wrist and hand being microscopic: the fingers are just equal in length to the hand. The true legs are slender, and are microscopically granular like the hand: the first pair exceed the arm by less than the length of their dactylus.

The abdomen of the male consists of only four pieces, but the second piece is hidden almost out of sight. The carapace of the adult male is 7 millim. long and broad, that of the female 10 millim.

An adult male and 5 females—three ovigerous—from the Andamans.

Ixa, Leach.

Ixa, Leach, Trans. Linn. Soc. Vol. XI. 1815, p. 334.

Ixa, Milne Edwards, Hist. Nat. Crust. II. 134.

Ixa Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 311, and Cat. Leucos. Brit. Mus. p. 23.

Ixa, Miers, 'Challenger' Brachyura, p. 300.

Carapace broadly rhomboidal, produced on either side, at the junction of the antero-lateral and postero-lateral borders, into a great sausage-shaped spine of enormous size often with an abruptly acuminate point. The median regions of the carapace are separated on either side from the branchial, either by a broad trench which bifurcates anteriorly to isolate the hepatic regions from the branchial regions and from the front, or by a shallow groove which has similar relations. The

front is broadish and broadly bilobed, and does not project as far as the salient edges of the afferent branchial canal.

The orbits are deep and completely conceal the eyes, their outer wall is marked by 3 closed sutures, the surfaces between which are very convex; there is a widish gap at the inner canthus where the antennæ with their small flagellum are found. The antennules fold obliquely.

The external maxillipeds are sunk altogether or in part a good deal below the level of the sharp edges of the buccal cavern: they are longitudinally hollowed or grooved along their inner border, the merus more deeply than the ischium: the last-named joint is about twice the length of the narrowly-triangular merus.

The chelipeds are hardly stouter than the slender legs: and are markedly less than twice the length of the carapace: the distal half of the hand is almost filiform: the fingers are hardly half the length of the hand, are filiform, and open in a vertical plane.

The abdomen of the male has the 3rd 4th and 5th segments coalescent, that of the female has the 3rd–6th coalescent.

Key to the Indian species of Ixa.

I. Channels of carapace with very definite undermined edges: lateral processes with very abruptly acuminate tip: buccal frame distinctly triangular: exognaths with the surface concave and almost devoid of granules ..... *I. cylindrus.*

II. Channels of carapace simply grooves of no very remarkable appearance: lateral processes gradually tapering: buccal frame quadrangular: exognaths with the surface, in the basal three-fourths, tumid and covered with a mosaic of large granules ..... *I. inermis.*

95. *Ixa cylindrus*, (Fabr). Leach.

Cancer cylindrus, Fabricius, Mantiss. Ins. I. 323, and Ent. Syst. II. 456.

Cancer cylindricus, Herbst, Krabben, I. ii. 109, pl. ii. figs. 29–31.

Leucosia cylindrus, Fabricius, Ent. Syst. Suppl. p. 352: Bosc, Hist. Nat. Crust. I. 237: Latreille, Hist. Nat. Crust et. Ins. VI. 119.

Ixa cylindrus, Leach, Trans. Linn. Soc. Vol. XI. 1815, p. 338: Bell, Trans. Linn. Soc. Vol. XXI. 1855, p. 311 (*part*): Miers, 'Challenger' Brachyura, p. 301 and footnote.

Ixa canaliculata, Leach, Zool. Miscell. III. p. 26, pl. 129, fig. 1: Desmarest, Consid. Crust. p. 171, pl. xxviii. fig. 3: Milne Edwards, Cuvier, Règne An., Crust. pl. xxiv. fig. 1, and Hist. Nat. Crust. II. 135: A. Milne Edwards, in Maillard's l'Ile Réunion, Annexe F, p. 10.

Ixa megaspis, Adams and White, 'Samarang' Crust. p. 55, pl. xii. fig. 1: Miers, 'Challenger' Brachyura p. 301 (var. of *cylindrus*).

Carapace covered with vesiculous granules between which it is smooth and polished, and there are some largish smooth patches on the branchial regions: the channels of the carapace are deep and very well defined, with undermining edges, and have the floor more or less coated with pubescence: the huge cylindrical lateral processes are of almost the same diameter at their distal end as at their base, and their rounded end is abruptly surmounted by a spine: the distance between the edge of the raised plane of the gastric region and the free edge of the front is nearly equal to the anterior breadth of the front: the ends of the posterior margin are a little thickened and prominent, but are hardly dentiform even in the young.

The buccal cavern, though truncated, has a distinctly triangular shape: the exognath, when denuded of its distal pubescence, is found to have a smooth and longitudinally concave surface, the concavity falling along the inner border; and is seen to fall short of the raised anterior edge of the afferent branchial channel by a mean distance equal to nearly half the length of the merus: the raised outer border of the ischium has a narrow band of vesiculous granules, wanting at the basal end.

Four males and four females (three adult) are in the Indian Museum collection from the Andamans, and from the Madras coast in the neighbourhood of Palk Straits.

The largest female has the carapace 20 millim. long by 60 millim. in extreme breadth.

96. ? *Ixa inermis*, Leach.

Ixa inermis, Leach, Zool. Miscell. III. p. 26, pl. 129, fig. 2: Desmarest Consid. Crust. p. 171: Milne Edwards, Hist. Nat. Crust. II. 135: Haswell, P. L. S., N. S. Wales, IV. 1879, p. 59, and Cat. Austral. Crust. p. 132.

Carapace covered with vesiculous granules between which it is distinctly rough: the channels of the carapace are merely grooves, and are devoid of pubescence: the lateral processes are curved forwards, and taper gradually to a point: the distance between the gastric region (no part of which region has the form of a definitely raised plane) and the free edge of the sharply bidentate front is much less than the anterior breadth of the front: there is a large granular petaloid tubercle at either end of the posterior margin.

The buccal cavern is distinctly quadrangular, owing to the eversion of the outer lip of the afferent branchial channel: the exognath in its basal three-fourths is very strongly convex, the surface of the convexity

being covered with large polished pearly granules polygonal by mutual appression; its hairy distal end is suddenly depressed and does not fall much short of the front edge of the afferent branchial canal: the ischium is grooved along its inner border, but the rest of its surface is tumid and granular just like the exognath.

In the Indian Museum collection is a single female with the carapace 17 millim. long by 42 millim. in extreme breadth, from 23 fathoms off the Orissa Coast.

I believe that this species must be Leach's *Ixa inermis*, as it corresponds with Leach's figure. Unfortunately the mouth-parts are not figured or described. They are most characteristic in this species, which cannot be mistaken for *I. cylindrus*.

Family DORIPPIDÆ.

Dorippiens, Milne Edwards, Hist. Nat. Crust. II. 151 (*partim*).
Dorippidea, De Haan, Faun. Japon. Crust. p. 120.
Dorippidæ, Dana, U. S. Expl. Exp. Crust. pt. I. p. 390.
Dorippidæ, Miers, Challenger Brachyura, p. 326.

Carapace flat, generally broadest behind near the plane of the posterior border, hiding not much more than half of the abdominal terga, the first three of which are commonly visible in a dorsal view quite uncovered. The orbits are somewhat incomplete. The antennules are commonly too large to fold inside their fossettes. The antennæ are large. The mouth-parts somewhat resemble those of the *Calappidæ*: the buccal cavern is prolonged forwards to form an efferent branchial canal which is covered in below by a long lamellar process of the first maxillipeds. The first two pairs of true legs are remarkably long and stout: the last two pairs on the contrary are remarkably short and slender, and occupy a singular position in the dorsal plane of the body. The position of the afferent branchial canal varies. The vasa deferentia perforate the 5th thoracic sternum on either side. The branchiæ are less than nine in number on either side.

The Dorippidæ may be divided into two sections or subfamilies as follows:—

1. *Dorippinæ*, in which the external maxillipeds leave a considerable part of the buccal cavern uncovered, and in which the afferent branchial openings are situated either immediately or shortly in advance of the bases of the chelipeds.

2. *Tymolinæ*, in which the external maxillipeds almost completely cover the buccal cavern, and in which the afferent branchial openings may or may not be situated near the bases of the chelipeds.

The following is a list of known genera, Indian genera being printed in Roman type and genera known to me by autopsy being marked with an asterisk.

Family **Dorippidæ.**

Sub-family I. *Dorippinæ.*

*Dorippe.
*Ethusa (*Ethusina).
? *Cymopolus*, A. Milne Edwards, Bull. Mus. Comp. Zool. VIII. 1880, p. 27.

Sub-family II. *Tymolinæ.*

Tymolus, Stimpson, Proc. Acad. Nat. Sci. Philad., 1858, p. 163.
Cyclodorippe, A. Milne Edwards, Bull. Mus. Comp. Zool. VIII. 1880, p. 24.
Cymonomus, A. Milne Edwards, Bull. Mus. Comp. Zool. VIII. 1880, p. 26.
*Cymonomops.

Uncertain in position.

Corycodus, A. Milne Edwards, Bull. Mus. Comp. Zool. VIII. 1880, p. 23.

It appears to me to be quite possible that further investigation may discover *Cyclodorippe* to belong to Stimpson's genus *Tymolus*. Ortmann, (Zool. Jahrbucher, Syst. VI. 1892, p. 559) has already suspected the identity of these two genera.

Cepheyra, Guèrin, which was included with the *Dorippidæ* by Milne Edwards, has by other authors been shown to belong to quite another section of the Brachyura; and I cannot think that *Cymopolia* either has any right to be classed with the *Oxystoma*. Previous authors also, such as Dana (U. S. Expl. Exped. Crust. pt. I. p. 403) and Miers ('Challenger' Brachyura p. 334) have suggested the advisability of removing *Cymopolia* from this group.

Key to the Indian Genera of Dorippidæ.

I. The external maxillipeds leave all the anterior part of the buccal cavern uncovered:—
  1. The anterior extremity of the buccal cavern passes between the antennules to or even beyond the tip of the front: the afferent branchial apertures are

situated in front of the bases of the chelipeds, a bridge of the carapace intervening ..... DORIPPE.

2. The anterior extremity of the buccal cavern either stops at, or does not reach as far as, the basal joint of the antennules: the afferent branchial openings are situated *immediately* in front of the bases of the chelipeds ..... ETHUSA.

II. The external maxillipeds are greatly elongate and do not leave any appreciable portion of the buccal cavern uncovered: the afferent branchial openings are not situated in front of the bases of the chelipeds ..... CYMONOMOPS.

Dorippe, Fabricius.

Dorippe, Fabricius, Ent. Syst. Suppl. p. 361.
Dorippe, Milne Edwards, Hist. Nat. Crust. II. 154.
Dorippe, Miers, Challenger Brachyura, p. 327.

Carapace very flat, truncate-triangular and broadest behind, covering little more than the first two thoracic sterna, its regions well defined, the hepatic region small.

The front consists of two flat triangular teeth: on either side of it, in the same plane, are (1) a hood-like fold covering the base of the long completely exposed geniculate eyestalks, and separated by a deep narrow fissure from (2) a long flat triangular tooth, formed by the prolongation of the antero-external angle of the carapace, and forming the outer angle of the orbit. The floor of the orbit is even more incomplete than the roof, and is formed almost entirely by the base of a great projecting spine at the inner canthus, but even this spine may be rudimentary. The antennules fold longitudinally, they are too large to fold into the fossettes. The antennæ also are rather large: the basal joint is wedged in between the front and the spine at the inner canthus of the orbit.

The buccal cavern is abruptly narrowed anteriorly and prolonged as a deep well defined canal to, or even slightly beyond, the front: the canal is closed in below by long stout foliaceous processes of the first maxillipeds. The external maxillipeds do not cover this canal: their flagellum or palp arises at the outer angle of the long narrow merus and is completely exposed in flexion. The afferent branchial orifices are oblique pocket-like slits in the pterygostomian region.

The chelipeds in the adult male are commonly unequal, having the hand of one side much enlarged and swollen.

The first and second pairs of true legs are long stout and compressed: the last two pairs on the other hand are short and rather slight; they arise much dorsad of the other legs, and are subchelate,—the four subchelæ being so disposed as to enable the animal to hold over its back—as in a loose frame—some sort of defensive or protective object, such as a lamellibranch shell or an inhabited worm-tube.

The abdomen of both sexes consists of seven distinct segments, the first two and most of the third terga being visible in a dorsal view.

Key to the Indian species of Dorippe.

I. The tips of the foliaceous processes that close the endostomial canal, but never the canal itself, may sometimes be seen between the frontal teeth in a dorsal view:—

1. The greatest length of the carapace is slightly, but distinctly, more than the greatest breadth:—

i. Carapace nodular and wrinkled: spine at the inner canthus of the orbit ponderous, curved, serrated along the under surface: fourth (last) pair of true legs less than half the length of the second (longest) pair ..... *D. dorsipes.*

ii. Carapace smooth: spine at inner canthus of orbit rudimentary: fourth pair of true legs more than half the length of the second..... *D. astuta.*

2. The greatest length of the carapace is less than the greatest breadth: spine at the inner canthus of the orbit long, slender, acute, straight: carapace smooth: fourth pair of legs from a little less than half to one-third the length of the second:—

i. Carapace and last two pairs of legs densely pubescent: both edges of merus and posterior edge of carpus and propodite of 1st and 2nd legs densely pubescent in the male ..... *D. facchino.*

ii. Carapace hardly pubescent: last two pairs of legs very slightly hairy: 1st and 2nd legs perfectly devoid of hair ..... *D. granulata.*

II. The roof of the endostomial canal projects considerably between the bases of the frontal teeth in a dorsal view: the greatest length of the carapace is hardly less than the greatest breadth: carapace smooth, it and all the appendages perfectly devoid of pubescence: spine at inner canthus of orbit rudimentary: last pair of legs much more than half the length of the second (longest) pair..... *D. polita.*

97. *Dorippe dorsipes*, (Linn.) Miers.

Cancer dorsipes, Linn. Mus. Lud. Ulr. p. 452, and Syst. Nat. ed. xii. I. ii. 1053 (*nec syn.*)

Cancer frascone, Herbst, Krabben, I. ii. 192, pl. xi. fig. 70.

Cancer quadridens, Fabricius, Ent. Syst. II. 464.

Dorippe quadridens, Fabricius, Ent. Syst. Suppl. p. 361: Bosc, Hist. Nat. Crust. I. 207: Latreille, Hist. Nat. Crust. et Ins. VI. 125, [and Encycl. pl. 306, fig. 1]: Desmarest, Consid. Crust. p. 135: De Haan, Faun. Japon. Crust. p. 121, pl. xxxi. fig. 3: Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 163: de Man, Journ. Linn. Soc., Zool., XXII. 1888, p. 206.

Dorippe quadridentata, Milne Edwards, Hist. Nat. Crust. II, 156: Hilgendorf, MB. AK. Berl. 1878, p. 812: E. Nauck, Zeits. Wiss. Zool. XXXIV. 1880, p. 49 (*gastric teeth*): Haswell, Cat. Austral. Crust. p. 137.

Dorippe dorsipes, Miers, Zool. H. M. S. 'Alert,' pp. 185, 257: de Man, Archiv. für Naturges. LIII. 1887, i. 393: [Cano, Boll. Soc. Nat. Napol. III, 1889, p. 254]: Ortmann, Zool. Jahrbuch., Syst., VI. 1892, p. 562: Henderson, Trans. Linn. Soc. Zool. (2) V. 1893, p. 404.

Dorippe atropos, Lamarck, Syst. Anim. sans. vert. p. 245 (1818).

Dorippe nodulosa, Lamarck, Syst. Anim. sans. vert. p. 245 (1818): Bosc, Hist. Nat. Crust. I. 208. pl. iv. fig. 2; Guérin, Icon. Règne Animal, pl. xiii. fig. 2.

Body and appendages (except the hands and fingers, and the propodites and dactyli of the 1st and 2nd true legs) rather thickly covered with hair.

Extreme length of carapace greater than extreme breadth. Surface of carapace wrinkled and uneven, with about a dozen nodules which are often granular; the regions well defined by grooves and puckers.

The spine at the outer angle of the orbit is long and acute, and usually projects well beyond the level of the frontal teeth: the spine at the inner canthus is huge, curved, serrated along the lower border,

and projects far beyond the frontal teeth: the hood-like fold, on either side of the front, that covers the base of the eyestalks, has its angles not pronounced.

The lateral margins of the carapace are denticulated up to a stoutish tooth near the middle of the branchial border.

The abdomen of the male has both on the second and on the third terga a transverse row of 3 tubercles, the middle one large rounded and polished, the lateral ones smaller and acute, and one stout tubercle in the middle line on the fourth tergum: in the female the third fourth and fifth terga are transversely carinate, the carinæ being denticulate, and one tooth on the third and 4th terga, in the middle line, being much enlarged; the second tergum is also transversely carinate, but bluntly and indistinctly.

The chelipeds of the adult male are asymmetrical, the hand of one side being greatly swollen and being a good deal broader than long: in both chelipeds the ischium merus and carpus have the outer surface covered with spinules and acute granules.

The second true leg is more than twice the length of the fourth, and nearly three times the length of the carapace: its carpus like that of the first is traversed longitudinally by two granular crests.

Large males have the carapace 36 millim. long, and 34 millim. in extreme breadth: ovigerous females have the carapace 25 millim. long by 24 millim. broad.

In the Indian Museum collection are very numerous specimens from Mergui, Andamans, East coast of India from Ganjam to Palk Straits, and Persian Gulf.

As Miers states, there can be little doubt that Linnæus' diagnosis (Mus. Lud. Ulr. p. 452) refers to this species. But De Haan long before (Faun. Japon. Crust. pp. 121, 139) had bespoken the identity of *D. dorsipes* and *D. quadridens* and had noticed the confusion by earlier authors of *Cancer dorsipes* of Linnæus with *Cancer dorsipes* of Fabricius.

98. *Dorippe facchino* (Herbst), De Haan.

Dorippe facchino, Herbst, Krabben, I. ii. 190, pl. xi. fig. 68: De Haan, Faun. Japon. Crust. p. 123: Stimpson, Proc. Acad. Nat. Sci. Philad. 1858, p. 163: Miers, 'Challenger' Brachyura, p. 328: Ortmann, Zool. Jahrbuch., Syst. VI. 1892, p. 561: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 405.

Dorippe sinica, Milne Edwards, Hist. Nat. Crust. II. 157, pl. xx. figs. 11–14: Dana, U. S. Expl. Exp. Crust. pt. I. p. 398: Miers, Ann. Mag. Nat. Hist. (5) V. 1880, p. 317: A. O. Walker, Journ. Linn. Soc., Zool., XX. 1886-90, p. 111.

The body and appendages though on the whole very hairy, are not quite so hairy as in *D. dorsipes*: the chelipeds have the hair confined almost entirely to their borders, especially the upper border; the 1st and 2nd pairs of legs are almost hairless in the female, and in the male have the hair confined to the anterior border of the merus and the posterior border of the merus carpus and propodite; and hair is absent from the convexities of the thoracic sterna.

Extreme length of carapace considerably less than extreme breadth.

The surface of the carapace, when denuded, is either perfectly smooth, or smooth in the middle and finely granular at the sides and in front: the regions are well defined by grooves.

The hood-like fold covering the base of the eyestalks, on either side of the front, has its inner or anterior angle dentiform: the spine at the external orbital angle is broad and suddenly acuminate, and projects to but not beyond the level of the frontal teeth: the spine at the inner canthus is slender, straight, and acute, and projects well beyond the frontal teeth.

The lateral borders of the carapace are sometimes granular, but never denticulate.

The abdomen of the male is unarmed: in the female the 3rd–5th terga are coarsely and bluntly carinate, the carinæ of the 4th and 5th being finely granular. The chelipeds when denuded have all their joints quite smooth: those of the adult male are asymmetrical just as in *D. dorsipes*.

The second true leg is much more than twice, often three times, the length of the fourth, and $2\frac{1}{2}$ to $2\frac{2}{3}$ times the length of the carapace: its carpus, like that of the first is bicarinate, the carinæ being granular under the lens but not to the naked eye.

Large males have the carapace 29 millim. long and 34 millim. in extreme breadth: ovigerous females have the carapace 20 millim. long by 24 millim. broad.

In the Indian Museum are very numerous specimens from the East coast from the mouth of the Hooghly to Madras, and a few from the Andamans. It is common on soft muddy bottoms, and I have rarely found it without a protective bivalve shell and sea-anemone.

99. ? *Dorippe granulata*, De Haan.

Dorippe granulata, De Haan, Fann. Japon. Crust. p. 122, pl. xxxi. fig. 2: Simpson Proc. Acad. Nat. Sci. Philad., 1858. p. 163: [Targioni-Tozzetti, Zool. Record, 1877, Crust. p. 19]: Ortmann Zool. Jahrbuch., Syst., VI. 1892, p. 561.

Almost exactly resembles *D. facchino* (Herbst), but has the carapace a little more granular and with scanty or obsolete pubescence.

There is almost no hair on the carapace,—none sufficient to conceal its grooving and texture: on the chelipeds there is, on the upper edge, extending along basal part of finger, a narrow fringe of hair, and on the lower edge a narrow fringe extending as far as the end of the merus: on the first two pairs of true legs there is no hair at all in either sex; and on the last two pairs of legs there is not very much hair.

The chelipeds of males that are as big as the largest ovigerous females are hardly asymmetrical.

Ovigerous females have the carapace 14 millim. long and 16 millim. in extreme breadth.

In the Indian Museum collection are 21 specimens from various stations along the shores of the Bay of Bengal from Mergui to Madras, one of these—the smallest and most immature of all—belongs to Dr. Anderson's Mergui collection and is referred to in Dr. de Man's report (J. L. S., Zool., Vol. XXII) as allied to *D. granulata*.

If they are not De Haan's species, they are a mere variety of *D. facchino*.

100. *Dorippe astuta*, Fabr.

Dorippe astuta, Fabricius, Ent. Syst. Suppl. p. 361.
Cancer astutus, Herbst, Krabben, III. iii. 45, pl. lv. fig. 6.
Dorippe astuta, Bosc, Hist. Nat. Crust. I. 208: Milne Edwards, Hist. Nat. Crust. II. 157: Haswell, Cat. Austral. Crust. p. 136: A. O. Walker, Journ. Linn. Soc., Zool., Vol. XX. 1886-90, p. 111: Ortmann, Zool. Jahrbuch., Syst., VI. 1892, p. 562: Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 405.

Body and appendages not pubescent as in *D. dorsipes* and *facchino*, but covered with short distant hairs that are not very plainly visible to the naked eye: the hairs on the edges of the propodites and dactyli of the first two pairs of true legs, however, form a long thick fringe.

The carapace is extremely flat, almost laminar; its surface is smooth, and the regions are defined by grooves.

Extreme length of carapace a little greater than extreme breadth.

The spine at the outer angle of the orbit does not nearly reach to the level of the tip of the frontal teeth: the part of the carapace that covers the base of the eyestalk is not hood-like, and has not its angles pronounced: the spine at the inner canthus of the orbit is quite rudimentary.

The lateral margins of the carapace are smooth. The abdomen of the male is unarmed, that of the female has the 3rd and 4th ter[illegible] bluntly and very inconspicuously carinate transversely.

The chelipeds are smooth when denuded; in the adult male they are asymmetrical just as in *D. dorsipes* and *facchino*.

The second true leg is three times as long as the carapace, and very much less than twice the length of the fourth leg.

The adult male has the carapace 12 millim. long and 11·5 millim. broad, as has also the apparently adult female.

In the Indian Museum collection are eight specimens from the Andamans, Mergui, Orissa coast, and Karáchi.

Several of them are encrusted with a small species of *Scalpellum*, and one carries across its back a large (inhabited) worm-tube, which is said by Dr. Giles to be a habit with this species.

101. *Dorippe polita*, Alcock and Anderson.

Dorippe polita, Alcock and Anderson, J. A. S. B., Vol. LXIII. 1894, pt. 2, p. 208, and Ill. Zool. 'Investigator,' Crustacea, pl. xxiv. fig. 4 (*in the press*).

General surface of the body and appendages smooth hard polished and free of hairs: there are a few scanty hairs on the edges only of some of the joints of the chelipeds and external maxillipeds.

The extreme length of the carapace is a very little less than the extreme breadth: the grooves that define the regions are shallow and not very conspicuous. The end of the endostomial channel projects between, and a little beyond the tips of the frontal teeth; and has its free edge emarginate, so that the front appears to consist of four sharp lobes, the median two of which are on a lower level than the other two.

The spine at the outer angle of the orbit is broadly triangular, its tip scarcely surpasses the level of the tips of the frontal teeth: the spine at the inner canthus is blunt and very small and inconspicuous: the portion of the carapace that covers the base of the eyestalk is, as in *D. astuta*, in simple continuity with the side of the front.

The abdominal terga of the female are smooth and polished.

The second pair of true legs are about $2\frac{1}{3}$ times the length of the carapace and are very much less than twice the length of the fourth pair; their carpopodites, like those of the first pair, are faintly bicarinate. The pleura covering the bases of the last two pairs of legs are singularly large.

The larger of two ovigerous females in the Indian Museum collection has the carapace 11·5 millim. long and 12 millim. in extreme breadth.

Ethusa, Roux.

Ethusa, Roux, Crust. de la Méditerranée, pl. xviii. and text relating thereto.

Ethusa, Milne Edwards, Hist. Nat. Crust. II. 161.

Ethusina, S. I. Smith, 'Albatross' Crustacea, 1883, in Ann. Rep. U. S. Comm. Fish, &c., 1882 (1884).

Ethusa, Miers, 'Challenger' Brachyura, pp. 328, 331.

Carapace shaped much as in *Dorippe*. The front consists of two laminar teeth each of which again is bifid at tip: on either side of the front, and separated from it by a deep cleft, is a long flat tooth or spine formed by the prolongation of the antero-external angle of the carapace, and forming the outer angle of the orbit. There is practically no orbital floor. The antennules fold obliquely: they are large, but fold fairly well into their fossæ. The antennæ have a long flagellum: their basal joint is inserted between the eyestalk and the basal antennulary joint, but on a slightly lower level.

The buccal cavern is elongate-triangular and does not extend to the front: the external maxillipeds cover only its basal three-fourths, or thereabout, somewhat as in *Dorippe*, but the distal part is closed in by stout foliaceous processes of the first maxillipeds. The flagellum or palp of the external maxillipeds arises near the antero-external angle of the rather broad merus, and is completely exposed in flexion.

The afferent branchial orifices are wide openings immediately in front of the bases of the chelipeds.

The chelipeds in the adult male are often unequal: the legs have the same form and relations as in *Dorippe*, but the last two small and dorsally placed pairs are not subchelate, although their little hook-like dactylus folds backwards. The dactyli of the 1st and 2nd pairs are palmulate and are very long and stout. The abdomen of the male usually consists of 5 pieces, the 3rd–5th terga being fused, that of the female consists of 7 separate terga. As in *Dorippe* the first three terga are visible in a dorsal view.

There is very little hair about the carapace and larger appendages.

In the Indian seas the species of this genus are, so far as is known, found only at depths of between 200 and 1,300 fathoms.

Key to the Indian species of Ethusa.

I. Carapace barely longer than broad: basal antennulary joint not abnormally enlarged and swollen: eyestalks freely movable:—

1. Branchial regions much swollen, and causing a strong bulge of the lateral borders of the carapace posteriorly: external orbital spines long slender acute, and projecting obliquely:—

i. External orbital spines projecting beyond the frontal spines ..... *E. indica.*

ii. External orbital spines not projecting to the level of the frontal spines ... *E. pygmæa.*

2. Lateral borders of the carapace gradually convergent without any strong bulge in their posterior (branchial) part: external orbital spines short broad flat triangular, with a mucronate tip ..... *E. andamanica.*

II. Carapace manifestly longer than broad: basal antennulary joint enormously enlarged and swollen, globular in shape, pushing the eyes permanently outwards:—

1. Eyes practically immobile: chelipeds in the male symmetrical..... *E. investigatoris.*

2. Eyes preserving good power of movement: one cheliped in the male very markedly larger than the other..... *E. desciscens.*

102. *Ethusa indica*, Alcock.

Ethusa indica, Alcock, Ann. Mag. Nat. Hist., May, 1894, p. 405, and Ill. Zool. 'Investigator,' Crust. pl. xiv. fig. 2, ♀.

Carapace convex; its extreme length, including the frontal teeth, in the male only just exceeds, and in the female equals, its extreme breadth; its surface is finely and closely granular almost everywhere, except sometimes on the cardiac-intestinal region.

The branchial regions are much swollen, both dorsally and laterally, the lateral swelling making the carapace more than one-third broader across the middle of the branchial regions than across the bases of the external orbital spines. The cardiac-intestinal region is small and well defined, and although it is tumid it is commonly sunk below the level of the branchial convexities. The anterior regions of the carapace are undefined.

The spine at the external orbital angle is broad-based, but long slender and acute: it projects obliquely outwards well beyond the tips of the frontal teeth. The two pairs of frontal teeth are longish and acute—the outer pair being somewhat the longer: they as well as the external orbital spine are a good deal concealed in a fringe of long hairs.

The eyestalks are short slender and freely movable: the eyes are often a little deficient in pigment.

The basal antennulary joint is not abnormally enlarged.

The chelipeds in the adult male only are asymmetrical, all the joints of one side being enlarged in all dimensions: the smaller cheliped is hardly as stout as the first two pairs of legs.

The second pair of true legs are not very much longer than the first: in the adult male they are a little more than three times the

length of the carapace, and slightly more than three times the length of the 4th (last) pair; in the female they are not quite three times the length of the carapace, and about $2\frac{3}{4}$ times the length of the 4th pair.

The abdomen of the male consists of 5 pieces, the 3rd–5th terga being fused together.

The extreme length of the carapace is in the fully adult male 16·5 millim., in the fully adult female 15 millim.; the breadth 16 millim. in the male, 15 millim. in the female.

Has been dredged in the Andaman Sea at 240 fms., in the "Swatch" of the Gangetic Delta at 409 and at 405 to 285 fms., in the Laccadive Sea at 696 fms., off the Maldives at 719 fms., and off both coasts of Ceylon at 406 to 296 fms.

103. *Ethusa pygmæa*, Alcock.

Ethusa pygmæa, Alcock, Ann. Mag. Nat. Hist., May 1894, p. 406, and Ill. Zool. 'Investigator,' Crust. pl. xiv. fig. 5, ♀.

Distinguished from *E. indica* only in the following particulars:—

(1) its size is much smaller, the largest known specimen—an ovigerous female—having the carapace slightly over 6 millim. long and nearly 7 millim. broad:

(2) the external orbital spines, though of the same slender acute shape, are not so prominent, not reaching as far as the tips of the frontal teeth:

(3) the anterior regions of the carapace are plainly defined by grooves.

Andaman Sea 188 to 220 fathoms, and 240 to 220 fms.

104. *Ethusa andamanica*, Alcock.

Ethusa andamanica, Alcock, Ann. Mag. Nat. Hist., May 1894, p. 405, and Ill. Zool. 'Investigator,' Crust. pl. xiv. fig. 8, young ♀.

Carapace flat, its extreme length only just exceeds its extreme breadth, its surface finely granular under the lens, but smooth to the naked eye.

The branchial regions are a little tumid dorsally, but do not bulge laterally, so that the convergent lateral borders are nearly straight.

The external orbital spine is broadly triangular, with a mucronate tip which does not quite reach to the tips of the frontal spines; these also are acutely triangular, and all are a good deal hidden by a fringe of long hairs.

The eyestalks are short and rather stout, movable, but not very freely so: the eyes are not deficient in pigment. The basal antennulary joint is not enlarged.

The chelipeds of the adult male are unknown: in the female they are not so stout as the first two pairs of legs.

The second pair of legs in the female (adult male unknown) exceed the first almost by the length of the dactylus, they are three times the length of the carapace and about $2\frac{1}{2}$ times the length of the 4th pair.

The extreme length of the carapace of the largest specimen, which is not adult, is 9·5 millim., the extreme breadth 9 millim.

Andaman Sea 188 to 220 fms., and 238 to 290 fms.

This species may possibly be only a variety of *Ethusa orientalis*, Miers, Challenger Brachyura, p. 330, pl. xxviii. fig. 4.

105. *Ethusa (Ethusina) investigatoris*, n. sp.

Carapace manifestly longer than broad, somewhat convex, smooth to the naked eye though finely granular under the lens.

The branchial regions are a good deal swollen both dorsally and laterally, bulging out the lateral margins and making the carapace a third broader across the middle of the branchial regions than across the bases of the external orbital spines.

The cardiac-intestinal region is well-defined and tumid, but not sunk below the level of the branchial convexities: the anterior regions of the carapace are fairly well defined.

The frontal portion of the carapace is separated from the rest of the carapace by a transverse groove or crease. The external orbital spine is long and needle-like, but its tip falls considerably short of the tips of the rather long acute frontal spines.

The basal antennal joint is huge and swollen, almost globular in shape. Owing to its size the eyes are pushed outwards until the eye-stalks have come to lie almost in the transverse axis of the carapace, with the tips of the eyes just visible, dorsally, beyond the lateral edge of the external orbital spine; and in this position they are almost immovably fixed.

The chelipeds in the apparently adult male are symmetrical and are not much stouter, except as to the hands, than the first two pairs of legs; the hands, however, are somewhat enlarged.

The second pair of true legs exceeds the first by about a third of the length of the dactylus; they are more than three times the length of the carapace, and about $2\frac{3}{4}$ times the length of the 4th pair.

The abdomen of the male consists of 5 pieces, the 3rd–5th terga being fused together.

Length of carapace of an adult male 12·3 millim., extreme breadth 11·3 millim.

Colours in life milk-white with the tip of the legs faint pink.

Bay of Bengal 1300 fathoms, Laccadive Sea 1200 fms.

This species may possibly be only a variety of *Ethusa* (*Ethusina*) *gracilipes*, Miers, Challenger Brachyura, p. 332, pl. xxix. fig. 1.

106. *Ethusa* (*Ethusina*) *desciscens*, n. sp.

Only differs from *E. investigatoris* (1) in its smaller size, (2) in having the eyestalks somewhat more mobile, and (3) in having the hand of one cheliped (in the male) much larger than the other.

I should have regarded it as a variety of *E. investigatoris* but that two specimens coming from very different localities and depths present the same peculiarities.

Length of carapace of largest specimen 9 millim., extreme breadth 8 millim.

Andaman Sea 265 fathoms, Laccadive Sea 912 to 931 fms.

Cymonomops, Alcock.

Cymonomops, Alcock, Ann. Mag. Nat. Hist., May 1894, p. 406.
Allied to *Cyclodorippe*, *Cymonomus*, etc.

Carapace of the *Dorippe* type (that is to say having its greatest breadth at its extreme posterior limit and leaving about half of the abdominal terga exposed to dorsal view), but arched anteriorly almost in a semicircle; its regions well defined in much the same way as *Dorippe*. The front is narrow and the whole fronto-orbital region lies well inside the semicircular curve of the antero-lateral margins: the narrow front ends in two little teeth between and beyond which can be seen the roof of the greatly prolonged buccal cavern, as in *Dorippe polita*. On either side of the front is a spine that forms the roof of the orbit, and outside of this spine, and separated from it by a deep notch, is a spine that forms the outer wall of the orbit.

The eyestalks are slender, moderately long, and freely movable: the eyes are almost without pigment.

The antennules have their basal joint lodged in a deep crevice between the edge of the anterior prolongation of the buccal cavern and the antennæ: their long flagellum cannot be concealed in flexion. The antennæ are large, but are much smaller than the antennules.

The buccal cavern is of great size,—not much less than half the length of the body, and is gradually narrowed anteriorly, and prolonged beyond the tip of the front: it is closed, except at its extreme frontal tip, by the long narrow external maxillipeds, the merus of which is not very much shorter than the ischium measured along the inner border and the flagellum of which is exposed in flexion: the long narrow pointed exognath is not much longer than the ischium: beneath the

external maxillipeds the anterior prolongation of the buccal cavern is closed in below by a lamellar process of the first maxillipeds.

The chelipeds in both sexes are short, massive, and equal and symmetrical: the hands are of the chopper-shaped, almost subcheliform, Raninoid type, the stout fingers being almost at right angles to the long axis of the hand.

The first and second pairs of true legs are stout and are of great length, their merus being of relatively enormous length: the third and fourth pairs on the other hand, which are dorsal in position as in *Dorippe*, are extremely short and of filiform tenuity.

The abdomen in both sexes consists of six segments: in the male two or three of them are fused and the whole abdomen is very small, in the female the last segment is of great size.

[? The afferent branchial opening appears to lie in the deep crevice between the base of the antennæ and the edge of the buccal frame in which the basal joint of the antennules is lodged.]

107. *Cymonomops glaucomma*, Alcock.

Cymonomops glaucomma, Alcock, Ann. Mag. Nat. Hist., May 1894, p. 406, and Ill. Zool. 'Investigator,' Crustacea pl. xiv. fig. 9.

Carapace subcircular; it and the appendages are very closely and finely granular beneath a dense pubescence. The front consists of three deeply cut lobes, the middle one of which is the true front and is the largest and most prominent. The middle lobe again is slightly cleft at the tip, and in the cleft is to be seen projecting the roof of the remarkably prolonged buccal cavity.

The external orbital angle, which is somewhat ventrad in position, also forms a projecting tooth, so that the orbito-frontal region, which is sharply delimited from the rest of the inflated carapace, has the form of a five-pronged crest or crown. The regions of the carapace are plainly delimited, excepting only in the case of the boundary between the gastric and cardiac regions. The pterygostomian regions are most remarkably puffed out.

The abdomen (in the female) is large, and the terminal segment has the form of a broad semicircular plate, broader than any of the other segments and nearly as long as all of them put together: in the male the abdomen is very small.

The orbits are capacious, but the eyestalks are slender and the eyes are unpigmented and semi-opaque.

The antennules, which are much larger and longer than the antennæ, are incapable of flexion beneath the front.

The external maxillipeds are of great length, in correspondence with

The antennules are large, but do not fold into fossettes. The antennæ also are large, and arise on a plane more or less ventrad of the antennules.

The buccal cavern is remarkably elongate, and is completely closed by the external maxillipeds. As in all other *Oxystoma* the efferent branchial channels form a canal in the middle of the endostome, which canal is covered by a lamellar prolongation of the exopodites of the first maxillipeds: as in *Dorippe* the canal is prolonged forwards between the bases of the antennules.

As in the *Leucosiidæ* the afferent branchial channels are not found in front of the bases of the chelipeds.

Somewhat in the same way as in the *Leucosiidæ* the palp of the external maxillipeds is small and arises at the far end of a groove along the inner edge of the merus, so as to be completely concealed in repose: the exognath is very narrow, and, as in the *Tymolinæ*, does not reach very far beyond the end of the ischium of the endognath.

Except in *Zanclifer* the chelipeds have the hand broad flat and somewhat chopper-shaped, the fingers (which form the head of the chopper) being at right angles, or nearly so, with the long axis of the hand; and as the immobile finger springs from a very broad base, the chelæ rather resemble subchelæ.

The legs commonly have the propodite broad or foliaceous, and the dactylus foliaceous or very broadly palmulate, somewhat as in *Matuta*: the last pair of legs is in, and the penultimate pair approaches, the dorsal plane of the body.

The genital ducts of the male perforate, and protrude far beyond, the bases of the fifth pair of legs: those of the female perforate the bases of the third pair of legs.

The following genera belong to this family. Indian genera are printed in Roman type and those represented in the Indian Museum collection are marked with an asterisk:—

Family **Raninidæ**.

* Cosmonotus.
* Lyreidus.
* Notopus.
Notopoides, Henderson, 'Challenger' Anomura, p. 29.
Ranilia, Milne Edwards, Hist. Nat. Crust. II. 195.
* *Ranina*, Lamarck, Milne Edwards, Hist. Nat. Crust. II. 191.
* Raninoides.
Raninops, A. Milne Edwards, Bull. Mus. Comp. Zool. VIII. 1880, p. 34.
Zanclifer, Henderson, 'Challenger' Anomura, p. 34.

Key to the Indian genera of Raninidæ.

I. Last pair of legs of normal size: antennæ with a very stout peduncle that hides the antennules: antennary flagellum long and stiff:—
  1. A well-developed rostral spine..... *Notopus.*
  2. A V-shaped excision in the carapace in place of a rostrum..... *Cosmonotus.*

II. Last pair of legs abnormally small and slender—almost filiform: antennary peduncle not completely hiding the antennules: antennary flagellum small:—
  1. Fronto-orbital border more than half the width of the carapace: sternum broad as far as the third pereiopods: merus of the external maxillipeds shorter than the ischium ..... *Raninoides.*
  2. Fronto-orbital border less than half the width of the carapace: sternum broad only as far as the second pereiopods: merus of the external maxillipeds a little longer than the ischium ..... *Lyreidus.*

Notopus, De Haan.

Notopus, DeHaan, Faun. Japon. Crust. pp. 137, 138.
Notopus, Henderson, 'Challenger' Anomura, p. 31.

Carapace obovate or obconical in outline, strongly convex from side to side, nearly smooth: regions undefined. Fronto-orbital border more than half the breadth of the carapace. Eyes distinct, eyestalks long slender and cylindrical, orbits oblique.

Antennules much smaller than the antennæ. Antennæ with a long very stout peduncle and long stout flagellum, the peduncle concealing the antennulary peduncle. Merus of the external maxillipeds a little shorter than the ischium, and having its inner border thickened and raised. Sternum broad between the chelipeds and then suddenly becoming very narrow. Last pair of legs of normal size, arising a little in advance of the penultimate pair.

The abdomen in both sexes has all 7 terga separate.

108. *Notopus dorsipes*, (Fabr.) De Haan.

Pediculus marinus, Rumph, Amboin. Raritcitk. I. 29, pl. x. fig. 3.
Hippa dorsipes, Fabricius, Ent. Syst. II. 475.
Albunea dorsipes, Fabricius, Ent. Syst. Suppl. p. 397.
Ranina dorsipes, Latreille, Hist. Nat. Crust. et Ins. VI. 133, [and Encycl. Method. X. 268, pl. 287, fig. 2]: Milne Edwards, Hist. Nat. Crust. II. 195.

Notopus dorsipes, DeHaan, Faun. Japon. Crust. p. 139, pl. xxxv. fig. 5; Stuler, Abh. Ak. Berl. 1882 (1883) p. 17, pl. i. figs. 6 *a–b* and pl. ii. figs. 7 *a–d*.

The greatest breadth of the carapace—at the fronto-orbital border—is about two-thirds the greatest length.

On the fronto-orbital border are 5 spines of about equal size, separated by deep bights, the middle spine being the true front or rostrum: the outermost spines on either side form the antero-external angles of the carapace, are on a different plane from the others, and are joined across the carapace by a serrated ridge.

The carapace is a good deal pitted in the centre: the lateral borders in their anterior half have, like the surface of the merus of the external maxillipeds and of the greater part of the pterygostomian region, numerous squamiform granules; in their posterior half the lateral borders are finely raised, and milled. A raised ridge traverses the carapace in the middle line from the tip of the front nearly to the posterior border. The trigonal ischium of the chelipeds is somewhat swollen and has its outer surface tattooed with linear dents with hairy edges; the carpus has its dorsal surface serrated; the hand has hairy linear dents and squamiform rows of serrations on both its surfaces, but especially on the outer; and the dactylus has a smooth cutting edge and closes against a single distinctly large tooth at the tip of the immobile finger.

The true legs have one or both edges of many of their joints scantily fringed with long stiff hairs: except in the case of the last pair—in which the carpopodites and propodites are foliaceously expanded—these joints are only moderately expanded; and except in the case of the penultimate pair—in which the dactylus is foliaceous—this joint is broadly palmulate.

In the Indian Museum collection are specimens from the Andamans, and from off the Malabar coast 45 fathoms.

Cosmonotus, Adams & White.

Cosmonotus, Adams & White, 'Samarang' Crust. p. 60, 1848.
Cosmonotus, Dana, U. S. Expl. Exp., Crust. pt. I. p. 404.
Cosmonotus, Henderson, 'Challenger' Anomura, p. 32.

Carapace elongate-heptagonal in outline, strongly convex, the summit of the convexity forming a sharp mid-dorsal ridge. *Instead of a "front" there is a V-shaped excision*, filled by the basal joints of the eyestalks. The eyes are distinct, the eyestalks are slender and are of remarkable length: each orbit forms a narrow trench just beneath and along almost the whole length of either anterior border of the carapace, the two orbits together forming a very perfect and obvious V.

The antennules are almost hidden by the much larger and stouter antennæ, as in *Notopus*.

The maxillipeds, legs, sternum and abdomen are as in *Notopus*.

109. *Cosmonotus grayii*, Ad. & Wh.

Cosmonotus grayii, Adams and White, 'Samarang' Crust. p. 60, pl. xiii. fig. 3 (P. Z. S. 1847, p. 227, fig., and Ann. Mag. Nat. Hist. (2) II. 1848, p. 287): Stimpson, Proc. Acad. Nat. Sci. Philad. 1858, p. 241: Henderson, 'Challenger' Anomura, p. 33: [Cano, Boll. Soc. Nat. Napol. III. 1889, p. 256].

The carapace is unevenly covered with pits and dents which give it, when examined with a lens, a somewhat squamiform appearance. There is a small denticle on either side of the frontal notch and a claw-like spinule at either antero-external angle of the carapace—this is all the armature. The pterygostomian region is granular. The outer edge of the exognath is thickly fringed with hair, the merus and the outer margin of the ischium of the endognath are granular.

The chelipeds are hairy along the dorsal edge, and the edges of the legs—of the last pair especially—are hairy. The chelipeds are also a good deal pitted and dented, like the dorsum of the carapace.

The movable finger is rather strongly curved, and owing to the prominence of a single tooth just beyond the middle of the cutting edge, is curiously sickle-shaped.

In the Indian Museum collection is a single male from the Persian Gulf.

Raninoides, Milne Edwards.

Raninoides, Milne Edwards, Hist. Nat. Crust. II. 196.
Raninoides, Henderson, 'Challenger' Anomura, p. 27.

Carapace remarkably elongate-obovate, strongly convex from side to side, about twice as long as broad, its surface for the most part smooth, the regions undefined. Fronto-orbital border slightly less than the greatest width of the carapace. Eyes small but distinct, eyestalks broadly dilated at base, orbits slightly oblique.

Antennules about equal in size to the antennæ: antennæ with a stout peduncle and a rather short slender flagellum, the peduncle not concealing the antennulary peduncle. Merus of the external maxillipeds shorter than the ischium; its edges slightly thickened and raised. Sternum broad between the chelipeds and as far as the bases of the second pair of true legs, then becoming extremely narrow.

Last pair of legs abnormally short and slender, arising much in advance of the penultimate pair. The abdomen in both sexes consists of 7 separate segments.

110. *Raninoides personatus*, White, Henderson.

Raninoides personatus, White MS., Henderson 'Challenger' Anomura p. 27 pl. ii. fig. 5.

Carapace twice as long as broad. The lateral border in its posterior half is defined by a fine raised and milled line, and at either external orbital angle is prolonged into a spine, at a distance behind which equal to the distance between it and the rostrum is a second smaller, but still large, spine. The carapace between the two latter spines is finely punctate and in places granular, elsewhere it is smooth and polished.

The front consists of three teeth, the middle one of which alone is large and prominent forming the true rostrum, the lateral teeth being small: between each of these small lateral teeth and the external orbital spine, and separated from both by a fissure, is an angular lobe that completes the roof of the orbit. The whole fronto-orbital border is hairy. The pterygostomian regions are densely granular in a well defined band that occupies much more than their outer half.

The chelipeds have the ischium armed distally, on its inner border with a sharp slender spine: two similar spines occur towards the distal end of the carpus—the larger one being on the outer border, the smaller on the dorsal surface: a similar spine is found towards the far end of the outer border of the hand, and three occur along the inner border of the hand: the dactylus has a smooth cutting edge, but the opposed edge of the immobile finger is very sharply laciniate up to a sharp terminal spine. There is no spine on the outer edge of the dactylus. The third pair of true legs has its merus on both edges and the other joints on the posterior edge fringed with long stiff hairs, the second pair has similar hairs on the posterior edge of merus carpus and propodite, the first pair on lower edge of propodite.

Excluding the filiform last pair, the other legs have the carpus dorsally carinate, and the propodite and dactylus foliaceous.

In the Indian Museum collection are numerous specimens from the coasts of the Bay of Bengal, from 12 to 70 fathoms.

111. *Raninoides serratifrons*, Henderson.

Raninoides serratifrons, Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 408, pl. xxxviii. figs. 10–12.

Differs from *R. personatus* Henderson in the following particulars:—

(1) the rostrum is carinated, and it, as well as the dentiform lobe at either side of its base, has the edge sharply clearly and uniformly serrated:

(2) between the dentiform lobe at the base of the rostrum and the

external orbital spine is, not an angular lobe, but a sharp spine:

(3) the spine on the lateral border behind the external orbital spine is a mere spinule, and the carapace in front of a well defined transverse line that connects these spines is covered with small squamiform granules:

(4) there is no spine on the ischium of the chelipeds; the wrist has its dorsal surface closely covered with somewhat scale-like granules; the hand has its inner surface covered, but not nearly so closely, with rather larger granules and has its outer edge sharply bicarinate:

(5) the dactylus of the second and third pairs of true legs is sickle-shaped:

(6) the small last pair of legs are stouter.

In the Indian Museum collection are two specimens—a small female from off Ceylon 28 fms., and a large female from off the Malabar coast 45 fms.

Lyreidus, De Haan.

Lyreidus, DeHaan, Faun. Japon. Crust. p. 138.
Lyreidus, Henderson, 'Challenger' Anomura, p. 33.

Carapace elongate-obovate, the antero-lateral margins independent and gradually convergent; strongly convex from side to side and slightly convex from before backwards; smooth and polished, with the regions undefined. Fronto-orbital border less than half the breadth of the carapace. Eyes small; eyestalks short, broad at base, orbits hardly oblique.

Antennules about equal in size to the antennæ: antennæ with a stoutish peduncle and rather short slender flagellum, the peduncle not concealing the antennulary peduncle.

Merus of the external maxillipeds a little longer than the ischium.

Sternum broad as far as the bases of the first pair of true legs, then becoming narrow. Last pair of legs abnormally short and slender, arising well in advance of the posterior pair. The abdomen in both sexes consists of 7 distinct segments.

112. *Lyreidus channeri*, Wood-Mason.

Lyreidus channeri, Wood-Mason, P. A. S. B., August, 1885, p. 104, and J. A. S. B., Vol. LVI. 1887, pt. 2, p. 206, pl. i.
Lyreidus gracilis, Wood-Mason, J. A. S. B., Vol. LVI. 1887, pt. 2, p. 376.

The greatest breadth of the carapace—considerably in rear of the front—is a good deal more than half its greatest length, and is about $2\frac{1}{2}$ times the width of the fronto-orbital border.

The rostrum consists of a simple flat acutely-triangular spine; on either side of it, projecting beyond it, separated from it by a deep bight, and parallel with its tip, is a long acicular spine forming the external orbital angle. The fronto-orbital region is hairy.

The gradually convergent antero-lateral borders are about two-fifths the length of the postero-lateral borders, the junction of the two borders being occupied by a long oblique acicular spine; and nearly midway between this spine and the spine at the external angle of the orbit on either side, is another similar but rather shorter spine. The postero-lateral borders are defined in more than their posterior half by a very fine raised line.

The surface of the carapace is finely and closely punctulate in all its anterior half, as are also the pterygostomian regions.

The eyestalks are broad and flat, and taper to the cornea, which has a somewhat lateral position and is a little deficient in pigment. The [illegible]s have a spine or two little spines near the middle of their dorsal [illegible]face: the wrist has a large spine in the distal half of its upper [illegible]rder: the hand has its outer (upper) edge carinate up to a subterminal denticle, and has its lower edge cut into two or three sharp teeth: the dactylus has its cutting edge faintly and irregularly sinuous, but by no means denticulate, and the opposed edge of the immobile finger is irregularly and rather bluntly jagged. The legs are almost free from hair, a few hairs occurring on the posterior edge of the propodite and dactylus of the third pair and on the last two joints of the rudimentary fourth pair only: in the first and third pairs the carpus is dorsally carinate and the propodite foliaceously expanded, in the first and second pairs the dactylus is little more than broadly palmulate, and in the third pair the dactylus is foliaceous. The third and fourth abdominal terga are armed each with a median recurved spine, in both sexes.

The largest female in the Indian Museum collection has the carapace 28·5 millim. long, a smaller ovigerous female has the carapace 26·5 millim. long.

Wood-Mason established his two species on two specimens, one of which—*L. channeri*—had suffered a good deal from breakage and imperfect re-growth about the frontal region.

A considerable series of the specimens since obtained shows that the two supposed species are really one.

In the Indian Museum collection are numerous specimens, from the Andaman Sea 220 to 271 fms., from the Bay of Bengal 200 to 405 fathoms, and from both sides of Ceylon 296 to 406 fms.

Uniform salmon-colour in life, white in spirit.

EXPLANATION OF PLATES.

Plate VI.

Fig. 1. Calappa pustulosa.
„ 2. Calappa woodmasoni.
„ 3. Pseudophilyra woodmasoni.
„ 4. Leucosia corallicola.
„ 5. Leucosia sima.
„ 6. Leucosia truncata.
„ 7. Pseudophilyra blanfordi.

Plate VII.

Fig. 1. Philyra corallicola.
„ 2. Philyra sexangula.
„ 3. Ebalia woodmasoni.
„ 4. Ebalia diadumena.
„ 5. Nursia blanfordi.
„ 6. Nursia nasuta.
„ 7. Nursia persica.

Plate VIII.

Fig. 1. Heteronucia vesiculosa.
„ 2. Pariphiculus rostratus.
„ 3. Actæomorpha morum.
„ 4. Tlos patella.

On Croftia, *a new Indo-Chinese genus of* Scitamineae.—

By G. King *and* D. Prain.

[Read. 31st May, Read 3rd June.]

With Plate IX.

While engaged in sorting into the Calcutta Herbarium the material of the natural order *Scitamineae* received since 1892 (the date when the account of the family published in vol. vi. of the *Flora of British India* was completed) the writers met with a form that appears to differ generically from any hitherto described.

A member of the tribe *Zingibereae*, this plant by the form and arrangement of its flowers recalls the genus *Globba*, by its habit and its fruit the genus *Cautleya*. In reality, however, it is equally remote from both; its 3-locular ovary forbids more than a passing comparison with *Globba;* the absence of a lip makes its association with *Cautleya* impossible.

Its nearest natural ally appears to be the genus *Rhynchanthus*, alongside of which it must be placed. This genus * is remarkable among *Euzingibereae* in possessing small erect corolla-lobes, a lip that is reduced to a mere tooth, and a most curious petaloid filament bearing an anther with no appendage; it is at the same time devoid—though this is a less unusual character—of any trace of lateral staminodes. *Rhynchanthus* has been compared by its author with the genus *Burbidgea* † which differs in having broad corolla lobes, a distinct lip, a stamen with short filament and an anther with a long appendage; here again there is no trace of lateral staminodes.

The present plant resembles *Rhynchanthus* in possessing small erect corolla-lobes and an inappendiculate anther; it agrees further in having no lip—that organ not being represented even by a tooth. But its filament is not petaloid and there are present two distinct petaloid lateral staminodes resembling a good deal those of a *Globba* or of a *Mantisia;* the corolla tube, moreover, which in *Rhynchanthus* is funnel-shaped above the middle, is in the present plant very narrowly tubular from base to limb, as in *Globba;* the stylodes also are elongated and

* Rhynchanthus Hook. fil. Bot. Mag. t. 6861 (1886); Engler, Natürlich. Pflanzenfam. ii. part 6. p. 23 (1889); Baker in Hook. fil. Flor. Brit. Ind. vi. 257 (1892). One species; *R. longiflorus* Hook. f. *loc. cit.*, obtained in Upper Burma by Dr. J. Anderson, and by the Collectors of Hort. Low.

† Burbidgea Hook. fil. Bot. Mag. t. 6403 (1879); Engler, Natürlich. Pflanzenfam. ii. part 6. p. 22 (1889). One species; *B. nitida* Hook. f. *loc. cit.*, obtained by Mr. F. W. Burbidge in North-West Borneo.

filiform in place of being short and oblong. While then *Burbidgea* deviates from *Rhynchanthus* in having a lip, the present plant differs equally in having lateral staminodes. And though it comes nearer to *Rhynchanthus* both as regards structure and as regards habitat than *Burbidgea* does, it seems to the writers to differ sufficiently in essentials to deserve generic rank apart from *Rhynchanthus*.

The necessary diagnosis and description are appended. The genus has been named in honour of Sir Alfred Croft, K.C.I.E., lately President of the Society, whose warm sympathy with every branch of Natural Science and of Literature is so well known to us all.

Nat. Ord. SCITAMINEAE.

Trib. Zingibereæ.

Croftia King & Prain; *gen. nov.* *Calyx* spathaceo-tubulosus, antice parum fissus, postice oblique breviter 3-dentatus. *Corollae* tubus elongatus prorsus angustatus, lobi breves 3, ovato-lanceolati acuti, erecti, postico ceteris paullo majore. *Staminodia* lateralia falcata subpetaloidea prope basin filamenti opposita erecta dimidiumque filamenti inferius arcte imbricatim amplectentia; labellum plane obsoletum. *Filamentum* elongatum ad styli receptionem canaliculatum; antherae loculi 2, parum distantes, connectivo ultra loculos haud producto. *Ovarium* 3-loculare, placentis axilibus; stylus filiformis in canali filamenti receptus; stigma ultra loculos parvum apice fimbriatum; stylodia filiformia. *Fructus* ovatus pericarpio demum membranaceo; semina subglobosa arillo cupulari parvo tenui margine dentato basin tantum seminis amplectente; embryone centrali, lineari, recto.

Rhizoma e fibris carnosis fasciculatis. *Folia* ovato-lanceolata vel lanceolata basi cordata, vaginis longis laxis. *Inflorescentia* terminalis, spicata, subsecunda. *Flores* singuli bracteâ spathaceâ, bracteolis 2 inaequalibus, sessiles, lutei.

Croftia spectabilis King & Prain. A herb with thickly fascicled root-fibres, rhizome very small. *Stem* 8-10 in. high, leafy. *Leaves* ovate-lanceolate or lanceolate, base cordate, apex acute or acuminate, with lax sheaths 5-6 in. long; blades 3–5 in. long, 1·5 in. wide, thin glabrous green on both surfaces, rather paler beneath. *Spikes* 3 in. long, subsecund, 8–12-fld. *Bracts* thin ·75–·9 in. long, ovate-lanceolate; bracteoles ·3 in. long linear. *Calyx* ·25 in. pale yellow with red spots. *Corolla* with yellow tube ·65 in. long, very slender throughout, hirsute externally; lobes ·3 in. long ·15 in. wide ovate-lanceolate acute, glabrous on both surfaces. *Filament* ·75 in. long; lateral staminodes ·4 in. long, glabrous on both surfaces, falcate, erect, closely overlapping each other and the somewhat produced margins of the

lower half of the filament so as to form a subgibbous tube ; the channel along the filament slightly pubescent with scattered hairs. *Ovary* pubescent externally, crowned with a style 2 in. long and with 2 filiform stylodes ·35 in. long. *Fruit* hirsute, ·35 in. long, ·25 in. across. *Seeds* ·12 in. long with a cupular hyaline basal arillus.

Upper Burma: Shan Hills, at Taungyi. *Dr. King's Collectors!*

Flowers most resembling those of a *Globba* both in appearance and in arrangement ; there is here, however, no labellum, while the lateral staminodes and the petals, in place of being patent, are erect ; the lateral staminodes moreover are here closely imbricately opposed to the lower half of the slender filament which they embrace anteriorly, and to which consequently they impart some degree of support. In habit and in fruit this plant most resembles a *Cautleya*, but its floral structure removes it as far from the *Hedychieae* as its ovarian structure removes it from the *Mantisieae*. Its nearest ally is *Rhynchanthus*, one of the *Euzingibereae*, of which it has much the bracts and calyx and quite the corolla. *Rhynchanthus*, however, differs in having a petaloid filament without lateral staminodes ; a stigma with truncate entire, not fimbriate margin, and short oblong, not elongated filiform appendicula.

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Natural History Notes from H. M. Indian Marine Survey Steamer 'Investigator,' Commander C. F. Oldham, R. N., commanding. Series II. No. 23. *A Supplementary List of the Marine Fishes of India, with Descriptions of 2 New Genera and 8 New Species.*—*By* A. ALCOCK, M.B., C.M.Z.S., *Superintendent of the Indian Museum.*

[Recd. 5th June:—Read 1st July.]

In Day's *Fishes*, in the *Fauna of British India*, which was published in 1889, 1,418 Indian fishes are described.

Of these about 1,010 are true marine species, most of them being inhabitants of shallow water. During the last eleven years, however, the deeper waters of India have been to a certain extent explored, with the result that 201 (? 202) species of marine fishes have been added to the Fauna known to Dr. Day.

These 201 (? 202) species belong to 118 (119) genera, of which 86 (? 87) are not recorded in the *Fauna of British India*, and to 32 families, of which 8 are not recorded in the *Fauna of British India*.

In describing the latest collection of fishes made by the officers of the "Investigator" I have thought it advisable to bring together in one list all these additions to the Indian Fauna, preliminary to the preparation of a complete and succinct account of the whole.

In this list the Families and Genera new to the Indian Fauna are marked with an asterisk and are numbered serially.

§ 1. *Descriptions of new species.*

Family **Scorpænidæ.**

1. *Scorpæna bucephalus*, n. sp.

D. XI. $\frac{1}{9\text{-}10}$ A. III. 5. L. lat. *circ.* 40.

Extreme length of head, in the adult, half the total without the caudal: height of body rather more than one-third of the same measure.

Length of snout equal to that of eye, and one-fourth that of head. Interorbital space not quite half an eye-length in breadth, traversed by two diverging ridges that do not end in spines. Spines of head and cheek prominent and acute, supra-orbital margin with one in front and two behind, a fimbriated tentacle about half as long as the eye intervening.

No occipital groove.

The maxilla does not quite reach the level of the posterior bo of the orbit. Teeth in the palatine bones.

Scales large, about 40 rows from occiput to base of caudal: verte occiput, cheeks, and opercles scaly.

The 3rd, 4th and 5th dorsal spines are the longest—nearly one-third the length of the head: the 2nd anal spine much the longest and strongest—*nearly half the length of the head.* Pectorals hardly longer than the ventrals, not reaching to the anal.

An air-bladder.

Colours in spirit: light reddish yellow, with numerous purplish blotches on the head and on and above the lateral line; fins unspotted hyaline.

A female with gravid ovaries measures rather over $4\frac{1}{2}$ inches.

Off Malabar coast 36 fms., off Coromandel coast 33 fms.

2. *Scorpæna crostris*, n. sp.

D. XI. $\frac{1}{9}$ A. III. 5. L. lat. *circ.* 40.

Very near *Sebastes bougainvillii*, C. V.

Extreme length of head nearly half the total without the caudal. *Profile of snout almost in the same vertical line with the front border of the orbit.* Diameter of eye about one-third the length of the head: interorbital space over half an eye-length in breadth, traversed by two ridges that do not end in spines. Spines of head and cheek small but acute: supra-orbital margin with a tooth and small tentacle in front, and with two spines and a large fimbriated tentacle behind. No occipital groove. The maxilla reaches to the posterior border of the orbit. Palatines

either toothless or with a few teeth anteriorly. About 40 rows of scales from occiput to base of caudal: opercles and cheeks densely, occiput and vertex sparsely, scaly: lateral line with a few long tentacles.

The 2nd, 3rd and 4th dorsal spines much the longest—*considerably more than half the length of the head*: the 2nd anal spine the longest—not quite half the length of the head. The pectorals reach to the anal fin, *only a few of the rays are branched.*

No air-bladder.

Colours in spirit: ventral half of body and all the fins light reddish yellow, dorsal half of head and body mottled purple; a dark purple blot between the 7th and 10th dorsal spines, and a fainter streak of the same colour between the 2nd and 6th dorsal rays.

Length not quite 3 inches.

Off Ceylon in 34 fms.

3. *Pterois macrura*, n. sp.

D. XIII. 9. A. II. 7. L. lat. *circ.* 45.

Caudal pointed, one at least of its upper rays produced as a slender filament which is as long as the body behind the eye.

Length of the head about two-fifths, height of the body about one-third of the total without the caudal. Snout as long as the eye, or rather more than one-fourth the length of the head: interorbital space deeply concave, its width half the length of the eye. Pre-orbital with spines and finely serrated crests, with a few scales, and with a large tentacle overhanging the angle of the mouth. Spines and crests of the head and cheek well developed and finely serrated.

About 45 rows of scales between the occiput and the base of the caudal: head scaly everywhere except jaws, tip of snout, and middle line of interorbital space.

The pectorals reach to the base of the caudal.

Colours in spirit: sepia with black cross-bars; vertical fins with dark spots which are only distinct along the upper edge of the caudal; pectorals and ventrals nearly black, with white spots.

Three large pyloric cæca.

Off Malabar coast in 45 fms.

Fam. **Squamipinnes.**

Holacanthus alternans, C. V., var. *meleagris*, nov.

This variety differs from the descriptions of the type only in colouration.

The colours in spirit are: head body and all the fins dark indigo-

blue, fading to lavender near the middle of the body, where, however, every alternate scale has a large indigo blotch: edges of dorsal caudal and anal fins, ventral spine and filament of outer ventral ray, light blue, the interradial membranes of all these fins with numerous light blue spots: head and body with numerous narrow light blue stripes not involving the fins, namely one from the nape, in the middle line, to the snout and chin, one from the angle of the mouth to the isthmus, one from the temple in front of the eye to the interoperculum, one (the plainest of all) from the occiput to the preopercular angle and thence to the ventral spine, five or six (all more or less faint) in concentric series across the body, and three straight across the caudal peduncle.

Length about $7\frac{1}{2}$ inches.

Palk Straits.

Family **Ophidiidæ.**

4. †*Neobythites* (*Monomitopus*) *conjugator*, n. sp.

B. 8. D. *circ.* 90. A. *circ.* 72. P. *circ.* 28. V. 2 (fuse

to form a single filament). L. lat. 100–110. L. tr. $\frac{10\text{-}12}{25\text{-}30}$.

Length of head just under length of distance between gill-opening and vent, and about $4\frac{3}{4}$ in the total; greatest height of body one-sixth total. Snout hardly overhanging the upper jaw, very nearly as long as the eye—which is two-ninths the length of the head—and equal to the width of the flattened interocular space. Mouth wide, the maxilla half as long as the head: villiform teeth in the jaws vomer and palatines, the outer row in the premaxilla slightly but very distinctly enlarged: mucous membrane of mouth and gill-chamber black. Operculum with a strong spine above: angle of preoperculum excised, the angles of the excision strongly spiniform.

Gill-openings wide, gill-membranes free, four gills, about 12 gill-rakers on the outer side of the first arch are elongate, pseudobranchiæ reduced to two small filaments.

The whole body and head, including parts of the gill-membranes, covered with small adherent scales which also cover the basal half of the dorsal and anal fins. Lateral line very distinct anteriorly, becoming indistinct in the posterior fourth of the body.

The dorsal fin begins about an eye-length behind the gill-opening: it and the anal are confluent with the caudal. The pectoral fin broad, short, pointed, about half the length of the head, springing from a fleshy scaly base. The ventrals arise at the pectoral symphysis: each consists of two rays intimately fused throughout.

† Ill. Zool. Investigator, Fishes pl. xvii. fig. 4 (*in preparation*).

Nine very short pyloric cæca and two or three papillæ: a stout-walled air-bladder.

Colours sepia; caudal, distal two-thirds of pectoral, and outer part of dorsal and anal fins black.

Off Ceylon 296-320 fms., and off Travancore coast, 406 fms. This species is very closely related to *Neobythites* (*Monomitopus*) *nigripinnis*.

5. †*Dermatorus melampeplus*, n. sp.

At once distinguished from *Dermatorus trichiurus* and *melanocephalus* (1) by the complete absence of teeth on the vomer, and (2) by its uniform purple-black colour.

In the other two species there are a few scattered teeth on the vomer, and the head alone is black.

The single specimen has been too much damaged for description, but it is undoubtedly a good species.

Laccadive Sea, 931 fms.

Family **Pleuronectidæ.**

BOOPSETTA, n. gen.

Cleft of the mouth narrow: teeth in the jaws only, in broadish villiform bands on the blind side, gradually becoming obsolescent on the coloured side. Eyes on the right side, very large, almost in contact, the upper bulging beyond the dorsal profile, the lower in advance of the upper. The dorsal fin begins above the after part of the upper eye. Both pectorals and both ventrals well developed. Scales of moderate size, stout ctenoid and adherent on the coloured side, thin cycloid and deciduous on the blind side. Lateral line with a strong curve above the pectoral.

Gill-openings somewhat contracted, the membranes very broadly united below the isthmus: gill-rakers styliform.

Closely allied to *Pleuronectes*.

6. §*Boopsetta umbrarum*, n. sp.

B. 6. D. 60. A. 51. C. 18. P. *d.* 8, *s.* 6. V. 6. L. lat. *circ.* 110.

Height of the body one-third, length of the head one-fourth the total, without the caudal.

The mouth is short and broad, the cleft approaching the vertical, the maxilla being a little over three-fourths the length of the eye, which is slightly over one-third the length of the head. The teeth are in broad villiform bands in the jaws on the blind side, the bands gradually becoming narrow and disappearing on the coloured side. The upper eye bulges very strongly beyond the general dorsal profile.

† Ill. Zool. Investigator, Fishes pl. xvii. fig. 3 (*in preparation*).

§ Ill. Zool. Investigator, Fishes pl. xvii. fig. 5 (*in preparation*).

The length of the snout—*i.e.*, of the space between the front wall of the lower orbit and the tip of the knob of the mandibular symphysis—is less than one-third the length of the eye.

The body, and the head excepting only the snout and gill-membranes, are covered with scales.

The rays of the vertical fins are stout, the longest are more than two-fifths the greatest body-height. The caudal is large, with a distinct though broad peduncle.

The coloured pectoral is rather longer than its fellow, the latter being half the length of the head. The coloured ventral is rather longer than its fellow, the latter being as long as the eye.

Colours in spirit: right side blackish-brown, with traces of six opalescent cross-bands: irides and coloured pectoral fin blue-black, the pectoral with a narrow white cross-stripe. Vertical fins (on coloured side), and right ventral, almost black, tipped with milk white. Left side rather dusky.

Length 6·25 inches.

Off Colombo, 180–217 fms.

Fam. **Scopelidæ.**

7. †*Bathypterois atricolor*, n. sp.

B. 13. D. 15. A. 10. P. 2/10. V. 9. L. lat. 52. L. tr. 15.

Length of head a little more than one-fifth, height of body about one-eighth, of total (without caudal).

Length of snout a little more than one-third that of head, and a little more than 5 times that of eye, equal to width of interorbital space.

Few or no teeth on the vomer.

The dorsal fin arises just behind the vertical through the base of the ventrals, and nearly half its extent is in the anterior half of the body (measured without caudal): the anal arises just behind the level of the last dorsal ray: the adipose fin is halfway between the end of the dorsal and the base of the caudal: the lower caudal lobe is very slightly prolonged. Upper two pectoral rays prolonged, coherent in basal part but not fused: outer two ventral rays thickened, unbranched, prolonged as far as 7th or 8th anal ray.

Colours, uniform black, except the pectoral filaments.

Laccadive Sea, 891 fms.

Group **Scopelarchina.**

Scopelarchus, n. gen.

Body elongate compressed, covered with deciduous scales, the scales, however, on the greater part of the lateral line being stout and

† Ill. Zool. Investigator, Fishes pl. xvii. fig. 6 (*in preparation*).

strongly adherent. Cleft of mouth very wide: premaxilla very long, tapering, firmly attached to the long thin maxillæ. A single row of small teeth in the premaxilla: a double row of teeth in the mandible, the inner row being large depressible and barbed at tip; an incompletely double series of similarly enlarged teeth on either palatine, and a long narrow row of almost similar teeth on the tongue and hyoid. Eye large. Gill-openings very wide, gill-membranes not attached to the isthmus, branchiostegals not very numerous (about 6?); pseudobranchiæ large.

The dorsal fin is short, it arises well in the anterior third of the body (measured with the caudal) and all its extent lies between the pectorals and ventrals: the anal is long, occupying the greater part of the tail. Pectorals large. Ventrals with 8 rays. An adipose dorsal fin. Caudal forked. No luminous spots.

This is a remarkable generalized form of Scopeloid, showing affinities with *Saurus*, *Chlorophthalmus*, *Scopelus*, *Odontostomus*, and *Paralepis*. At casual view it looks just like a *Scopelus* devoid of luminous organs.

8. †*Scopelarchus Guentheri*, n. sp.

D.9. A.26. P.19. V.8. L. lat. (of enlarged adherent scales) *circ.* 50.

Head and body compressed: shape as of *Scopelus*.

Length of head (with gill-cover) not quite one-fourth, height of body about two-elevenths of the total (without caudal). Snout about three-fourths the length of the eye: the lower jaw in repose fitting within the upper. The eyes are large—between one-third and one-fourth the length of the head—they are separated from one another by a mere linear space, and their visual axis is rather more superior than horizontal.

The mouth-cleft forms a slightly oblique sweep, and the maxilla extends a considerable distance behind the posterior border of the orbit.

The scales of the lateral line are much enlarged, and their vertical diameter is much greater than their antero-posterior diameter, each is chambered, the chamber opening dorsally and ventrally.

The first dorsal ray arises about an eye-length behind the base of the pectorals, the last stands a little in advance of the base of the ventrals. The first anal ray arises near the middle of the body (measured with the caudal), the last is less than an eye-length distant from the rudimentary rays at the base of the caudal. The adipose fin stands in the posterior third of the distance between the dorsal and

† Ill. Zool. Investigator, Fishes pl. xvii. fig. 7 (*in preparation*).

caudal. Pectorals broad and falciform, several times larger than the ventrals.

Colours in spirit hyaline, occiput and caudal peduncle black.

A single specimen about 5 inches long, and apparently mature, from off the Indus Delta, 947 fms.

It is so fragile that I am afraid to dissect it.

§ 2. *Notes on some of the previously described new forms.*

Family **Spinacidæ**.

Centroscyllium ornatum, Alcock.

Paracentroscyllium ornatum, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 379: Ill. Zool. 'Investigator,' Fishes, pl. viii. fig. 2.

This species, the supposed type of a new genus, was described from three very young and not very well preserved specimens from the Bay of Bengal.

Four much larger specimens—the largest nearly a foot long—have lately been dredged in the Arabian Sea, and these while quite clearly identical with the Bay of Bengal species, also quite clearly belong to Müller and Henle's genus *Centroscyllium*, of which *Paracentroscyllium* now becomes a synonym. The following is the amended diagnosis of the species:—

All the tissues extremely fragile. Head very large, very flat and depressed, branchial regions laterally expanded. Snout much depressed, polygonal: nostrils very large, situated on ventral surface of edge of snout. Under surface of snout with numerous rather large pores, two rows of which form an elegant Y- or V-shaped figure that extends between the nostrils. Eyes very large, their major diameter nearly as long as the snout and nearly a fifth the length of the head (branchial region included). Spiracles rather small, situated on the upper surface of the head, behind the eye. Mouth crescentic, large: minute tricuspid teeth in both jaws. Body covered with minute deciduous placoid scales, the spine of each scale with a stelliform base.

Dorsal spines very strong and acute, the 2nd nearly twice the size of the 1st. The 1st dorsal fin arises in advance of a point midway between the pectorals and ventrals, the 2nd arises immediately behind the level of the base of the ventrals.

Colours uniform jet-black, but the integument is very deciduous.

Family **Ophidiidæ**.

Neobythites, Goode and Bean.

In the definition of this genus the ventral fins should, I think, be stated to consist of either one or two rays, so as to include *Monomitopus*,

mihi. *Monomitopus* agrees with *Neobythites* in every particular, except that each ventral fin consists either of a single ventral ray (*M. nigripinnis*) or of two rays firmly fused throughout their extent (*M. conjugator*).

Dicrolene, Goode and Bean.

In the definition of this genus the branchiostegals should be stated as eight. *Paradicrolene*, mihi, then becomes a synonym of *Dicrolene*. It seems to me almost doubtful whether *Dicrolene* (and *Pteroidonus*) should be kept separate from *Neobythites*. For there is an undoubted *Neobythites* (*N. pterotus*) in which the pectoral rays, in the male at any rate, are much produced, although none of them are strengthened and entirely independent.

Dicrolene intronigra, G. and B.

I have compared Indian specimens with one from the North Atlantic and the only difference is that, in the former, the inside of the mouth and the fins are much blacker.

There are 8 branchiostegals in both.

Glyptophidium, Alcock.

In the definition of this genus the ventral fins should be stated as consisting of either one or two rays each: the lateral line should be stated to be absent.

Lamprogrammus, Alcock.

To the definition of this genus it should be added that an air-bladder is present.

Family **Macruridæ**.

Macrurus (*Mystaconurus*) *heterolepis*, Alcock.

This species is very probably identical with *Macrurus* (*Mystaconurus*) *cavernosus* (=*Bathygadus cavernosus*) Goode and Bean, from the Gulf of Mexico, 227 fms., a specimen of which I have examined.

Family **Stomiatidæ**.

Thaumastomias, Alcock.

Prof. Chr. Lütken (K. Dansk. Vid. Selsk. Skr. 6 Række, Nat. Math. Afd. VII. 6, 1892, p. 281) considers *Thaumastomias* to be identical with *Photostomias* (Collett, Bull. Soc. Zool. France, XIV. 1889, p. 291), notwithstanding that the dentition and the whole structure of the

mouth are entirely different. He appears to think that *Thaumastomias atrox* is specifically identical with *Photostomias guernei* Collet (*loc. cit.*) but a comparison of the descriptions of the two species will hardly be held to justify this opinion.

§ 3. *Supplementary List of the Fishes of India.*

Order CHONDROPTERYGII.

Family **Scyllidæ**.

Scyllium.

1. *Scyllium hispidum*, Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 21: Ill. Zool. 'Investigator,' Fishes, pl. viii. figs. 3, 3*a*.

Andaman Sea in 188–220 fms.

2. *Scyllium ?canescens*, Gthr.

Scyllium canescens, Günther, 'Challenger,' Deep Sea Fishes, p. pl. i. fig. A.

A small specimen, from the Arabian Sea 690–620 fms., answers to Dr. Günther's description and figure, except only that the body is almost black.

I. * Family **Spinacidæ**.

i. * Centroscyllium, M. & H.

Centroscyllium, Müller and Henle, Plagiostomen, p. 191: Günther, Cat. Fishes Brit. Mus. VIII. p. 425.

Paracentroscyllium, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 379 (immature form).

3. *Centroscyllium ornatum*, Alcock.

Paracentroscyllium ornatum, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 379: Ill. Zool. 'Investigator,' Fishes, pl. viii. fig. 2: and *ante p.* 308.

"Swatch," Bay of Bengal in 405–285 fms., and Arabian Sea, 690–620 fms.

Family **Rajidæ**.

ii. * Raja, Cuv.

4. *Raja mammillidens*, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 380: Ill. Zool. 'Investigator,' Fishes, pl. viii. fig. 1.

Gulf of Manaar at 597 fms.

II. * Family **Chimæridæ.**

iii. * Chimæra.

5. * *Chimæra monstrosa*, Linn.? An empty egg-capsule from off Coromandel coast in 410 fms. (Ann. Mag. Nat. Hist. (6) X. 1892, p. 347).

iv. * Callorhynchus.

6. An empty egg-capsule from off the west coast of the Andamans in 561 fms. (Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 21, p. 22 fig. 1.)

Order TELEOSTEI.

Sub-Order ACANTHOPTERYGII.

Family **Serranidæ.**

v. * Chelidoperca, Boulenger.

7. *Chelidoperca investigatoris* (Alcock). *Centropristis investigatoris*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 199: Ill. Zool. 'Investigator,' Fishes, pl. x. fig. 1. *Chelidoperca investigatoris*, Boulenger, Brit. Mus. Cat. Fishes, (2) I. p. 305.

Off Madras coast in 98–102 fms.

Priacanthus.

8. *Priacanthus fax*, C. V.

Cuvier and Val., Hist. Nat. Poiss. VII. 473: Sauvage, in Grandidier, Hist. Madagascar, Vol. XVI. p. 126, pl. xvi. fig. 1.

Off Ceylon in 32 fathoms.

Mr. Boulenger (Cat. Fishes Brit. Mus. (2) I. p. 354) considers this to be the young of *P. macracanthus*, C. V.

vi. *Synagrops, Gthr.

Synagrops, Günther, 'Challenger' Deep Sea Fishes, p. 16. 1887.
Melanostoma, Döderlein, Denk. Ak. Wien, XLVIII. 1884, p. 5.
Parascombrops, Alcock, J. A. S. B. Vol. LVIII. pt. 2, 1889, p. 296.

9. *Synagrops philippinense* (*Gthr.*)

Acropoma philippinense, Günther, 'Challenger' Shore Fishes, p. 51: *Parascombrops pellucidus*, Alcock, J. A. S. B. Vol. LVIII. pt. 2, 1889, p. 296, pl. xxii. fig. 1: *Acropoma philippinense*, Alcock, J. A. S. B. Vol. LXII. pt. 2, 1894, p. 116.

Common all along the east coast in 60 to 100 fathoms.

vii. *Brephostoma.

Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 383, and (6) VI. 1890, p. 201 (*diagnosis of genus*).

10. *Brephostoma carpenteri*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1889, p. 383, and (6) VI. 1890, p. 201, pl. ix. fig. 4.

Bay of Bengal in 1370—1520 fathoms.

Family **Squamipinnes.**

11. *Chætodon triangulum* (K. v. H.), C. V.

Chætodon triangulum, Klunzinger, Fisch. Roth. Meer. Theil I. 1884, p. 57 (*ubi synon.*)

[*Tetragonopterus triangulum*, Bleeker, Atlas Ichthyologique, IX. p. 53, Chæt. Tab. XII. fig. 1.]

Andamans.

12. *Holacanthus alternans*, C. V.

Cuv. and Val., Hist. Nat. Poiss. VII. 193: Günther, Cat. Fi... Brit. Mus. II. 53: Playfair and Günther, Fishes of Zanzibar, p. 3... Sauvage in Grandidier, Hist. Madagascar, Vol. XVI. p. 269.

Palk Straits.

Family **Scorpænidæ.**

Sebastes.

13. *Sebastes serrulatus*, Richardson.

Richardson, Ichthyology of the Seas of China and Japan, p. 215: Günther, Cat. Fishes Brit. Mus. II. p. 106: Alcock, Journ. A. S. B. Vol. LVIII. pt. 2, 1889, p. 298, pl. xxii. fig. 2.

Off Ganjam (Madras coast) in 23 fathoms.

14. *Sebastes hexanema*, Gthr.

Günther, 'Challenger' Shore Fishes, p. 40, pl. xvii. fig. B, and Challenger Deep Sea Fishes, p. 18: Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 23.

Andaman Sea in 188—220 fms.

15. *Sebastes muciparus*, Alcock, Journ. A. S. B. Vol. LVIII. pt. 2, 1889, p. 298, pl. xxii. fig. 3.

Off Ganjam coast in 45 fms.

viii. *Lioscorpius, Gthr.

16. *Lioscorpius longiceps*, Gthr.

Günther, 'Challenger' Shore Fishes, p. 40, pl. xvii. fig. C: Alcock

Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 23, and Ill. Zool. 'Investigator,' Fishes, pl. x. fig. 3.

Andaman Sea in 188–220 fms.

SCORPÆNA.

17. *Scorpæna bucephalus*, ante p. 302.
18. *Scorpæna erostris*, ante p. 302.

PTEROIS.

19. *Pterois macrura*, ante p. 303.

PROSOPODASYS.

20. *Prosopodasys trachinoides*, (C. V.)

Apistus trachinoides, Cuv. and Val. Hist. Nat. Poiss IV. 401, pl. 92, fig. 1: *Prosopodasys trachinoides*, Günther, Cat. Fishes Brit. Mus. II. (*ubi synon.*): Bleeker, Atlas Ichthyologique IX. Scorp. Tab. III. fig. 3: Sauvage, Nouv. Archiv. du Mus. (2) I. 1878, p. 131.

Mergui Archipelago.

21. *Prosopodasys leucogaster*, (Richardson).

Apistus leucogaster, Richardson, 'Samarang' Fishes, pl. v. figs. 1-2: *Prosopodasys leucogaster*, Günther, Cat. Fishes Brit. Mus. II. p. 141: *Gymnapistus leucogaster*, Bleeker, Atlas Ichthyologique, IX. Scorp. Tab. I. fig. 6.

Off Makrán (Baluchistán) coast.

MICROPUS.

22. *Micropus unipinna*, Gray.

Gray, Zool. Miscell. p. 20: Günther, Cat. Fishes Brit. Mus. II. 147 and Fische der Südsee, p. 86.

? *Amphiprionichthys apistus*, Blkr., Günther, *op. cit.* II. 144: ? *Caracanthus apistus*, Bleeker Atl. Ichth. IX. Scorp. Tab. VI. fig. 5: *Amphiprionichthys apistus*, Kner, SB. Ak. Wien, LVIII. 1868, p. 309, pl. iii. fig. 8.

Reefs of Andaman Islands.

MINOUS.

23. *Minous trachycephalus*, Blkr.

Günther, Cat. Fishes Brit. Mus. II. p. 149: Bleeker, Atlas Ichthyologique IX. Scorp. Tab. V. fig. 4.

Off Malabar coast in 45 fms.

24. *Minous coccineus*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 428.

Off Ganjam coast in 28–30 fms.

25. *Minous inermis*, Alcock, J. A. S. B. Vol. LVIII. pt. 2, 1889, p. 299, pl. xxii. fig. 4; Ann. Mag. Nat. Hist. (6) X. 1892, pp. 207–214; J. A. S. B. Vol. LXII. pt. 2, 1894, p. 116.

Off Coromandel and Malabar coasts in 45–133 fms.

Family **Berycidæ.**

ix. *Hoplostethus, C. V.

26. *Hoplostethus mediterraneum*, Gthr.

Günther, 'Challenger' Deep Sea Fishes, p. 21 (*ubi synon.*) : Alcock, J. A. S. B. Vol. LXII. pt. 2, 1894, p. 116, and Ill. Zool. 'Investigator,' Fishes, pl. xiv. fig. 3.

Bay of Bengal in 145–250 fms., and off Ceylon in 320–296 fms.

x. *Trachichthys, Shaw.

27. *Trachichthys intermedius*, Hector.

Hector, Trans. New Zealand Inst. VII. p. 245, pl. xi. fig. 18*a* : Günther, 'Challenger' Deep Sea Fishes, p. 24, pl. v. fig. D : Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889 p. 380.

Bay of Bengal, off Gangetic Delta in 272 fms.

28. *Trachichthys darwinii*, Johns.

Trachichthys darwinii, Johnson, P. Z. S., 1866, p. 311, pl. xxxii : *Trachichthys japonicus*, Steindachner and Döderlein, Denk. Ak. Wien, XLVII. 1883, p. 218, pl. ii : *Trachichthys darwinii*, Günther, 'Challenger' Deep Sea Fishes, p. 24 (*ubi synon.*)

Off Ceylon in 320–296 fms.

xi.* Melamphaës, Gthr.

29. *Melamphaës mizolepis*, Gthr.

Günther, 'Challenger' Deep Sea Fishes, p. 28 : Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 201.

Bay of Bengal in 1310 fms.

30. *Melamphaës* sp., Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 23.

Bay of Bengal in 1644 and 1803 fms.

xii. * POLYMIXIA, Lowe.

31. *Polymixia nobilis*, Lowe.

Polymixia nobilis, Günther, Cat. Fishes Brit. Mus. I. p. 17, and 'Challenger' Deep Sea Fishes, p. 34, pl. i. fig. B (*ubi synon.*) : Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 381, and (6) VIII. 1891 p. 23.

Andaman Sea in 188–271 fms.

HOLOCENTRUM.

32. *Holocentrum punctatissimum*, C. V.

Günther, Cat. Fishes Brit. Mus. I. p. 38: Bleeker, Atl. Ichth. VIII. Trachichth. Tab. V. fig. 2.

Palk Straits.

Family **Scilænidæ**.

33. *Sciæna ophiceps*, Alcock, J. A. S. B. Vol. LVIII. pt. 2, 1889, 300.

Orissa coast.

Family **Trichiuridæ**.

xiii. * THYRSITES, C. V.

34. *Thyrsites bengalensis*, Alcock, J. A. S. B. Vol. LXII. pt. 2, 1894, p. 117, pl. vi. fig. 1, and Ill. Zool. 'Investigator,' Fishes, pl. xv. fig. 10.

Bay of Bengal in 145–250 fms.

May prove to be identical with *Thyrsites promethcoides* Bleeker.

Family **Acronuridæ**.

35. *Naseus vlamingii*, C. V.

Günther, Fische der Sudsee, p. 123 pl. lxxxi. (*ubi synon.*)

Off Minnikoy I., Laccadives.

Family **Carangidæ**.

xiv. * BATHYSERIOLA.

Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 202.

36. *Bathyseriola cyanea*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 202, and (6) VIII. 1891, p. 23.

Off Coromandel coast in 98–276 fms.

Family **Cyttidæ.**

xv. *Antigonia, Lowe.

37. *Antigonia capros*, Lowe.

Günther, Cat. Fishes Brit. Mus. II. p. 497: Steindachner and Döderlein, Denk. Ak. Wien, XLIX. 1885, p. 187, pl. v. (*ubi synon.*): Günther Challenger Deep Sea Fishes, p. 44 (*ubi synon.*)

Off Ceylon in 320–296 fms.

Family **Trachinidæ.**

Uranoscopus.

38. *Uranoscopus cognatus*, Cantor.

Cantor, Cat. Malayan Fishes (J. A. S. B. Oct. 1849, p. 1003) p. 21: Günther, Cat. Fishes Brit. Mus. II. p. 227: Alcock, J. A. S. B. Vol. LVIII. pt. 2, 1889, p. 301.

Off Orissa and Ganjam coasts at 10–25 fms.

39. *Uranoscopus crassiceps*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 205, and Ill. Zool. 'Investigator,' Fishes, pl. x. fig. 4.

Off Madras coast at 98–102 fms.

xvi. *Champsodon, Gthr.

40. *Champsodon vorax*, Gthr.

Günther, P. Z. S. 1867, p. 102, and Challenger Shore Fishes, pp. 43, 52, 56, pl. xxiii. fig. A, and Challenger Deep Sea Fishes, p. 49: Alcock, J. A. S. B. Vol. LVIII. pt. 2, 1889, p. 302, and Ann. Mag. Nat. Hist. (6) IV. 1889, p. 381.

Common all round the coasts of India at about 30 to about 60 fms.

Percis.

41. *Percis tetracanthus*, Blkr.

Günther, Cat. Fishes Brit. Mus. II. p. 241, and Fische der Südsee, p. 158, pl. xciii. fig. B: Kner and Steindachner, SB. Ak. Wien, LIV. 1866, i. p. 362, pl. iii. fig. 18.

Bay of Bengal and Andamans.

xvii. *Bembrops, Stdr.

Bembrops, Steindachner, SB. Ak. Wien, LXXIV. 1877, i. p. 211: *Hypsicometes*, Goode, Proc. U. S. Nat. Mus. Vol. III. 1881, p. 347, and

Günther, Challenger Deep Sea Fishes, p. 85: *Bathypercis*, Alcock, J. A. S. B. Vol. LXII. pt. 2, 1893, p. 177: *Bembrops*, Alcock, J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 118.

42. *Bembrops platyrhynchus*, Alcock.

Bathypercis platyrhynchus, Alcock, J. A. S. B. Vol. LXII. pt. 2, 1893, p. 178, pl. ix. fig. 1: *Bembrops platyrhynchus*, Alcock, J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 118.

Off Madras coast in 128 fms.

43. *Bembrops caudimacula*, Stdr.

Steindachner, SB. Ak. Wien, 1877, Vol. LXXIV. i. p. 212: Alcock, J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 118.

Off Madras coast in 107 fms.

xviii. *Chiasmodus, Johnson.

Chiasmodon, Johnson, P. Z. S. 1863, p. 408, and Ann. Mag. Nat. Hist. (3) XIV. 1864, p. 76: *Chiasmodus*, Günther, Cat. Fishes Brit. Mus. V. p. 435: *Ponerodon*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 203, and (6) VII. 1891, pp. 9, 10. ? *Pseudoscopelus*, Lütken, Vid. Selsk. Skr., 6 Ræk. nat. math. Afd. VII. 6, p. 285, (pl. i.)

44. *Chiasmodus niger*, Johns.

Johnson, P. Z. S. 1863, p. 408, and Ann. Mag. Nat. Hist. (3) XIV. 1864, p. 76: Günther, Cat. Fishes Brit. Mus. V. p. 435, and Challenger Deep Sea Fishes, p. 99: Carter, P. Z. S. 1866, p. 35, pl. ii: Jordan and Gilbert, Cat. Fish. N. Amer. p. 119: A. Agassiz, Bull. Mus. Comp. Zool. XV. 1888, p. 29, fig. 208.

Ponerodon vastator, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 203, pl. ix. fig. 5.

Off Madras coast in 920-690 fms.

Family **Pediculati.**

xix. * Lophius, Art.

45. *Lophius indicus*, Alcock, J. A. S. B. Vol. LVIII. pt. 2, 1889, p. 302.

Off Ganjam coast, 25 fms. and off Malabar coast at 28 fms.

46. *Lophius mutilus*, Alcock, J. A. S. B. Vol. LXII. pt. 2, 1893, p. 179, and Ill. Zool. Investigator, Fishes, pl. x. fig. 2.

Off Madras coast at 128 fms.

47. *Lophius lugubris*, Alcock, J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 118, and Ill. Zool. Investigator, Fishes, pl. xiv. fig. 1.

Off Colombo at 142–400 fms.

xx. * Ceratias, Kröyer.

48. *Ceratias bispinosus*, Gthr.

Günther, Challenger Deep Sea Fishes, p. 53, pl. xi. fig. B.

Laccadive Sea at 636 fms.

xxi. * Paroneirodes.

Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 206.

49. *Paroneirodes glomerosus*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 206, pl. ix. fig. 6.

Off Madras coast at 1260 fms.

xxii. * Chaunax, Lowe.

50. *Chaunax pictus*, Lowe.

Lowe, Trans. Zool. Soc. III. 1849, p. 340, pl. li: Günther, Cat. Fishes Brit. Mus. III. p. 200, and Challenger Deep Sea Fishes, p. 58, pl. x. fig. A: Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 381.

Bay of Bengal at 272 fms.

Halieutæa.

51. *Halieutæa coccinea*, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 382, and J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 120.

Andaman Sea at 265 fathoms.

52. *Halieutæa nigra*, Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 24, and J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 120.

Andaman Sea at 188–220 fms.

53. *Halieutæa fumosa*, Alcock, J. A. S. B. Vol. LXIII. pt. 2, 1894, pp. 119, 120, and Ill. Zool. Investigator, Fishes, pl. xiv fig. 2.

Bay of Bengal at 145–250 fms.

xxiii. *Dibranchus, Peters.

54. *Dibranchus micropus*, Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 25, pl. viii. figs. 2, 2*a*, 2*b*, and (6) X. 1892, p. 348.

Bay of Bengal at 240–276 fms., off C. Comorin at 902 fms., and off coast of Travancore at 406 fms.

55. *Dibranchus nasutus*, Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 24, pl. vii. fig. 1.

Andaman Sea at 188–220 fms., and off coast of Travancore at 406 fms.

xxiv. *Malthopsis.

Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 26.

56. *Malthopsis luteus*, Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 26, pl. viii. figs. 2, 2*a*.

Andaman Sea at 188–220 fms.

xxv. *Halicmetus.

Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 27.

57. *Halicmetus ruber* Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, 27, pl. viii. figs. 1, 1*a*, 1*b*.

Andaman Sea at 188–220 fms., and off Travancore coast at 406 fms.

Family **Cottidæ.**

58. *Trigla hemisticta*, Schlegel.

Temm. and Schleg. Faun. Japon. Poiss. p. 36, pl. xiv. figs. 3, 4, pl. xiv. B: Günther, Cat. Fishes Brit. Mus. II. p. 201: Day, Fauna Brit. Ind., Fishes, II. p. 241: Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 207.

Mentioned by Day as from Muscat, not from India.

Off Madras coast in 98–102 fms.

[? *Prionotus alepis*, Alcock, J. A. S. B. Vol. LVIII. pt. 2, 1889, p. 303, pl. xxii. fig. 5.

This species may possibly be the young of *Trigla hemisticta*, but it undoubtedly has a band of teeth on the palatine bones and vomer.

Off Orissa coast in 68 fms.]

xxvi. *Lepidotrigla, Gthr.

59. *Lepidotrigla spiloptera*, Gthr.

Günther, Challenger Shore Fishes, p. 42, pl. xviii. fig. C: Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 429 (*var. longipinnis*).

Off Ganjam coast in 18 fms., and off Gangetic Delta in about 60 fms.

Family **Cataphracti.**

60. *Peristethus murrayi*, Gthr.

Günther, Challenger Shore Fishes, p. 52, pl. xxxii. fig. A: Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 28.

Andaman Sea, in 188–220 fms.

61. *Peristethus rivers-andersoni*, Alcock, J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 121, pl. vi. figs. 2, 2*a*, 2*b*.

Off Colombo, in 142–400 fms.

62. *Dactylopterus macracanthus*, Bleeker.

Günther, Cat. Fishes Brit. Mus. II. p. 223.

Off Malabar coast, in 28–45 fms., and off Orissa coast in 60 fms.

63. *Dactylopterus chirophthalmus*, Bleeker.

Günther, Cat. Fishes Brit. Mus. II. p. 223.

Off Madras.

Family **Pegasidæ.**

64. *Pegasus natans*, L.

Günther, Cat. Fishes Brit. Mus. VIII. p. 148 (*ubi synon.*)

Off Makrán (Baluchistán) coast.

Family **Gobiidæ.**

65. *Gobius cometes*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 208, pl. viii. fig. 2.

Off Madras coast in 98–102 fms.

66. *Amblyopus arctocephalus*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 432.

Off Mahánaddi Delta at 50 fms., and off Vizagapatam coast at 20–25 fms.

67. *Callionymus carebares*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 209, pl. viii. fig. 8.

Off Madras coast at 98–102 fms.

Family **Trichonotidæ.**

xxvii. **Tæniolabrus*, Stdr.

Steindachner, SB. Ak. Wien, LV. 1867, i. p. 713.

68. *Tæniolabrus cyclograptus*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, pp. 430, 431, fig. 1.

Off Ganjam coast in 10–13 fms.

Suborder ANACANTHINI.

Family **Gadidæ.**

xxviii. * PHYSICULUS, Kaup.

69. *Physiculus roseus*, Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 28, and J. A. S. B., Vol. LXIII. pt. 2, 1894, p. 122, and Ill. Zool. Investigator, Fishes pl. xi. fig. 2.

Andaman Sea in 188–220 fms.

70. *Physiculus argyropastus*, Alcock, J. A. S. B. Vol. LXII. pt. 2, 1893, p. 180, pl. ix. fig. 2, and Vol. LXIII. pt. 2, 1894, pp. 121, 122.

Off Madras and Ceylon coasts in 128–217 fms.

Family **Ophidiidæ.**

xxix. * NEOBYTHITES, Goode and Bean.

Neobythites, Goode and Bean, Proc. U. S. Nat. Mus. VIII. 1886, p. 600, and Günther, Challenger Deep Sea Fishes, p. 100. And *ante* p. 308.

Pycnocraspedum, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 386.

Monomitopus, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 297.

71. *Neobythites macrops*, Gthr.

Günther, Challenger Deep Sea Fishes, p. 102, pl. xx. fig. A: Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 385, and VIII. 1891, p. 30.

Andaman Sea in 188–271 fms.

72. *Neobythites steatiticus*, Alcock, J. A. S. B. Vol. LXII. pt. 2, 1893, p. 181, pl. ix. fig. 3.

Off Madras coast in 107–250 fms.

73. *Neobythites pterotus*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, pp. 210, 297, and VIII. 1891, p. 30, and Ill. Zool. Investigator, Fishes, pl. xi. fig. 4.

Bay of Bengal in 1310 and 1748 fms. Laccadive Sea, 1000 fms.

74. *Neobythites squamipinnis*, Alcock.

Pycnocraspedum squamipinne, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 386: *Neobythites squamipinnis*, Alcock, J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 123.

Bay of Bengal in 193–250 fms.

75. *Neobythites nigripinnis*, Alcock.

Sirembo nigripinnis, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 384: *Monomitopus nigripinnis*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 297, and VIII. 1891, p. 29, and Ill. Zool. Investigator, Fishes, pl. xi. fig. 3.

Andaman Sea in 490 fms., Bay of Bengal in 561–753 fms., Laccadive Sea in 740–891 fms.

76. *Neobythites conjugator*, ante p. 304.

xxx. *Dicrolene, Goode and Bean.

Dicrolene, Goode and Bean, Bull. Mus. Comp. Zool. X. 1883 p. 202, and Günther, Challenger Deep Sea Fishes, p. 107. And *ante* p. 309.

Paradicrolene, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 387.

77. *Dicrolene intronigra*, Goode and Bean.

Goode and Bean, Bull. Mus. Comp. Zool. X. 1883, p. 202: Günth Challenger Deep Sea Fishes, p. 107: Vaillant, Exp. Sci. Travaill et Talisman, Poiss. p. 258, pl. xxiii. fig 2. And *ante* p. 309.

Paradicrolene vaillanti, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 297.

Laccadive Sea in 740 fms., off Ceylon in 406 fms.

78. *Dicrolene multifilis*, Alcock.

Paradicrolene multifilis, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 387, and VIII. 1891, p. 32, and X. 1892, p. 348, and Ill. Zool. Investigator pl. xi. fig. 1.

Bay of Bengal in 193–281 fms.

79. *Dicrolene nigricaudis*, Alcock.

Paradicrolene nigricaudis, Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 30, and Ill. Zool. Investigator, Fishes, pl. ii. fig. 4.

Andaman Sea in 188–220 fms.

The "Explanation of the plate" was prepared in my absence, and in it this species, though correctly designated on the plate itself, is wrongly referred to *D. multifilis*.

xxxi. *Dinematichthys, Blkr.

80. *Dinematichthys piger*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 432.

Great Coco I., Andamans.

xxxii. * Diplacanthopoma, Gthr.

81. *Diplacanthopoma brachysoma*, Gthr.

Günther, Challenger Deep Sea Fishes, p. 115, pl. xxiii. fig. C: Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 385.

Andaman Sea in 490 fms.

82. †*Diplacanthopoma rivers-andersoni*, Alcock, Ann. Mag. Nat. Hist. (6) XVI. 1895, p. 144.

Off Indus Delta in 947 fms.

xxxiii. * Saccogaster.

Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 389.

83. *Saccogaster maculata*, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 389; VIII. 1891, p. 30, pl. vii. fig. 3; P. Z. S. 1891, pp. 226, 227, fig.

Bay of Bengal in 145–250 fms.

xxxiv. * Bathyonus, Gthr.

84. *Bathyonus glutinosus*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 211, and Ill. Zool. Investigator, Fishes, pl. i. fig. 3.

Off Madras coast in 1310 fms.

xxxv. *Dermatorus.

Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 298.

85. *Dermatorus trichiurus*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 298, and Ill. Zool. Investigator, Fishes, pl. i. fig. 1.

Laccadive Sea in 1000 fms., and off Makrán (Baluchistán) coast in 890 fms.

86. *Dermatorus melanocephalus*, Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 32.

Bay of Bengal in 1641-1748 fms.

87. *Dermatorus melampeplus*, ante p. 305.

xxxvi. * Tauredophidium.

Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 212.

88. *Tauredophidium hextii*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 213, pl. viii. fig. 1.

Off Madras coast at 1310 fms.

† Ill. Zool. Investigator, Fishes pl. xvii. fig. 1 (*in preparation*).

xxxvii. * Glyptophidium.

Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 390. And *ante* p. 309.

89. *Glyptophidium argenteum*, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 390, and Ill. Zool. 'Investigator,' Fishes, pl. ii. fig. 3.

Andaman Sea in 271 fms., off Travancore coast in 406 fms.

90. *Glyptophidium macropus*, Alcock, J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 122, pl. vi. fig. 3, and Ill. Zool. Investigator, Fishes, pl. xv. fig. 6.

Bay of Bengal in 145–250 fms.

xxxviii. * Lamprogrammus.

Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 32. And *ante* p. 309.

91. *Lamprogrammus niger*, Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 33, fig. 2, and Ill. Zool. Investigator, Fishes, pl. i. fig. 2.

Bay of Bengal, off west coast of Andamans in 561 fms., Andaman Sea in 405 fms.

92. *Lamprogrammus fragilis*, Alcock, Ann. Mag. Nat. Hist. (6) X. 1892, p. 348.

Bay of Bengal in 678 fms., off Travancore coast in 406 fms.

xxxix. * Hephthocara.

Alcock, Ann. Mag. Nat. Hist. (6) X. 1892, p. 349.

93. *Hephthocara simum*, Alcock, Ann. Mag. Nat. Hist. (6) X. 1892, p. 349, pl. xviii. fig. 1.

Gulf of Manaar in 902 fms.

III. * Family **Macruridæ**.

xl. * Macrurus, Bl.

94. *Macrurus* (*Cœlorhynchus*) *parallelus*, Gthr.

Günther, Challenger Deep Sea Fishes, p. 125, pl. xxix. fig. A: Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 391, and J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 126.

Gulf of Manaar in 597 fms.

95. *Macrurus* (*Cœlorhynchus*) *flabellispinis*,† Alcock, J. A. S. B. Vol. LXIII. pt. 2, 1894, pp. 123, 126, and Ill. Zool. Investigator, Fishes, pl. xvi. figs. 2, 2*a*.

Off N. Maldive Atoll in 719 fms.

† Erroneously "*flabellispinnis*" on p. 123.

96. *Macrurus* (*Coelorhynchus*) *quadricristatus*, Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 119, and Ill. Zool. Investigator, Fishes, pl. iii. fig. 1, and J. A. S. B., Vol. LXIII. pt. 2, 1894, p. 126.

Andaman Sea in 188–405 fms.

97. *Macrurus* (*Macrurus*) *investigatoris*, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 391; VIII. 1891, p. 121; X. 1892, p. 351, and Ill. Zool. Investigator, Fishes, pl. iii. fig. 4, and J. A. S. B., Vol. LXIII. pt. 2, 1894, p. 127.

Andaman Sea in 188–490 fms., Bay of Bengal in 193–410 fms.

98. *Macrurus* (*Macrurus*) *petersonii*, Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 121, and Ill. Zool. Investigator, Fishes, pl. iii. fig. 5, and J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 127.

Andaman Sea in 188–220 fms.

99. *Macrurus* (*Macrurus*) *semiquinquenciatus*, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 392; VIII. 1891, p. 121; X. 1892, p. 351, and Ill. Zool. Investigator, Fishes, pl. xii. fig. 2, and J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 127.

Bay of Bengal in 130–410 fms.

100. *Macrurus* (*Macrurus*) *brevirostris*, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 393, and Ill. Zool. Investigator, Fishes, pl. xiii. fig. 3, and J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 127.

Andaman Sea in 490 fms.

101. *Macrurus* (*Macrurus*) *macrolophus*, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 394; VIII. 1891, p. 121; X. 1892, p. 351, fig. 1, p. 352, and Ill. Zool. Investigator, Fishes, pl. xii. fig. 1, and J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 126.

Bay of Bengal in 240–410 fms., off Travancore coast in 406 fms.

102. *Macrurus* (*Macrurus*) *lophotes*, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 395, and Ill. Zool. Investigator, Fishes, pl. iii. fig. 2, and J. A. S. B., Vol. LXIII. pt. 2, 1894, p. 126.

Bay of Bengal, "Swatch", in 285–405 fms.

103. *Macrurus* (*Macrurus*) *polylepis*, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 395, and J. A. S. B., Vol. LXIII. pt. 2, 1894, p. 127.

Bay of Bengal in 193–272 fms.

104. *Macrurus* (*Macrurus*) *pumiliceps*, Alcock, J. A. S. B., Vol. LXIII. pt. 2, 1894, pp. 125, 127, and Ill. Zool. Investigator, Fishes, pl. xvi. fig. 3.

Off N. Maldive Atoll in 712 fms.

105. *Macrurus* (*Macrurus*) *hoskynii*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 214, and Ill. Zool. Investigator, Fishes, pl. ix. fig. 4, and J. A. S. B., Vol. LXIII. pt. 2, 1894, p. 126.

Off Madras coast in 1310 fms.

106. *Macrurus* (*Macrurus*) *hextii*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 299; X. 1892, p. 351, and Ill. Zool. Investigator, Fishes, pl. xii. fig. 3, and J. A. S. B., Vol. LXIII. pt. 2, 1894, p. 126.

Laccadive Sea in 865–1000 fms.

107. *Macrurus* (*Macrurus*) *wood-masoni*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 301; VIII. 1891, p. 121; X. 1892, p. 353, and Ill. Zool. Investigator, Fishes, pl. xiii. fig. 1, and J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 126.

Laccadive Sea, G. of Mannar, and off Konkan coast, in 559–1000 fms.

108. *Macrurus* (*Mystaconurus*) *heterolepis*, Alcock, Ann, Mag. Nat. Hist. (6) IV. 1889, p. 396; VIII. 1891, p. 122, and Ill. Zool. Investigator, Fishes, pl. iii. fig. 3. And *ante* p. 309.

Neighbourhood of Andaman Is. in 188–271 fms., Gulf of Manaar in 180–217 fms.

109. *Macrurus* (*Chalinurus*) *hispidus*, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 397, and Ill. Zool. Investigator, Fishes, pl. xiii. fig. 2.

Off west coast of Andamans in 220–240 fms.

110. *Macrurus* (*Malacocephalus*) *lævis*, Lowe.

Lowe, P. Z. S. 1843, p. 92: Günther, Cat. Fishes Brit. Mus. IV. p. 397, and Challenger Deep Sea Fishes p. 148, pl. xxxix. fig. B: Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 398, and VIII. 1891, p. 123.

Andaman Sea in 188–265 fms.

xli. *Bathygadus, Gthr.

111. *Bathygadus longifilis*, Goode and Bean.

Goode and Bean, Proc. U. S. Nat. Mus. VIII. 1885, p. 599: Günther, Challenger Deep Sea Fishes, p. 157: Vaillant, Exp. Sci. Travailleur et Talisman, Poiss. p. 218, pl. xxiii. fig. 1: Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 302, and VIII. 1891, p. 123.

Laccadive Sea in 740 fms., Andaman Sea in 683 fms.

112. *Bathygadus cottoides*, Gthr.

Günther, Challenger Deep Sea Fishes, p. 154, pl. xlii. fig. A: Alcock, Ann. Mag. Nat. Hist. (6) X. 1892, p. 353.

Bay of Bengal in 410 fms.

113. *Bathygadus furvescens*, Alcock, J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 128, and Ill. Zool. Investigator, Fishes, pl. xvi. fig. 1.

Off N. Maldive Atoll in 719 fms.

IV. *Family **Ateleopodidæ**.

xlii. *Ateleopus, Schleg.

114. *Ateleopus indicus*, Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, pp. 123, 124, fig. 3, and Ill. Zool. Investigator, Fishes, pl. ii. fig. 2.

Andaman Sea in 188–220 fms.

Family **Pleuronectidæ**.

xliii. *Arnoglossus, Blkr.

115. *Arnoglossus macrolophus*, Alcock, J. A. S. B. Vol. LVIII. pt. 2, 9, p. 280, pl. xviii. fig. 2, and Ann. Mag. Nat. Hist. (6) VI. 1890, 433.

Off Ganjam coast at 25–35 fms.

116. *Arnoglossus brevirictis*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 433.

Off Ganjam coast at 30 fms.

xliv. * Brachypleura, Gthr.

117. *Brachypleura xanthosticta*, Alcock, J. A. S. B. Vol. LVIII. pt. 2, 1889, p. 281, pl. xvii. fig. 3.

Off Orissa and Ganjam coasts at 25–35 fms.

xlv. * Samaris, Gray.

118. *Samaris cristatus*, Gray.

Gray, Zool. Miscell., p. 4: Günther, Cat. Fishes Brit. Mus. IV. p. 420: Alcock, J. A. S. B., Vol. LVIII. pt. 2, 1889, p. 291, pl. xvii. fig. 4.

Off south and east coast of Ceylon at 26–34 fms.

xlvi. * Chascanopsetta.

Alcock, J. A. S. B., Vol. LXIII. pt. 2, 1894, p. 128.

119. *Chascanopsetta lugubris*, Alcock, J. A. S. B., Vol. LXIII. pt. 2, 1894, p. 129, pl. vi. fig. 4, and Ill. Zool. Investigator, Fishes, pl. xv. fig. 3.

Bay of Bengal at 145–250 fms.

RHOMBOIDICHTHYS.

120. *Rhomboidichthys angustifrons*, Gthr.

Günther, Challenger Shore Fishes, p. 46, pl. xxi. fig. B; Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 435.

Off south-east coast of Ceylon at 32 fms.

121. *Rhomboidichthys azureus*, Alcock, J. A. S. B., Vol. LVIII. pt. 2, 1889, p. 283, pl. xvi. fig. 3, and Ann. Mag. Nat. Hist. (6) VI. 1890, p. 435.

Off Ganjam coast at 7–33 fms., off south-east coast of Ceylon at 32 fms.

122. *Rhomboidichthys valde-rostratus*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 435.

Off south-east coast of Ceylon at 32 fms.

123. *Rhomboidichthys polylepis*, Alcock, J. A. S. B., Vol. LVI[illegible] pt. 2, 1889, p. 290, pl. xvi. fig. 1, and Ann. Mag. Nat. Hist. (6) VI. 189[illegible] p. 434.

Off east and south-east cost of Ceylon at 32–34 fms.

xlvii. *PSETTYLLIS.

Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 436.

124. *Psettyllis pellucida*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 437, fig. 2 p. 438.

All along Coromandel coast at 7–20 fms.

125. *Psettyllis ocellata*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 437, fig. 3 p. 48.

Off coast of Ganjam and Vizagapatam at 7½–13 fms.

xlviii. *PŒCILOPSETTA, Gthr.

126. *Pœcilopsetta maculosa*, Alcock, J. A. S. B., Vol. LXIII. pt. 2, 1894, p. 130, pl. vii. fig. 1, and Ill. Zool. Investigator, Fishes, pl. xv. fig. 1.

Bay of Bengal at 145–250 fms.

127. *Pœcilopsetta prælonga*, Alcock, J. A. S. B., Vol. LXIII. pt. 2, 1894, p. 130, pl. vii. fig. 2, and Ill. Zool. Investigator, Fishes, pl. xv. fig. 2.

Off Colombo at 142–400 fms.

xlix. *LÆOPS, Gthr.

128. *Læops guentheri*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 438.

G. of Martaban at 20 fms., off coasts of Vizagapatam, Ganjam and Orissa at 15–60 fms.

I. * Sciaenctes.

Alcock, [J. A. S. B., Vol. LVIII. pt. 2, 1889, p. 284] Ann. Mag. Nat. Hist. (6) VI. 1890, p. 216.

129. *Sciaenctes macrophthalmus* [Alcock, J. A. S. B., Vol. LVIII. pt. 2, 1889, p. 292, pl. xvi. fig. 4] Ann. Mag. Nat. Hist. (6) VI. 1890, p. 216.

Off Arakan coast at 100 fms., off Madras coast at 98–102 fms.

130. *Sciaenctes lophoptera*, Alcock, J. A. S. B., Vol. LVIII. pt. 2, 1889, p. 284, pl. xvi. fig. 2.

Off Orissa coast at 68 fms.

Ii. * Boopsetta, ante p. 305.

131. *Boopsetta umbrarum*, ante p. 305.

Solea.

132. *Solea* (*Achirus*) *oculus*, Alcock, J. A. S. B. Vol. LVIII. pt. 2, 1889, p. 285, pl. xviii. fig. 3.

Off Orissa and Ganjam coasts at 7–10 fms.
Possibly only a variety of *S. harzfeldii*, Blkr.

133. *Solea* (*Achirus*) *cyanea*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 439.

Off Ganjam and Vizagapatam coasts at 20–33 fms.

134. *Solea* (*Achirus*) *umbratilis*, Alcock, J. A. S. B., Vol. LXIII. pt. 2, 1894, p. 131, pl. vii. fig. 3, and Ill. Zool. Investigator, Fishes, pl. xv. fig. 4.

Off Coromandel coast at 91–107 fms., off Kattiawár coast, 82 fms.

Synaptura.

135. *Synaptura quagga* (Kaup).

Aesopia quagga, Kaup, Wiegm. Archiv, 1858, p. 98: *Synaptura quagga*, Günther, Cat. Fishes Brit. Mus. IV. p. 85: Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 440 (*nec* J. A. S. B., Vol. LVIII. pt. 2, 1889, p. 286).

Off Coromandel coast at 26–33 fms.

136. *Synaptura altipinnis*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 441.

Off Vizagapatam coast at 25 fms.

liii. * Aphoristia, Kaup.

137. *Aphoristia wood-masoni*, Alcock, J. A. S. B., Vol. LVIII. pt. 2, 1889, p. 294, pl. xvii. fig. 1; Ann. Mag. Nat. Hist. (6) X. 18 p. 354; J. A. S. B, Vol. LXIII. pt. 2, 1894, p. 132; Ill. Zool. Investigator, Fishes, pl. xvi. fig. 4.

Andaman Sea at 490 fms., Bay of Bengal at 475 fms.

138. *Aphoristia gilesii*, Alcock, J. A. S. B., Vol. LVIII. pt. 2, 1889, p. 293, pl. xvii. fig. 2, and LXIII. pt. 2, 1894, p. 132; Ill. Zool. Investigator, Fishes, pl. xiv. fig. 4.

Bay of Bengal, "Swatch" at 193 fms., and off Madras coast at 210 fms.

139. *Aphoristia septemstriata*, Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 125; Ill. Zool. Investigator, Fishes, pl. ii. fig. 1; J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 133.

Andaman Sea at 188–220 fms., off Colombo at 142–400 fms.

140. *Aphoristia trifasciata*, Alcock, J. A. S. B, Vol. LXIII. pt. 1894, p. 132, pl. vii. fig. 4, and Ill. Zool. Investigator, Fishes, pl. xv fig. 5.

Bay of Bengal at 145–250 fms.

Cynoglossus.

141. *Cynoglossus monopus*, Blkr.

Cynoglossus melanopterus, Günther, Cat. Fishes Brit. Mus. IV. p. 502: *Cynoglossus monopus*, Bleeker, Atl. Ichth. VI. p. 38, pl. ccxlv. fig. 4: *Cynoglossus melanopterus*, Alcock, J. A. S. B., Vol. LVIII. pt. 2, 1889, p. 289.

Off Ganjam coast at 7 fms.

142. *Cynoglossus versicolor*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 442.

Off Orissa coast at 11 fms.; off Makrán (Baluchistán) coast.

143. *Cynoglossus præcisus*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 442.

Off Coromandel coast at 20–33 fms.

144. *Cynoglossus carpenteri*, Alcock, J. A. S. B., Vol. LVIII. pt. 2, 1889, p. 287, pl. xviii. fig. 1; and Ann. Mag. Nat. Hist. (6) VI. 189 p. 217.

Off Coromandel coast at 68–107 fms.

Sub Order PHYSOSTOMI.

V. *Family **Sternoptychidæ.**

liii. *Argyropelecus, Cocco.

145. *Argyropelecus hemigymnus*, Cocco.

Günther, Cat. Fishes Brit. Mus. V. p. 385, and Challenger Deep Sea Fishes, p. 167: Goode and Bean, Bull. Mus. Comp. Zool. Vol. X. 1883, p. 220: Facciola, Nat. Sicil. II. 206: Vinciguerra, Ann. Mus. Genov. (2) II. 469: Carus, Prod. Faun. Medit. II. 568: Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 126.

Bay of Bengal in 1803 fms.

liv. *Sternoptyx, Herm.

146. *Sternoptyx diaphana*, Herm.

Günther, Cat. Fishes Brit. Mus. V. p. 387, and Challenger Deep Sea Fishes, p. 169, pl. xlv. figs. D. D': Goode and Bean, Bull. Mus. Comp. Zool. Vol. X. 1883 p. 220: A. Agassiz, Bull. Mus. Comp. Zool. Vol. XV. p. 22, fig. 195.

Off Malabar coast in 912–931 fms.

lv. *Polyipnus, Gthr.

147. *Polyipnus spinosus*, Gthr.

Günther, Challenger Deep Sea Fishes, p. 170, pl. li. fig. B: Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 398, and VIII. 1891, p. 126.

Off coasts of Andaman Is. in 188–240 fms.

lvi. *Gonostoma, Raf.

148. *Gonostoma microdon*, Gthr.

Günther, Challenger Deep Sea Fishes, p. 175 (*ubi synon.*): Alcock, Ann. Mag. Nat. Hist., (6) IV. 1889, p. 399.

Off coasts of Andamans in 485–265 fms.

149. *Gonostoma elongatum*, Gthr.*

Günther, Challenger Deep Sea Fishes, p. 173, pl. xlv. fig. B: Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 127; and X. 1892, p. 354.

Laccadive Sea in 738–1200 fms.

lvii. *Chauliodus, Bl. Schn.

150. *Chauliodus sloanii*, Bl. Schn.

Günther, Cat. Fishes Brit. Mus. V. p. 392 (*ubi synon.*), and Challenger Deep Sea Fishes, p. 179: Goode and Bean, Bull. Ess. Inst. XI. 1879, p. 22: Goode, P. U. S. N. M., III. 1880, p. 483: Facciola, Nat. Sicil. II. 206: Vinciguerra, Ann. Mus. Genov. (2) II. 469: A. Agassiz, Bull. Mus. Comp. Zool. XV. p. 32, fig. 214: Carus, Prod. Faun. Medit. II. 570: Alcock, Ann. Mag Nat. Hist. (6) IV. 1889, p. 399; VIII. 1891, p. 127; X. 1892, p. 355.

Bay of Bengal in 1590 fms., G. of Manaar in 597 fms., Laccadive Sea.

151. *Chauliodus pammelas*, Alcock, Ann. Mag. Nat. Hist. (6) X. 1892, p. 355.

Laccadive Sea in 1370 fms.

Family **Scopelidæ**.

Harpodon.

152. *Harpodon squamosus*, Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 127, and X. 1892, p. 356.

Bay of Bengal, off east coast of India in 200–300 fms.

lviii. *Scopelarchus, ante, p. 306.

153. *Scopelarchus guentheri*, ante, p. 307.

lix. * Bathypterois, Gthr.

154. *Bathypterois guentheri*, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 450; VIII. 1891, p. 129; and Ill. Zool. Investigator, Fishes, pl. vii. fig. 6.

Off coasts of Andaman Is., 490–561 fms.

155. *Bathypterois insularum*, Alcock, Ann. Mag. Nat. Hist. (6) X. 1892, p. 356.

Laccadive Sea, 1140 fms.

156. *Bathypterois atricolor*, ante, p. 306.

*lx. * Chlorophthalmus, Bonap.

157. *Chlorophthalmus corniger*, Alcock, J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 133, pl. vi. fig. 5, and Ill. Zool. Investigator, Fishes, pl. xv. fig. 8.

Bay of Bengal in 145–250 fms.

Scopelus.

158. *Scopelus pyrsobolus*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 218, pl. viii. fig. 3.

Off Madras coast in 920-690 fms.

159. *Scopelus* (*Myctophum*) *pterotus*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 217, and Ill. Zool. Investigator, Fishes, pl. ix. fig. 3.

Off Madras coast in 98-102 fms.

160. *Scopelus engraulis*, Gthr.

Günther, Challenger Deep Sea Fishes, p. 197, pl. li. fig. C: Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 129.

Andaman Sea in 188-220 fms.

lxi. *Neoscopelus, Johns.

161. *Neoscopelus macrolepidotus*, Johns.

Johnson, P. Z. S. 1863, p. 44, pl. vii: Günther Cat. Fishes Brit. Mus. p. 414, and Challenger Deep Sea Fishes, p. 196 (*Scopelus macrolepidotus*): Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 129.

Andaman Sea in 188-220 fms.

lxii. *Scopelengys.

Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 302.

162. *Scopelengys tristis*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 303, and Ill. Zool. Investigator, Fishes, pl. vii. fig. 7.

Laccadive Sea in 1000 fms.

lxiii. *Odontostomus, Cocco.

163. *Odontostomus atratus*, Alcock, J. A. S. B., Vol. LXII. pt. 2, 1893, p. 182, pl. ix. fig. 4.

Bay of Bengal in 573 fms.

VI. *Family **Stomiatidæ**.

lxiv. *Stomias, Cuv.

164. *Stomias nebulosus*, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 451, and Ill. Zool. Investigator, Fishes, pl. vii. fig. 1.

Gulf of Manaar in 597 fms.

165. *Stomias elongatus*, Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 129.

Laccadive Sea in 738 fms.

lxv. * Malacosteus, Ayres.

166. *Malacosteus indicus*, Gthr.

Günther, Challenger Deep Sea Fishes, p. 214, pl. liv. fig. B: Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 452.

Andaman Sea in 650 fms.

lxvi. * Thaumastomias.

Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 220, and *ante*, p. 309.

167. *Thaumastomias atrox*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 220, pl. viii. fig. 7.

Off Madras coast in 1310 fms.

Family **Clupeidæ**.

lxvii. *Bathyclupea.

Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 130.

168. *Bathyclupea hoskynii*, Alcock, Ann. Mag. Nat. Hist. (6) VI 1891, p. 131, fig. 4, p. 132.

Andaman Sea in 188–220 fms., off Madras coast in 145–250 fms.

VII. *Family **Alepocephalidæ**.

lxviii. *Alepocephalus, Risso.

169. *Alepocephalus bicolor*, Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 133, and Ill. Zool. Investigator, Fishes, pl. iv. fig. 2.

Off Madras coast in 240–276 fms.

170. *Alepocephalus blanfordi*, Alcock, Ann. Mag. Nat. Hist. (6) X. 1892, p. 357, and Ill. Zool. Investigator, Fishes, pl. ix. fig. 1.

Gulf of Manaar in 902 fms.

171. *Alepocephalus edentulus*, Alcock, Ann. Mag. Nat. Hist. (6) X. 1892, p. 358, pl. xviii. fig. 2.

Off Madras coast in 475 fms.

lxix. *Bathytroctes, Gthr.

172. ? *Bathytroctes microlepis* Gthr.

Günther, Challenger Deep Sea Fishes, p. 226, pl. lvii. fig. A: Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 452.

Andaman Sea in 500 fms.

173. *Bathytroctes squamosus*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 303, and Ill. Zool. Investigator, Fishes, pl. v. fig. 1.

Off Goa coast in 740 fms.

lxx. *Narcetes.

Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 305.

174. *Narcetes erimelas*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890 p. 305; Ill. Zool. Investigator, Fishes, pl. iv. fig. 1.

Off Goa coast in 740 fms.

lxxi. *Platytroctes, Gthr.

175. *Platytroctes apus*, Gthr.

Günther, Challenger Deep Sea Fishes, p. 229, pl. lviii. fig. A: Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 307.

Off Goa coast in 740 fms.

lxxii. *Xenodermichthys, Gthr.

176. *Xenodermichthys guentheri*, Alcock, Ann. Mag. Nat. Hist. (6) X. 1892, p. 359, pl. xviii. fig. 3.

Off Madras coast in 678 fms.

lxxiii. *Aulastomomorpha.

Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 307.

177. *Aulastomomorpha phosphorops*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 307, and VII. 1891. fig. 1, p. 10; Ill. Zool. Investigator, Fishes, pl. v. fig. 2.

Laccadive Sea in 1000 fms.

lxxiv. *Leptoderma, Vaillant.

178. *Leptoderma macrops*, Vaill.

Vaillant, Exp. Sci. Travailleur et Talisman, Poiss. p. 166, pl. xiii. fig. 2: Alcock, Ann. Mag. Nat. Hist. (6) X. 1892, p. 361.

Off Madras coast in 753 fms.

VIII. * Family **Halosauridæ.**

lxxv. *Halosaurus, Johns.

Halosaurus, Johnson, P.Z.S. 1863, p. 406: Günther, Cat. Fishes Brit. Mus. VII. p. 482, and Challenger Deep. Sea Fishes, p. 232.
Halosaurichthys, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 454.

179. *Halosaurus affinis*, Gthr.

Günther, Challenger Deep Sea Fishes, p. 241, pl. lix. fig. B: Alcock, Ann. Mag. Nat. Hist. (6) VI. p. 309.

Laccadive Sea in 1000 fms.

180. *Halosaurus hoskynii*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 309, and Ill. Zool. Investigator, Fishes, pl. vii. fig. 3.

Laccadive Sea in 1000 fms.

181. *Halosaurus mediorostris*, Gthr.

Günther, Challenger Deep Sea Fishes, p. 239, pl. lix. fig. C: Alcock, J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 136.

Off N. Maldive Atoll in 719 fms.

182. *Halosaurus anguilliformis*, Alcock, Ann. Mag. Nat. Hist (6) IV. 1889, p 453.

Gulf of Manaar in 675 fms.

183. *Halosaurus parvipennis*, Alcock, Ann. Mag. Nat. Hist (6) X: 1892, p. 362.

Laccadive Sea in 865–880 fms.

184. *Halosaurus carinicauda*, Alcock, Ann. Mag. Nat. Hist. IX. 1889, p. 454, and Ill. Zool. Investigator, Fishes, pl. vii. figs. 2, 2a

Andaman Sea in 490 fms.

Family **Murænidæ.**

lxxvi. *Nemichthys, Richdsn.

185. *Nemichthys acanthonotus*, Alcock, J. A. S. B., Vol. LXIII. pt. 2, 1894, p. 136, and Ill. Zool. Investigator, Fishes, pl. xiv. fig. 5.

Bay of Bengal in 475 fms.

lxxvii. *Gavialiceps, Wood-Mason.

Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 460.

186. *Gavialiceps microps*, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 461; X. 1892, p. 364.

Bay of Bengal, off Andamans and Nicobars, 1045 fms., Laccadive Sea in 1370 fms., G. of Manaar in 902 fms.

lxxviii. *Dysomma.

Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 459.

187. *Dysomma bucephalus*, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 459; VIII. 1891, p. 137, fig 5: Ill. Zool. Investigator, Fishes, pl. vi. fig. 1: J. A. S. B. Vol. LXII. pt. 2, 1893, p. 184.

Bay of Bengal, off east coast of Peninsula in 128–276 fms.

lxxix. *Dysommopsis.

Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 137.

188. *Dysommopsis muciparus*, Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 137.

Off Madras coast in 240–270 fms.

lxxx. *Coloconger.

Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 456.

189. *Coloconger raniceps*, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 456; X. 1892, p. 364: Ill. Zool. Investigator, Fishes, pl. vii. fig. 4.

Andaman Sea in 265–271 fms., Bay of Bengal in 200–400 fms.

lxxxi. * Bathymyrus.

Alcock, J. A. S. B., Vol. LVIII. pt. 2, 1889, p. 305.

190. *Bathymyrus echinorhynchus*, Alcock, J. A. S. B., Vol. LVIII. pt. 2, 1889, p. 305, pl. xxii. fig. 6.

Bay of Bengal in 68–95 fms.
This form connects *Coloconger* and *Congromuræna*.

Congromuræna.

191. *Congromuræna macrocercus*, Alcock, Ann. Mag. Nat. Hist. (6) VI. 1889, p. 455; VIII. 1891, p. 135; X. 1892, p. 362: Ill. Zool. Investigator, Fishes, pl. vii. fig. 5: J. A. S. B. Vol. LXIII. pt 2, 1894, p. 134.

Andaman Sea in 265 fms., Bay of Bengal in 200–300 fms.
= *C. longicauda*, Alcock *nec* Ramsay and Ogilby.

192. *Congromuræna squaliceps*, Alcock, J. A. S. B., Vol. LXII. pt. 2, 1893, p. 183, and Vol. LXIII. pt. 2, 1894, p. 134.

Off Madras coast in 128–210 fms.

193. *Congromuræna nasica*, Alcock, J. A. S. B., Vol. LXII. pt. 2, 1893, p. 183, and Vol. LXIII. pt. 2, 1894, p. 134; Ill. Zool. Investigator, Fishes, pl. ix. fig. 2.

Off Madras coast in 128–210 fms.

194. *Congromuræna musteliceps*, Alcock, J. A. S. B., Vol. LXIII. pt. 2, 1894, pp. 133, 134, pl. vii. fig. 5: Ill. Zool. Investigator, Fishes, pl. xv. fig. 7.

Off Madras coast in 165–250 fms.

lxxxii. *Promyllantor.

Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 310.

195. *Promyllantor purpureus*, Alcock, Ann. Mag. Nat. Hist. (6) I. 1890, p. 310: Ill. Zool. Investigator, Fishes, pl. vi. fig. 2.

Laccadive Sea in 1000 fms.

UROCONGER.

196. *Uroconger vicinus*, Vaillant.

Vaillant, Exp. Sci. Travailleur et Talisman, Poissons, p. 86, pl. vi. fig. 1: Alcock, Ann. Mag. Nat. Hist. X. 1892, p. 363.

Off Madras coast in 475 fms., Laccadive Sea in 636 fms.

lxxxiii. *SAUROMURÆNESOX.

Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 457.

197. *Sauromuraenesox vorax*, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 458: Ill. Zool. Investigator, Fishes, pl. vi. fig. 3.

Bay of Bengal in 193–250 fms.
Very closely allied to *Muræncsox*.

lxxxiv. * XENOMYSTAX, Gilbert.

198. *Xenomystax truncidans*, Alcock, J. A. S. B., Vol. LXIII. pt. 2, 1894, p. 134: Ill. Zool. Investigator, Fishes, pl. xvi. fig. 5.

Off N. Maldive atoll in 719 fms., off Travancore coast in 406 fms.

lxxxv. * NETTASTOMA, Raf.

199. *Nettastoma tæniola*, Wood-Mason, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 460 (*Gavialiceps tæniola*); VIII. 1891, p. 135; X. 1892, p. 364.

Andaman Sea in 265 fms., Bay of Bengal in 240–280 fms.

Sub-Order PLECTOGNATHI.

Family **Sclerodermi.**

lxxxvi. * TRIACANTHODES, Blkr.

200. *Triacanthodes ethiops*, Alcock, J. A. S. B., Vol. LXIII. pt. 2, 1894, p. 137, pl. vii. fig. 6: Ill. Zool. Investigator, Fishes, pl. xv. fig. 9.

Off Madras coast in 145–250 fms.

OSTRACION.

201. *Ostracion fornasini*, Bianc.

Bleeker, Atl. Ichth. V. 34, Ostrac. Tab. III. fig. 4: Günther, Cat. Fishes Brit. Mus. VIII. p. 264.

Off Ceylon in 34 fms.

UROCONGER.

196. *Uroconger vicinus*, Vaillant.

Vaillant, Exp. Sci. Travailleur et Talisman, Poissons, p. 86, pl. vi. fig. 1: Alcock, Ann. Mag. Nat. Hist. X. 1892, p. 363.

Off Madras coast in 475 fms., Laccadive Sea in 636 fms.

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197. *Sauromuraenesox vorax*, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 458: Ill. Zool. Investigator, Fishes, pl. vi. fig. 3.

Bay of Bengal in 193–250 fms.
Very closely allied to *Muræneson*.

lxxxiv. * XENOMYSTAX, Gilbert.

198. *Xenomystax trucidans*, Alcock, J. A. S. B., Vol. LXIII. pt. 2, 1894, p. 134: Ill. Zool. Investigator, Fishes, pl. xvi. fig. 5.

Off N. Maldive atoll in 719 fms., off Travancore coast in 406 fms.

lxxxv. * NETTASTOMA, Raf.

199. *Nettastoma tæniola*, Wood-Mason, Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 460 (*Gavialiceps tæniola*); VIII. 1891, p. 135; X. 1892, p. 364.

Andaman Sea in 265 fms., Bay of Bengal in 240–280 fms.

Sub-Order PLECTOGNATHI.

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Bleeker, Atl. Ichth. V. 34, Ostrac. Tab. III. fig. 4: Günther, Cat. Fishes Brit. Mus. VIII. p. 264.

Off Ceylon in 34 fms.

Materials for a Flora of the Malayan Peninsula.—*By* George King, M.B., LL.D., F.R.S., C.I.E., *Superintendent of the Royal Botanic Garden, Calcutta.*

No. 8.

[Read. 18th May, Read 3rd June.]

Order XXXI. Celastrineæ.

Erect or climbing trees or shrubs. *Branches* sometimes spinescent. *Leaves* opposite or alternate, more or less coriaceous, simple, petioled, rarely subsessile, entire or serrate; stipules caducous or 0. *Flowers* hermaphrodite or polygamous, usually cymose. *Calyx* small, with 4 or 5 imbricate lobes, persistent. *Petals* 4–5, rarely 0, inserted below the disc or continuous with its margin, imbricate. *Stamens* 3–5, rarely 2, filaments subulate or flattened, anthers 2-celled. *Disc* usually conspicuous, pulvinate or flattened, lobed or entire, rarely 0. *Ovary* sessile, the disc free at the base or confluent with it, 3–5-celled; style short or 0; sigma triangular, rarely 3-partite. Ovules 2 or 4 in each cell, anatropous, erect, rarely 1 and pendulous; or many, ascending and attached to the axis. *Fruit* capsular, baccate, drupaceous or samaroid. *Seed* arillate or exarillate, sometimes winged, albumen fleshy or 0; embryo usually large; cotyledons foliaceous, flat.—Distrib. Species about 500, scattered over the tropical and temperate regions of the whole world.

Tribe I. Celastrineæ, *Stamens* 4 or 5; the filaments slender, often recurved, inserted on or beneath the margin of the disc. *Seeds* (except in *Kokoona*) albuminous.

Fruit dehiscent, leaves opposite (sometimes alternate in *Lophopetalum*).

Ovules 2 in the axis of each cell, petals efoveolate.	
Petals connate, seeds not arillate ...	1. Microtropis.
Petals free, seeds arillate ...	2. Euonymus.
Ovules 1 in each cell, pendulous; petals bifoveolate, seeds arillate	3. Glyptopetalum.
Ovules 4 or more in each cell; seeds winged.	
Petals inappendiculate; disc cupular, the stamens inserted on its edge or on the inner vertical surface of its upturned edge; ovary not buried in the disc	4. Kokoona.
Petals lamellate or crested on the upper surface; disc broadly orbicular, flat, the stamens inserted half way between the	

centre and circumference; ovary buried in the disc ... ... 5. LOPHOPETALUM.

Fruit dehiscent; leaves alternate; ovules 2 in each cell, erect; seeds arillate.

Disc free from the ovary, the stamens inserted on its margin, capsule 3-celled ... 6. CELASTRUS.

Disc confluent with the ovary, stamens inserted underneath it, capsule 3-celled ... 7. GYMNOSPORIA.

Ovary free from the disc, and crowned by a tuft of hairs; styles 2, capsule entire or 2-lobed ... ... 8. KURRIMIA.

Fruit a dry or pulpy indehiscent drupe ... 9. ELAEODENDRON.

Tribe II. HIPPOCRATEÆ. *Stamens* 3, rarely 2, 4 or 5; the filaments broad, flattened, recurved so that the anthers dehisce outwardly, inserted on the disc; seeds exalbuminous; leaves usually opposite.

Fruit flattened, dehiscent, seeds winged ... 10. HIPPOCRATEA.

Fruit globular or ovoid, pulpy and indehiscent, seeds not winged ... ... 11. SALACIA.

1. MICROTROPIS, Wall.

Glabrous trees or shrubs. *Leaves* opposite, petioled or subsessile, exstipulate, entire. *Flowers* in sessile clusters or in peduncled cymes, axillary or supra-axillary, sometimes unisexual. *Sepals* 4 or 5, imbricate. *Petals* 4 or 5, rarely 0, connate at the base, erect. *Stamens* 5, inserted on the disc or on the tube of the corolla. *Disc* 0, or small. *Ovary* free, ovoid, perfectly or imperfectly 2–3-celled; style very short or absent; stigma minutely 2–4-lobed; ovules 2 in each cell, collateral at the inner angle. *Capsule* ovoid, coriaceous, 1-celled, 2-valved, 1-seeded, surrounded at the base by the persistent calyx. *Seed* erect, stipitate; aril 0.—DISTRIB. Species about 12; mountains of India, Ceylon, the Malayan Peninsula and Java.

Cymes sessile, very condensed, about as long as the petioles, axillary, under ·5 in. long ... ... 1. *M. elliptica.*

Cymes and their peduncles ·5 to ·75 in. long ... 2. *M. discolor.*

Cymes extra-axillary, on long thin peduncles.

Cymes 3- to 5-flowered, their peduncles ·5 to ·75 in. long; petals ovate-rotund ... ... 3. *M. bivalvis.*

Cymes many-flowered, their peduncles 1·25 to 3 in. long; petals oblong ... ... 4. *M. filiformis.*

1. MICROTROPIS ELLIPTICA, n. sp. King. A shrub or small tree; young branches terete, pale when dry. *Leaves* thinly coriaceous, broadly

elliptic, rather suddenly and sharply acuminate, the base more or less cuneate; lower surface pale brown when dry, the upper olivaceous; main nerves about 6 pairs, curved, ascending, faint; length 4·5 to 5 in., breadth 1·85 to 2·5 in., petiole ·3 in. *Cymes* axillary, condensed, sessile, not much longer than the petioles, 6- to 8-flowered. *Flowers* ·25 in. in diam., sessile. *Sepals* 4 or 5, narrowly reniform, with dark coarse teeth. *Petals* 4 or 5, larger than the sepals, sub-rotund, fleshy, with sub-entire membranous edges. *Stamens* 4 or 5, slightly shorter than the ovary, much shorter than the petals; anther-cells divaricate at the base; the filaments flattened, broad and united into a tube in their lower half. *Ovary* 2-celled, produced into the long cylindro-conic glabrous style; stigma capitate, faintly 2-lobed. *Fruit* glabrous, ovoid, tapering to apex and base, the style and calyx persistent, length ·6 to ·7 in., its peduncle ·2 in.

Malacca: Maingay (Kew Distrib.), No. 945/2. Penang: Curtis s. 345, 968. Perak: King's Collector, Nos. 1333, 1582, 4193.

2. Microtropis discolor, Wall. Cat. 4337. An erect shrub or all tree; young branches thin, terete, smooth, dark-coloured when y. *Leaves* thinly coriaceous, oblong-lanceolate, much acuminate, entire, the base acute; both surfaces dull when dry, the lower pale: main nerves 4 or 5 pairs, curved, ascending, faint; length 3·5 to 4·5 in., breadth 1 to 1·75 in., petiole ·25 to ·3 in. *Cymes* ·5 to ·75 in. long or less, slightly extra-axillary, spreading, divaricate, 8- to 10-flowered, bracteolate. *Flowers* ·1 in. in length, subsessile. *Sepals* narrowly reniform, unequal, the edges minutely ciliolate. *Petals* much larger than the sepals, broadly oblong-ovate, rather concave, with a slight central ridge, glabrous. *Anthers* 5, ovoid, with short filaments inserted on a thin hypogynous disc. *Ovary* longer than the stamens, 2-celled, tapering into the thick conical style: stigma truncate, 2-lobed. *Fruit* sub-globular, glabrous, ·3 in. long. Kurz For. Flora Burma, I, 251; Lawson in Hook. fil. Fl. Br. Ind. I, 614; Arn. in Ann. Nat. Hist. iii. 152. *Cassine discolor*, Wall. in Roxb. Fl. Ind., ed. Carey, ii, 378. *Celastrinea*? Wall. Cat. 9014. *Euonymus garcinifolius*, Roxb. Fl. Ind. i. 628.

Penang, in damp ravines on West Hill, elevat. 2,000 feet, Curtis No. 1727; also on Government Hill.—Distrib. Sub-tropical Himalaya, Khasia Hills, Burma.

A species very common along the base of the Himalaya and the Khasia Hills and in Burma; but found in these provinces only in nang. Mr. Curtis's specimens differ from those from British India having rather smaller flowers and fruit, and much shorter filaments; otherwise they agree perfectly.

3. Microtropis bivalvis, Wall. Cat. 4340. A bush or small tree;

young branches terete, dark-coloured when dry. *Leaves* thinly coriaceous, oblong-lanceolate, acuminate, entire, the base narrowed; both surfaces pale and rather dull when dry: main nerves 5 or 6 pairs, faint, not more prominent than the intermediates: length 2·5 to 3·5 in., breadth 1 to 1·75 in., petiole ·25 to ·35 in. *Cymes* extra-axillary, from 1 to 1·5 in. long; the peduncle filiform, ·5 to ·75 in. long. *Flowers* about 3 to 5, ·25 in. in diam., on thin divaricating pedicels ·2 to ·3 in. long (longer in fruit). *Sepals* narrowly reniform, imbricate in two rows, sub-glabrous, pale, the edges dark-coloured and minutely crenulate. *Petals* larger than the sepals, spreading, rather coriaceous, ovate-rotund, narrowed to the base, glabrous. *Stamens* 5; the anthers broadly ovate, the filaments dilated and conjoined in their lower half into a tube. *Disc* none. *Ovary* short, 2-celled; style about as long as the stamens, cylindric, striate, expanded at the apex, the stigma truncate and 2-lobed. *Fruit* ovoid, glabrous, crowned by the persistent style and with the calyx persistent at t[he] base, ·5 in. long, usually 1-celled and 1-seeded, but sometimes 2-celled a[nd] 2-seeded. Lawson in Hook. fil. Fl. Br. Ind. I. 614 (in part).

Penang: Wallich's Collector; Curtis, No. 1025. Malacca: Maing[ay] (Kew Distrib.) No. 392/2.

The plant here described is that issued by Wallich doubtfully as a *Microtropis* under the name *M.? bivalvis*. It is not, as Wallich apparently supposed, the plant published by Jack in 1820 (Malayan Miscellanies No. V) as *Celastrus? bivalvis*; for Jack describes his plant as apetalous. I have seen no authentic specimen of Jack's plant; but I have little doubt that it is, as Miquel believed, the same as the species to receive which that Botanist founded in 1859 the genus *Paracelastrus* (Miq. Flora Ind. Bat. I, pt. 2, p. 590). Wallich issued under his Catalogue number 7270, and the name *Euonymus capillaceus*, a Penang plant with solitary capillary extra-axillary pedicels; but his specimens have neither flowers nor fruit. It is possible that this may be the lost *Celastrus? bivalvis* of Jack. The issue of Wallich's Catalogue was not begun until 1828, eight years later than the issue of the number of the Malayan Miscellanies where Jack's *C.? bivalvis* was published. But, as Wallich correctly suggested the genus *Microtropis* for his No. 4340, that author's name must stand for this plant, and another must be found for the true apetalous *Celastrus? bivalvis* of Jack, should Miquel's genus *Paracelastrus* not be maintained.

4. Microtropis filiformis, King. A small tree, 10 to 15 feet high; young branches slender, terete, dark-coloured when dry. *Leaves* thinly coriaceous, more or less broadly elliptic, shortly acuminate, the edges sub-undulate, slightly recurved when dry, the base cuneate; the upper surface shining, the lower dull, pale; main nerves 5 to 8 pairs,

spreading, indistinct, not more prominent than the intermediate and secondary; length 4·5 to 7 in., breadth 1·5 to 2·75 in., petioles ·3 to ·4 in. *Cymes* axillary or extra-axillary, on filiform peduncles 1·25 to 3 in. long, divaricate, bracteolate, 1-many-flowered. *Flowers* ·3 in. in diam., on pedicels ·1 to ·2 in. long. *Sepals* narrowly reniform, sparsely-puberulous. *Petals* much longer than the sepals, oblong, obtuse, with a central longitudinal ridge on the upper surface, puberulous, united into a short tube at the very base. *Stamens* 5, longer than the pistil but much shorter than the petals; *anthers* broadly ovoid, the filaments dilated especially at the base and attached to the corolla tube. *Ovary* short, disc none; *style* cylindric, ridged; *stigma* broad, flat. *Fruit* ovoid, pointed, glabrous, smooth; 5 in. long, the calyx persistent at its base, the style subpersistent on the apex. *M. bivalvis*, Lawson in Hook. fil. Fl. Br. Ind. I. 614 (in part) *not of Wall. Microtropis bivalvis*, Kurz (not of Wall.) For. Flora Burma, I, 251. *Euonymus? lacta*, Wall. Cat. No. 4294. *Euonymus filiformis*, No. 4295.

Penang: Porter, Stolickza. Perak: Wray No. 435, King's Collector, No. 2025. Distrib. Tenasserim. Helfer, No. 1980 (Kew Distrib.)

This has been included by Mr. Lawson in Fl. Br. Ind. under *M. bivalvis*, Wall., but it is a perfectly distinct plant; differing from that in the great length of the peduncles of its cymes, in the larger size of its leaves, and in its fewer larger flowers.

2. Euonymus, Linn.

Trees or shrubs, erect, rarely scandent, glabrous. *Leaves* opposite, petioled, rarely subsessile; stipules caducous. *Calyx* 4–5-fid, spreading or recurved. *Petals* 4–5, free, cfoveolate. *Stamens* 4–5, inserted on the disc; anthers broad, 2-celled. *Disc* large, fleshy, 4–5-lobed. *Ovary* sunk in the disc, 3–5-celled; style short or 0, stigma 3–5-lobed; ovules 2 in each cell, attached to the inner angle, ascending and suspended. *Capsule* 3–5-celled, 3–5-lobed, angled or winged, coriaceous, rarely echinate; cells 1–2-seeded, loculicidal. *Seeds* covered by the aril, albuminous.—Distrib. About 80 species chiefly tropical Asiatic and Malayan; a few European and North American.

Flowers usually in fascicles of 2 or 3, rarely in 2- to 3-flowered cymes; petals fimbriate ... ... 1. *E. Javanicus.*
Flowers in very lax divaricate slender spreading 10- to 20-flowered cymes; petals not fimbriate ... 2. *E. Wrayi.*

1. Euonymus Javanicus, Blume Bijdr. 1146. A shrub or small tree; young branches slender, sub-terete. *Leaves* sub-coriaceous, ob-

long-lanceolate or elliptic-oblong, acuminate, remotely and obscurely serrate, or entire, the base cuneate; main nerves 5 or 6 pairs, impressed on the upper surface when dry; length 4 to 6 in., breadth 1·35 to 2·5 in., petioles ·3 to ·5 in. *Flowers* in fascicles of 2 or 3 from the axils of leaves or of fallen leaves, sometimes from a common peduncle 1 to 2 in. long: peduncles slender, ·5 in. long, (much longer in fruit). *Sepals* 5, small, rotund. *Petals* 5, broadly oblong, much larger than the sepals, fimbriate. *Stamens* 5, the anther cells divaricate, the connective thick. *Ovary* conical. *Fruit* obovate or pyriform, deeply 5-lobed, ·75 in. long. Benn. in Horsf. Pl. Jav. Rar. 13, t. 28; Hassk. in Nat. Tijdschr. Gesch. x. 149; Miq. Fl. Ind. Bat. I. pt. 2. p. 588; Hook. fil. Fl. Br. Ind. I. 607; Kurz For. Flora Burma, I. 249. *E. sumatranus*, Miq. Fl. Ind. Bat. Suppl. 512. *E. sphaerocarpus*, Hassk. Cat. Hort. Bogor. 229. *E. timoreusis*, Zipp. ex Spanoghe in Linnæa XV, (1841) 186.

In all the Provinces except the Andaman and Nicobar Isla[nds]. Distrib. Burma, the Malayan Archipelago.

A widely distributed species, varying very little. The form [dis]tinguished as *E. sumatranus* by Miquel has rather longer fruit th[an] usual, and its leaves are more distinctly serrate.

2. Euonymus Wrayi, n. sp. King. A small tree; young branches terete, smooth, dark-coloured when dry. *Leaves* as in *E. javanicus*, but the main nerves less prominent. *Cymes* axillary or terminal, long-pedunculate, very lax, 3 to 4 in. across; the branches filiform, divaricate, 12- to 20-flowered, bracteolate at the base; the peduncles slender, 1·5 to 2 in. long. *Flowers* nearly ·25 in. in diam. on slender minutely bracteolate pedicels ·25 to ·35 in. long. *Sepals* 5, large, rotund, spreading, concave, glabrescent, the edges membranous. *Petals* 5, not much larger than the sepals, rotund, clawed; the edges incurved, undulate but not fimbriate, minutely puberulous, green with dull crimson veins. *Anthers* 5, short, with globular cells opening upwards, the connective orbicular. *Disc* thick, fleshy, obtusely 5-lobed. *Ovary* sunk in the disc, broad with a conical apex: stigma capitate, small. *Fruit* shortly and broadly pyriform, deeply 5-lobed; calyx persistent at its much-contracted base, ·75 in. long and nearly as broad at the apex.

Perak: on Gunong Batu Patch, elevat. 4,500 feet; Wray No. 403. Pahang: Kota Glanggi, Ridley No. 2652.

3. Glyptopetalum, Thwaites.

Erect shrubs or small trees, glabrous. *Leaves* opposite, petio[late] ex-stipulate. *Cymes* 3- or more-flowered. *Calyx* with 4 short spreading lobes. *Petals* 4, each with 2 pit-like depressions on the upper surface. *Stamens* 4, inserted above the disc; the connective dilated; anther-cells

diverging. *Disc* 4-lobed. *Ovary* immersed in the disc, 4-lobed, 4-celled; style short, stigma capitate; ovules solitary and pendulous from the top of each cell. *Capsule* subglobose, coriaceous, 1–4-celled, 1–4-seeded. *Seeds* as in *Euonymus*.—DISTRIB. Species 7; in Ceylon, Southern India, and Malayan Peninsula.

Leaves 2·5 to 3·5 in. long ... ... 1. *G. Scortechinii.*
,, 6 to 12 in. long ... ... 2. *G. quadrangulare.*

1. GLYPTOPETALUM SCORTECHINII, n. sp. King. Young branches terete, striate. *Leaves* coriaceous, elliptic, often slightly obovate, very shortly and obtusely cuspidate, the edges with a few remote obscure serratures in the upper third, the base cuneate; main nerves 8 to 10 pairs, spreading, much curved, very faint and not more prominent than the intermediate and secondary nerves; length 2·5 to 3·5 in., breadth 1·35 to 1·75 in., petioles ·25 in. *Flowering peduncles* rather stout, supra-llary, 1·5 to nearly 2 in. long; pedicels 2 or 3, under an inch in gth. *Fruit* broadly obovate, deeply 5-lobed, glabrous, ·45 in. long, 5 sub-rotund reflexed sepals persistent at its base.

Perak: Scortechini, No. 1617.

A species collected only by the late Rev. Father Scortechini, whose specimens are not in flower. He referred the plant to *Euonymus*, but the solitary ovules in the cells of the immature fruit show that its place is in *Glyptopetalum*.

2. GLYPTOPETALUM QUÁDRANGULARE, Prain MSS. in. Herb. Calc. A shrub 8 to 15 feet high; young branches boldly 4-angled, narrowly winged. *Leaves* coriaceous, elliptic or elliptic-oblong, shortly acuminate, obscurely and remotely serrate in the upper half, the base rounded or cuneate; both surfaces bullate, the upper shining, the lower dull; main nerves 10 to 12 pairs, when dry much depressed on the upper and very prominent on the lower surface, the reticulations wide and distinct; length 6 to 12 in., breadth 2·5 to 5 in., petiole ·3 to ·6 in. *Cymes* much shorter than the leaves, dichotomous, minutely 2-bracteolate at the bifurcations, axillary, few-flowered, on slender peduncles 1·5 to 2 in. long (nearly twice as long in fruit). *Flowers* ·3 in. in diam., their pedicels 2·5 in. long (longer in fruit). *Sepals* 4, narrowly reniform, entire. *Petals* 4, attached to the edges of the thick fleshy 4-lobed disc, much longer than the sepals, broadly rotund-reniform, clawed, the edges incurved, smooth. *Anthers* reniform; the cells on short thin filaments, sub-orbicular. *Ovary* sunk in the disc, the apitate stigma alone projecting, 4-celled: ovules solitary. *Fruit* depressed, obtusely 4-angled, capsular, ·4 to ·6 in. in diam.

Perak: Scortechini No. 524. Wray No. 3229: King's Collector Nos. 7106, 8222.

4. Kokoona, Thwaites.

Trees with opposite petioled coriaceous leaves. *Calyx* small, 5-lobed. *Petals* 5, free, coriaceous, without crests. *Stamens* 5, inserted on the margin of the disc; anthers oblong. *Disc* thick, glandular, sub-entire. *Ovary* immersed in the disc, 3-celled; style short, stigma 3-lobed; ovules 4 in each cell, in 2 series, adnate to the axis, ascending. *Capsule* woody, oblong, 3-gonous, 3-celled, 3-valved; cells 4-seeded. *Seeds* broadly winged above, imbricate, exalbuminous.—Distrib. Species 5; Ceylon, Malayan Peninsula and Borneo.

The only tangible distinctions between this genus and *Lophopetalum* appear to be that (1) in this there are no appendages of any kind on the petals, whereas in *Lophopetalum* they are lamellate or crested (or both) on the anterior surface; (2) the disc in this is cupular and the stamens are inserted either on its edge or on the inner vertical surface of its up-turned edge; (3) the ovary is not buried in the disc, whereas in *Lophopetalum* the disc is broadly orbicular and flat and the stamens are inserted (often in pits) half way between its centre and circumference, the ovary being buried in the disc. The seeds, which used to be relied upon for distinctive marks, are found, now that the ripe fruit of *Lophopetalum* is better known, to be winged in both, and the fruit in both to be an elongated triquetrous or 3-winged capsule. It seems doubtful whether this genus should be maintained as distinct from *Lophopetalum*.

Panicles much longer than the leaves, 4 to 6 in. long; flowers ·1 in. in diam. ...	1. *K. littoralis.*
Panicles shorter or only a little longer than the leaves; flowers ·25 or ·3 in. in diam.	
Leaves elliptic or elliptic-oblong, 2·75 to 3·5 in. long	2. *K. Scortechinii.*
Leaves broadly ovate to ovate-oblong, 4·5 to 5 in. long	3. *K. coriacea.*

1. Kokoona littoralis, Laws. in Hook. fil. Fl. Br. Ind. I, 617. A tree; leaves thinly coriaceous, broadly ovate, acute or sub-cuspidate, entire, subundulate, the base rounded; main nerves 8 to 10 pairs, spreading, faint; length 3 to 4 in., breadth 2 to 2·5 in., petiole ·8 to 1 in. *Panicles* axillary or terminal, large, 4 to 6 in. long and about as much across, many-flowered, bracteolate, the branches divergent, the branchlets cymose. *Flowers* ·1 in. in diam., the pedicels about as long. *Calyx* lobes sub-acute. *Petals* not crested or fimbriate; filaments inserted on the edge of the disc. *Disc* orbicular and without appendages. *Fruit* capsular, broadly 3-winged, 4·5 in. long and 1·5 in. broad, the pericarp coriaceous; *Seeds* 1·5 to 2 in. long, oblong, compressed, winged all round. *Lophopetalum littoralis*, Kurz For. Flora Burma, I, 255. *Trigonocarpus littoralis*, Wall. Cat. No. 6520.

Malacca: Maingay. Singapore; Lobb.—Distrib. Burma.

2. Kokoona Scortechinii, King n. sp. A large tree 70 to 80 feet high; young branches smooth, dark-coloured when dry. *Leaves* coriaceous, elliptic or elliptic-oblong, acute or sub-acute, entire, the base cuneate, lower surface cinereous when dry; main nerves about 6 or 7 pairs, spreading, faint; length 2·75 to 3·15 in., breadth 1·35 to 2 in., petioles ·25 to ·35 in. *Panicles* axillary, pedunculed, pyramidal, sometimes longer than the leaves; the branches divaricate, the ultimate branchlets racemose. *Flowers* not crowded, about ·25 in., in diam., on bracteolate pedicels about as long as themselves. *Calyx* cupular, fleshy, glabrous, with 5 (rarely 4) shallow broad teeth. *Petals* 5, (rarely 4), inserted below the disc, longer than the calyx, fleshy, broadly ovate, with a slight vertical central ridge on the anterior surface. *Disc* fleshy, shortly cylindric, with 10 shallow quadrate teeth. *Stamens* 5; the filaments fleshy below, slender above, inserted on the inner sur- of the disc. *Anthers* large, ovate, sub-cordate at the base, the apex a short stout incurved appendage. *Ovary* conical, short, thick, from the disc, 3-celled. *Stigma* sessile, large, capitate-cylindric. *Fruit* unknown.

Perak: Scortechini, No. 2042. Penang, Curtis, No. 1576.

This has been gathered in Penang by Mr. Curtis, who describes it as a tree about 40 feet high. The late Father Scortechini, who gathered it once in Perak, and who referred it doubtfully to *Lophopetalum reflexum* Laws., describes it as a tree 70 to 80 feet high. Its fruit is still unknown.

3. Kokoona coriacea, King n. sp. A tree 30 to 50 feet high; young branches cinereous when dry. *Leaves* coriaceous, broadly ovate to ovate-oblong, sub-acute, the base cuneate, the edge when dry slightly recurved; upper surface dark when dry, the lower cinereous; main nerves 6 or 7 pairs, curved, erecto-patent, rather faint on both surfaces; length 4·5 to 5 in., breadth 2 to 3 in., petiole ·5 to ·6 in. *Panicles* axillary, pedunculate, from half as long to as long as the leaves, the branches divaricate, racemose, few-flowered. *Flowers* ·3 in. in diam., on bracteolate pedicels shorter than themselves. *Calyx* cupular, thick, with 5 short shallow broad teeth. *Petals* 5, attached outside the short disc, longer than the calyx, thick, broadly ovate, with a vertical ridge in the middle. *Stamens* 5; the filaments subulate, inserted on the inner vertical surface of the cupular fleshy obscurely 5-lobed corrugated disc; anthers large, cordate, with a long apical appendage. *Ovary* ovoid, brous, inserted in the fundus of the flower and separate from the disc, 3-celled: *stigma* sessile, cylindric-capitate. *Fruit* unknown.

Perak: King's Collector, No. 4226.

5. Lophopetalum, Wight.

Trees or shrubs, usually glabrous. *Leaves* opposite or alternate, petioled, exstipulate. *Sepals* 5, rounded, short, spreading. *Petals* 5, continuous with the disc, persistent, the upper surface cristate or lamellate, or covered with fleshy villi, or naked. *Stamens* 5, inserted on the disc far from its edge; *anthers* oblong. *Disc* large, flat, entire or lobed. *Ovary* small, immersed in the disc and continuous with it, trigonal or pyramidal, 3–4-celled, contracted into a short style, stigma capitate; ovules 4 or more in each cell, in 2 series. *Capsule* coriaceous, 3–4-angled, 3–4-celled, loculicidal. *Seeds* winged, albumen fleshy.—Distrib. Species 15; Indian and Malayan.

Leaves very thickly coriaceous; flowers ·75 in. in diam., cymes longer than the leaves ...	1.	*L. pachyphyllum.*
Leaves thinly coriaceous.		
Flowers ·5 in. in diam.	2.	*L. fimbriatum.*
Flowers ·25 to ·3 in. in diam.		
Leaves more or less obovate ...	3.	*L. subobovatum.*
Leaves not obovate.		
Disc without fleshy hair-like processes		
Sepals bluntly ovate	4.	*L. Scortechinii.*
Sepals deltoid-rotund	5.	*L. oblongum.*
Disc with numerous fleshy hair-like processes over its whole surface.		
Leaves 2·5 to 3 in. long; petals rotund-deltoid, the upper surface with numerous fleshy processes ...	6.	*L. pallidum.*
Leaves 4·5 to 6 in. long; petals ovate-elliptic, with a broad-based acuminate fleshy process on the upper surface	7.	*L. oblongifolium.*
Disc with fleshy processes only at the edges of the pits in which the filaments are inserted	8.	*L. Curtisii.*
Flowers only about ·1 in. in diam. ...	9.	*L. reflexum.*
Imperfectly known species		*L. fuscescens.*

1. Lophopetalum pachyphyllum, n. sp. King. A tree 80 to 100 feet high; young branches slender, terete, dark-coloured when dry. *Leaves* thickly coriaceous, elliptic-oblong, sub-acute, entire, the base narrowed; upper surface pale when dry; the lower cinereous, thickly

covered with very minute papillae; main nerves 7 or 8 pairs, ascending, curved; length 4 to 5·5 in., breadth 1·6 to 2·75 in., petiole ·5 to ·75 in. *Cymes* paniculate, axillary or terminal, bracteolate, 3 or 4 in. in diam., on peduncles 2 to 3 in. long. *Flowers* ·75 in. in diam.; their pedicels slender, bracteolate, about ·5 in. long. *Calyx* and disc rotund, scarcely lobed. *Petals* attached to the edge of the disc, rotund with truncate bases, thick, not fimbriate. *Disc* fleshy, slightly convex, the slender filaments rising far from its edge; anthers ovate. *Ovary* expanded below, 3-angled above, glabrous. Fruit unknown.

Malacca: Maingay (Kew Distrib.) No. 403. Perak: King's Collector No. 7325.

Fruit of this is unknown. The species is a very distinct one, at once recognisable by its large flowers and very thick leaves. The petals, according to Kunstler, are pale yellow with a dark patch at the base.

2. LOPHOPETALUM FIMBRIATUM, Wight Ill. I. 178. A small tree: young branches terete, dark-coloured when dry. *Leaves* thinly coriaceous, elliptic or elliptic-oblong, shortly cuspidate, entire, the base rounded or slightly narrowed; upper surface olivaceous when dry, the lower brown; main nerves 7 to 9 pairs, spreading, curving, slightly prominent beneath; length 3 to 4·5 in., breadth 2 to 2·25 in., petiole ·65 in. *Cymes* axillary or terminal, peduncled, paniculate; the branches divaricate, many-flowered. *Flowers* ·5 in. in diam., on pedicels ·25 in. long. *Calyx-lobes* very short. *Petals* rotund-obovate, much larger than the sepals, with transverse fimbriate crests about the middle. *Stamens* with long slender filaments, inserted on the middle of the broad 5-lobed disc. *Ovary* depressed, tapering into the conical style. *Fruit* 3-angled (ripe unknown). Laws. in Hook. fil. Fl. Br. Ind. I. 615; Kurz For. Flor. Burma, I. 255. *L. ovatum*, Presl. Botan. Bemerk. 32. *L. javanum*, Turcz. in Bull. Soc. Nat. Mosc. 1863, pt. i. 545. *Euonymus ovata*, Wall. Cat. 4300.

Malacca: Griffith.—DISTRIB. Burma, Chittagong, Sylhet.

3. LOPHOPETALUM SUB-OBOVATUM, n. sp., King. A tree; young branches cinereous when dry. *Leaves* obovate-oblong, obtuse, slightly cuspidate, entire, much narrowed to the base, the lower surface pale brown when dry; main nerves about 6 pairs, spreading, faint; length 2·5 to 4 in., breadth 1·4 to 2 in., petiole ·35 to ·45 in. *Panicles* axillary, peduncled, 2 to 3·5 in. long, and 1 to 2·5 in. in diam., branching from near the base, the branches divaricating; the branchlets cymose, few-flowered. *Flowers* ·3 in. in diam. *Calyx* spreading; the teeth deltoid, sub-acute. *Petals* 5, larger than the calyx, broadly-oblong, sub-obtuse, corrugated on the upper two-thirds of the anterior surface and

crested. *Disc* thick, fleshy, entire, pitted. *Stamens* 5; the filaments subulate, their bases in small inappendiculate pits; *anthers* small, ovate. *Ovary* sunk in the disc, conical; *stigma* minute. *Fruit* unknown.

Penang: on Government Hill, Curtis, No. 1501.

4. LOPHOPETALUM SCORTECHINII, n. sp. King. A tree 60 to 80 feet high: young branches slender, terete, dark-coloured when dry. *Leaves* coriaceous, broadly elliptic or ovate, sometimes obovate; the apex obtuse sub-acute or very shortly cuspidate, the base narrowed; main nerves about 5 pairs, spreading or ascending, faint; length 3·5 to 4·5 in., breadth 1·75 to 2·25 in., petioles ·4 to ·5 in. *Panicles* cymose, axillary, shorter than the leaves, the flowers rather crowded towards the end of the short divaricating compressed branches. *Flowers* ·25 in. in diam. *Sepals* 5, bluntly ovate, spreading. *Petals* 5, deltoid-rotund, spreading, flat with undulate edges, attached to the edges of the broad thin 5-angled fleshy disc. *Anthers* 5, sub-sessile, ovate-orbicular; ovary much depressed, sunk in the disc with only the capitate stigma protruding, 4- or 5-celled. *Fruit* (mature not seen) elongate, glabrous, 3-winged, 3-celled, the calyx persistent at its base; seeds flat, winged at both ends. *Euonymus mammillaris*, Scortechini MSS.

Perak: Scortechini, No. 1941; King's Collector, No. 6676.

5. LOPHOPETALUM OBLONGUM, n. sp. King. A tree 50 feet high: young branches striate, dark-coloured when dry. *Leaves* coriaceous, oblong or elliptic-oblong, acute, entire, the base cuneate; main nerves 7 or 8 pairs, curved, spreading; length 3·5 to 4·5 in., breadth 1·5 to 1·8 in., petiole ·4 to ·5 in. *Panicles* axillary, rather shorter than the leaves, 2·5 to 3·5 in. in diam., the branches divaricate; the branchlets cymose, many-flowered. *Flowers* ·3 in. in diam.; their pedicels ·1 in length. *Sepals* 5, deltoid-rotund, thick, spreading. *Petals* 5, thinner and longer than the sepals, each with an elongate sub-fimbriate crest on the anterior surface. *Stamens* 5, inserted far from the edge of the thick fleshy slightly 5-angled disc: anthers ovate, filaments short. *Ovary* sunk in the disc, tapering into the rather thin style, *stigma* minute. *Fruit* woody, 3-winged, 5 in. long and nearly 1·5 in. broad. *Seeds* flat, 2·5 in. long (including the wings.)

Penang: near the waterfall, Curtis, No. 2736.

6. LOPHOPETALUM PALLIDUM, Laws. in Hook. fil. Fl. Br. Ind. I. 615. A glabrous tree; young shoots slender, dark-coloured when dry. *Leaves* thinly coriaceous, elliptic-oblong, sub-acute, entire, the base rounded, both surfaces pale when dry; main nerves 8 to 10 pairs, spreading, faint; length 2·5 to 3 in., breadth 1·1 to 1·3 in., petiole ·3 to ·4 in. *Cymes* ·5 to ·75 in. long, axillary, 6- to 8-flowered, the peduncle and branches 4-angled. *Flowers* ·25 in. in diam.; calyx and disc rotund, not lobed. *Petals* rotund-deltoid, fleshy, attached to the edge of the

disc, incurved, with a number of fleshy lobular processes on their upper surface. *Disc* fleshy, almost flat, with many thick fleshy hair-like processes shorter than the filaments. *Anthers* 5, ovate; the filaments longer than the anthers, inserted in pits on the disc. *Ovary* broadly conical. *Fruit* unknown.

Malacca: (Kew Distrib.) No. 393.

Known only by Maingay's scanty specimens, not one of which is in fruit.

7. Lophopetalum oblongifolium, King n. sp. A tree 80 to 100 feet high: young branches glabrous, terete, dark-coloured when dry. *Leaves* opposite, coriaceous, oblong or elliptic-oblong, shortly and rather bluntly acuminate, entire, the base cuneate, both surfaces glabrous; main nerves 8 or 9 pairs, spreading, slightly curved; length 4·5 to 6 in., breadth 1·75 to 2·25 in., petiole ·5 to ·65 in. *Panicles* axillary and terminal, about half as long as the leaves, minutely bracteolate, glabrous; the branches spreading, the ultimate branchlets cymose. *Flowers* ·25 in. in diam., their pedicels about as long as themselves. *Calyx* flat, corrugated externally, the edge with 5 broad sub-reniform short teeth closely applied to the corolla. *Petals* 5, continuous with the margin of the disc, much larger than the calyx-lobes, ovate-elliptic, the edges slightly laciniate or entire, the upper surface with a broad-based pointed fleshy appendage and some hairs. *Disc* flat, broad, obscurely 5-angled, covered with very short coarse bristle-like hairs. *Stamens* 5, inserted on the disc, filaments short: anthers ovate, 2-celled, longitudinally dehiscent. *Ovary* conical, sunk in the disc, 3-celled; *style* short, thick; stigma small. *Fruit* unknown. *Euonymus adenophorus*, Scort. MSS. in Herb. Calc.

Perak: Scortechini, No. 1943.

8. Lophopetalum Curtisii, n. sp. King. A medium-sized tree: young branches very slender, dark-coloured when dry. *Leaves* coriaceous, broadly ovate, cuspidate, entire, the base cuneate; upper surface when dry at first glaucous, afterwards dark-coloured, the lower always pale and very minutely dotted, both glabrous; main nerves about 6 pairs, curving, faint; length 2 to 2·5 in., breadth 1 to 1·5 in.; petiole ·5 or ·6 in., slender. *Cymes* axillary or terminal, about 1 to 1·35 in. long; the branches divaricating, 10- to 20-flowered. *Flowers* ·3 in. in diam., as in *L. pallidum* but the hair-like processes on the disc confined to the edges of the pits in which the bases of the filaments are inserted.

Penang on Government Hill; Curtis No. 1577.

A species with flowers like *L. pallidum*, but with leaves of thicker texture, broader, and with longer petioles. The cymes also are larger and the disc is devoid of processes, except round the edges of the pits from which the filaments spring.

9. Lophopetalum reflexum, Laws. in Hook. fil. Fl. Br. Ind. I. 616. A tree 40 to 50 feet high, young branches darkly cinereous when dry. *Leaves* coriaceous, ovate-lanceolate, acuminate, the edges undulate; the base slightly cuneate, rarely rounded; main nerves 4 or 5 pairs, very faint; length 2·25 to 3·25 in., breadth 1 to 1·2 in., petiole ·25 to ·3 in. *Panicles* longer than the leaves, pedunculate; the branches divaricate, cymose, many-flowered, bracteolate, sparsely and minutely rufous-pubescent. *Flowers* ·1 in. in diam., their pedicels twice as lo or more. *Sepals* 5, thick, fleshy, rotund-deltoid, spreading. *Petals* thinner and larger than the sepals, rotund-ovate, inserted on the e of the orbicular entire fleshy disc. *Anthers* 5, almost sessile on disc far from its edge, broadly ovate. *Ovary* broadly conical, sunk in the disc, 3-celled, tapering into the short style, *stigma* minute. *Fruit* unknown.

Malacca: Maingay (Kew Distrib.) No. 393/2. Penang: Curt No. 1502.

Imperfectly known species.

Lophopetalum fuscescens, Kurz in Journ. As. Soc. Beng. for 187 pt. 2, p. 202. A glabrous tree. *Leaves* coriaceous, oblong, shortly acuminate, entire, rounded at the base, the lower surfaces of the leaves ferrugineous when dry: main nerves 16 to 18 pairs, prominent on the lower surface; length 4 to 8 in., breadth 2·5 to 3 in., petiole ·8 to 1·25 in. *Panicles* axillary and terminal, shorter than the leaves, pedunculate; the branches spreading, cymose, puberulous, minutely bracteolate. *Flowers* probably about ·2 in. in diam., their pedicels stout and longer than themselves. *Calyx*-lobes short, broad, rounded. *Petals* ovate, rather obtuse, coriaceous with broad membranous margins, induplicate in bud, glabrous, each with an elongated trigonous corrugated process on its upper surface. *Disc* indistinctly 5-lobed, rugulose when dry. *Stamens* 5, with rather long filaments. *Fruit* unknown.

Singapore; T. Anderson.

The description of the flowers of this species is taken from Kurz (*l. c.*). The only specimens which I have seen are two collected by the late Dr. T. Anderson at Singapore and named by Kurz himself, and the flowers on these are too imperfect for examination. These specimens have quite the *facies* of a *Lophopetalum* allied to *L. oblongifolium*.

6. Celastrus, Linn.

Scandent shrubs. *Leaves* alternate, petioled; stipules minute and deciduous, or 0. *Flowers* polygamous or hermaphrodite, in terminal or axillary panicles or racemes. *Calyx* 5-cleft. *Petals* 5, spreading. *Disc*

broad, concave. *Stamens* 5, inserted on the margin of the disc. *Ovary* not immersed in the disc, 2–4-celled; *style* short; stigma 3-lobed, rarely 3-fid with the segments recurved; ovules 2 in each cell, erect. *Capsule* globose or obovoid, 1–3-celled, 1–6-seeded. *Seeds* enveloped in a fleshy aril, albumen fleshy; cotyledons foliaceous.—Distrib. Species about 20; natives of tropical Asia, China, Japan, Australia and North America.

Celastrus Championi, Benth. in Hook. Journ. Bot. for 1851, p. 334. A climber 40 to 50 feet long: branches slender, smooth, black when dry. *Leaves* coriaceous, elliptic, elliptic-oblong or ovate, acute or shortly acuminate, the base rounded or sub-cuneate, the edges minutely serrate or sub-entire, both surfaces glabrous; main nerves 5 or 6 pairs, slightly prominent on the lower surface; length 3·5 to 4·5 in., breadth 1·8 to 2·5 in., petiole ·5 in. *Racemes* several from one axil, usually shorter than the leaves. *Fruits* on pedicels as long as themselves, dehiscing, 3-valved: the dehisced valves broadly ovoid, black externally, pale within, about ·5 in. long, one-seeded. Benth. Flora Hongkongensis, 64. *Catha Benthami*, Gardn. and Champ. in Hook. Journ. Bot. for 1851, 310.

Perak: Wray Nos. 175, 1031, 1096: King's Collector No. 6928 and 6982; Scortechini No. 1428; Ridley No. 5237.

7. Gymnosporia, W. & A.

Shrubs or small trees, branches often spinescent. *Leaves* alternate, exstipulate. *Flowers* in small dichotomous cymes. *Calyx* 4–5-cleft. *Petals* 4–5, spreading. *Stamens* 4–5, inserted underneath the disc. *Disc* broad, sinuate or lobed. *Ovary* attached by a broad base, or immersed in the disc, 2–3-celled; style short, 2–3-lobed; ovules 2 in each cell. *Capsule* obovoid or nearly globose. *Seeds* 1–2 in each cell; aril completely or partially covering the seed, or 0, albumen fleshy; cotyledons foliaceous.—Distrib. Species 60; natives of the hotter parts of the whole world.

Gymnosporia Curtisii, King n. sp. A scandent shrub; young branches rather stout, cinereous, glabrous. *Leaves* coriaceous, ovate-elliptic, sub-acute, the edges with distant shallow crenations, the base rather suddenly narrowed to the petiole; both surfaces glabrous, the lower slightly paler when dry; main nerves about 10 to 15 pairs, often forking below the middle, faint; length 4 to 6 in., breadth 2·25 to 3 in., petiole ·4 to ·5 in. *Cymes* about ·5 to ·7 in. long, few-flowered, fasciculate, often collected at the apex of extra-axillary naked branches 1·5 to 2 in. long. *Flowers* ·15 in. in diam.; their pedicels two or three times as long, glabrous. *Sepals* 5, semi-orbicular, the edges with a few short thick cilia. *Petals* 5, oblong, obtuse, much longer than the sepals. *Stamens* 5, shorter than the petals, the filaments inserted below the

disc, flat, incurved; anthers small, sub-orbicular. *Disc* a wide fleshy cup with thick entire edge. *Ovary* ovoid, obscurely 3-angled, seated on and confluent with but not immersed in the disc, 3-celled. *Style* short, clavate. *Fruit* broadly ovoid, almost globular, 3-angled; the pericarp coriaceous, dark-coloured externally, 3-valved, the dehisced valves almost square. *Seeds* 1 or often 2 in each cell.

Kedah: Curtis No. 2500.

Known only by Curtis's specimens. Inasmuch as (1) the stamens are inserted below and not on the margin of the disc, (2) the ovary is inserted on and confluent at its base with the disc, and (3) the inflorescence is cymose and not racemose or paniculate, this is a *Gymnosporia* rather than a *Celastrus*. The scandent habit, however, is that of *Celastrus*. It appears to me a little doubtful whether these two genera ought to be kept distinct. The species of both are in want of careful revision.

8. Kurrimia, Wall.

Trees, usually glabrous, young branches tipped with the deciduous stipules. *Leaves* opposite, rarely alternate, towards the ends of the branches, coriaceous, entire, shining, penninerved, petiole slender. *Flowers* in panicles or racemes. *Calyx* 5-fid, spreading. *Petals* 5, inserted under the margin of the disc, spreading or recurved. *Stamens* 5, inserted with the petals. *Disc* fleshy, sub-entire or 5-lobed. *Ovary* free, glabrous or puberulous at the base, crowned at the top with a tuft of hairs; styles 2, filiform; stigmas small, capitate; ovules 2 in each cell, erect. *Capsule* entire or 2-lobed, 1–2-celled, dehiscing by 2 valves, 1–2-seeded. *Seeds* erect, completely or partially covered by a fleshy aril; albumen abundant, fleshy, cotyledons linear-oblong.—Distrib. India, Ceylon, Malayan Peninsula and Archipelago: species 3 or 4.

Flowers in racemes, glabrous, disc sub-entire, fruit not bifid	1. *K. pulcherrima.*
Flowers in panicles, puberulous, disc deeply 5-lobed, fruit bifid	2. *K. paniculata.*

1. Kurrimia pulcherrima, Wall. Cat. 4334. A tree 40 to 70 feet high; young branches glabrous. *Leaves* coriaceous, oblong or elliptic-oblong, acuminate, entire, the base rounded; both surfaces glabrous, the upper shining, the lower dull and pale when dry; main nerves about 12 pairs, curved, ascending, prominent on the lower surface; length 6 to 8 in., breadth 1·75 to 3·25 in., petiole ·8 to 1 in., narrow and spike-like. *Racemes* several from an axil, shorter than the leaves, glabrous. *Flowers* on pedicels shorter than themselves, ·15 in. in diam.,

glabrous. *Sepals* 5, free, elliptic, obtuse. *Petals* 5, elliptic-rotund, obtuse, larger than the sepals. *Stamens* 5; *anthers* broadly ovate, cordate, filaments flattened. *Disc* cupular, glabrous or nearly so, the edges obscurely lobed. *Capsule* narrowly ellipsoid, *with 2 vertical grooves*, much tapered to the apex, glabrous, 1 to 1·5 in. long, 1-celled, 1-seeded. *Seed* ·6 to ·8 in. long, ellipsoid, brown, shining. Lawson in Hook. fil. Fl. Br. Ind. I. 622. *K. Maingayi*, Laws. *l. c.* *K. robusta*, Kurz For. Flora Burma, I. 253. *K. calophylla*, Wall. Cat. 4335. *K. robusta*, Kurz MSS. *Rhesa Moja*, Ham. MSS. ex Arn. in Ed. Phil. Journ. xvi. 315; Walp. Rep. i. 538. *Celastrus robustus*, Roxb. Fl. Ind. i. 626. *Nothocnestis sumatrana*, Miq. Fl. Ind. Bat. Suppl. i. 531.

Malacca: Griffith, No. 1994 (Kew Distrib.). Singapore; Maingay, Kew Distrib. No. 394. Andamans, King's Collectors. Distrib. Burma, Chittagong, Khasia Hills, Assam and Sikhim, Sumatra.

I cannot discover any mark to separate *K. Maingayi*, Laws. from typical *K. pulcherrima*, Wall, and I have therefore reduced that species here. This is a much rarer tree in the Malayan Peninsula than the next which is very common.

2. Kurrimia paniculata, Wall. Cat. 4336. A tree 30 to 60 feet high; young shoots glabrous. *Leaves* coriaceous; leaves as in the last but often slightly narrowed to the base, and sometimes with as many as 24 pairs of nerves; petioles varying from 1 to 2·25 in. and occasionally even 3 in. in length. *Panicles* shorter than the leaves, the branches sparse and spike-like, puberulous. *Flowers* ·15 in. in diam., on pedicels about as long as themselves. *Sepals* 5, spreading, ovate, obtuse, puberulous. *Petals* 5, much larger than the sepals, broadly ovate, sub-acute, puberulous, especially on the inner surface. *Stamens* 5, rather shorter than the petals, inserted between the deep quadrate lobes of the disc; the filaments flattened, puberulous; the *anthers* short, broadly ovate. *Ovary* sub-rotund, pubescent towards the narrowed apex. *Fruit* ·65 in. long, more or less deeply bifid, each half 1- or sometimes 2-seeded; the pericarp leathery, nearly black externally and glabrous. *Seeds* oblong, often plano-convex, with dark shiny testa, ·3 in. long. Lawson in Hook. fil. Fl. Br. Ind. I. 622. *Rhesa paniculata*, Arn. in Ed. Phil. Journ. xvi. 315; Walp. Rep. i. 538. *Trochisandra indica*, Bedd. Fl. Sylv. t. 120; Fl. Sylv. Anal. Gen. lxvii. *Pyrospermum calophyllum*, Miq. Fl. Ind. Bat. Suppl. i. 402.

In all the provinces except the Nicobar and Andaman islands. A much commoner tree than the last. Distrib. Sumatra.

There is considerable variety in the length of the petiole in this species, but I cannot discover that differences in its length are associated with differences in any other organ.

9. Elæodendron, Jacq. f.

Small trees or shrubs. *Leaves* opposite or subopposite, crenate or entire. *Flowers* in axillary branching cymes, often polygamous. *Calyx* 4- or 5-cleft. *Petals* 4 or 5, spreading. *Disc* cupular. *Stamens* 4 or 5; anthers nearly globose. *Ovary* continuous with the disc, conical, rarely 2–4- or 5-celled, style very short, ovules 2 in each cell. *Fruit* succulent or dry, 1–2-celled, indehiscent; cells 1- rarely 2-seeded. *Seed* without an aril, albuminous.—Distrib. About 40 species, natives of South Africa, Tropical Asia, America and Australia.

Elæodendron sub-rotundum, King n. sp. A tree 20 feet high: young branches sub-compressed, glabrous, dark-coloured when dry. *Leaves* broadly ovate or sub-rotund, obtuse or sub-cuspidate, the edges entire and slightly revolute, the base slightly narrowed or rounded; both surfaces glabrous, dull, the upper pale, the lower brown when dry: main nerves 6 or 7 pairs, spreading obliquely, little curved: length 2 to 2·5 in., breadth 1·2 to 1·8 in.; petiole ·3 to ·5 in., slender. *Cymes* axillary and terminal, umbellate on a common peduncle, 1·5 to 2·5 in. long, 1·5 to 2 in. in diam., much-branched, many-flowered. *Flowers* numerous, nearly ·2 in. in diam., their pedicels longer than themselves. *Calyx* short, cupular, deeply divided into 4 or 5 rotund concave lobes. *Petals* 4 or 5, broadly oblong, blunt, spreading, glabrous, sparsely scaly outside. *Disc* short, cupular, thin, wavy, not lobed. *Stamens* 4 or 5, inserted on the outer surface of the disc; the filaments nearly as long as the pistil, slender; *anthers* ovate, basifixed. *Ovary* ovoid, tapering, surrounded at the base, but not confluent with, the thin disc, 2-celled; *style* short, *stigma* small. *Fruit* (immature) ·5 in. long, oblong-clavate, dark-coloured, glabrous, crowned by the persistent style, 1-celled (by abortion) and 1-seeded.

Perak: King's Collector No. 1166. Andamans; Kings's Collector. Johore; King, Pahang; Ridley No. 1001 *a*.

This differs from *E. glaucum*, Pers, in having smaller flowers which are always 4-merous; in having a smooth (not lobed or corrugated) disc; a much less tapering ovary; and entire leaves with fewer nerves.

10. Hippocratea, Linn.

Small trees or scandent shrubs. *Leaves* opposite, petioled; stipules small, caducous. *Flowers* small, white or greenish, disposed in axillary cymes, more rarely in terminal cymose panicles. *Calyx* small, 5-parted or of 5 free sepals. *Petals* 5, spreading, much larger than the calyx, imbricate or valvate. *Stamens* 3, the filaments recurved and lying in the grooves of the ovary; anthers short, broad, often 1-celled and with transverse dehiscence. *Disc* flat or cupular. *Ovary* surrounded by the

disc, 3-celled; style very short or 0, stigmas 1–3; ovules 2–10 in each cell, in 2 series, inserted on the inner angle. *Fruit* of 3 flattened carpels connate at the base, usually dehiscent. *Seeds* compressed, usually winged below, exalbuminous.—Distrib. Species about 90, natives of the tropics of both hemispheres.

Panicles and flowers ferrugineous-tomentose.

Flowers ·2 in. long	1.	*H. ferruginea.*

Panicles and flowers glabrous, or at most puberulous, never ferrugineous.

Flowers ·3 in. or more in diam.		
Petals glabrous on the upper surface ...	2.	*H. macrantha.*
Petals densely glandular-villous on the upper surface	3.	*H. Cumingii.*
Flowers ·15 in. in diam.		
Leaves entire; petals broadly oblong-obovate	4.	*H. Andamanica.*
Leaves remotely and rather minutely serrate; petals orbicular	5.	*H. Nicobarica.*
Flowers ·05 in. in diam.	6.	*H. indica.*
Doubtful species		*H. Maingayi.*

1. Hippocratea ferruginea, King n. sp. A climber; young shoots slender, glabrous, the older cinereous. *Leaves* coriaceous, elliptic-oblong, sub-acute or shortly cuspidate, entire, the base rounded or sub-cuneate; both surfaces glabrous, shining, the reticulations rather distinct; main nerves about 5 pairs, curved, ascending; length 3·25 to 5·5 in., breadth 2 to 2·5 in., petiole ·3 to ·4 in. *Panicles* axillary, nearly as long as the leaves, with large divaricating ferrugineous-pubescent pyramidal branches. *Flowers* ·2 in. long, on pedicels rather shorter than themselves. *Sepals* 5, rotund, concave, densely rusty-tomentose outside, glabrous inside. *Petals* 5, several times longer than the sepals, oblong-obovate, with long slender claws, conduplicate, rusty-tomentose outside, glabrous inside, falcately curved so that the tips connive. *Disc* large, its lower edge thickened and wavy. *Stamens* 3, the filaments flattened, broad, reflexed; the *anthers* sub-globular, 1-celled, with transverse dehiscence. *Ovary* inserted on the disc, sub-globular, deeply 3-lobed. *Style* cylindric, *stigma* minute. *Fruit* unknown.

Penang: Curtis, No. 175.

Known only by Mr. Curtis's specimens.

2. Hippocratea macrantha, Korth. Verh. Nat. Gesch. 187, t. 39. A climber; young branches slender, minutely lenticellate, glabrous. *Leaves* coriaceous, elliptic, sometimes rotund-elliptic, rarely slightly obovate, shortly and obtusely cuspidate, the edges with shallow cre-

nations, the base cuneate or rounded, both surfaces glabrous; main nerves 5 or 6 pairs, spreading, curving, prominent on the lower surface; length 4 to 7 in., breadth 1·75 to 3·25 in., petiole ·2 to ·4 in. *Panicles* axillary, cymose, pedunculate, much shorter than the leaves, puberulous, minutely bracteolate. *Flowers* ·3 in. in diam., on thin pedicels longer than themselves. *Calyx* cupular, puberulous, with 5 broad shallow obtuse teeth. *Petals* 5, much longer than the calyx, lanceolate, puberulous on the lower, glabrous on the upper surface. *Disc* deep, fleshy, with a broad ring of minute hairs on its upper half, deeply scooped out on the upper surface to receive the small 3-celled ovary; the 3 stamens attached to the margin of the disc, their filaments flat and much recurved; *anthers* small, rounded. *Carpels* usually 2, flat, oblong, obtuse, sometimes obovate-oblong and emarginate at the apex, striate, 2·5 to 4 in. long. *Seeds* 2 to 3 in. long, the wing large and thinly membranous. Miq. Fl. Ind. Bat. I, pt. 2 p. 599: Kurz For. Flora Burma, I, 257. *H. lanceolata*, Ham. Wall. Cat. 4214. *H. grandiflora*, Wall. Cat. 4215. *H. obtusifolia*, Laws. (in part but not of Roxb.) in Hook. fil. Fl. Br. Ind. I, 624.

South Andaman: King's Collector. Perak: King's Collector. Wray: common. Distrib. Burma, Chittagong, Assam, Sikhim, Terai.

Flowers of Chittagong and Assam specimens of this which I have dissected agree perfectly with Korthal's figure. Most of the specimens from the other localities cited are in fruit only; but their leaves agree so absolutely with the flowering specimens from Assam as to leave no doubt that they are conspecific. Helfer's No. 905 (Kew Distrib.), and perhaps Griffith's No. 911 from the Eastern Himalaya, belong to this. *H. Cumingii*, Laws. resembles this both in flowers and leaves; but the petals in that are glandular-hairy on the upper surface, while in this the upper surface of the petals is quite glabrous.

3. Hippocratea Cumingii, Laws. in Hook. fil. Fl. Br. Ind. I, 624. Scandent; young branches slender, brown when dry, glabrous. *Leaves* coriaceous, broadly elliptic, acute or shortly and obtusely cuspidate, the base rounded; both surfaces glabrous, the lower reticulate. *Panicles* axillary, shorter than the leaves, dichotomously cymose, few-flowered. *Flowers* ·45 in. in diam., their pedicels longer than themselves. *Calyx* cupular, covered with minute deciduous tomentum, the mouth with 5 shallow broad rather blunt lobes. *Petals* much longer than the calyx, linear-oblong, sub-acute, densely glandular-villous on the upper surface, minutely tomentose on the lower. *Disc* broad, with a belt of hairs about the middle. *Fruit* unknown.

Malacca: Griffith. Distrib.—Philippines.

An imperfectly known species.

4. HIPPOCRATEA ANDAMANICA, n. sp. King. A climber; young branches slender, glabrous, pale-brown when dry. *Leaves* thinly coriaceous, oblong to elliptic, sub-acute or shortly and obtusely cuspidate, entire, the base cuneate; both surfaces glabrous; main nerves 5 to 7 pairs, ascending, curved, slightly prominent beneath; length 4 to 5·5 in., breadth 1·8 to 2·75 in., petiole ·4 to ·6 in. *Panicles* often several together, axillary or terminal, as long as or slightly longer than the leaves, many-flowered, much-branched. *Flowers* ·15 in. in diam., on pedicels longer than themselves, buds globular. *Calyx* of 5 broad rotund spreading sepals, united at the base and irregularly dentate on the edges. *Petals* 5, larger than the sepals, broadly oblong-obovate, obtuse, glabrous, spreading. *Disc* broad, fleshy, hollowed out to accommodate the small 3-partite ovary. *Stamens* 3, inserted on the inverted edge of the disc; filaments short, broad, recurved; *anthers* broad, 1-celled by abortion, dehiscing transversely. *Style* short, *stigma* sub-capitate. *Fruit* unknown.

South Andaman Island; King's Collectors.

5. HIPPOCRATEA NICOBARICA, Kurz in Journ. As. Soc. Beng. for 1875, pt. 2, p. 203. Scandent; young branches slender, dark-coloured, with sparse minute pale warts. *Leaves* coriaceous, elliptic, shortly and obtusely cuspidate, remotely and rather minutely serrate, the base rounded; both surfaces glabrous, the upper shining, the lower dull and paler; main nerves 7 to 10 pairs, spreading, faint; length 4·25 to 6·5 in., breadth 2·25 to 3·25 in., petiole ·35 in. *Panicles* dichotomously cymose, axillary, shorter than the leaves, about 2 in. in diam., minutely bracteolate, many-flowered. *Flowers* nearly ·15 in. in diam. *Calyx* cupular, glabrous; the lobes short, broad, blunt. *Petals* larger than the calyx, orbicular, glabrous. *Disc* convex, its edge up-turned, glabrous, obscurely 5-angled, almost concealing the ovary. *Anthers* small, subsessile. *Fruit* unknown.

Nicobar Islands; Kurz.

6. HIPPOCRATEA INDICA, Willd. Sp. Pl. I, 193. A small glabrous shrub or tree usually with climbing branches; young branches slender, dark-coloured. *Leaves* thinly coriaceous, elliptic or elliptic-ovate, sub-acute or bluntly cuspidate, the edges finely serrate; the base more or less narrowed, rarely rounded; main nerves about 5 pairs, inconspicuous; length 2·5 to 3·5 in., breadth 1·4 to 1·8 in., petiole ·3 in. *Panicles* umbellately cymose, much-branched, pedunculed, spreading, axillary or terminal, usually shorter than the leaves but sometimes much longer, 1 to 3 in. in diam. *Flowers* ·05 in. in diam. *Calyx-lobes* broadly triangular, the edges hairy. *Petals* longer than the calyx, sub-erect, oblong, obtuse, concave. *Anthers* small, sub-orbicular. *Ovary* broadly

ovoid, glabrous, 3-grooved; *stigma* sub-sessile, capitate. *Carpels* usually 2, oblong, blunt, flat, vertically striate, 2 in. long, each with two long winged seeds. DC. Prodr. i. 568; Roxb. Fl. Ind. i. 165; Cor. Pl. ii. t. 130; W. & A. Prodr. 104: Dalz. & Gibs. Bomb. Fl. 32; Thwaites Enum. 52; Oliv. Fl. Trop. Afr. i. 368; Brand. For. Fl. 83; Miq. Fl. Ind. Bat. Vol. 1, pt. 2, 599; Lawson in Hook fil. Fl. Br. Ind. I, 624: Kurz For. Flora Burma, I, 256. *H. barbata*, Mull. Phil. Trans. Inst. Vict. III, 23. *H. disperma*, Vahl. Enum. II, 28: Wall. Cat. 4210 (in part.). *H. euonymoides*, Vahl, Enum. II, 98. *H. obtusifolia*, Wall. (not of Roxb.) Cat. 4211 A and B. *H. tortuosa*, Wall. Cat. 4126 (in part). *Tonsella disperma*, Poir. *Celastrinea* ? Wall. Cat. 9013.

Malacca: Griffith, Maingay (Kew Distrib.) No. 396. Singapore; Hullett. Distrib.—Sumatra, Java, British India, Ceylon.

There has been considerable confusion about the Indian species of the genus *Hippocratea*. The confusion originated to some extent with Wallich who issued, under the name *H. obtusifolia*, Roxb. and the number 4211, a plant which is really *H. indica*, Willd. In Mr. Lawson's account of *H. obtusifolia* Roxb. in Hooker's Flora of British India (I, 623) the following six are reduced to that species, *viz.*, *H. barbata*, Mull.; *H. rigida*, Spanoghe; *Salacia laevigata*, Wight: *Hippocratia ? grandiflora*, Wall. Cat. 4213; *H. volubilis*, Heyne in Wall. Cat. 4215, and *H. tortuosa*, Wall. Cat. 4216. Besides Roxburgh's description of *H. obtusifolia*, in Fl. Ind. I, 166, there is his original coloured figure in the Calcutta Herbarium to guide us as to what plant the author really meant to describe under this name. Moreover, so recently as 1883, there have been collected by Mr. J. S. Gamble at Chengalapalam (in the Nellore district of the Madras Presidency) specimens (Herb. Gamb. No. 12216) of a plant which agree absolutely with Roxburgh's description and figure. These specimens have the short panicles and obtuse emarginate fruits of Roxburgh's figure. Of the six species mentioned by Mr. Lawson, *H. barbata*, Mull. alone should in my opinion be reduced here, Muller's specimen of it exactly resembling Roxburgh's figure in Herb. Calcutta. *Salacia laevigata*, Wight (of which there is a coloured figure in Hooker's Bot. Misc. III, 295, Suppl. t. XXXVI) in my opinion more nearly resembles *H. Grahamii* Wight (Ill. I, 134 and Ic. 380) than *H. obtusifolia*, Roxb. I have seen no specimen of *H. rigida*, Spanoghe, but Miquel's description of it (Fl. Ind. Bat. I, pt. 2, 600) does not agree either with Roxburgh's description or with his figure of *H. obtusifolia*. Of the three Wallichian species, *H. grandiflora* (Cat. No. 4213) is a perfectly distinct good species which has been described and figured by Korthals (Verh. Nat. Gesch. p. 187 t. 39) as *H. macrantha*. *H. volubilis* (Cat. No. 4215) consists of two

things, *viz.*, *H. obtusifolia* Roxb. and *H. Grahamii*, Wight; while *H. tortuosa*, Cat. No. 4216, is a mixture of *H. obtusifolia*, Roxb. and of *H. indica*, Willd. To *H. Grahamii*, Wight, Mr. Lawson (*l. c.* p. 624) has reduced the plant issued by Wallich as his No. 4214, under the name *H. lanceolata*, Ham. But in my opinion this reduction is wrong. Under *H. Arnottiana*, Wight, Mr. Lawson proposes to include *Salacia terminalis*, Thwaites, which is a tree with cymose panicles on long peduncles much longer than the leaves.

Doubtful Species.

HIPPOCRATEA MAINGAYI, Laws. in Hook. fil. Fl. Br. Ind. I, 625. Branches terete. *Leaves* coriaceous, lanceolate, glabrous, 3 in. long by ·75 in. broad. *Cymes* 3-flowered, racemose. *Carpels* triquetrous, woody, 4 to 5 in. long. *Seeds* oblong, 3·5 to 4·5 in. long.

Malacca: Maingay, (Kew Distrib.) No. 397. DISTRIB. ? Borneo.

Known only by Maingay's imperfect descriptions. (The above description is copied from Lawson *l. c.*)

11. SALACIA, Linn.

Scandent or sarmentose shrubs or small trees. *Leaves* opposite, rarely alternate, petiolate, exstipulate. *Flowers* few or many, clustered in the axils of the leaves or extra-axillary, more rarely in cymes. *Calyx* small, 5-parted. *Petals* 5, imbricate. *Stamens* 3, rarely 2 or 4, continuous with the disc, recurved. *Ovary* conical, immersed in the disc, 3-celled; style very short, stigma simple or 3-lobed; ovules 2–8 in each cell, in 1–2 series, inserted on the inner angle. *Fruit* baccate, 1–3-celled, sub-woody or fleshy. *Seeds* large, angular.—DISTRIB. Species about 130; natives of the tropics of both hemispheres.

Leaves alternate ... ... 1. *S. viminea.*
Leaves opposite.
Flowers solitary or in pairs from the leaf-axils, not on tubercles ... ... 2. *S. Maingayi.*
Flowers in pedunculate axillary cymes.
Flowers campanuloid; the petals erect in their lower half, spreading in the upper ... ... 3. *S. campanuloidea.*
Petals spreading from the base.
Leaves serrate-crenate .. .. 4. *S. Griffithii.*
Leaves entire ... ... 5. *S. Perakensis.*
Flowers from short axillary tubercles.
Flowers ·35 to ·45 in. in diam.
Leaves 6 to 12 in. long.
axillary tubercles each bearing 10 or 12 flowers... ... ... 6. *S. Scortechinii.*
axillary tubercles bearing only 3 to 6 flowers... ... ... 7. *S. grandiflora* var. *longifolia.*

Leaves not more than 6 in. long.
Main nerves of leaves 7 to 9 pairs ... 7. *S. grandiflora.*
Main nerves of leaves 4 to 6 pairs ... 8. *S. latifolia.*
Flowers ·25 in. in diam.
Petals broadly cordate, obtuse, often clawed at the base; flower-pedicels ·25 to ·35 in. long ... 9. *S. prinoides.*
Petals broadly elliptic; flower pedicels ·5 to ·65 in. long ... ... 10. *S. polyantha.*
Flowers ·1 to ·15 in. in diam.
Leaves broadly elliptic, cuspidate; petals sub-erect, oblong ... ... 11. *S. Wrayi.*
Leaves oblong-lanceolate; petals orbicular, spreading ... ... 12. *S. Kunstleri.*
Leaves oblong or elliptic-oblong, much reticulate and yellowish when dry.
Leaves sub-acute; flowers ·15 in. in diam., the disc convex... ... ... 13. *S. flavescens.*
Leaves obtuse; flowers ·1 in. in diam., disc saucer-like ... ... 14. *S. Lawsoni.*

Imperfectly known species.

S. Lobbii.
S. rubra.

1. Salacia viminea, Wall. Cat.. 7267. A glabrous scandent shrub. *Leaves* membranous, usually alternate, lanceolate, shortly and bluntly acuminate, entire, the base cuneate; main nerves 5 to 7 pairs, oblique, faint; length 2·5 to 4 in., breadth ·8 to 1·5 in., petiole ·2 to ·3 in. *Flowers* ·15 in. in diam., on thin pedicels ·3 in. long, usually solitary or in groups of 2 or 3 (rarely in cymes), from minute bracteolate tubercles, axillary or extra-axillary. *Calyx* cupular, flat, with 5 triangular concave lobes. *Petals* 5, rotund or ovate, thin, larger than the calyx-lobes. *Disc* very convex, fleshy, glabrous, with a pale zone at the base. *Stamens* 3; the filaments very broad, flat, triangular, erect; *anthers* transversely oblong, dehiscing by 2 transverse 2-celled apical slits. *Ovary* sunk in the disc, 3-angled, conical; *stigma* small. *Fruit* (young) sub-globular, glabrous. Laws. in Hook. fil. Fl. Br. Ind. I. 627. *S. alternifolia* Scort. MSS. in Herb. Calc.

Penang; Wallich. Perak; King's Collector No. 374; Scortechini, No. 1811.

The alternate leaves are the best mark of the plants thus named. I think it however possible that two species are included under these alternate-leaved specimens. Those with flowers in short cymes may belong to a different plant from those with flowers solitary or on tubercles. The material is not good; and, in the absence of complete flowering and fruiting specimens, it is difficult to differentiate species of *Salacia* when the leaves present no good head marks, as the structure of the flowers is very much alike in many species.

2. Salacia Maingayi, Laws. Hook. fil. Fl. Br. Ind. I, 626. A scandent shrub 6 to 15 feet long; branches rather slender, terete, pale-brown when dry and with minute warts. *Leaves* coriaceous, ovate, elliptic or oblong-elliptic, shortly cuspidate, entire, the base rounded; both surfaces glabrous, shining; main nerves 5 to 7 pairs, slightly prominent on the lower; length 2·5 to 4·5 in., breadth 1·25 to 2·25 in., petiole ·25 to ·3 in. *Flowers* solitary or in pairs, axillary, not on tubercles, ·45 in. in diam., their pedicels stout, about ·3 in. long. *Calyx* fleshy, cupular, with 5 short reniform spreading lobes. *Petals* 5, much larger than the calyx, oblong or oblong-obovate, sub-rotund, obtuse, rather fleshy, concave, glabrous, spreading. *Disc* very deep, fleshy, glabrous. *Stamens* 3, attached to the upper part of the disc; the filaments short, flattened, triangular, recurved and closely applied to the disc; *anthers* transversely oblong, dehiscing transversely. *Ovary* conical, 3-angled, sunk in the disc at the base and confluent with it, 3-celled. *Style* none, *stigma* with 3 radiating lobes. *Fruit* unknown.

Malacca; Maingay. Perak; King's Collector Nos. 6639 and 7471.

This resembles *S. grandiflora*, Kurz, but the flowers are solitary or in pairs from the axils of the leaves, and they are not inserted on tubercles; the petals are also oblong or oblong-obovate. Moreover this is scandent, while *S. grandiflora* is an erect shrub.

3. Salacia campanuloidea, King, n. sp. A glabrous creeper 50 feet long; young branches 4-angled, slender, pale when dry. *Leaves* thinly coriaceous, ovate or elliptic-oblong, widest above the middle, the apex obtuse and shortly cuspidate; the edges pale thickened and wavy, crenulate in the lower, remotely serrulate in the upper half, slightly narrowed in the lower third to the base; both surfaces (but especially the lower) pale and often purplish when dry; main nerves 6 to 8 pairs, spreading, faint; length 3 to 4·5 in., breadth 1·35 to 2 in., petiole ·3 to ·4 in. *Cymes* short, axillary, few-flowered. *Flowers* campanulate, ·15 to ·2 in. in diam. at the mouth, their pedicels about as long as themselves or longer, slender. *Cymes* solitary, axillary, not longer than the petioles, pedicelled, with numerous bracteoles at the apex where the pedicels are inserted. *Calyx* fleshy, spreading, deeply divided into 5 transversely oblong obtuse suberect lobes. *Petals* 5, fleshy, broadly obovate-elliptic with broad bases, glaucous (especially externally) erect, spreading at the apex so as to form a campanulate corolla. *Disc* conical with truncate apex, fleshy, pale. *Stamens* 3, inserted near the upper edge of the disc; the filaments flattened, as long as the ovary, at first erect then recurved horizontally across the disc; *anthers* large, transversely oblong, 2-celled. *Ovary* conical, buried in the disc, style

rather long, stigma small. *Fruit* when ripe sub-globular or pyriform, glabrous, 1·5 to 2 in. in diam., sometimes nearly 3 in. long, and of a dark yellowish red colour.

Perak: King's Collector, No. 2708, 3198, 4410, 5953, 6488 and 10747. Scortechini.

4. Salacia Griffithii, Laws. in Hook. fil. Fl., Br. Ind. I, 628. *Leaves* coriaceous, elliptic-oblong, shortly and bluntly acuminate, the edges serrate-crenate, the base sub-cuneate; both surfaces glabrous, minutely reticulate; main nerves 5 to 7 pairs, ascending, curving; length 4·5 to 5 in., breadth 2 in., petiole ·3 in. *Cymes* solitary, axillary, on peduncles ·6 to ·75 in. long, divaricating, about 1 in. in diam. *Flowers* less than 20, ·1 in. long, on pedicels shorter than themselves. *Calyx* puberulous, a shallow cup deeply divided into 5 rotund-ovate concave lobes. *Petals* 5, erect, much longer than the calyx-lobes, thick, oblong, puberulous, the point slightly inflexed, the apex apiculate. *Disc* very convex, fleshy, glabrous; *stamens* 3, inserted on its upper edge; filaments erect, broad; anthers reniform. *Ovary* buried in the disc. *Fruit* unknown.

Penang: Curtis No. 692.

5. Salacia Perakensis, King, n. sp. Scandent; young branches dark-coloured when dry, lenticellate. *Leaves* elliptic, shortly and bluntly acuminate, entire, the base minutely cordate; both surfaces shining, minutely reticulate; main nerves 4 or 5 pairs, ascending, curving, faint, length 2 to 2·75 in., breadth 1 to 1·35 in., petiole ·2 in. *Cymes* axillary; ·3 to ·45 in. in diam., on peduncles ·3 to ·75 in. long, 5- to 8-flowered. *Flowers* ·15 in. long, on pedicels shorter than themselves. *Calyx* cupular, shallow, fleshy, deeply divided into 5 rotund concave lobes. *Petals* 5, erect, fleshy, oblong, concave, apiculate, puberulous, much longer than the calyx. *Disc* thick, cylindric. *Anthers* 3, sessile on the convex apex of the disc, large, transversely oblong, 2-celled. *Ovary* buried in the disc, conical, stigma minute. *Fruit* unknown.

Perak: Scortechini, No. 1042.

6. Salacia Scortechinii, King, n. sp. A tall robust climber; young branches rather stout, pale-brown when dry, lenticellate. *Leaves* coriaceous, opposite, oblong or oblong-elliptic, sometimes slightly obovate, sub-acute, the edges entire, the base usually narrowed but sometimes rounded; both surfaces glabrous, the upper shining, the lower dull, not reticulate; main nerves 6 to 8 pairs, slightly prominent beneath; length 6 to 10 in., breadth 2·25 to 3·5 in.; petioles ·6 to ·75 in., stout. *Flowers* ·35 in. in diam., glabrous, rather numerous (10 to 12) on very short woody axillary tubercles, their pedicels ·35 or ·4 in. long. *Calyx* cupular, divided to the base into 5 shallow broad sub-reniform

lobes. *Petals* 5, much longer than the calyx, thick, spreading, orbicular. *Disc* broad, convex, fleshy. *Stamens* 3, inserted near the apex of the disc; the filaments broadly triangular, compressed; *anthers* small. *Ovary* flat, buried in the disc, the short conical thick style protruding; ovules 3 in each cell. *Fruit* unknown.

Perak; Scortechini, No. 1848.

This is known only by the late F. Scortechini's scanty specimens. It is a very distinct species.

7. SALACIA GRANDIFLORA, Kurz in Journ. As. Soc. Beng., 1872, pt. 2, p. 300. A shrub or small tree; young branches rather slender, their bark pale when dry. *Leaves* coriaceous, oblong-elliptic or elliptic, shortly cuspidate, the edges entire, the base slightly narrowed or rounded; both surfaces glabrous, the upper very shining and reticulate; main nerves 7 to 9 pairs, ascending, curved, slightly prominent; length 5 or 6 in., breadth 2·25 to 3·25 in., petiole ·5 in. *Flowers* glabrous, ·25 to ·45 in. in diam., in groups of 3 to 6 from very short axillary or extra-axillary bracteolate tubercles; their pedicels ·2 in. long. *Calyx* cupular, deeply divided into 5 sub-orbicular fleshy segments. *Petals* 5, orbicular or obovate-orbicular, concave, spreading. *Disc* very convex, fleshy, glabrous. *Stamens* 3, inserted towards the apex of the disc; the filaments broad, triangular, recurved. *Ovary* buried in the disc, the 3-angled style alone protruding, stigma small. *Fruit* globular or ovoid, glabrous, 1 to 1·25 in. diam., the calyx and corolla persistent at the base while young, about 1·5 in. long when ripe. Kurz For. Flora Burma, I, 259; Laws. in Hook. fil. Fl. Br. Ind. I, 626.

Malacca: Griffith. Perak: King's Collector, Nos. 5924 and 7579. DISTRIB.—Tenasserim (Kew Distrib.), No. 891.

Kurz describes his *S. grandiflora* (Journ. As. Soc. Beng., pt. 2, p. 300), as scandent, and as having its flowers on minutely bracteolate axillary or extra-axillary tubercles. He has with his own hand written the name *S. grandiflora* on various specimens in the Calcutta Herbarium which, although they have all axillary tubercles, shew no evidence of being scandent. These sheets are as follows:—Helfer, Tenasserim or Andamans (Kew Distrib.), Nos. 898 and 891; Griffith, Malacca (without number); and Wall. Cat. No. 2812 from Penang. These in turn agree with various specimens from Penang, Perak, Singapore and Malacca which are described by their collectors as small erect shrubs, and not scandent. The character of being scandent must therefore be eliminated from Kurz's diagnosis of *S. grandiflora*. In this view Mr. Lawson appears to agree, for he describes both *S. grandiflora* and *S. longifolia* Hook. fil. (which I reduce to a variety of *S. grandiflora*) as erect shrubs. There *is* however a *scandent* species very closely re-

sembling the foregoing in leaves, the flowers of which are not on tubercles but arise singly or in pairs from the leaf-axils, and this I have named *S. macrantha*.

As in the case of *S. flavescens* there is a considerable range in the size of the flowers of *S. grandiflora*, some measuring only ·25 in. diam., while others are ·45 in. There is also some difference in the shape of the leaves. The specimens with very long, comparatively narrow, leaves have been accepted as a species by Mr. Lawson. But I cannot find that these differ in their flowers from Helfer's No. 898 (Kew Distrib.) which Kurz, the author of this species, has named *S. grandiflora* with his own hand. I therefore treat these as a variety only.

Var. *longifolia*. Leaves oblong or oblong-oblanceolate, the base much narrowed, 9 to 12 in. long. *S. longifolia*, Hook. fil. in Fl. Br. Ind. I, 626; Kurz For. Flora Burma, I, 258.

Malacca: Maingay (Kew Distrib.) No. 400[a]. Perak: Wray. Distrib.—Tenasserim, Helfer (Kew Distrib.) No. 898. Penang: Curtis, Nos. 134, 1146, 1266, 2939.

8. Salacia latifolia, Wall. Cat. 4222. A scandent glabrous shrub many feet in length; young branches slender, terete, dark-coloured when dry. *Leaves* thinly coriaceous, elliptic to elliptic-rotund, obtuse or shortly cuspidate, entire, the base rounded; upper surface pale-greenish when dry, the lower pale-brown; main nerves 4 to 6 pairs, spreading, forking far from the margin, slightly prominent beneath; length 3 to 6 in., breadth 2 to 3·5 in., petiole ·5 in. *Flowers* ·4 in. in diam., in fascicles of 6 to 8 from short axillary tubercles, pedicels about ·5 in. long. *Calyx* cupular, with 5 broad reniform blunt lobes. *Petals* 5, much longer than the calyx-lobes, obovate, blunt, spreading or recurved. *Disc* large, thick, glabrous. *Stamens* 3, inserted near the upper edge of the disc: the filaments long, flat, recurved; the anthers transversely oblong, 2-celled. *Fruit* globose, smooth, 1 in. in diam.; seeds ·75 in. long, semi-convex, slightly rugose. Hook. fil. Fl. Br. Ind. I, 629. *S. platyphylla*, Kurz in Journ. As. Soc. Beng. for 1875, pt. 2, p. 203.

Singapore; Wallich. Pangkore: Scortechini, Nos. 39, 951. Andaman and Nicobar Islands.

This is allied to *S. prinoides* DC., but differs in being a large climber, also in having larger more rotund leaves and larger flowers and fruit.

9. Salacia prinoides, DC. Prod. I, 571. A large straggling shrub; young branches divaricating, slender, somewhat four-angled, glabrous. *Leaves* thinly coriaceous, elliptic-oblong, shortly and obtusely cuspidate, coarsely serrate or entire, the base cuneate; both surfaces glabrous, the lower pale; main nerves 5 or 6 pairs, ascending, curved;

length 1·75 to 3·5 in., breadth 1 to 1·5 in., petiole ·15 to ·25 in. *Flowers* ·25 in. in diam., 3 to 6 from small tubercles in the axils of the leaves or from the smaller branches below the leaves; their pedicels slender, about ·25 to ·35 in. long. *Calyx* cupular, with 5 rounded concave lobes. *Petals* much larger than the calyx-lobes, broadly cordate, obtuse, often clawed at the base, the edges membranous. *Disc* broad, fleshy, convex. *Stamens* 3, from the upper edge of the disc; the filaments flat but not broad, erect: *anthers* small, transversely oblong, 2-celled. *Ovary* small, conical, 3-angled, buried in the disc. *Fruit* ovoid-globular, ·5 in. in diam., 1-celled, 1-seeded. Blume Bijdr. 221; Wall. Cat. 4219: W. and A. Prod. 105: Dalz. and Gibs. Fl. Bomb. 33; Kurz For. Flora Burma, I, 260: Miq. Fl. Ind. Bat. I, pt. 2, p. 597; Hook. fil. Fl. Br. Ind. I, 626. *S. podopetala*, Turcz. in Bull. Soc. Nat. Mosc. 1863, I, 581. *S. Wightiana*, Wall. Cat. 4221. *Johnia coromandeliana*, Roxb. Fl. Ind. 169; DC. Prod. I, 571. *Tonsella prinoides*, Willd. in Act. Acad. Cur. r. IV, 184.

In all the provinces.—Distrib: British India, Ceylon, the Malay rchipelago, Philippines.

Var. *macrophylla*, leaves broadly elliptic, acuminate, much narrowed at the base, 4 to 5 in. long, and 1·75 to 2·75 in. broad. *S. macrophylla*, Bl. Bijdr. 221.

Perak: King's Collector, 7552; Wray, No. 2133. Distrib.—Java.

10. Salacia polyantha, Korth. in Flora XXXI for 1848, p. 373. Scandent, glabrous; young branches dark-coloured when dry, minutely warted. *Leaves* coriaceous, narrowly elliptic-lanceolate, the apex shortly and obtusely acuminate, the base cuneate, the edges with remote shallow serrations; the upper surface shining when dry and sub-olivaceous, the lower dull brown; length 3·5 to 4·5 in., breadth 1·25 to 2 in., petiole ·35 in. *Flowers* about ·25 in. in diam., on slender pedicels ·5 to ·65 in. long, crowded on very short bracteolate axillary tubercles. *Calyx* flat, fleshy, with 5 rotund slightly imbricate lobes. *Petals* 5, much larger than the calyx-lobes, broadly elliptic, obtuse, concave, spreading. *Disc* very convex, fleshy, glabrous. *Stamens* 3, inserted near the upper edge of the disc: filaments flat but not very broad, short, sub-recurved; *anthers* small, transversely oblong. *Fruit* unknown.

Tongkah: Curtis, No. 2917. Kedah: Curtis, No. 2574. Distrib.—Borneo.

Mr. Curtis describes his Tongkah plant as a climbing shrub and his Kedah plant as a tree; but I cannot find any difference in their flowers or leaves.

11. Salacia Wrayi, King, n. sp. A stout climber: young

branches slender, glabrous, dark-coloured when dry. *Leaves* membranous, broadly elliptic, shortly cuspidate, entire, rounded or very slightly narrowed at the base; upper surface shining, darkly cinereous when dry; the lower pale, cinereous, dull: main nerves 6 or 7 pairs, obsolete on the upper, faint on the lower surface when dry; length 1·75 to 2·5 in., breadth 1 to 1·35 in.; petiole ·3 to ·4 in., slender. *Flowers* ·15 in. in diam., their pedicels about ·2 in., in fascicles of 3 to 6 on very short axillary tubercles shorter than the petioles. *Calyx* fleshy, sub-campanulate, deeply divided into 5 broad reniform-ovate spreading teeth. *Petals* sub-erect, twice as long as the calyx-lobes, fleshy, very broadly oblong; the apex obtuse, the base broad and truncate. *Disc* cupular, fleshy, entire. *Ovary* broad, depressed, 3-angled, surrounded by the disc, stigma small. *Stamens* 3, spreading; the filaments stout, slightly flattened, recurved over the edge of the disc: *anthers* small, rounded, 2-celled. *Fruit* globular, nearly 2 in. in diam., a[illegible] bright orange when ripe, glabrous, the surface much corrugated wh[illegible] dry especially towards the apex; pedicel very stout, ·5 in. long.

Perak: Wray, No. 2542.

12. Salacia Kunstleri, King, n. sp. A scandent shrub; young branches cinereous, glabrous, lenticellate, the bark striate when dry. *Leaves* membranous, oblong-lanceolate or oblong-oblanceolate, shortly cuspidate, much narrowed to the base, both surfaces glabrous, the lower brown when dry, the transverse reticulations very distinct; main nerves about 7 pairs, spreading and curving upwards; length 3·5 to 5·5 in., breadth 1·75 to 2·3 in., petiole ·15 in. *Flowers* ·15 in. in diam., on thin pedicels ·5 in. long, in fascicles of 3 to 6 from very small bracteolate axillary tubercles. *Calyx* small, cupular, spreading, deeply divided into 5 concave ovate-orbicular teeth with coarsely ciliate edges. *Petals* 5, orbicular, spreading, much larger than the calyx-teeth. *Disc* flat, thin, annular, not toothed. *Stamens* 3, attached to the inner edge of the disc; the filaments very broad, triangular, recurved, *anthers* small. *Ovary* buried in the disc. *Fruit* unknown.

Perak: King's Collector, No. 683, (collected only once and probably a rare plant).

13. Salacia flavescens, Kurz, Journ. As. Soc. Bengal, for 1872, pt. 2, p. 300. A scandent shrub 40 to 60 feet long: young branches slender, black when dry and with numerous minute split warts. *Leaves* opposite, coriaceous, oblong, sub-acute, the edges entire and slightly revolute when dry, the base rounded, almost sessile; both surfaces, but especially the lower, yellowish when dry; main nerves 6 to 9 pairs, spreading, interarching far from the edge: length 4 to 7 in., breadth 1·25 to 2·5 in.; petiole about ·2 in., stout. *Flowers* about ·15 in. in

diam., in axillary clusters of 2 or 3 or on very short woody tubercles; pedicels rather longer than the flowers. *Calyx* of 5 broadly ovate acute concave sepals sometimes with coarsely ciliate edges, otherwise glabrous. *Petals* twice as long as the sepals, broadly elliptic, glabrous, the inner two sometimes with two imperfect transverse thickened bands on the upper surface. *Disc* with saucer-like wavy lower rim, the upper part fleshy and confluent with the ovary. *Stamens* 3, inserted on the disc; the filaments broadly triangular, embracing the ovary: *anthers* small, transversely elongated, 2-celled. *Ovary* immersed in the disc, conical, 3-angled, glabrous, the style protruding, the stigma small. *Fruit* globular, glabrous, 1·5 to 2 in. in diam. *Seeds* several. Kurz For. Flora Burma. I, 260: Laws. in Hook. fil. Fl. Br. Ind. I, 627. *Microtropis coriacea*, Wall. Cat. 4338. *M. longifolia*, Wall. Cat. 4339 (in part). *Xanthochymus ovalifolius*, Wall. (not of Roxb.) Cat. 4839 B.

Malacca: Maingay (Kew Distrib.), No. 404/2. Perak: King's Collector, Scortechini, Curtis. Penang: Wallich, Curtis, No. 12. Kedah: Curtis, No. 2653. Distrib.—Tenasserim, Helfer (Kew Distrib.) No. 897.

Var. *dumosa*: a small erect shrub; flowers brick-red.

Perak: Scortechini, No. 505, 1734: King's Collector, No. 10948. Kedah: Curtis, No. 2654.

I think it probable that better acquaintance with this shrubby non-scandent variety will prove it to be quite as well entitled to specific rank as many members of this genus.

14. Salacia Lawsoni, King. A scandent shrub with smooth pruinose branches, becoming black when dry. *Leaves* sub-coriaceous, elliptic, obtuse, entire, the base rounded; both surfaces glabrous, pale yellowish-brown when dry, reticulate, shining: main nerves 6 or 7 pairs, faint; length 2·5 to 5 in., breadth 1·5 to 3 in., petiole ·2 to ·35 in. *Flowers* ·1 in. in diam., 3 to 6 from small axillary bracteolate tubercles; their pedicels slender, ·25 to ·3 in. long. *Calyx* of 5 ovoid-deltoid thick sepals. *Petals* 5, larger than the sepals, broadly ovoid, obtuse. *Disc* convex, fleshy. *Stamens* 3, inserted on the upper edge of the disc; filaments flat, broadly triangular; *anthers* small, broader than long. *Fruit* unknown. *S. ovalis*, Lawson (not of Korth.) in Hook. fil. Fl. Br. Ind. I, 627.

Malacca: Maingay (Kew Distrib.), No. 400.

A species with leaves like those of *S. flavescens* Kurz, but with much smaller flowers: collected only by Maingay. I have been obliged to change the name of this, as there is an earlier *S. ovalis* published by Korthals in 1848 (Flora, XXXI, 579); whereas Mr. Lawson's name dates from 1875.

Imperfectly known species.

Salacia Lobbii, Laws. in Hook. fil. Fl. Br. Ind. I, 626. An erect shrub; branches terete, covered with minute warts. *Leaves* elliptic-oblong with a short obtuse point, entire, not drying black, 3 to 3·5 in. long and 1 to 1·75 in. broad. *Flowers* 1 to 3 in each axil, thick and fleshy; pedicels stout, 1 to 1·5 in. long. *Petals* roundly ovate, sub-cordate at the base, ·25 in. long. *Fruit* unknown.

Singapore, Lobb.

This is known only by Lobb's imperfect specimen said to have been collected at Singapore. The description above given is copied from Lawson (*l. c.*).

Salacia rubra, Laws. in Hook. fil. Fl. Br. Ind. I, 627. A scandent ? shrub with coarse pale-coloured branches. *Leaves* sub-coriaceous, elliptic-lanceolate or ovate-lanceolate, acuminate, entire, the base cuneate, both surfaces glabrous, the lower paler; main nerves 5 pairs. *Flowers* unknown. *Fruit* globose, bright red when ripe, rugose, 1·5 in. in diam., 2-seeded.

Malacca: Maingay (Kew Distrib.), Nos. 398/2 and 1525.

The above description is taken from Lawson (*l. c.*)

Order XXXII. Rhamneæ.

Shrubs or trees, erect or scandent (cirrhose in *Gouania*). *Branches* unarmed spinous or aculeate. *Leaves* simple, alternate, or rarely opposite, usually coriaceous, often 3–5-nerved; stipules small, deciduous or changed into prickles. *Flowers* hermaphrodite or polygamous, small, greenish, in cymes which are solitary or disposed in spikes or panicles. *Calyx* 4–5-fid; lobes triangular, erect or recurved, usually carinate within, valvate. *Petals* 4–5, rarely 0, inserted on the throat of the calyx-tube, usually shorter than its lobes, cucullate or involute. *Stamens* 4–5, inserted with the petals and opposite to them, often enclosed within their folds; *anthers* versatile, 2-celled, dehiscing longitudinally. *Disc* fleshy and filling the calyx-tube, or thin and lining it, entire or lobed, glabrous, rarely tomentose. *Ovary* sessile, free or immersed in the disc, wholly free from the calyx-tube or more or less adherent to it, 3- rarely 2–4-celled; style short, simple, or 2–4-cleft; ovules 1 in each cell, erect, anatropous, raphe dorsal. *Fruit* free or girt at the base or middle by the adhering calyx-tube, 3- more rarely 1–4-celled, capsular and often winged, or drupaceous. *Seed* with fleshy albumen, rarely exalbuminous; embryo large, erect.—Distrib. tropical and temperate regions; species about 420.

Fruit superior.
Armed trees or shrubs; fruit drupaceous ... 1. ZIZYPHUS.
Fruit half inferior.
Unarmed erect shrubs; fruit dry, 3-celled, 3-seeded ... ... 2. COLUBRINA.
Scandent unarmed shrubs; fruit dry, 1-celled, 1-seeded (by abortion), epicarp prolonged into a long apical wing.
Fruit indehiscent, apical wing not splitting 3. VENTILAGO.
Fruit dehiscent, apical wing splitting at least at the base ... ... 4. SMYTHEA.
Fruit inferior, crowned by the persistent calyx, 3-winged or triquetrous ... ... 5. GOUANIA.

1. ZIZYPHUS, Juss.

Trees or shrubs, often decumbent or sarmentose and usually armed with sharp, straight or hooked prickles (transformed stipules). *Leaves* alternate, 3-nerved, usually coriaceous. *Flowers* fascicled, or in sessile or pedunculated cymes. *Calyx* 5-fid; lobes spreading, keeled within; tube broadly obconical. *Petals* 5, rarely 0, cucullate, deflexed. *Disc* 5–10-lobed, flat or pitted, with a free margin. *Stamens* 5. *Ovary* sunk in the disc and confluent with it at the base, 2–4-celled; styles 2–4, free, or more or less united. *Fruit* fleshy or dry, with a woody or bony 1–4-seeded 1–4-celled stone. *Seed* plano-convex, albumen 0, or very scanty.—DISTRIB. Species about 60, found in tropical Asia and America, and in the temperate regions of both hemispheres.

Leaves pubescent underneath.
Leaves uniformly tomentose beneath, broadly ovate or sub-orbicular, blunt; drupe glabrous, with much pulp and bony endocarp ... ... 1. *Z. Jujuba.*
Leaves rusty-pubescent beneath, ovate lanceolate, oblique, acute; drupe glabrous, with scanty pulp and leathery endocarp ... ... 2. *Z. Oenoplia.*
Leaves rusty-pubescent beneath, elliptic-oblong, acute or shortly acuminate, cordate; drupe rufous-tomentose, with thin pulp and bony endocarp ... ... 3. *Z. Kunstleri.*
Leaves sparsely pubescent beneath, ovate-lanceolate, oblique, bluntly acuminate; drupe glabrous, with thin pulp and leathery endocarp ... 4. *Z. elegans.*

Leaves glabrous on both surfaces.

Cymes in thyrsoid terminal panicles, fruit tomentose ... ... 5. *Z. calophylla.*

Cymes axillary.

Sepals connivent, disc pitted, drupe glabrous 6. *Z. affinis.*

Sepals spreading, disc not pitted.

Lateral nerves of leaves either unbranched, or very faintly so, drupe glabrous ... ... 7. *Z. glabra.*

One at least of the lateral nerves strongly branched, drupe tomentose ... 8. *Z. Horsfieldii.*

1. Zizyphus Jujuba, Lamk. Dict. III, 318. A small tree: young branches, flowers and under surfaces of leaves more or less pale or tawny-tomentose. *Leaves* ovate-elliptic, ovate or sub-orbicular, blunt, sub-entire, somewhat narrowed at the base, upper surface glabrous; length 1 to 2 in., breadth ·5 to 1·15 in.; prickles solitary or in pairs: petiole ·25 to ·5 in. *Cymes* short, lax or dense, axillary. *Calyx* flocculent outside, glabrous inside. *Petals* sub-spathulate, concave. *Disc* with 10 grooved lobes. *Ovary* glabrous, 2-celled; *styles* united to the middle. *Fruit* globose or ovoid, glabrous, fleshy, ·5 to ·75 in. in diam., yellow or orange-yellow, stone 1- or 2-celled. DC. Prodr. ii. 21; Roxb. Fl. Ind. i. 608; Wall. Cat. 4244; W. & A. Prodr. 162; Wight Ic. t. 99; Hook. Journ. Bot. i. 320, t. cxl. (1834); Dalz. & Gibs. Bomb. Fl. 49; Thwaites Enum. 74; Bedd. Fl. Sylvat. t. cxlix.; Hook. fil. Fl. Br. Ind. 1, 632: Kurz For. Flora Burma, I, 266; Boiss. Fl. Orient. ii. 13; Brandis For. Flor. 86, t. 17; Trimen Fl. Ceyl. I. 280. *Z. mauritiana*, Herb. Ham. in Wall. Cat. 4245; DC. Prodr. ii. 21. *Z. Sororia*, Schult. Syst. v. 337; DC. Prodr. ii. 21. *Z. trinervius*, Roth Nov. Sp. 168, excl. var. *β. Rhamnus Jujuba*, Linn. Fl. Zeyl. 36; Rheede Hort. Mal. iv. t. 40.

Malacca and Province Wellesley, but probably introduced. Distrib. India, Affghanistan, Ceylon, China, Australia, Africa.

A widely distributed species, and therefore presenting considerable variety. The description above given refers to the plant as found in the Malay Peninsula. As a rule there are two stipular prickles, of which one is straight and the other curved. The fruit is eaten and several garden forms are found.

2. Zizyphus Oenoplia, Mill. Gard. Dict. No. 3. A scandent or straggling shrub; young branches rusty-tomentose; prickles solitary, tomentose at the base, glabrous at the apex, short, recurved. *Leaves* ovate-lanceolate, often very oblique, acute, entire or obscurely crenate-serrate, with 3 bold vertical nerves and numerous connecting ascending

branches; upper surfaces sparsely strigose, the lower densely rufescent-villous: length 1·25 to 2·25 in., breadth ·7 to 1·2 in.; petiole ·2 to ·3 in., tomentose. *Cymes* slightly longer than the petioles, subsessile, 12-to 15-flowered, pubescent. *Calyx* sparsely pubescent outside, glabrous inside. *Disc* glabrous, with 10 short deeply pitted lobes. *Styles* united to the apex. *Drupe* globular, slightly compressed, black, glabrous, shining, with scanty pulp, ·25 in. in diam., endocarp leathery. DC. Prodr. ii. 21; Roxb. Fl. Ind. i. 611; Wall. Cat. 4246; Don Prodr. 190; W. & A. Prodr. 163; Dalz. & Gibs. Bomb. Fl. 49; Thwaites Enum. 74; Hook. fil. Fl. Br. Ind. I, 634; Kurz For. Flora Burma, I, 266; Bedd. Fl. Sylv. Anal. Gen. lxix.; Brandis For. Fl. 86. *Z. albens*, Roxb. Fl. Ind. i. 607. *Z. celtidifolia*, DC. Prodr. ii. 20; Miq. Fl. Ind. Bat. I, pt. 2, p. 641). *Z. ferruginea*, Heyne in Wall. Cat. 4246, B, in part. *Z. Napeca*, Roxb. Fl. Ind. i. 612, not Willd.; Roth Nov. Sp. 159. *Z. pallens*, Wall. Cat. 4247 ? *Z. pedicellata*, Wall. Cat. 4243. *Z. rufula*, Miq. Fl. Ind. Bat. i. 643. *Z. scandens*, Roxb. Hort. Beng. 17; Wall. Cat. 7269. *Rhamnus Œnoplia*, Linn. Sp. Pl. 282.

In all the Provinces; common.—Distrib., British India, Ceylon: tropical Asia and Australia.

In Perak there is a form of this (King's Collector Nos. 5106 and 5276) with leaves rather larger than the measurements above given, and nearly glabrous.

3. Zizyphus Kunstleri, King n. sp. A scandent or straggling shrub: young shoots rusty-pubescent; spines stout, solitary, decurved. *Leaves* coriaceous, elliptic-oblong, acute or shortly acuminate, very finely serrate, narrowed to the minutely cordate base; upper surface shining, glabrous except the impressed rusty-pubescent nerves; the lower dull, rusty-pubescent especially on the 3 main vertical nerves and their lateral branches; length 4 to 6 in., breadth 2 to 3 in., petiole ·15 to ·2 in. *Cymes* 5- to 8-flowered, sub-sessile and crowded on branches 4 to 10 in. long, many of them in the axils of leaves much smaller than those of the stem. *Calyx* rusty-tomentose outside, glabrous inside; its teeth broadly triangular, acute, spreading. *Disc* with 5 broad truncate emarginate teeth, glabrous except a villous elevated ring surrounding the base of the sunk tomentose ovary. *Styles* united for half their length. *Drupe* ovoid, slightly compressed, rufous-tomentose, the persistent calyx reflexed; 1 to 1·25 in. long, and from ·5 to ·75 in. diam.; pulp scanty, endocarp woody; seed single, compressed.

Province Wellesley, King's Collector No. 1607. Perak: Wray, Nos. 1911, 3281 and 3285; King's Collector Nos. 3772 and 6853.

A very distinct species, the flowering branches of which have much smaller leaves than those of the barren branches. Named in memory

of its first collector, *H. H. Kunstler*, who sent it from Province Wellesley in 1881.

4. Zizyphus elegans, Wall. Cat. 4233. A straggling or scandent shrub: young branches slender, softly pubescent. *Leaves* ovate-lanceolate, bluntly acuminate, oblique, the edges obscurely glandular-serrate-crenate, the base slightly narrowed; upper surface glabrous except the pubescent nerves; the lower sparsely pubescent especially on the nerves; the middle of the 3 main bold vertical nerves unbranched, one, and sometimes both, of the lateral sending a few faint branches from one side; length 2 to 3 in., breadth ·75 to 1·25 in.; petiole ·25 to ·35., tomentose. *Cymes* with stalks as long as the leaves, dichotomous, 20- 30-flowered, tomentose. *Calyx* adpressed-pubescent outside, glabrous inside. *Disc* glabrous, fleshy, with 5 broad emarginate lobes, each lobe with 3 deep pits; *styles* short, slightly united. *Drupe* sub-globular, compressed, glabrous, ·3 in. in diam., pulp very thin, endocarp leathery. *M. subquinquenervius*, Miq. Fl. Ind. Bat., Suppl. 330.

Singapore; Wallich, King's Collector. Malacca; Ridley No. 1504. Maingay (Kew Dist.) No. 412. Perak: King's Collector, No. 4260 and 4770—Distrib.; Sumatra, Forbes 3137; Diepenhorst.

This species was first described by Miquel from specimens collected at Prianam in Sumatra, one of which is in Herb. Calcutta. Miquel does not describe the fruit, which differs from that of *Z. Horsfieldii* of the same author in being smaller and glabrous. This is no doubt very closely allied to *Z. Horsfieldii*, and it would have been better had Miquel transposed the names of the two; for there is much more disposition to an increase in the number of the nerves of the leaves in *Z. Horsfieldii* than in *Z. subquinquenervis*. Wallich had however, long prior to the publication of Miquel's name for this, issued leafless twigs of it as No. 4233 of his Catalogue, under the name *Z. elegans*; and this name must therefore, as the earliest, be adopted.

5. Zizyphus calophylla, Wall. in Roxb. Fl. Ind., ed. Carey, II, 366. A powerful climber; young branches dark-coloured, rusty-puberulous or glabrous, sparsely lenticellate; prickles short, recurved, usually solitary, rarely in pairs. *Leaves* coriaceous, elliptic or elliptic-oblong, shortly and obtusely acuminate, the edges minutely crenate-dentate or sub-entire; the base usually narrowed, not oblique; both surfaces glabrous, shining, the upper pale, olivaceous; main nerves 3, bold, unbranched, vertical; length 3 to 5 in., breadth 1·5 to 2·5 in., petiole ·25 to ·35 in. *Cymes* rusty-pubescent, disposed in axillary or terminal thyrsoid panicles. *Calyx* rusty-tomentose outside, glabrous inside; its teeth broadly triangular, acute, spreading. *Disc* entire. *Styles* united to near the apex. *Drupe* minutely rufous-tomentose,

ovoid or ovoid-globose, the pulp scanty and the endocarp leathery, seed solitary. Wall. Cat. 4230; Hook. fil. Fl. Br. Ind. I, 636. *Z. ornata*, Miq. Fl. Ind. Bat., Vol. I, pt. I, 642. *Berchemia calophylla*, G. Don Gen. Syst. II, 28.

Penang; Wallich. Malacca; Griffith, No 2046. Maingay (Kew Distrib.), No. 411. Perak, common. Singapore; Ridley, Nos. 1915, 4939. Pahang, Ridley, No. 5021. Selangor, Ridley's Collector.

A handsome and very distinct species. Ridley's Singapore No. 3646 seems to be a form of this with smaller leaves and more globular smaller fruit than usual. *Z. ornata*, Miq., of which there is a type specimen in Herb. Calcutta, differs in no respect from this.

6. ZIZYPHUS AFFINIS, Hemsley in Hook. Ic. Pl. t. 1544. Scandent: young branches dark-coloured, glabrous, the older often with many prominent lenticels, prickles and leaves as in *Z. calophylla*. *Cymes* solitary, axillary, on pedicels longer than the petioles, spreading, many-flowered, puberulous. *Flowers* sub-globular, opening only slightly; the calyx coriaceous, rugulose and sub-glabrous externally; its lobes broadly ovate, very concave, erect, with incurved apices lined internally with a pale glabrous membrane. *Disc* minutely 10-crenate, pitted, glabrous. *Styles* united to the apex. *Fruit* ovoid, glabrous, ·75 in. long and ·6 in. in diam., the pulp scanty and the endocarp bony.

Perak: Wray Nos. 1885, 1886 and 1995. King's Collector Nos. 3568, 3747, 5238, 5528, 6720. Scortechini No. 192.

The leaves of this species so much resemble those of *Z. calophylla* Wall., that its author, who had very scanty material to work with, expressed some doubt whether it should not be considered as a variety of that species, rather than as a distinct one. An examination of numerous specimens with good flowers and ripe fruit, shows however that it is perfectly distinct from *Z. calophylla*. Its calyx differs in fact very much from that of any other Asiatic species of this genus known to me, inasmuch as the lobes are coriaceous, cucullate, connivent and lined by a pale membrane.

7. ZIZYPHUS GLABRA, Roxb. Fl. Ind. I, 614. A scandent shrub; young branches puberulous; spines short, curved, solitary. *Leaves* ovate-oblong, rarely ovate-lanceolate, shortly and obtusely caudate-acuminate, the edges serrulate or sub-entire, the base slightly narrowed, oblique, and sometimes emarginate on one side, boldly 3-nerved, nerves unbranched, both surfaces shining, glabrous except the midrib on the upper which is pubescent; length 2·5 to 3·5 in., breadth 1·25 to 1·6 in., petiole ·2 to ·4 in. *Cymes* slightly longer than the petioles, on short stalks, axillary, spreading, 10- to 20-flowered, pubescent like the outer-surface of the calyx. *Disc* with a circular hairy centre and glabrous edge with 10

obscure broad teeth. *Drupe* round or ovoid, at first puberulous, when quite ripe yellow and usually nearly glabrous, ·5 or ·6 in. in diam., stone usually 1-celled. Kurz For. Flora Burma, I, 267. *Z. rennlosa*, Wall. Cat. 4235.

Andaman and Nicobar Islands.—Distrib. Burma, Chittagong.

This is a perfectly good and distinct species. Mr. Lawson however, misled no doubt by Wallich's wrong identification of No. 4242 of his catalogue as *Z. glabra*, Roxb., and in the absence of an authentic specimen of the species, reduced this (in Hooker's Flora of Brit. India I, 636,) to a glabrous form of *Z. rugosa* Lamk., which is a plant with a totally different inflorescence. The nearest ally of this is undoubtedly the Indian Peninsular species *Z. trinervia* Roxb., which was published by Roxburgh in his Hortus Bengalensis in 1813 as *Z. trinervius*, and of which a full and excellent description was given as *Z. trinervia* in his Flora Indica I, 606. The synonymy of this species is rather curious, and I therefore make a note of it here. Roth described what is undoubtedly a different plant in his *Novæ Plantarum Species* (published in 1821) as a species of his own under the name *Z. trinervius*, and of that plant he describes, as var. *glabratus*, a form to which he reduces *Z. glabratus* Heyne, which is unmistakably the *Z. trinervius* of Roxburgh; I can find no other publication of Heyne's *Z. glabratus* than this one of Roth's. Unfortunately Mr. Lawson has taken Heyne's name as that of the species, although Roxburgh's dates from 1813.

8. Zizyphus Horsfieldii, Miq. Fl. Ind. Bat., Vol. I, pt. I, p. 643. Young branches sparsely puberulous; spines short, curved, usually solitary or with a second abortive. *Leaves* ovate-elliptic or ovate-lanceolate, acuminate, minutely serrate, the base slightly narrowed, sometimes oblique or sub-cordate, glabrous on both surfaces, the latter with a few scattered hairs on the nerves; vertical nerves 3, bold, impressed on the upper and prominent on the lower surface, the middle one unbranched, the two lateral sending bold curved, ascending branches towards the margin; length 2·5 to 3 in., breadth 1 to 1·75 in., petiole ·3 to ·5 in. *Cymes* longer than the petioles, branched, few-flowered. *Flowers* on pedicels longer than themselves; calyx puberulous outside, glabrous inside: *disc* tomentose with a glabrous 10-crenate wavy edge, not pitted; *styles* united to the apex. *Fruit* globular, slightly compressed, ·5 to ·6 in. in diam., densely but minutely tawny-tomentose.

Nicobar Islands: Kurz. Singapore, Ridley, No. 6379.—Distrib. Java.

This species much resembles *Z. glabra*, Roxb, but the outer nerves of the leaves are boldly branched outwards, and the fruit is minutely tomentose. The specimens of this are scanty. When more materials

of this and of *Z. glabra*, Roxb. are obtained, it may be found impossible to keep this up as more than a variety of the older species. Ridley's Singapore specimens (No. 6379) have longer-stalked cymes than those from the Nicobar Islands or from Java. In the latter the cymes do not much exceed the petiole in length, while in the former they are, even when in flower, half as long as the leaf.

2. COLUBRINA, Rich.

Erect shrubs. *Leaves* alternate. *Flowers* in very short axillary cymes. *Calyx* 5-fid; tube hemispherical. *Petals* 5, clawed, springing from the margin of the disc, hooded. *Stamens* 5. *Disc* fleshy, filling the calyx-tube. *Ovary* sunk in the disc and confluent with it, 3-celled; style 3-cleft; stigmas reflexed. *Fruit* the size of a pea, subglobose, surrounded below the middle by the remains of the calyx-tube, 3-celled, cells 1-seeded, tardily dehiscent.—DISTRIB. Species 18, chiefly tropical American.

Leaves broadly ovate, crenate-serrate ... 1. *C. asiatica.*
„ oblong-oblanceolate, entire ... 2. *C. anomala.*

1. COLUBRINA ASIATICA, Brongn. in Ann. Sc. Nat. Ser. I, x, 369. A glabrous unarmed shrub. *Leaves* broadly ovate, acute, crenate-serrate, (sometimes obscurely), rounded at the base; main nerves about 3 pairs, curved, ascending; length 1·5 to 3 in., breadth 1 to 2·25 in.; petiole ·4 to ·6 in., slender. *Cymes* shorter than the petioles, flowers yellowish. W. & A. Prodr. 166; Wight Ill. i. t. 74; Dalz. & Gibs. Bomb. Fl. 50; Thwaites Enum. 75; Hook. fil. Fl. Br. Ind. I, 642; Kurz For. Flora Burma, I, 268; Bedd. Fl. Sylv. Anal. Gen. lxix. *C. javanica*, Miq. Fl. Ind. Bat. vol. I, pt. 1, 649. *Ceanothus asiaticus*, Lamk Ill. t. 129, f. 2; DC. Prodr. ii. 30; Roxb. Fl. Ind. i. 615; Wall. Cat. 4262. *C. capsularis*, Forst. Prodr. 18; DC. Prodr. ii. 32. *Pomaderris capsularis*, G. Don *Gen. Syst.* ii. 39; Burm. Zeylan. t. 48. *Rhamnus acuminata*, Colebr. in Roxb. Fl. Ind. i. 615.

Pahang, Perak, Nicobar and Andaman Islands.—DISTRIB.; Malay Archipelago, British India.

2. COLUBRINA ANOMALA, King n. sp. A tree 30 to 40 feet high with spreading pendent branches; young shoots softly rusty-puberulous. *Leaves* oblong-oblanceolate, caudate-acuminate, entire, much narrowed to the base: upper surface glabrous, shining; the lower puberulous, liver-coloured when dry; main nerves 4 pairs, slightly curved, ascending, the lowest pair springing from the very base: length 4 to 6·5 in., breadth 1·1 to 2·25 in., petiole ·4 to ·5 in. *Cymes* axillary or crowded on the branches between the leaves, branching, many-flowered, rusty-tomentose, minutely bracteolate. *Flowers* ·15 in. in

diam., on pedicels longer than themselves. *Calyx* sparsely puberulous outside, its lobes triangular, glabrous and keeled inside. *Disc* glabrous, thick, filling the calyx tube; *ovary* glabrous, 3-celled, the styles short, distinct, sometimes slightly reflexed. *Fruit* on a thin glabrous pedicel elongated to nearly 1 inch, depressed-globular, glabrous, ·25 in. in diam., black when dry, the withered calyx teeth forming a ring above its base.

Perak: King's Collector, Nos. 6561 and 7476.

This plant differs from the other species of the genus in the character of its foliage, and in the fact that the styles are quite short, and not united. The flowers, however, in other respects, and the fruit, are exactly those of the genus.

3. Ventilago. Gaertn.

Scandent shrubs with alternate *leaves*. *Flowers* small, panicled, minutely bracteolate. *Calyx* obconic, 5-fid; the teeth spreading, keeled internally. *Petals* 5, deltoid or obcordate, deflexed, cucullate. *Stamens* 5, adnate to the petals at the base. *Disc* 5-angled, its margin free. *Ovary* immersed in the disc, 2-celled, the style very short. *Ripe fruit* sub-globose, 1-celled, 1-seeded, surrounded at its base or middle by the adherent calyx-tube, the fruit prolonged upward above the seed-chamber into a linear or linear-oblong coriaceous apical wing. *Seed* sub-globose, exalbuminous.—Distrib. Species about 16; tropical.

Fruit pubescent	1.	*V. Madraspatana.*
Fruit glabrous.		
Leaves sub-acute, with 8 to 11 pairs of main nerves, fruit ·25 to ·35 in. in diam....	2.	*V. Maingayi.*
Leaves more or less shortly caudate-acuminate, with 6 or 7 pairs of main nerves...	3.	*V. leiocarpa.*

1. Ventilago madraspatana, Gaertn. Fruct. I, 223, t. 49, p. 2. Young branches and panicles pubescent. *Leaves* oblong-ovate to ovate, sub-acute, the edges entire or obscurely sinuate in the upper half, the base rounded; main nerves 4 to 6 pairs, alternate, ascending; upper surface glabrous, the lower glabrous or puberulous; length 2·25 to 5 in., breadth 1·25 to 2·25 in.; petiole ·25 to ·6 in. *Panicles* terminal and axillary, longer than the leaves, narrow, with distant short many-flowered cymose branches. *Flowers* about ·15 in. in diam., shorter than their pedicels, densely crowded. *Calyx* pubescent or puberulous outside, glabrescent inside; *disc* velvetty. *Ovary* tomentose, *styles* more or less divergent. *Fruit* yellowish, densely pubescent, often becoming sub-glabrous with age; the nut about ·2 in. in diam.; the wing 1-nerved, blunt, 1·75 to 2·25 in. long and ·3 to ·4 in. broad. *V. calyculata*, Tulasne in Ann. Sc. Nat. Ser. 4, VIII. 124; Brandis For. Flora 96; Lawson in

Hook. fil. Fl. Br. Ind. I, 631; Kurz For. Flora Burma. I, 262. *V. denticulata*, Willd. Nov. Act. Ber. iii. 417; DC. Prodr. ii. 38. *V. macrantha*, Tulasne in Ann. Sc. Nat. Ser. 4, viii. 123. *V. madraspatana*, Roxb. Fl. Ind. i. 629; Cor. Pl. i. 55, t. 76; Wall. Cat. 4268, in part. W. & A. Prodr. 164. *V. silhetiana*, *Smithiana*, *and sulphurea*, Tulasne in Ann. Sc. Nat. Ser. iv–viii. 125.

South Andaman.—DISTRIB. Throughout the hotter parts of India and Java.

Tulasne was the first to establish *V. calyculata* as a species, and he founded it upon three Indian specimens, *viz.*, Herb. Strachey and Winterbottam No. 349, Wall. Cat, 4268G. (both from Kamaon) and Wall. Cat. 4268H. (from Sylhet). The characters used by him to distinguish *V. calyculata* as a species distinct from the older *V. madraspatana*, Gaertn. are that the latter has more slender and more glabrous panicles; that the ovary is less hairy and the styles less divergent; the wing being attached to the base of the fruit in *V. madraspatana*, while it springs from about the middle of it in *V. calyculata*. The last character is the one most relied upon; but, as regards it, I find no degree of constancy. I do not think the form named *calyculata* deserves rank as more than a variety of typical *V. madraspatana* Gaertn., the synonymy of which (as distinct from this variety) is as follows: Brougn. Mem. sur la Fam. des Rhamnées, Ann Sc. Nat. for 1827, Ser. I (Vol. X) p. 358, t. 12, fig. IV; W. & A. Prodr. 164; Wight Ic. 163; Wall. Cat. 4268, in part; Dalz. & Gibs. Bomb. Fl. 48; Thwaites Enum. 74; Brandis For. Fl. 96; Laws. in Fl. Br. Ind. I, 631. *V. bracteata*, Wall. Cat. 4269.

The typical form seems to occur only in Southern India and Ceylon.

2. VENTILAGO MAINGAYI, Laws. in Hook. fil. Fl. Br. Ind. I, 631. Young branches and panicles puberulous. *Leaves* thinly coriaceous, glabrous, oblong or oblong-lanceolate, sub-acute, entire, the bases narrowed; main nerves 8 to 11 pairs, spreading; length 2·5 to 4·5 in., breadth 1·25 to 1·75 in., petiole ·1 to ·2 in. *Panicles* narrow and spike-like, shorter than the leaves when in flower, longer when in fruit; the branches very short, distant, cymose. *Flowers* crowded; 1 in. in diam., about as long as their pedicels. *Calyx* puberulous outside, glabrous inside, the keels of its lobes very bold. *Disc* pubescent. *Ovary* glabrous. *Fruit* greenish-yellow, glabrous; the nut ·25 to ·35 in. in diam.; the wing blunt, 1-nerved, mottled with red, 3 to 3·5 in. long and about ·6 in. broad. Kurz For. Flora Burma, I, 263.

Malacca: Maingay (Kew Dist.) No. 407; King's Collector, No. 7721. DISTRIB. Tenasserim? Cambodia!

A species easily recognised by its elongated entire thinly coriaceous leaves, and long-winged glabrous fruit. Tenasserim is given as a local-

ity for this species by its author; but if this distribution be given on the strength of Helfer's Tenasserim specimen No. 2022 (Kew Distrib.), I think it is erroneous: for that specimen does not agree with Maingay's (from Malacca) No. 407 which is the type of the species.

3. Ventilago leiocarpa, Benth. Fl. Hongkong 67; Journ. Linn. Soc. V, 77. Young shoots angled and, like the inflorescence, puberulous. *Leaves* thinly coriaceous, glabrous, ovate-oblong, more or less shortly caudate-acuminate; the edges more or less minutely crenate-serrate, sometimes entire, except at the rounded or slightly narrowed base: main nerves 6 or 7 pairs, curved, ascending; length 2·25 to 3·5 in., breadth 1 to 1·1 in., petiole ·2 in. *Panicles* very narrow and spike-like, much longer than the leaves even when only in flower; their lateral branches distant, very short, cymose. *Flowers* shorter than their pedicels, ·1 in. to ·125 in. in diam. *Calyx* and disc glabrescent. *Fruit* golden yellow, glabrous; nut about ·2 in. in diam.; the wing with several vertical nerves, blunt, from 2 to 2·5 in. long and ·4 (rarely ·75 in.) broad. Lawson in Hook fil. Fl. Br. Ind. I, 631; Kurz For. Flora Burma, I, 263. *V. madraspatana*, Benth. (not of Gaertn.) in Hook. Kew Journ. IV, 42.

Singapore: Ridley, No. 3607. Malacca; Maingay (Kew Distrib.) 406; Griffith (Kew Distrib.), Nos. 2022 and 2026. Perak; King's Collector, Nos. 6573, 7758; Wray, Nos. 2276, 2335. Scortechini, No. 2110.—Distrib. Sumatra, Java, Hongkong. A common plant.

In a few specimens the flowers are arranged in small axillary cymes; but, by the fall of the leaves, the inflorescence would be converted into narrow spikes of cymes as above described. Some of the specimens from Perak have entire leaves as much as 8 in. long and 2·5 in. broad; and these may belong to a distinct species. The species is readily distinguished by its crenate-serrate shining glabrous leaves, and by its glabrous several-nerved fruit-wings. A species from Sumatra described by Miquel (Fl. Ind. Bat. Suppl. 330) under the name of *V. lucens* must be very near to, if not identical with this. If it be identical, the name *V. lucens* (published in 1860) must take precedence of Bentham's name which was not published until 1861.

4. Smythea, Seem.

Scandent or sub-scandent unarmed woody shrubs. *Leaves* alternate, petiolate. *Flowers* in axillary fascicles, or on leafless terminal branches which form lax panicles. *Calyx-tube* obconic; the lobes 5, spreading. *Petals* 5, cucullate, broadly emarginate or 2-lobed. *Stamens* 5, not covered by the petals; the anthers incurved, didymous. *Disc* 5-angled. *Ovary* half-inferior, 2-celled: styles 2, recurved. *Capsule* with the calyx adherent to its base, ovate-lanceolate, compressed,

produced above the seed-cavity into a much elongate leathery wing, 1-celled, 1 seeded, dehiscing vertically into 2 valves. *Seed* solitary, large, compressed, exalbuminous.—Distrib. Four species, Malayan and Polynesian.

The differences between the genera *Smythea* and *Ventilago* lie entirely in the fruit. Both have 2-celled ovaries with two styles, and in both only one ovule becomes a seed. In both the epicarp of the fruit is prolonged above the apex of the seed-chamber into a long coriaceous wing with a vertical midrib. In *Ventilago* the fruit never dehisces, and the wing never divides. In *Smythea* the seed-chamber dehisces vertically along its dissepiment, and the wing separates to some extent, from below upwards and along the mesial line, into two pieces. In *Ventilago* the mesial line has the appearance of the midrib of a leaf, being quite single: in *Smythea* the mesial line consists, in its lower part at least, of two parallel sets of fibro-vascular bundles.

Leaves entire, much and conspicuously reticulate	1. *S. reticulata.*
...ves serrate, widest above the middle; disc and ovary glabrous	2. *S. macrocarpa.*
Leaves remotely crenate-serrate, widest below the middle; disc and ovary minutely tomentose	3. *S. calpicarpa.*

1. Smythea reticulata, King n. sp. Young branches puberulous. *Leaves* ovate-elliptic or lanceolate, shortly acuminate, entire, with minutely cordate or rounded bases, glabrous, shining and minutely reticulate on both sides; main nerves 4 or 5 pairs, faint; length 2 to 3 in., breadth ·8 to 1·5 in.; petiole ·1 in., glabrous. *Fascicles* 12-to 15-flowered; flowers ·15 in. in diam. *Calyx* sparsely pubescent outside, glabrous inside, its lobes erect, neither lobed nor pitted. *Ovary* tomentose. *Fruit* lanceolate, acuminate, minutely cinereous-tomentose, 2 in. long and ·8 in. broad.

Singapore: Ridley, No. 3592. Johore: Ridley, 1917. Perak: Scortechini, No. 1008.

Distinguished by its entire perfectly glabrous very reticulate leaves, glabrous petiole, hairy ovary, and lanceolate acuminate fruit.

2. Smythea macrocarpa, Hemsley in Hook. Ic. Pl. t. 1558. Young branches slender, rufous-puberulous. *Leaves* oblong-oblanceolate to obovate-elliptic, acuminate, serrate, narrowed to the slightly oblique base; both surfaces glabrous; main nerves 6 to 9 pairs, slightly curved, ascending; length 2·5 to 5 or even 7 in., breadth 1 to 1·5 or even 2 in.; petiole ·1 to ·2 in. or none. *Fascicles* about 10-flowered; the flowers ·15 in. in diam., pedicellate. *Calyx* sparsely pubescent ...utside, glabrous inside; its 5 lobes triangular, thick. *Disc* glabrous, ...ther lobed nor pitted. *Ovary* glabrous. *Fruit* leathery, oblong, ...tuse, with one stout vertical double line along which dehiscence takes

place and several faint lateral lines, about 3 in. long and ·5 to ·75 in. broad. *Ventilago macrocarpa*, King MSS.

Perak: common. Penang: Curtis, No. 1751.

Var. *pubescens*, young branches tomentose; leaves pubescent on the under surface.

Perak: Scortechini, No. 2110; King's Collector, No. 7726.

3. Smythea calpicarpa, Kurz Journ. As. Soc. Bengal, Vol. XLI, (for 1872) pt. 2, p. 301; For. Flora Burma 1, 264. Young branches sparsely tawny-pubescent. *Leaves* lanceolate, acuminate, remotely crenate-serrate; both surfaces glabrous but for a few scanty hairs on the 5 or 6 pairs of ascending slightly curving lateral nerves; length 2·25 to 2·75 in., breadth ·8 to 1 in.; petiole ·15 in., tomentose. *Fascicles* 3- to 10-flowered; the flowers ·15 in. in diam., pedicellate. *Calyx* hirsute outside; *disc* and *ovary* minutely tomentose. *Fruit* (unripe) coriaceous, oblong, obliquely truncate at the apex, minutely tawny-tomentose.

Andaman Islands: Helfer (Kew Distrib.), No. 2026/1; Collectors.

5. Gouania, Linn.

Unarmed climbing shrubs. *Leaves* alternate, petiolate. *Flowers* polygamous, in axillary or terminal spikes of cymes; rachis often cirrhose. *Calyx* superior, 5-fid; tube short, obconic. *Petals* 5, inserted below the margin of the disk, hooded. *Stamens* 5, enfolded by the petals. *Disc* filling the calyx-tube, 5-angled or stellate. *Ovary* sunk in the disc, 3-celled; style 3-cleft. *Fruit* inferior, coriaceous, crowned by the persistent limb of the calyx, 3-winged or boldly 3-angled, dehiscent. Distrib. About 50 species all tropical and mostly American.

Leaves entire; fruit triquetrous ...	1.	*G. Andamanica.*
Leaves crenate or serrate; fruit winged.		
Young branches glabrous; disc-lobes oblong, truncate-emarginate at the apex ...	2.	*G. leptostachya.*
Young branches rufous-tomentose; disc-lobes linear, acuminate	3.	*G. Javanica.*

1. Gouania Andamanica, King n. sp. Young branches ferruginous-pubescent, the older almost glabrous and striate. *Leaves* oblong-ovate, sub-acute, entire, narrowed to the base; both surfaces, but especially the lower, sparsely adpressed-pubescent; length 1·5 to 3·5 in., breadth ·75 to 2 in., petiole ·4 to ·6 in. *Spikes* 3 to 9 in. long, sometimes cirrhiferous near the base, slender, rufous-pubescent. *Flowers* in distant 3–4-flowered cymes, sessile; bracteoles numerous, linear-lanceolate, rufous-pubescent. *Disc* glabrous, with 5 linear lobes. *Stamens* united near the base, ovary densely tomentose. *Fruit* oblong, bold

triquetrous but not winged, rusty-tomentose, ·4 to ·5 in. long and ·25 to ·35 in. in diam., the withered calyx very prominent at its apex.

Middle Andaman Island: common.

The nearest ally of this species is undoubtedly *G. Brandisii*, Hassk. from which however, this is easily distinguished by its more glabrous flowers, and oblong wingless fruit. This also (in its entire leaves) resembles *G. microcarpa* DC. and the S. American species *G. discolor*, Spruce.

2. Gouania leptostachya, DC. Prod. II, 4. Young branches glabrous. *Leaves* broadly ovate, acute or shortly and bluntly caudate-acuminate, serrate or crenate in the upper three-fourths, the base rounded sub-truncate or slightly cordate; upper surface glaberulous, minutely sub-scaberulous when dry; the lower minutely areolate when dry, glabrous except the nerves which are sometimes puberulous; length 1·75 to 3 in. *Racemes* 6 to 12 in. long, slender, pubescent. *Flowers* in distant 3–4-flowered cymes, shortly pedicelled, almost glabrous. *Disc* glabrous, with 5 oblong truncate-emarginate lobes. *Styles* united for half their length. *Fruit* broader than long, emarginate at base and apex, glabrous; length ·25 to ·3 in., breadth ·4 to ·5 in. Roxb. Corom. Pl. I, 67, t. 98 (not Lamk.); Wall Cat. 4270: W. and A. Prod. 166: Dalz. and Gibs. Fl. Bomb. 50; Hook. fil. Fl. Br. Ind. I, 643; Kurz For. Flora Burma, I, 269; Miq. Fl. Ind. Bat. Vol. I, pt. 1, 650 (in part.) *G. Nepalensis*, Wall. in Roxb. Fl. Ind., ed. Carey, II, 417; Wall. Cat. 4272.

Perak and Andamans:—Distrib. Brit. India.

3. Gouania Javanica, Miq. Fl. Ind. Bat. I, pt. 1, p. 649. Young branches and racemes rufous-tomentose. *Leaves* ovate, acute, crenate in the upper three-fourths, the base rounded or slightly cordate; upper surface shortly pubescent especially on the nerves; under surface areolate, sparsely pubescent, the nerves rufous-tomentose; main nerves 6 or 7 pairs, very little curved, ascending; length 1·5 to 2·5 in., breadth 1·1 to 2 in., petiole ·5 in. *Spikes* ·3 to ·6 in. long, sometimes cirrhiferous near the base. *Flowers* in very short 2–4-flowered cymes, subsessile, each cyme with several sub-persistent ultimately reflexed lanceolate bracteoles. *Calyx* woolly, more or less rufescent. *Disc* glabrous, with 5 subulate marginal lobes. *Styles* united nearly to the apex. *Fruit* as in *G. leptostachya*, but one-third smaller. *M. Javanica*, Miq. Fl. Ind. Bat. Vol. I, Pt. 2, p. 649.

Malacca: Griffith; Sungei Ujong, Cantley 1855. Perak; King's Collector, Nos. 1009, 1046; Ridley, No. 3014; Wray, Nos. 3324, 4260. Distrib. Sumatra, Forbes, 1263, 2593, 2933*a*. Java.

This species has been often confounded with *G. microcarpa* DC., which it certainly resembles in some respects. I have examined a

large number of specimens of Indo-Malayan *Gouania*, and I have never seen one of true *G. microcarpa* from anywhere except Southern Peninsular British India or Ceylon. That species is characterised by sessile flowers covered externally by dense woolly white tomentum, and by glabrous usually entire or sub-entire leaves; while the flowers of *G. Javanica*, although sometimes woolly, are more or less rufescent, and the leaves are never quite glabrous or entire. The species of *Gouania* run, however, very close together, and I am not sure that it would not be better to reduce this and both *G. microcarpa* and *leptostachya* to *G. tiliæfolia* Lamk. which dates from 1791. The obscure Malayan species *G. denticulata* (Smith in Ree's Cyclop. XVI); the West Indian *G. pubescens* (Lamk. Ill. 845 t. 1, ex. Poir. II, 819); *G. dasyantha*, (Miq. Analecta Bot. Ind. III, 6) and *G. Retinaria*, DC. (*Retinaria scandens*, Gaertn. Fruct. II, p. 187 t. 120 fig. 4) appear to me, from their descriptions, to be probably all reducible also to *G. tiliæfolia*, Lamk.

Order XXXIII. Ampelideae.

Shrubs, usually climbing by tendrils, sometimes erect (*Leea*) or small trees; juice copious, watery. *Stems* angled, compressed or cylindric. *Leaves* alternate, usually petioled, simple or digitately or pedately 3–9-foliolate, rarely pinnate or decompound. *Flowers* in umbellate paniculate or spicate cymes, or spicate. *Peduncles* often transformed into simple or compound tendrils, or adhering to rocks or trees by viscid pads terminating the ultimate segments, or expanded into a broad floriferous membrane (*Pterisanthes*). *Flowers* regular, hermaphrodite, rarely unisexual. *Calyx* small, entire or 4–5-toothed or- lobed. *Petals* 4–5, distinct or cohering, valvate, usually caducous. *Stamens* 4–5, opposite the petals, inserted at the base of the disc or between its lobes; filaments short, subulate; anthers free or connate, 2-celled, introrse. *Disc* free, or connate with the petals stamens or ovary, annular or variously expanded. *Ovary* 2–6-celled; style short, slender, conical, or 0; stigma minute, or large flat and lobed; ovules 1–2 in each cell, ascending, anatropal, raphe ventral. *Berry* 1–6 celled, cells 1–2-seeded. *Seed* erect, often rugulose, albumen cartilaginous; embryo short, basal, cotyledons ovate.—Distrib. Species about 375, inhabiting the tropical and temperate regions of the whole world.

Scandent shrubs, usually bearing tendrils.

Flowers spicate or cymose. *Ovary* 3-celled, cells 2-ovuled	1.	Vitis.
Flowers sessile on the dilated membranous peduncle	2.	Pterisanthes.

Erect shrubs destitute of tendrils. *Petals* and *stamens* connate with the disc. *Ovary* 3-6-celled, cells 1-ovuled ... ... 3. LEEA.

1. VITIS, Linn.

Sarmentose shrubs, usually climbing by means of leaf-opposed tendrils. *Leaves* simple or 3–9-foliolate, digitate or pedate, rarely pinnate or bipinnate. *Flowers* in umbellate paniculate racemose or spicate cymes, usually ebracteate, sometimes polygamous. *Calyx* short, entire, or 4–5-toothed. *Petals* 4–5, free or cohering at the apex. *Stamens* 4–5, inserted below the margins of the disk; anthers free. *Ovary* 2- very rarely 3–4-celled; style 0 or short; stigma minute and entire, or large and 4-lobed, ovules 2 in each cell. *Berry* ovoid or globose, 1–2-celled; cells 1–2-seeded.—DISTRIB. About 375 species growing mostly in the tropics and subtropics of Asia Africa and Polynesia, more rarely in America.

Note.—The genus *Vitis* as understood by Messrs. Bentham and Hooker in their *Genera Plantarum* and by Mr. Lawson in his account of the Indian species in Hooker's Flora of British India, comprises various plants which many botanical writers (and among others M. Planchon) distribute into genera which, as it appears to me, are founded on characters rather insufficient to warrant generic rank, although sufficient to form the bases of sections of one large broadly-marked genus. As the species treated of here are numerous and not very easy of identification, I have made two keys for them; the first drawn up under four sections which are considered genera by M. Planchon in his monograph of the *Ampelideæ* in M. De Candolle's *Suites du Prodromus*; the second on the principle followed by Mr. Lawson in Sir Joseph Hooker's Flora of British India.

Sect. I. *AMPELOCISSUS.* *Flowers* 4- to 5-merous; *disc* annular, adherent to the base of the ovary; *style* conical, striate, *stigma* minute; *inflorescence* thyrsoid corymbiform or cymose, the peduncle often tendril-bearing.

Inflorescence thyrsoid; leaves simple ... 1. *V. barbata.*
Inflorescence spicate or paniculate-spicate, the flowers in fascicles or solitary ... ... 2. *V. macrostachya.*
Inflorescence an elongated pendulous raceme of short spikes.
Leaves simple.
Sparsely strigose on both surfaces ... 3. *V. gracilis.*
Densely cinnamoneous-tomentose on the lower surface ... ... 4. *V. cinnamonea.*

Leaves digitate.
Both surfaces of leaflets glabrous ... 5. *V. polystachya.*
Upper surfaces of leaflets glabrous except the midrib and main nerves.
Lower surface with pale cobwebby pubescence ... ... 6. *V. polythyrsa.*
Lower surface rusty-pubescent.
Main nerves of leaflets 5 to 8 pairs, flowers oblong; fruit obovoid-oblong, slightly angled ... ... 7. *V. thyrsiflora.*
Main nerves of leaflets 8 to 10 pairs, flowers sub-globular; fruit oblong, boldly 3- to 4-angled ... ... 8. *V. compositifolia.*
Upper surfaces of leaflets minutely rugulose-papillose, each papilla ending in a short hair ... ... 9. *V. elegans.*

Sect. II. *Tetrastigma. Flowers* 4-merous, expanding; *disc* adherent to base of ovary; *style* very short; *stigma* large, dilated, 4-lobed; *cymes* axillary, corymbiform and not tendril-bearing.

Leaves simple ... ... 10. *V. Scortechinii.*
Leaves digitately 3-foliolate.
Leaflets glabrous on the upper surface, glaucous on the lower ... ... 11. *V. pedunculariis.*
Leaflets glabrous on both surfaces, not glaucous.
Flowers only ·05 in. long; seeds convex on one surface, 3-ridged on the other ... 12. *V. andamanica.*
Flowers ·1 in. long.
Fruit dry; seeds 3-sided, excavated on one side ... ... 13. *V. Wrayi.*
Fruit pulpy; seeds compressed, grooved in front ... ... 14. *V. Lawsoni.*
Leaves 3- to 5-foliolate, leaflets glabrous.
Fruit pulpy; seeds compressed, concave on one surface, convex and rugulose on the other 15. *V. lanceolaria.*
Fruit dry; seeds obovoid, slightly compressed, shortly beaked, not rugulose, vertically grooved on both surfaces ... ... 16. *V. Kunstleri.*

Sect. III. *Ampelopsis. Flowers* 5-merous; *disc* cupular; *style* subulate, *stigma* entire; *cymes* leaf-opposed, usually dichotomous, no tendril-bearing.

Leaves digitately 3-foliolate ... ... 17. *V. semicordata.*
Leaves pinnate or bipinnate ... ... 18. *V. cantoniensis.*

Sect. IV. *Cissus.* *Flowers* 4-merous, petals more or less calyptriform; *disc* 4-lobed; *style* subulate; *stigma* minute; *inflorescence* cymose or corymbiform, leaf-opposed, not tendril-bearing.

Leaves simple; flowers in umbellate cymes.

Stems thick, succulent, 4-winged ... ... 19. *V. quadrangularis.*

Stems herbaceous or woody.

Leaves pubescent underneath, ovate-rotund, with rusty or rufescent pubescence ... 20. *V. adnata.*

Leaves quite glabrous.

Flowers not more than ·1 in. long.

Leaves coriaceous; their bases rounded or cuneate, not cordate; fruit obovoid, black ... ... 21. *V. furcata.*

Leaves membranous, usually coloured on the upper surface, ovate-lanceolate or lanceolate, their bases usually cordate rarely cuneate or rounded; fruit red ... ... 22. *V. discolor.*

Leaves membranous, broadly ovate, green, their bases deeply and widely cordate; fruit globose or obovoid ... 23. *V. repens.*

Flowers more than ·1 in. long; leaves rounded, sub-truncate or slightly sub-cordate at the base: fruit nearly 1 in. in diam. ... ... 24. *V. cerasiformis.*

Flowers ·2 in. or more in length; leaves sagittate, sub-hastate or sub-truncate at the base; fruit ·15 in. in diam. ... 25. *V. glaberrima.*

Leaves trifoliolate.

Leaflets more or less softly tomentose ... 26. *V. mollissima.*

Leaflets slightly pubescent on both surfaces 27. *V. trifolia.*

Leaves 3- to 5-foliolate; leaflets glabrous or pubescent; seeds triangular with one side convex and very rugose ... ... 28. *V. japonica.*

Leaves pedately 7- to 9-foliolate, glabrous; seeds globular with one side truncate ... 29. *V. novemfolia.*

1. Vitis barbata, Wall. in Roxb. Fl. Ind., ed. Carey, II, 478. *Stems* woody; the branches terete, sparsely covered with long dark subulate bristles and also some pale soft cobwebby hairs. *Leaves* ovate-reniform, with shortly acuminate apex and deeply cordate base, the edges unequally sinuate-dentate; upper surface when young with some scattered flexuose pale hairs especially on the nerves, when adult

glabrous or nearly so; the lower surface woolly on the nerves and with scattered hairs between, often glabrescent when old; main nerves 6 or 7 pairs, spreading, the lower one or two pairs much curved and branching outwards; length 6 to 10 in., breadth 4·5 to 9 in.; petiole 2·5 to 6 in., with pubescence like the young branches, becoming glabrous with age. *Inflorescence* thyrsoid, sericeous-tomentose, 4 to 6 in. long, on an equally long peduncle bearing a long once or twice dichotomous tendril clothed with wool and bristles. *Flowers* 4-merous, on short pedicels. *Calyx* cupular, glabrous like the separating petals. *Berry* pedicelled, globular, ·3 in. in diam., smooth, with scanty pulp and 3 or 4 compressed plano-convex shining seeds grooved on the plane surface and slightly rugulose on the convex. Wall. Cat. 5997, 5995 C. and D; Lawson in Hook. fil. Fl. Br. Ind. I, 651 *in part*; Kurz For. Flora Burma, I, 276. *Ampelocissus barbata*, Planch. in DC. Mon. Phan. V, 372. *V. lanata* Laws. (not of Roxb.) Fl. Br. Ind. I, 651, *in part*.

Andamans: King's Collectors. Distrib. Burma, Sylhet, As[illegible] and the base of the Eastern Himalaya.

Var. *trilobata*, leaves 3-lobed, pubescence rufous.

Perak: King's Collector, No. 1768. Distrib. Siam, Timor.

This species is distinguished by the mixture of soft pale hairs and dark subulate bristles with which the young stems petioles and tendrils are covered. The species is really an excellent one; but it has been misunderstood owing I believe mainly to a mistake of Wallich its author who issued, under the name *V. barbata*, specimens which bore the same number (5994) as his species *V. rugosa*, and which really belong to *V. rugosa*. As a rule the pubescence of *V. barbata* is pale brown, and not rufescent. But in the Perak specimens the pubescence is pale ferrugineous, and the leaves moreover are slightly three-lobed. In other respects the Perak plant agrees with specimens from Burma, the Andamans and Sylhet. *V. rugosa*, to which this species is undoubtedly allied, appears however to be quite different. It has not the characteristic bristles of *V. barbata*, and its pubescence is always rufescent. *V. rugosa* has really little affinity with *V. lanata*, Roxb. to which it has been reduced by Lawson and others.

2. Vitis macrostachya, Miq. in Ann. Mus. Lugd. Bat. I, 94. All parts quite glabrous; branches slender, sub-compressed, angled, not winged. *Leaves* coriaceous, shining, broadly ovate or oblong, shortly and abruptly acuminate, the edges with a few distant short exserted spinous teeth, the base rounded, the reticulations minute and distinct on both surfaces when dry; main nerves 5 or 6 pairs, spreading; length [illegible] 6 in., breadth 2 to 3·25 in., petioles 1·2 to 1·8 in. *Spikes* very narr[illegible] much longer than the leaves, often in lax panicles, pendulous. *F*[illegible]

sessile or sub-sessile, solitary or in fascicles of 2 or 3, 4-merous; buds sub-globose, under ·1 in. long. *Calyx* cup-shaped. *Fruit* oblong, succulent: *seeds* two, large, plano-convex, rugose. Laws. in Hook. fil. Fl. Br. Ind. I, 650. *Cissus spicifera*, Griff. Notulae IV, 963. Wall. Cat. 7468 *indeterm.* *Nothocissus spicigera*, Planch. in DC. Mon. Phan. V, 406.

Malacca, Griffith (No. 1300 K. D.); Derry No. 387; Maingay, No. 426 (K. D.), Harvey. Singapore: Wallich; Ridley, No. 5585. Penang, Porter. Perak: King's Collector, Nos. 2078, 3201, 6238, 10309: Wray, No. 2164; Scortechini, No. 482. Distrib. Sumatra.

Strictly speaking the name of this should perhaps be *Vitis specifera*. It is quite unlike any other Malayan *Vitis* and can be recognised at once.

3. Vitis gracilis, Wall. in Roxb. Fl. Ind., ed. Carey, II, 477. *Stems* slender, terete, not jointed, covered with sparse long rusty flexuose deciduous hair. *Leaves* broadly ovate-rotund, shortly acuminate; the base usually cordate, rarely sub-truncate, the edges with exserted bristle-teeth: upper surface sparsely strigose, the nerves pubescent: under surfaces very sparsely strigose, the nerves bristly-pubescent: main nerves 4 or 5 pairs, curving upwards, the lower pair branching outward; length 2·5 to 3·5 in., breadth 1·5 to 2·75 in.; petiole 1 to 1·5 in., rusty-sericeous. *Inflorescence* a slender pendulous raceme of short sub-horizontal spikes borne on a long slender tendril, the rachises rusty-sericeous. *Flowers* small, 4-merous, quite glabrous. *Fruit* elliptic, smooth, glabrous, red, somewhat 3-angled, about ·5 in. long, with scanty pulp, and 4 large compressed seeds boldly ridged on the inner surface. Wall. Cat. No. 6007; Lawson in Hook. fil. Fl. Br. Ind. I, 653. *Ampelocissus gracilis*, Planch. in DC. Mon. Phan. V, 407.

Singapore: Wallich; Ridley, No. 1922. Selangor, Ridley, No. 328. Malacca; Derry. Perak: King's Collector, No. 10274; Wray, No. 1343.

4. Vitis cinnamomea, Wall. in Roxb. Fl. Ind., ed. Carey, II, 483. *Stems* woody, channelled on one side, not jointed, yellowish or rusty-tomentose. *Leaves* coriaceous, ovate-reniform, sometimes 3-lobed, occasionally 3-partite, the apex or the lobes if present shortly acuminate, the edges sinuate-dentate with bristle points, or entire with exserted bristle-teeth; upper surface glabrous, dark olivaceous when dry, the lower uniformly covered with a thin closely adherent layer of dense cinnamoneous tomentum; main nerves 5 or 6 pairs, curving, spreading, prominent, the lower pair much branched outwards; length 5 to 7 in., breadth 4 to 5 in.; petioles 2·5 to 3 in., tomentose. *Inflorescence* a slender pendulous raceme of short sub-horizontal spikes borne on a long peduncle from the slender tendril, much longer than the leaves, rufous tomentose. *Flowers* sessile, glabrous, 4-merous, the buds sub-globular.

Calyx cupular. *Berry* sub-globular, 3-angled, ·4 in. in diam., with very scanty pulp and a single obcordate seed with muricate margins. Wall. Cat. 5989 A; Lawson in Hook. fil. Fl. Br. Ind. I, 659. *Ampelocissus cinnamomea*, Planch. in DC. Mon. Phan. V, 408.

Penang: Wallich. Singapore: Ridley. Johore; King. Perak: Scortechini, Wray, King's Collector,—a common plant.

5. VITIS POLYSTACHYA, Wall. Cat. No. 6028 *in part*. *Stems* glabrous, the older with thick corky lenticellate bark. *Leaves* 5- to 9-foliolate, often pedate; common petiole 3 in. or more in length: leaflets coriaceous, elliptic-oblong with cuneate bases, the apices cuspidate, the edges distantly serrate; both surfaces pale when dry, the upper shining, the lower dull and with a few scattered dark pustules: main lateral nerves 7 to 10 pairs, ascending; length 4 to 12 in., breadth 1·5 to 4 in., petiolules ·5 to ·75 in. *Inflorescence* as in *V. thyrsiflora*, but much longer, (1 to 2 feet) with only a few flexuose pale hairs. *Fruit* globose, succulent, ·75 in. in diam. Lawson in Hook. fil. Fl. Br. Ind. I, 662. *Ampelocissus polystachya*, Planch. in DC. Mon. Phan. V, 411.

Malacca: Griffith, No. 1321; Maingay, No. 420.

A species of which I have seen no good specimen. It is closely allied to *V. thyrsiflora* from which the longer inflorescence and general absence of pubescence distinguish it. It is also allied to *V. polythyrsa*, Miq.

6. VITIS POLYTHYRSA, Miq. in Ann. Mus. Lugd. Bat. I, 89. *Young stems* much warted and (like the petioles, petiolules, tendrils, inflorescence and under surfaces of the leaves) with pale, rarely rusty, rather scanty, cobwebby pubescence. *Leaves* 5- or often pedately 7-foliolate, the common petiole 3 to 5 in. long: leaflets coriaceous, elliptic or elliptic-oblong, usually with rounded (sometimes slightly oblique) bases, the middle one or two often with cuneate bases, the apices of all suddenly and shortly acuminate; the margins, except at the base, remotely and unequally crenate and with exserted teeth; upper surfaces glabrous except the pubescent midrib and nerves; length 3 to 7 in., breadth 1·5 to 3 in.; petiolules ·5 to 1 in., the outer the shorter. *Inflorescence* as in *V. thyrsiflora*, but with cobwebby, usually pale, pubescence. *Flowers* as in *V. thyrsiflora*. *Fruit* sub-globular, glabrous, ·5 in. in diam., when ripe green with a red flush. *Seeds* 4, compressed, concave on one side, ridged on the other.

Perak: Wray; Scortechini, Ridley, No. 2999, King's Collector, Nos. 2169, 6103. Johore: Ridley, No. 4178. DISTRIB. Sumatra, Korthal

This species comes very near to *V. thyrsiflora*, Miq., but di notably in the character of its pubescence. There is in the Calc Herbarium an original specimen of *V. polystachya*, Miq., named

author himself, and there is no doubt that the Perak plant is quite the same. I believe also that the Bornean species *V. Mottleyi* described by Sir Joseph Hooker in 1862 (Linn. Trans. XXIII, 165) is also the same: and, if this is so, Sir Joseph's name being the earlier must stand. *V. nitida*, Laws. in Hook. fil. Fl. Br. Ind. I, 662 should also, I believe, be reduced here.

7. Vitis thyrsiflora, Miq. in Ann. Mus. Lugd. Bat. I, 88 (excl. var. B.) Young stems, petioles, petiolules, tendrils and inflorescence densely rusty-tomentose. *Leaves* 5- to 7-foliolate, the common petiole 3 to 6 in. long; leaflets coriaceous, obovate-oblong or oblong, with cuneate bases, the outer two oblique, the apices of all shortly and abruptly caudate-acuminate; the edges in the upper half with hard cylindric exserted teeth, in the lower half entire: upper surface glabrous except the tomentose midrib and nerves; the lower rusty-pubescent; main nerves 5 to 8 pairs, ascending, prominent beneath and ending in the bristle teeth on the edge, transverse veins distinct; length 3·7 to 7 in., breadth 1·75 to 2·75 in.; petiolules ·5 to 1 in., those of the middle leaflets longest. *Inflorescence* a slender pendulous raceme of short horizontal spikes borne on a peduncle shorter than itself and proceeding from a leaf-opposed tendril. *Flowers* sessile, oblong, 4-merous, glabrous. *Calyx* truncate, petals expanding. *Fruit* obovoid-oblong, slightly angled, glabrous, with little pulp, about ·75 in. long; seeds 4. *Cissus thyrsiflora*, Blume Bijd. 187; Hassk. Pl. Jav. Rar. 453; Miq. Fl. Ind. Bat. Vol. I, Pt. 2, 604. *Ampelocissus thyrsiflora*, Planch. in Mon. Phan. V, 409 (excl. syn. *Vitis cinnamomea*, Wall. and *V. elegans*, Kurz).

Perak: Scortechini, Nos. 121, 266; Wray, Nos. 1925, 1937, 2551; King's Collector, Nos. 509, 2033, 6366. Selangor: Ridley, No. 319.

8. Vitis compositifolia, Laws. in Hook. fil. Fl. Br. Ind. I, 659. Young stems and petioles covered with soft felted semi-deciduous rufous or rusty tomentum. *Leaves* quinate, the common petiole 6 to 15 in. long; leaflets oblanceolate or obovate-elliptic, the two outer often oblique, the apices of all abruptly and shortly cuspidate, the edges with remote exserted bristle-teeth in their upper half, entire in the lower; the bases of the inner leaflets cuneate, those of the outer two unequal, the outer side rounded; upper surface finely reticulate, glabrous, but with a few scattered hairs on the nerves, the midrib pubescent; lower surface uniformly and densely rufous-tomentose: main nerves 8 to 10 pairs, spreading, curved; length 6 to 10 in., breadth 2·75 to 4 in., petiolules ·5 to ·75 in. *Inflorescence* a slender pendulous raceme of short sub-horizontal spikes borne on a long peduncle and proceeding from a leaf-opposed tendril longer than the leaves, rufous-tomentose like the stems: *flowers* sub-globular, sessile, immersed in the tomentum of

the rachis but themselves perfectly glabrous, 4-merous: *calyx* truncate, petals expanding. *Fruit* oblong, 3–4-angled, glabrous, ·5 to ·75 in. long; when ripe red, with scanty pulp and 3 or 4 plano-convex seeds, the convex surface angular. *V. cinnamomea*, var. *compositifolia*, Wall. Cat. 5989 B. *Ampelopsis compositifolia*, Planch. in DC. Mon. Phan. V, 412.

Penang: Wallich. Malacca: Maingay (Kew Distrib.), No. 418; Perak: King's Collector, Nos. 826 and 5230; Scortechini.

9. Vitis elegans, Kurz in Nat. Tijdsch. Ned. Ind. XXVIII, 166. Young stems, petioles, tendrils and inflorescence covered with dense reddish-brown tomentum. *Leaves* 3-foliolate, often pedately or digitately 5-foliolate, the common petiole 3 or 4 in. long; *leaflets* coriaceous, trapezoid-oblong or broadly oblong-lanceolate, much narrowed to the base, the outer two often very unequal-sided, with broad sub-truncate or sub-cordate bases, the apices of all acute or sub-acute, and the edges with remote shallow crenations and exserted bristle-teeth; upper surface covered with minute conical rugae each ending in a short white hair, the midrib and nerves rusty-tomentose: lower surface uniformly covered with dense short rusty tomentum; main nerves 6 or 7 pairs, the outer lower nerve in the lower pair of leaflets branching outwards; length 3 to 6 in., breadth 1·75 to 3 in.; petiolules ·5 in., subequal. *Inflorescence* as in *V. compositifolia*, but rather shorter and stouter; the flower buds oblong. *Fruit* unknown. Kurz Journ. As. Soc. Bengal, 1870 pt. 2, 74; Laws. in Hook. fil. Fl. Br. Ind. I, 659.

Singapore: Walker, Ridley, Hullett and others. Johore: Hullett and King. Malacca: Maingay (Kew Distrib.), No. 417. Distrib.—Bangka.

This resembles *V. compositifolia* Laws., but has more coriaceous leaves, rugulose-pubescent on the upper surface, and with shorter petioles. The inflorescence of this is also shorter and stouter, and the flower-buds are oblong rather than globular. The tomentum of this is shorter and less cobwebby and is of a darker colour. Planchon identifies this with *Cissus thyrsiflora* Bl. and it forms part of his *Ampelocissus thyrsiflora*, (DC. Mon. Phan. V, 409)—a reduction which he could hardly have proposed had he seen specimens of *C. elegans*. For although the two have many points of resemblance, their leaves are very different, those of *C. elegans* having their upper surfaces minutely rugulose-papillate, each papilla ending in a short white hair; while in *C. thyrsiflora*, Blume the upper surface is smooth and glabrous except the nerves.

10. Vitis Scortechini, King n. sp. *Branches* woody, terete, glabrous, scaberulous, not jointed. *Leaves* coriaceous, oblong-ovate, sometimes oblique and rarely broad at the base and with two unequ lobes about the middle, the apex shortly acuminate, the base minut cordate; the edges sub-entire, waved and slightly recurved, some

obscurely serrate; upper surfaces glabrous, the lower softly and shortly cinereous-pubescent especially on the nerves; main nerves about 8 pairs, curved, spreading, prominent on the lower surface; length 5 to 7 in., breadth 2·5 to 3·5 in., petiole ·75 to 1·25 in. *Cymes* compact, many-flowered, umbellate, about 1 in. in diam., on a peduncle ·5 to 1 in. long, minutely rusty-tomentose. *Flowers* small, pedicellate, 4-merous; *petals* minutely tomentose externally. *Fruit* globular, smooth, ·25 in. in diam., with scanty pulp and usually only one perfect seed, waxy-white when ripe.

Perak: Scortechini; King's Collector, Nos. 2897, 4644, 5942.

Var. *pubescens*, young stems pubescent, lower surface of leaves tomentose.

Perak: King's Collector, No. 5998.

11. Vitis peduncularis, Wall. Cat. 6024. *Stems* stout, woody, with lenticellate brown bark, the youngest rusty-pubescent. *Leaves* 3-foliolate, the common petiole 3 to 6 in. long; *leaflets* petiolulate, coriaceous, broadly ovate or elliptic, the lateral pair oblique, all shortly cuspidate, the edges crenate-serrate; the base of the lateral pair unequal-sided, that of the lateral cuneate; upper surface glabrous, shining; the lower sub-glaucous, reticulate; main nerves 6 to 8 pairs, prominent on the lower surface, bearing a few scattered hairs; length 3·5 to 5·5 in., breadth 2 to 3 in.; petiolules of the lateral leaves ·5 in. long, of the terminal about ·75 in., all stout; tendrils simple. *Cymes* from the old wood, when in flower much shorter than the leaves, when in fruit almost as long, on long peduncles, umbellate, much branched in the upper part, covered with coarse short rusty pubescence. *Flowers* small, numerous, 4-merous. *Calyx* very short, flat. *Petals* pubescent, conjoined at first, their apices forming small divergent pointed processes, afterwards separating. *Stigma* 4-lobed. *Fruit* globular, somewhat depressed, ·25 in. in diam., red when ripe, 2- to 3-seeded; *seeds* triangular-obovoid. Laws. in Hook. fil. Fl. Brit. Ind. I, 655. *V. pubiflora*, Miq. in Ann. Mus. Lugd. Bat. I, 74. *Cissus pubiflora*, Miq. Fl. Ind. Bat. Suppl. 516. *Tetrastigma ? pedunculare*, Planch. in DC. Mon. Phan. V, 438.

Penang: Wallich. Malacca: Maingay (Kew Distrib.), No. 423. Perak: Scortechini, No. 207; Wray, No. 366; King's Collector, Nos. 3521, 3970, 5087, 5364. Distrib.—Sumatra.

A species readily distinguished at a glance by its many-flowered much-branched cymes emerging from the old stems, and by its coriaceous leaves glaucous and boldly reticulate beneath. The petals are at first conjoined, except their apices which diverge: afterwards they separate and spread slightly from the base.

12. Vitis Andamanica, King, n. spec. All parts, except the

inflorescence, glabrous; young branches striate, lenticellate, black when dry. *Leaves* thinly coriaceous, oblong to elliptic, 3-foliolate or pedately 4- to 5-foliolate, shortly cuspidate, the edges with remote shallow teeth; main nerves 6 to 8 pairs, spreading, thin, slightly prominent on the upper surface; length 4·5 to 6 in., breadth 2 to 3·5 in., petiolules ·4 to ·85 in. *Cymes* axillary, many-flowered, much branched, spreading, about 1·5 in. in diam., puberulous, on peduncles shorter than themselves. *Flowers* small, buds oblong and about ·05 in. long, 4-merous, the calyx truncate, the petals rusty-puberulous outside. *Fruit* globular-ovoid, glabrous, ·3 in. in diam., with very scanty pulp and a single large sub-compressed seed grooved on one face and 3-ridged on the other.

Andaman Islands: King's Collectors.

A species allied to *V. peduncularis* Wall. and of which very few specimens have as yet been obtained.

13. Vitis Wrayi, n. sp. King. *Stems* slender, terete, puberulous when young. *Leaves* 3-foliolate; common petiole 1 to 2 in. long; *leaflets* membranous, oblong-lanceolate, the middle one the largest; the laterals oblique, expanding towards the outer side, all shortly acuminate and coarsely and remotely serrate except at the cuneate base: main nerves 5 or 6 pairs, not prominent, spreading, curved; length 2·5 to 6 in.; breadth 1 to 2 in.; petiolules of the lateral leaflets ·2 to ·4 in., of the central ·5 to 1·25 in.: tendrils slender, forked. *Cymes* slender, axillary, umbellate, spreading, 1 to 2 in. in diam., on slender pedicels shorter than themselves. *Flowers* ·1 in. long. *Calyx* flat, with 4 obscure teeth, pubescent. *Petals* 4, oblong, pubescent. *Fruit* depressed-globular, glabrous, red when ripe, ·45 in. in diam., with soft fleshy epicarp. *Seeds* 2 or 3, oblong, compressed, smooth, 3-sided, slightly convex on one side and with an oblong mark, flattened on the other two sides, one of them excavated and the concavity closed by a membrane, the other side plane.

Perak: Scortechini, No. 426. King's Collector, Nos. 2847, 4050, 5120, 6426: Wray, Nos. 2749, 3945.

This in some respects resembles *V. novemfolia*, but its leaves are only 3-foliolate, and its seeds are different.

14. Vitis Lawsoni, King. *Young stems* rather slender, tubercled as are usually the older stems. *Leaves* 3-foliolate: common petiole 1·25 to 4 in. long, glabrous: leaflets oblong, tapering to each end, acuminate, the margins (except at the entire bases) remotely crenate-serrate, often very obscurely so; both surfaces glabrous; main nerves 6 to 8 pairs, obscure; length 2·5 to 4 in., breadth 1 to 1·5 in., petiolules ·25 to ·5 in. *Cymes* small, 1 in. in diam., or less, dense, subsessile or on pedunc ·25 to 1 in. long: tendrils free from the cymes, slender, often abse

Flowers rather more than ·1 in. long, calyx truncate or obscurely 4-toothed. *Petals* 4, white. *Fruit* sub-globular, smooth, pulpy; seeds 3 or 4, compressed, grooved in fruit. *Vitis tuberculata*, Lawson (not of Wall.) in Hook. fil. Fl. Br. Ind. I, 656. *Cissus tuberculata*, Bl. Bijdr. 189; Miq. Fl. Ind. Bat. Vol. I, pt. 2, 604. sub *Tetrastigma lanceolarium*, Planch. DC. Mon. Phan. V, 424.

Penang: Curtis, Nos. 1580. Perak: Scortechini, No. 269. Wray, No. 1926, 2017, 2247. King's Collector, Nos. 1852, 3047, 3081, 6287, 6134.

This is no doubt closely allied to *Vitis lanceolaria*, Wall. to which Planchon reduces it. But the smaller and globular fruits, smaller leaves with fewer nerves, and the general absence of tendrils distinguish it well. This is the plant which Blume called *Cissus tuberculata*; but it is not the *Vitis tuberculata* of Wallich which becomes *Vitis ramicisperma*, Lawson. For this species Mr. Lawson keeps Blume's specific name, but he changes its generic name to *Vitis*—a course which I regret to be unable to follow, first because there is an earlier *Cissus tuberculata* than Blume's, (*viz.*, that of Jacquin dating from the years 1797 to 1804 during which that author's *Hortus Schoenbrunnensis* was published, and which is therefore the plant to which any author who reduces *Cissus* to *Vitis* ought to give the name *V. tuberculata*); second, because Blume did not call his plant *Vitis tuberculata* but *Cissus tuberculata*.

15. Vitis lanceolaria, Wall. Cat. 6013 (*most of the letters*). Whole plant except the inflorescence glabrous: *stems* sometimes boldly tuberculate. *Leaves* usually 3-foliolate, sometimes pedately 5-foliolate: common petiole 2 to 5 inches long; leaflets softly coriaceous, oblong or elliptic-oblong, tapering to each end, sometimes obovate-oblong, always shortly caudate-acuminate and the edges with remote shallow teeth; main nerves 6 to 10 pairs, spreading, slightly winged on the lower surface: length 4·5 to 6 in., breadth 1·75 to 2·75 in., petiolules ·4 to ·75 in. *Cymes* axillary, puberulous, spreading, about 1·5 in. across, on peduncles shorter than themselves. *Tendrils* rather short, forked. *Flowers* 4-merous, the stigma 4-lobed. *Fruit* globose-ovoid, as large as a cherry, white when ripe, pulpy, 1- or 2-seeded; the seeds compressed, concave on one surface, rugulose. W. and A. Prod. 128; Wight Ic. 177; Brand. For. Flora 101; Laws. in Hook. fil. Fl. Br. Ind. I, 660 (*in part*); Kurz For. Flora Burma, I, 272: Trimen Flora Ceylon, I, 296. *Tetrastigma lanceolarium*, Planch. in DC. Mon. Phan. V, 424. *Vitis muricata*, Wall. Cat. 6015; W. and A. Prod. 128; Wight Ic. 740. *Cissus lanceolaria*, Roxb. Fl. Ind. I, 412: DC. Prod. I, 632; Graham Cat. Bomb. Pl. 33; Thwaites Enum. Pl. Ceyl. 63. *Cissus muricata*, var. minor. Thwaites Enum. 63.

Penang: Curtis, No. 685, King. Singapore: Ridley, No. 5711. Perak: Scortechini, No. 102; Wray, No. 1889. Andamans: Kurz, King's Collectors. DISTRIB. Java, Sumatra, British India.

Very good characters to distinguish this from its allies are that the main nerves of the leaves are in dried specimens winged on the lower surface, and that the fruit is white when ripe.

16. VITIS KUNSTLERI, King n. sp. Whole plant except the inflorescence glabrous. *Stems* slender, the younger not lenticellate and the older sparsely so. *Leaves* pedately 5-foliolate, common petiole 2 to 3 in. long, slender; leaflets oblong-lanceolate, shortly and abruptly acuminate, narrowed to the base, the outer two rounded at the base on the outer side; main nerves 7 to 9 pairs, prominent and slightly pale on the lower surface; midrib stout, pale and prominent beneath: length 2·5 to 4·5 in., breadth 1·1 in. to 1·75 in.; petiolules of the lateral leaflets ·25 in., of the others about 1 in. *Cymes* axillary, many-flowered, branching, condensed, about 1·5 in. across, on peduncles shorter than themselves, puberulous. *Flowers* ·1 in. long, oblong in bud, 4-merous; the calyx flat, obscurely toothed, petals puberulous outside; stigma broad, 4-lobed. *Fruit* globular, glabrous, ·35 in. in diam., without pulp: seeds 2, obovoid, slightly compressed, transversely rugulose, with a short beak and a vertical groove on each side, that in front being the deepest and having two narrow ridges on it, ·25 in. long.

Perak: King's Collector, Nos. 2790, 8027: Scortechini. Pahang: Ridley, No. 2835.

A species allied to *V. andamanica*, King; also closely allied to *V. pycnantha*, Coll. and Hemsl., from which however it differs in its larger size and very different seeds; the seed of that species being longer (·35 in. long), more compressed, less prominently grooved, and less rugulose.

17. VITIS SEMI-CORDATA, Wall. *var.* Scortechinii. Whole plant glabrous; *stems* dark-coloured when dry, lenticellate, without tendrils. *Leaves* 3-foliolate; common petiole 3·5 to 5 in. long: leaflets coriaceous, the middle obovate rarely ovate, the two outer elliptic, oblique; the apices of all shortly cuspidate; the edges coarsely crenate-serrate except in the lower third, the middle leaflet cuneate at the base, the other two more or less rounded outside and oblique inside at the base; both surfaces minutely reticulate, the lower paler: main nerves 6 or 7 pairs, rather prominent beneath, arching upwards; length 4 to 5 in., breadth 2·5 to 3·5 in.; petiolules of the lateral leaflets ·1 to ·2 in., that of the middle one twice as much. *Cymes* leaf-opposed, umbellately panicled, glabrous, 2 to 2·5 in. in diam. (much wider in fruit), on peduncles 1·5 to 2 in. long. *Flowers* dicecious, numerous; buds oblong,

in. in length, pentamerous; the calyx flat, obscurely toothed; petals pale outside, glabrous, oblong. *Ripe fruit* ovoid, glabrous, smooth, black, ·25 in. long; seeds 2 or 3, if 2 plano-convex, if 3 triangular-convex.

Perak: Scortechini, 313, 317.—Distrib. Java. Forbes, Nos. 823, 983.

Scortechini's specimens are in fruit only, and Forbes's are in flower and have no fruits. But the two sets are so absolutely identical in other respects, that I have ventured (quite contrary to my usual practice) to describe the flowers from one set and fruit from another set of specimens. The species of which this is a variety was first issued by Wallich as No. 6020 of his catalogue, and was described by him in his own and Carey's edition of Roxburgh's Flora Indica I, 481. (1824). In his Illustrations of Himalaya Botany (1839), Royle published what is really only a glabrous form of it under the name *Cissus himalayana*, which Sir D. Brandis in his Forest Flora of the North-West Provinces of India reproduces as *Vitis Himalayana*. Lawson in Hooker's Flora of British India accepts Brandis's name as that of the species, and uses Wallich's trivial name *semi-cordata* to designate, as a variety, the form which Wallich published as a species. This state of matters I therefore propose to amend as follows:—

Vitis semi cordata, Wall. Cat. 6020; in Roxb. Fl. Ind., ed. Carey and Wall. I, 481. *V. Himalayana*, Brandis, var. *semi-cordata*, Laws. in Hook. fil. Fl. Br. Ind. I, 656. *Parthenocissus semi-cordata*, Planch. in DC. Mon. Phan. V, 451.

Var. 1 *Roylei*. *Vitis Himalayana*, Brandis For. Flora 100; Laws. *l. c.* 655. *Ampelopsis Himalayana*, Royle Ill. Him. Bot. 149. *A. neilgherensis*, Wight Ic. 965. *Cissus Himalayana*, Walp. Rep. I, 441. All parts glabrous, leaves membranous; flowers less than ·15 in. long.

Var. 2., *Scortechinii*. All parts glabrous; leaves obscurely serrate-crenate, sometimes almost entire, coriaceous; flowers ·15 in. long.

18. Vitis cantoniensis, Seem. Bot. Herald 370. Whole plant glabrous. *Stem* slender, cylindric. *Leaves* unequally pinnate, or the lower pair of pinnae ternately compound; common petiole from ·5 to 1 in. long; *leaflets* small, membranous, glaucous beneath, lanceolate or ovate-lanceolate, acuminate, remotely serrate in the upper two-thirds, entire and cuneate in the lower third; main nerves 3 or 4 pairs, faint; length ·75 to 1·5 in., rarely 2 in.; breadth ·5 to ·75 in., petiolules ·1 to ·2 in. *Cymes* umbellately-corymbose, dichotomous, about ·75 in. across, [illegible]ir peduncles about 1·5 to 2 in. long. *Flowers* sub-globular, ·1 in. long, [illegible]erous. *Calyx* cupular, obscurely toothed. *Petals* thick, oblong; [illegible] fleshy, 5-lobed. *Fruit* obovoid, glabrous, ·25 in. long, without pulp. [illegible]ls 3 or 4, the back rounded, the face wedge-shaped. Laws. in Hook.

fil. Fl. Br. Ind. I, 663. *Cissus cantoniensis*, Hook. et Arn. Bot. of Beechey's Voyage 175; *C. diversifolia*, Walp. in Nov. Act. Acad. Leop. Car. Nat. Cur. XIX, Suppl. I.; Repert. Bot. Syst. V, 377; Pl. Meyen. 314. *Ampelopsis Cantoniensis*, Planch. in DC. Mon. Phan. V, 460. *Hedera hypoglauca*, Hance in Walp. Ann. II, 724.

Malacca: Griffith. Perak: Scortechini, No. 234; King's Collector, No. 2285.—Distrib. China, Cochin-China.

19. Vitis quadrangularis, Wall. Cat. 5992. *Stems* fleshy, much contracted at the nodes, 4-winged, glabrous, leafless except when young. *Leaves* broadly cordate or reniform, sometimes 2–3-lobed, crenate-serrate, glabrous. *Cymes* on short peduncles, with spreading umbellate branches; *flowers* in umbels, glabrous, 4-merous. *Berry* globose, succulent, reddish-black when ripe, acrid W. & A. Prodr. 125; Wight Ic. t. 51; Brand. For. Fl. 100; Laws. in Hook. fil. Fl. Br. Ind. I, 645. *Cissus edulis*, Dalz. in Hook. Lond. Journ. Bot. ix. 248; Dalz. & Gibs. Bomb. Fl. 40; Thwaites Enum. 62. *Cissus quadrangularis*, Linn. Mant. 39; Roxb. Fl. Ind. i. 407; DC. Prodr. i. 628; Grah. Cat. Bomb. Pl. 33; Dalz. & Gibs. Bomb. Fl. 39; Miq. Fl. Ind. Bat. Vol. I, pt. 2, 606; Planch. in DC. Mon. Phan. V, 509. *Sælanthus quadragonous*, Forsk. Descr. 33, t. 2.—Rheede Hort. Mal. vii. t. 41.

Malacca, Andaman Islands.—Distrib. British India, Ceylon, Java, East Africa.

20. Vitis adnata, Wall. Cat. 5998. *Stems* woody below; the young shoots more or less minutely rusty-tomentose, sub-terete when fresh but slightly furrowed. *Leaves* ovate-rotund, shortly and sharply acuminate, the edges bristle-serrate, the base deeply and widely cordate; upper surface sub-glabrous except the pubescent nerves; the lower rusty-pubescent especially on the midrib and nerves; main nerves 4 or 5 pairs, sub-ascending, prominent beneath, the lower pair branching outward; length 2·25 to 5 in., breadth 1·75 to 4 in., petiole ·75 to 2·25 in. *Cymes* numerous, corymbose, in umbels on peduncles 1 to 2 in. long, about ·5 in. across, few-flowered. *Flowers* ·1 in. long, 4-merous; *calyx* tomentose outside. *Berry* obovoid-pisiform, glabrous, black when ripe, succulent, generally one-seeded. W. and A. Prod. 126; Brandis Forest Flora N. W. Ind. 100; Laws. in Hook. fil. Fl. Ind. I, 649: Trimen Fl. Ceyl. 290. *V. repens*, Wall. (not of W. and A.) 5999B. *Cissus adnata*, Roxb. Hort. Beng. Fl. Ind. I, 405: DC. Prod. I, 627: Wight. Ic. t. 144: Thwaites Enum. Pl. Ceyl. 62; Dalz. and Gibs. Bomb. Fl. 39. Miq. Fl. Ind. Bat. Vol. I, Pt. 2, 606; Planch. in DC. Mon Phan. V, 49[illegible] *C. cordata*, Wall. Cat. 6001A. *C. pyrrhodasys*, Miq. Fl. Ind. [illegible] Suppl. 517. ? *C. aristata*, Bl. Bijdr. 183.

Malacca: Ridley, No. 1165. Perak: Scortechini, Nos. 129, 1[illegible]

King's Collector, Nos. 2934; Wray, Nos. 496, 1929.—Distrib. Java, Sumatra, British India, New Guinea, Cochin China, Madagascar.

21. Vitis furcata, Laws. in Hook. fil. Fl. Br. Ind. I, 646. *Stems* woody, terete, slightly swollen at the nodes but not jointed, glabrous as are all the other parts except the inflorescence. *Leaves* coriaceous, broadly ovate, rarely ovate-oblong, shortly and bluntly acuminate, the edges faintly and remotely serrate, the base broad and rounded or narrowed and sub-cuneate; both surfaces glabrous, the lower paler; main nerves 4 or 5 pairs, spreading, ascending, the lower pair branching outwards; length 2 to 4 in., breadth 1·1 to 2·5 in. *Cymes* in spreading panicles shorter than the leaves, puberulous. *Flowers* 4-merous, pointed, the buds about ·1 in. long. *Calyx* truncate, glabrous. *Petals* minutely pubescent externally. *Fruit* obovate, glabrous, black when ripe with scanty pulp and a single seed, about ·35 or ·4 in. long when dry.

Malacca: Maingay (Kew Distrib.), 424; Griffith, No. 1314; Derry, 382. Singapore: G. Thomson; Ridley, No. 4748. Perak: Wray, Nos. 1235, 1430; King's Collector, Nos. 2716, 6315, 6858.—Distrib. Sumatra: Forbes, No. 2534.

Var. *pubescens*, branches of the cyme rufous-pubescent; petals almost glabrous externally.

Province Wellesley: King's Collector, No. 1606. Perak: King's Collector, Nos. 794, 6429, 8402; Scortechini, No. 299.

22. Vitis discolor, Dalz. in Hook. Kew Journ. Bot. Vol. II, (1850), 39. *Stems* woody at the base only, glabrous, not glaucous, red when young, sub-angular. *Leaves* ovate-lanceolate to lanceolate, acuminate, the edges remotely bristle-serrate, the base usually more or less deeply cordate, sometimes rounded or cuneate; both surfaces glabrous, the upper in most cases variegated with red and white, the lower purple: main nerves 5 to 7 pairs, the lower pair branching outwards; length 2·5 to 4 in., breadth ·85 to 2 in., petiole ·2 to 1·25 in. *Cymes* umbellate on slender peduncles, few-flowered, sparsely rufous-pubescent. *Flowers* ·1 in. long, oblong in bud, 4-merous. *Calyx* truncate, *petals* glabrous. *Fruit* globular, pyriform, glabrous, red when ripe and about ·2 in. in diam., pulp scanty, seed solitary. Dalz. & Gibs. Bomb. Fl. 40; Miq. in Ann. Mus. Lugd. Bat. I, 86; Laws. in Hook. fil. Fl. Br. Ind. I, 647. *V. inæqualis*, Wall. Cat. 6010; W. & A. Prodr. 125. ? *V. diversifolia*, Wall. Cat. 5996. ? *V. costata*, Wall. Cat. 6011. *Cissus discolor*, Blume Bijd. 181; Bot. Mag. 80, t. 4763; Miq. Fl. Ind. Bat. Vol. I, pt. 2, 606; Hassk. Pl. Jav. Rar. 453; Planch. in DC. Mon. Phan. V, 496. Perak: Scortechini. Andamans: King's Collector.—Distrib. Java, Sumatra, Cochin-China, British India.

There is one form of this in which the leaves are very nearly sessile: and in many specimens the upper leaves have short petioles and rounded bases, while the lower have long petioles and cordate bases. As a rule the leaves of this plant are beautifully variegated on the upper surface, but individuals are not uncommon in which the leaves are green.

23. Vitis repens, W. and Arn. Prod. Fl. Pens. Ind. 124. *Stems* sub-terete when fresh, 4-angled when dry, glabrous, the young shoots glaucous. *Leaves* pale green, more or less broadly ovate, shortly acuminate, the margins wavy and with a few distant setose teeth, the base deeply and widely cordate; main nerves about 4 pairs, the lower branching outwards; length 2·5 to 3·5 in., breadth 1·75 to 3·25 in., petiole ·75 to 1·5 in. *Cymes* few-flowered in shortly pedunculate compound umbels or thyrses, pubescent toward the upper part. *Flowers* pointed in bud, ·1 in. long, 4-merous. *Fruit* globose or obovoid, ·15 in. in diam. when dry, usually 1-seeded with little pulp, its pedicels recurved when ripe. Laws. in Hook. fil. Fl. Br. Ind. I, 646; Kurz For. Flora Burma I, 275. *V. glauca*, Wall. (not of Roxb.) Cat. 5990 (*for the most part*). *Cissus repens*, Lamk. Encyc. I, 31; DC. Prod. I, 628; Miq. Fl. Ind. Bat. Vol. I, pt. 2, 605; Planch. in DC. Mon. Phan. V, 504. ? *C. cordata*, Roxb. Fl. Ind. I, 407.

Perak: Wray, Nos. 1215, 1858, 2142. Andamans: King's Collector.—Distrib. British India, Java.

As was pointed out by Wallich, this differs from *V. glaberrima*, Wall. by its more deeply cordate leaves and smaller flowers. Closely allied to this must be the species named *Cissus pentagona* by Roxburgh (Fl. Ind. I. 408); but Roxburgh's description is too brief to identify a species by in such a difficult genus as *Vitis*; and he has unfortunately left no figure of *V. pentagona* at Calcutta.

24. Vitis cerasiformis, Teysm. and Binn. in Nat. Tijdsch. Ned. Ind. XXIX, 251, var. Wallichii, King.* Branches with pale shining bark, obtusely 4-angled, not winged. *Leaves* oblong to ovate or ovate-oblong, rounded sub-truncate or slightly sub-cordate at the base, the apex shortly and bluntly acuminate; the edges remotely crenate-serrate, the teeth setose; main nerves 5 or 6 pairs, curved, spreading: length 2 to 4 in., breadth 1·2 to 2·4 in., petiole ·5 to ·75 in. *Cymes* few-flowered, lax, under ·5 in. in diam., in pedicelled umbels from a common peduncle ·5 to 1 in. long, sometimes in small thyrses. *Flowers* large for the genus, 4-merous; their buds ·2 in. long, pointed. *Calyx* cup-shaped, truncate; *petals* coriaceous. *Fruit* when ripe as large as a cherry and similarly coloured. *Vitis glaberrima*, Wall. 5991 (in part); Laws. in Hook. fil. Fl. Br. I. I, 646, (*in part*). *Cissus cerasiformis*, Planch. in DC. Mon. Phan. V, 62

Singapore: Ridley, Nos. 1924, 6380, King. Perak: Scortechini. No. 262; Wray, No. 2858: King's Collector, Nos. 6212, 10170.—Distrib. Java, Forbes 480; Sumatra Forbes, Nos. 2583, 2861*a*.

The various specimens to which I have given the varietal name *Wallichii* vary somewhat as to the form of their leaves, some having them oblong with nearly truncate bases, while others have them broadly ovate with slightly cordate bases. In all, however, the leaves are broader than those in the typical form found in Java and originally described by Teysmann and Binnindyk, the bases of which are moreover cuneate. The large flowers and fruit, both of the typical form and of the variety *Wallichii*, however, at once distinguish this from the hastate or sagittate-leaved species which Wallich confused with it under one common name as *V. glaberrima*.

25. Vitis glaberrima, Wall. in Roxb Fl. Ind. ed. Carey, II, 476; Cat. 599, (*in part*). A weak climber, with herbaceous sub-compressed 4-angled slightly winged glaucous stems, the bark dark when dry. *Leaves* ovate-lanceolate, with broadly sagittate-cordate sub-hastate or sub-truncate bases, always attenuated upwards to the acute apex, the edges minutely and remotely bristle-serrate-crenulate; main nerves 4 or 5 pairs, faint, spreading, the lower branching outward; length 2 to 4 in., breadth 1·2 to 1·75 in.; petiole ·6 to ·8 or even 1·5 in. in the lower leaves. *Cymes* small, ·3 to ·6 in. in diam., umbellate on short pedicels from the apex of a common peduncle ·4 to ·8 in. long. *Flowers* 4-merous. *Berry* obovoid, 2-seeded, ·15 in. in diam. when dry. W. and A. Prod. Fl. Pen. Ind. 125; Laws. in Hook. fil. Fl. Br. Ind. I, 646 (*in part*). *Vitis hastata*, Miq. in Ann. Mus. Lugd. Bat. I, 85. *Vitis sagittifolia*, Laws. in Hook. fil. Fl. Br. Ind. I, 645. *Cissus glaberrima*, Planch. in DC. Mon. Phan. V, 498. *Cissus hastata*, Miq. Fl. Ind. Bat. Suppl. 517. *Vitis diffusa*, Laws. in Hook. fil. Fl. Br. Ind. I, 646.

Singapore: Anderson, No. 78; Hullett, No. 230, King. Malacca; King. Perak: Scortechini, Wray. Penang; Wallich, King. Kedah; Curtis No. 2606. Province Wellesley; King. Andamans and Nicobars; King's Collectors. Distrib. Sumatra, Bangka.

Under the name *V. glaberrima* and the number 5991, Wallich distributed two species of *Vitis* gathered partly in Penang and partly in Singapore. These two gatherings are not, as is usual with Wallich in similar cases, distinguished by letters. On two of the four sheets of No. 5991 which are now present in the Calcutta Herbarium, "Penang" is given as the locality; and these agree with the description of the species *Vitis glaberrima* from Penang which was published by Wallich in Carey's edition of Roxburgh's Flora Indica. This Penang plant agrees absolutely with type specimens of *Vitis hastata*, Miq. and *V. sagittifolia*,

Laws. On the third sheet of No. 5991 no locality is noted. On this sheet is glued down a specimen of a different species which I have identified as a variety of the one named *V. cerasiformis* by Teysmann and Binnindyk many years after the issue of Wallich's plants. The fourth sheet of No. 5991 at Calcutta is occupied by stems of the latter and a collection of leaves of both the former and latter. The *V. glaberrima* of Wall. Cat. is thus a mixed species; and as such the name would have had to be dropped had not Wallich published a description of his Penang No. 5991 under that name in Carey's edition of Roxburgh's Flora.

26. Vitis mollissima, Wall. in Roxb. Fl. Ind. ed. Carey, II, 482. *Stems* rather slender, woody, when young softly pubescent, when adult glabrous and shining. *Leaves* 3-foliolate; the common petiole 2 to 2·5 in. long, tomentose; leaflets petiolulate, the lateral pair obliquely elliptic, the terminal obovate-elliptic, all with shortly acuminate apices, and coarsely but sparsely serrate or sub-entire edges; the lateral pair with rounded or sub-cordate the terminal one with a cuneate base; upper surface sparsely adpressed-pubescent, the midrib and nerves rusty-tomentose; the lower uniformly and softly-tomentose: main nerves 5 or 6 pairs, ascending, the lower branching outwards; length 3·25 to 5 in., breadth 1·75 to 2·75 in., petiolules of the lateral leaflets ·25 to ·4 in., those of the terminal twice as long; tendrils slender. *Cymes* half as long as the leaves; their peduncles 1·5 to 3 in. long, umbellate, spreading, many-branched, many-flowered, 1·5 to 2·5 in. across, minutely tomentose. *Flowers* ·1 in. long, oblong, 4-merous; *calyx* short, truncate; petals puberulous outside. *Fruit* oblong, ·75 to 1 in. long, when ripe dirty white, with scanty pulp and two large plano-convex seeds. Wall. Cat. 6012; Laws. in Hook. fil. Fl. Br. Ind. I, 656. *Cissus mollissima*, Planch. in DC. Mon. Phan. V, 575.

Penang; Wallich, Curtis No. 1435. Malacca; Griffith, No. 1332, Maingay (Kew Distrib.), No. 422. Pahang: Ridley, No. 1134. Perak: King's Collector, Nos. 2744, 4223, 5848 and 10485.

27. Vitis trifolia, Linn. Sp. Pl. 203. *Stems* compressed, herbaceous, or woody near the base only, when young shortly and densely pubescent, becoming sub-glabrous with age. *Leaves* 3-foliolate, common petiole 1·25 to 2·25 in. long; leaflets shortly petiolulate, ovate, obovate or sub-rhomboid, shortly cuspidate, coarsely serrate or dentate, the bases rounded, more or less pubescent on both surfaces; main nerves 5 or 6 pairs, slightly curved and ascending; length 1·5 to 2·5 in., breadth ·8 to 1·25 in., petiolules of the lateral leaflets ·1 to ·25, of the terminal twice as much; tendrils short, slender, usually branched. *Cymes* 2 or 3 in. in diam., pubescent, on long peduncles rather exceeding the leaves, about 3-branched, the umbellules cymose. *Flowers* 4-merous

white, about ·1 in. long; the calyx truncate, short; the petals pubescent outside. *Berry* turbinate, fleshy, 2- to 4-seeded, *seeds* triangular. *Vitis carnosa*, Wall. Cat. 6018; W. and A. Prodr. 127; Wight Ic. 171; Brand. For. Fl. 101; Laws. in Hook. fil. Fl. Br. Ind. I, 654; Trimen Fl. Ceyl. I, 294; Planch. in DC. Mon. Phan. V, 570. *V. crenata*, Wall. Cat. 6021. *Cissus trifoliata*, Linn. Sp. Pl. 203. *C. auriculata*, Roxb. Wall. Cat. 6031*b*. *C. carnosa*, Roxb. Fl. Ind. I, 409; DC. Prodr. 1, 630; Grah. Cat. Bomb. Pl. 33; Dalz. and Gibs. Bomb. Fl. 40. *C. crenata*, Vahl, DC. Prodr. I. 631. *C. cinerea*, Lamk.; DC. Prodr. I, 631. *C. obtusifolia*, Lamk. Dict. I, 31 ?—Rheede Hort. Mal. vii. t. 9.

Malacca; Harvey. Singapore; Hullett, No. 95. Perak: Scortechini. Andamans; King's Collector. Nicobars; Kurz.—Distrib. British India, Java.

28. Vitis japonica, Thunbg. Fl. Japan, 104. Glabrous or pubescent. *Stems* slender. *Leaves* 3-foliolate or pedately 5-foliolate; common petiole 1·5 to 2·5 in. long; leaflets membranous, ovate to oblanceolate, the outer oblique, all shortly acuminate and coarsely and unequally serrate-dentate in the upper part, entire towards the narrowed base: main nerves slightly prominent on the under surface, 7 to 9 pairs, straight, ascending; length 1·5 to 4 in., breadth ·85 to 1·75 in.; petiolules ·2 to ·5 in., that of the middle leaflet sometimes even 1 in.; tendrils slender, forked. *Cymes* spreading, branched, open, 2 to 3 in. across, always more or less puberulous. *Flowers* ovoid-globose, ·15 in. long, 4-merous. *Calyx* cupular, petals broad. *Fruit* sub-globular, somewhat depressed, glabrous, ·25 to ·3 in. in diam. *Seeds* 3 or 4, triangular, one side convex and very rugose, the other two flat and pitted, one of the pits closed by a membrane. *Cissus japonica*, Willd. Sp. Pl. I, 659; DC. Prod. I, 632; Planch. in DC. Mon. Phan. V, 561 (*in part*). *Vitis mollis*, Wall. Cat., No. 6025; Laws. in Hook. fil. Fl. Br. Ind. I, 660.

Singapore, Malacca, Perak, Penang, Nicobar, Andaman Islands: common.—Distrib. Java, New Caledonia, Australia, Japan, China.

The larger forms of this resemble *V. novemfolia*, Wall., but have not so many leaflets. The two species are however closely allied, as also are the less pubescent forms of *V. pedata*, Vahl. The seeds of this are remarkable in shape, approaching those of *V. novemfolia* but with two plane sides instead of one. This is also even more closely allied to *V. tennifolia* W. and A., from which it is indeed very often difficult to distinguish it, in the Herbarium at least.

29. Vitis novemfolia, Wall. Cat. 6030. Whole plant except the [in]florescence glabrous. *Stems* slender, striate. *Leaves* membranous, [usu]ally pedately 7- to 9-foliolate; common petiole 2·5 to 3 in. long; [le]*aflets* oblong-lanceolate, shortly acuminate, entire or with a few exserted

bristle teeth near the apex, the base narrowed; lower surface minutely reticulate; length 2 to 3·5 in. breadth ·85 to 1·35 in.; petiolules of the middle leaflets sometimes as much as 3 in. long, those of the lateral leaflets from ·28 to 1·25 in.; *tendrils* long, slender, forked. *Cymes* axillary, puberulous, much-branched, spreading, 3 to 6 in. across, on peduncles as long as the leaves. *Flowers* broadly ovoid in bud, ·15 in. long, 4-merous; the calyx cupular, truncate; the petals broad, minutely puberulous externally; disc large, cupular, thin. *Fruit* ovoid or subglobular, with two deep grooves, glabrous, ·3 in. in diam., without pulp; *seeds* 2, globular, truncate and with a deep pit on one side, the opening occluded by a membrane. Laws. in Hook. fil. Fl. Br. Ind. I, 662. *Cissus novemfolia*, Planch. in DC. Mon. Phan. V, 559.

Perak: Scortechini, No. 1728; King's Collector, Nos. 1245, 2736. Andamans: King's Collectors.

The plant above described agrees with Wallich's imperfect specimens from Singapore. It is readily recognised by the great inequality of the petiolules of its leaflets. The middle leaflet is usually quite free from the others and has a much longer petiolule than they have.

Species imperfectly known.

VITIS CORIACEA, DC. Prod. I, 632. A species from Timor too briefly described by De Candolle for accurate identification. There are in the Calcutta Herbarium specimens from the Andamans (King's Collectors, No. 3000) and from Sumatra (Forbes, No. 1344), both of which agree with a specimen in the Kew Herbarium named *V. coriacea*, DC. The Sumatra specimens have pedately 5- to 7-foliolate leaves; the leaflets are coriaceous, glabrous, obliquely oblong or obovate-oblong, bluntly cuspidate, remotely serrate-crenate, with rounded or tapering bases; they are 2·5 to 4. in. long and 1·35 to 1·75 in. broad; the cymes are widely branching, nearly 3 in. across when in fruit, and on short warted peduncles 1 in. long: the fruit is ovoid-globose, ·2 in. in diam., with a thick pericarp and no pulp. The seeds are large, solitary, ovoid, smooth, with shallow transverse markings and a very shallow vertical groove down each face. In the Andaman specimens the leaflets are larger and less coriaceous, the cymes are larger (6 in. wide), and the fruit and seeds are slightly longer. But the appearance and structure of the seeds is exactly the same in both; and I believe both may be *V. coriacea*, DC.

Leaves simple, flowers 4-merous.
Flowers in umbellate cymes, not borne on tendrils.
Stems thick, succulent, 4-winged ... 19. *V. quadrangularis.*
Stems herbaceous or woody.
Leaves pubescent underneath.
Leaves oblong-ovate, with cinereous pubescence ... ... 10. *V. Scortechinii.*
Leaves ovate-rotund, with rusty or rufescent pubescence ... ... 20. *V. adnata.*
Leaves everywhere glabrous.
Flowers not more than 1 in. long.
Leaves coriaceous, their bases rounded or cuneate, not cordate; fruit obovoid, black ... ... 21. *V. furcata.*
Leaves membranous, coloured (usually) on the upper surface, ovate-lanceolate or lanceolate, their bases usually cordate, rarely cuneate or rounded; fruit red... ... 22. *V. discolor.*
Leaves membranous, broadly ovate, green, their bases deeply and widely cordate; fruit globose or obovoid... 23. *V. repens.*
Flowers more than 1 in. long; leaves rounded, sub-truncate or slightly sub-cordate at the base; fruit nearly 1 in. in diam. ... ... 24. *V. cerasiformis.*
Flowers 2 in. or more in length; leaves sagittate, sub-hastate or sub-truncate at the base; fruit 15 in. in diam. ... 25. *V. glaberrima.*
Flowers in much elongated simple, or sometimes branching, spikes ... ... 26. *V. macrostachya.*
Flowers in tendril-bearing thyrses ... 1. *V. barbata.*
Flowers in elongated racemes of sub-horizontal spikes proceeding from tendrils.
Leaves sparsely strigose and slightly pubescent, not rufescent ... ... 3. *V. gracilis.*
The under surface of leaves and the young branches and tendrils covered with dense adherent cinnamoneous tomentum ... ... 4. *V. cinnamomea.*

Leaves compound, digitate.
Inflorescence of corymbose or umbellate leaf-opposed or axillary cymes.
Leaves trifoliolate.
Flowers usually 5-merous, tendrils absent 17. *V. semicordata.*
Flowers 4-merous, tendrils usually present.
Leaflets more or less softly tomentose 26. *V. mollissima.*
Leaflets slightly pubescent on both surfaces ... ... 27. *V. trifolia.*
Leaflets glabrous on the upper, glaucous on the lower, surface ... 11. *V. pedunculariis.*
Leaflets glabrous on both surfaces, not glaucous.
Flowers only ·05 in. long; seeds convex on one surface, 3-ridged on the other ... ... 12. *V. andamanica.*
Flowers ·1 in. long.
Fruit dry, seeds 3-sided, excavated on one side ... ... 13. *V. Wrayi.*
Fruit pulpy; seeds compressed, grooved in front ... ... 14. *V. Lawsoni.*
Leaves 3- to 5-foliolate; flowers 4-merous.
Leaflets quite glabrous.
Fruit pulpy; seeds compressed, concave on one surface, convex and rugulose on the other ... ... 15. *V. lanceolaria.*
Fruit dry; seeds obovoid, slightly compressed, shortly beaked, not rugulose, vertically grooved on both surfaces ... ... 16. *V. Kunstleri.*
Leaflets glabrous or pubescent; seeds triangular with one side convex and very rugose, the other two sides flat and one of them with a membrane-closed pit ... ... 28. *V. japonica.*
Leaves pedately 7- to 9-foliolate; seeds globular with one side plane and with a membrane-closed pit ... ... 29. *V. novemfolia.*
Inflorescence a slender pendulous much elongate raceme of short horizontal spikes borne on a leaf-opposed tendril.
Both surfaces of leaflets glabrous ... 5. *V. polystach*

Upper surfaces of leaflets glabrous except the midrib and main nerves.
Lower surface with pale cobwebby pubescence ... ... 6. *V. polythyrsa.*
Lower surface rusty pubescent.
Main nerves of leaflets 5 to 8 pairs; flowers oblong, fruit obovoid-oblong, slightly angled ... ... 7. *V. thyrsiflora.*
Main nerves 8 to 10 pairs; flowers sub-globular, fruit oblong boldly 3- to 4-angled ... ... 8. *V. compositifolia.*
Upper surfaces of leaflets minutely rugulose-papillose, each papilla ending in short hair ... 9. *V. elegans.*
Leaves pinnate or bi-pinnate; flowers 5-merous... 18. *V. cantoniensis.*

2. Pterisanthes, Blume.

Scandent tendril-bearing slender shrubs. *Leaves* simple or trifoliolate, digitate or pedate. *Flowers* small, 4-5-merous, inserted on a flattened membranous rachis, a few pedicellate on the margin, the others sessile and sunk in the tissue of the rachis. *Calyx* cupular or obscurely toothed. *Petals* deciduous. *Disc* cushion-like, 4- or 5-angled. *Style* short; *stigma* capitate. *Berry* obovoid or globose, 1 to 4-seeded.—Distrib. 4 species, all Malayan.

Leaves simple ... ... 1. *P. coriacea.*
Leaves 3-foliolate.
Adult leaves glabrous ... ... 2. *P. cissoides.*
Adult leaves rusty-tomentose beneath ... 3. *P. heterantha.*
Leaves 5-foliolate ... ... 4. *P. pedata.*

1. Pterisanthes coriacea, Korth. ex. Miq. Ann. Mus. Lugd. Bat. I, 95. *Stems* slender, glabrous. *Leaves* broadly ovate, acute or acuminate, the edges distantly and sometimes obscurely glandular-dentate, slightly revolute when dry, the base minutely cordate; main nerves about 4 or 5 pairs, rather faint, spreading, the reticulations distinct, both surfaces glabrous and shining; length 3 to 5 in., breadth 1·75 to 3·35 in., petiole ·75 to 1·25 in. *Inflorescence* on a slender (often tendril-bearing) peduncle, membranous, narrowly oblong, 4 or 5 in. long and about 1 in. broad; the edges wavy, reddish when fresh. *Male flowers* 4-merous, few, distant, ·15 in. in diam., their pedicels ·5 in. long. *Female flowers* numerous. *Fruit* sessile, globular, glabrous, ·3 in. in diam. *P. polita*, Lawson in Hook. fil. Fl. Br. Ind. I, 663. *Vitis polita*, Miq. Ann. Mus. Lugd. Bat. I, 85.

In all the provinces except the Andamans and Nicobars: common.

The first author to put this plant into the genus *Pterisanthes* was Korthals who (*fide* Miquel Ann. Mus. Lugd. Bat. I, 85), thus named it in the Herbarium (at Leiden?). Miquel regarded *Pterisanthes* as only a section of *Vitis*. He had therefore to find a name for this plant in that genus; and, finding the name *V. coriacea* pre-occupied by a species of *Cissus* (DC. Prod. I, 632), he called this *V. polita*, Miq.

Var. *araneosa*; *Leaves* often ovate-oblong, always more or less rufescent cobwebby beneath. *Vitis araneosa*, Miq. Ann. Mus. Lugd. Bat. I, 94. *Cissus araneosa*, Miq. Fl. Ind. Bat. Suppl. 517.

Perak: King's Collector, No. 646; Wray, Nos. 2556, 3015, 4621.

Mr. Wray in his field note on this says "leaves with a shining black line round the edge on the outer margin of which is a line of warm brown hair, midrib beneath reddish."

2. Pterisanthes cissoides, Blume Bijdr. 193. *Stems* glabrous, striate. *Leaves* 3-foliolate; the middle leaflet narrowly wedge-shaped, the two lateral more or less oblong, rounded on the outer side, straight on the inner, all with a few obscure distant teeth in the upper half or third, entire in the lower; both surfaces with deciduous arachnoid hairs, glabrous when adult; main nerves about 4 pairs, spreading; length 3 to 6 in., breadth 1·25 to 3in., petioles 1·5 to 3·5 in.; petiolules of the middle leaflets twice as long as those of the lateral. Flattened floriferous rachis of the inflorescence variously lobed, from 2 to 6 in. long and less than half as broad, borne on tendril-bearing branches longer than the leaves. *Male flowers* on slender pedicels ·75 in. long, 4-merous. *Female flowers* numerous. *Fruit* globose, ·35 in. in diam., with coriaceous epicarp and about 4 seeds. Miquel in Linnaea, XVIII, 385, t. VIII; Fl. Ind. Bat. I, pt. 2, 608; Laws. in Hook. fil. Fl. Br. Ind. I, 664. *Vitis Pterisanthes*, Miq. Ann. Mus. Lugd. Bat. I, 94. *Embamma cordigera*, Griff. Notulae IV, 694: Ic. Pl. Asiat. t. 646. *Cissus involucrata*, Spreng. Syst. IV, pt. 2, 44. *Pterisanthes involucrata*, G. Don. Syst. I, 694.

Malacca: Griffith (Kew Dist.), No. 1299; Maingay. Perak: Scortechini; King's Collector, Nos. 727, 7914.—Distrib. Java.

3. Pterisanthes heteroantha, Laws. in Hook. fil. Fl. Br. Ind. I, 664. *Stems* cobwebby when young, ultimately glabrous. *Leaves* 3-foliolate, rarely 5-foliolate, the middle leaflet more or less wedge-shaped and usually broader than the obliquely ovate-oblong laterals, (sometimes all three more or less oblanceolate), acute or shortly acuminate, remotely glandular-dentate in the upper part; upper surface glabrous except the pubescent nerves; the lower rusty-tomentose; main nerv[es] of leaflets about 5 pairs, spreading, rather straight; length 2 to 4·5 [in.], breadth ·8 to 2·5 in., petioles ·8 to 1·5 in. *Flattened rachis* narro[w] oblong, sinuate, acuminate, 3 to 5 in. long and ·3 to ·75 in. broad,

on a tendril-bearing peduncle shorter than the leaves. *Flowers* 4-6-merous (*fide* Lawson). *Fruit* globular, ·25 in. in diam. *Embamma heterantha*, Griff. Notulae IV, 694. *Vitis rufula*, Miq. Ann. Mus. Lugd. Bat. I, 94. *Cissus involuccata*, Miq. (not of Spreng.) Fl. Ind. Bat. Suppl. 517.

Malacca: Griffith, Maingay. Perak: Scortechini; King's Collector, Nos. 678, 1084.

There are in Herb. Calcutta two specimens from Perak (Wray, No. 1178 and Scortechini without number) which apparently belong to this species, but which have pedate leaves with 5 leaflets.

4. Pterisanthes pedata, Laws. in Hook. fil. Fl. Br. Ind. I, 664. *Stems* sparsely pubescent when young, glabrous when old. *Leaves* pedate, 5-foliolate, oblanceolate; the lower two smaller, the apex with a short stout bristle, the edges remotely glandular-dentate in the upper part; both surfaces, but especially the lower, sparsely arachnoid-hairy, the edge on the lower surface densely so: main nerves of leaflets about 4 pairs, spreading; length 2 to 3 in., breadth ·6 to 1·25 in.; petiole about 1 in.; petiolules about ·35 in.; those of the lower leaflets rather shorter. *Inflorescence* glabrous, borne on a short tendril-bearing peduncle. *Flowers* 4-merous. *Fruit* unknown.

Malacca: Griffith, Maingay (Kew Distrib.), No. 432.

This is known only from Griffith's and Maingay's very scanty specimens. It may be only a pedate form of *P. heterantha*.

3. Leea, Linn.

Small trees, shrubs or herbs. *Branches* striate or sulcate, often herbaceous. *Leaves* alternate, usually very large, simple, or 1–2–3-pinnate; petiole often dilated at the base, stipules sheathing. *Peduncles* opposite the leaves or sub-terminal. *Tendrils* 0. *Inflorescence* corymbosely-cymose. *Flowers* red yellow or green. *Calyx* 5-toothed. *Petals* 5, connate at the base and adhering to the staminal tube, revolute. *Stamens* united at the base into a 5-lobed tube, the filaments inserted between the lobes of the tube, inflexed; *anthers* exserted. *Ovary* inserted on the disc, 3- to 8-celled; *style* short, stigma swollen; *ovules* 1 or 2 in each cell, erect. *Fruit* 3- to 8-celled, berry-like, usually succulent, depressed-globular and lobed, pulp often scanty. *Pyrenes* wedge-shaped, seeds compressed.—Distrib. Species about 50, mostly tropical Asiatic and African, a few Australian.

Leaves simple, or with 3 to 5 large pinnules.

Leaves pubescent beneath, cymes on long peduncles ... ... 1. *L. latifolia.*

Leaves quite glabrous on both surfaces; cymes on short peduncles.

A tree; leaflets 5 ... ... 2. *L. grandifolia.*

A shrub 12 to 18 in. high; leaves simple or at most 3-partite, teeth of staminal tube deeply bifid; flowers numerous ... 3. *L. simplicifolia.*

A shrub 12 to 18 in. high: leaves never simple, leaflets 3 to 5, teeth of staminal tube faintly emarginate but not bifid; flowers few ... ... 4. *L. pauciflora.*

Leaves pinnate or bi- or tri-pinnate, leaflets numerous.

Leaflets glabrous on both surfaces.

Buds oblong, cymes 9 to 24 in. across: flowers red ... ... 5. *L. gigantea.*

Buds globular:

Stem and branches thorny ... 6. *L. angulata.*

Unarmed.

Cymes not more than 8 or 9 in. across, spreading, lax, on long peduncles, flowers white... ... 7. *L. Sambucina.*

Cymes only 1·25 to 2·25 in. across, compact, flowers red ... ... 8. *L. acuminata.*

Buds obovoid and on long pedicels; cymes large, lax, divaricating; flowers ·25 in. long ... ... 9. *L. Curtisii.*

Leaflets glabrous on both surfaces, main nerves winged and crisped and with lines of minute black hairs along them when young... ... ... 10. *L. rubra.*

Leaflets hairy underneath but without glands.

Cymes on long peduncles, lobes of staminal tube not emarginate ... 11. *L. robusta.*

Cymes on short peduncles, lobes of staminal tube emarginate ... ... 12. *L. javanica.*

Leaflets hairy underneath and with numerous flat discoid glands ... ... 13. *L. aequata.*

1. Leea latifolia, Wall. Cat. 6821. A shrub, young branches rusty furfuraceous-puberulous. *Leaves* simply pinnate, leaflets 3 to 5, oblong to sub-orbicular, sub-acute or obtuse, remotely serrate, the base sub-cordate; upper surface glabrous; the lower paler with some scattered pale hairs on the midrib and 10 to 12 pairs of spreading nerves, the reticulations transverse and very distinct; length 9 to 12, breadth 6 to 11 in. *Cymes* on long peduncles, umbellate, with bra

3 to 5 in. long, shortly pubescent. *Lobes* of the staminal tube notched. Kurz For. Flora Burma, I, 278: in Journ. As. Soc. Beng., Vol. 44, pt. II, p. 178; Clarke in Trimen's Journ. Bot. for 1881, p. 138. *L. macrophylla*, Laws. (not of Hornem.) in Hook. fil. Fl. Br. Ind. I, 664. *L. cinerea* and *L. coriacea*, Laws. in Hook. fil. Fl. Br. Ind. I, 665.

Andaman Islands: King's Collectors.—Distrib. Burma.

2. Leea grandifolia, Kurz in Trimen's Journ. Bot. 1875, p. 325. A small tree 10 to 20 feet high: young branches lenticellate, glabrous, sparsely verrucose. *Leaves* glabrous, simply pinnate; *leaflets* 5, broadly ovate to oblong-ovate, shortly acuminate, the edges with large shallow crenations or sub-entire; the base broad, rounded: main nerves 8 to 10 pairs, spreading, much curved at the tips; both surfaces glabrous, the reticulations not prominent: length 9 to 12 in., breadth 4 to 5 in.; petiolules of the terminal leaflet 2 in., of the laterals ·5 to ·75 in. *Cymes* about 4 in. across, on peduncles only about 1 in. long, trichotomously umbellate, the branches about 1 in. long, almost glabrous. *Flowers* greenish white; *lobes* of staminal tube emarginate. *Fruit* sub-globular, depressed, lead-coloured when ripe.

Nicobar Islands: Jelinek; Katchal, Kurz: Bati Malv, Prain.

This differs from *L. latifolia* in having verruculose branches, perfectly glabrous obscurely reticulate leaves, and small very shortly pedunculate cymes.

3. Leea simplicifolia, Zoll. in Natur en Geneesk. Arch. II, 577. An unbranched shrub 12 to 18 in. high; *stem* glabrous, sparsely lenticellate. *Leaves* simple or ternate: the *simple* broadly elliptic, somewhat obovate, shortly and abruptly acuminate, the edges sinuate-serrate or sub-entire, the base narrowed and sometimes minutely cordate; both surfaces glabrous, the lower bright brown when dry and with the reticulations very distinct; main nerves 9 to 12 pairs, spreading, rather straight; length of the simple leaves 4·5 to 9 or 12 in., breadth 2·5 to 6·5 in., petiole ·75 to 2 in.: the *pinnate* leaves with the lateral leaflets narrowly elliptic and sub-oblique, 8 to 10 in. long, and about 3 in. wide, the terminal larger, petiolules about ·3 in. long; the terminal leaflet like the simple and with a petiolule 1·5 in. long. *Cymes* capitate, dense, about ·75 in. in diam., on peduncles ·5 in. or less in length. *Flowers* numerous, crowded, white: the *lobes* of the staminal tube with 2 broad deep teeth. *Fruit* sub-globular, ·3 or ·4 in. in diam., glabrous, dark-coloured and pulpy when ripe. Miq. Fl. Ind. Bat. Vol. I, pt. 2, p. 612; Ann. Mus. Lugd. Bat. I, 101; C. B. Clarke in Trim. Journ. Bot. 1881, p. 166.

Perak: Scortechini, No. 1206; King's Collector, No. 2195.—Distrib. Sumatra.

4. LEEA PAUCIFLORA, King n. sp. A shrub 12 to 15 in. high; the *stems* slender, glabrous, sparsely lenticellate. *Leaves* pinnate, the rachises and petioles sub-terete; *leaflets* 3 to 5, oblong to elliptic-oblong, the terminal one larger and broader than the lateral, all with short rather blunt acuminate apex, the edges with a few remote shallow serrations or sometimes almost entire, the laterals slightly oblique towards the rounded or cuneate base: both surfaces glabrous and shining, the reticulations very distinct on the lower when dry: main nerves 6 to 8 pairs, faint, spreading: length of the lateral leaflets 2·5 to 4·5 in., breadth 1 to 2·5 in., the terminal one from 4·5 to 6 in. long, and from 2 to 3·5 in. broad: petiolules of the laterals ·2 to ·3 in. long, of the terminal about ·75 in. *Cymes* terminal, capitulate, densely few-flowered, about ·35 in. in diam., on pedicels ·35 in. long. Colour of flowers unknown; lobes of staminal column broad, very slightly emarginate, covered with pale dots. *Fruit* depressed-globular, deeply lobulate, glabrous, about ·4 in. in diam., white when ripe and with little pulp.

Perak: Scortechini, King's Collector, No. 1113.

This is allied to *L. simplicifolia* Zoll., but differs in its leaves which are never simple and which have 3 to 5 leaflets smaller than in the pinnate forms of *L. simplicifolia*. The cymes of this are moreover few-flowered and much smaller than in that species, and the lobes of the staminal column in this are broad and very slightly emarginate or sub-entire, whereas in *L. simplicifolia* they are more deeply bifid than in any species here described. The ripe fruit of this is moreover stated by Kunstler to be white.

5. LEEA GIGANTEA, Griff. Notul. IV, 697: Ic. Pl. Asiat. t. 645, fig. 3. A tall shrub or small tree; young branches puberulous, lenticellate. *Leaves* often several feet in length, 3-pinnate, the rachis and petiole sub-terete, not winged: *leaflets* oblong or elliptic-oblong, shortly and abruptly acuminate, coarsely and sharply serrate, the base cuneate; both surfaces glabrous, shining; main nerves 8 to 13 pairs, spreading; the connecting veins numerous, wavy, sub-horizontal, and very prominent on the lower surface; length 5 to 10 in.; breadth 2·25 to 4 in.; petiolules of lateral leaflets ·3 to ·75 in., the terminal two or three times as long. *Cymes* in a lax many-branched spreading panicle from 9 in. to 2 feet across, minutely puberulous or glabrescent. *Flowers* purplish red, the buds oblong; *staminal tube* with acute bifid teeth. *Fruit* depressed-globular, smooth, black when ripe, with scanty pulp, ·25 to ·3 in. in diam. *Seeds* flattened, with dorsal ridge, the sides irregularly ribbed. Kurz in Journ. As. Soc. Bengal, Vol. 42, pt. 2, 65; Vol. 44, Pt. 2, p. 178; For. Flora Burma, I, 280; C. B. Clarke Trimen's Journ. Bot. for 1881, p. 140. *L. Sambucina*, Wall. Cat. 682 (in part). *L. Staphylea*, Wall. Cat. 6823 K.

Penang: Wallich, Stoliczka, Curtis, King. Johore; King. Perak; King's Collector, Nos. 505, 2494.

The specific name given to this is unfortunate, as it implies that the plant is a large one. As a matter of fact it is a much smaller plant than *L. angulata*, Korth. which often forms a tree 30 feet in height; while this is usually a shrub about 10 feet high. This species has however very much larger leaves and panicles than any other *Leea* known to me. The flowers of this are bluish red: the teeth of the staminal tube I find, contrary to the observations of the late Mr. Kurz and Mr. C. B. Clarke, to be bifid at the apex. My colleague Dr. Prain, to whom I have shown dissections of flowers taken from Wall. Cat. 6823B, (as well as from other specimens) quite agrees with me in this. As Mr. Clarke has remarked in his excellent *Revision of the Indian Species of Leea* (Trimen's Journ. Bot. for 1881, p. 100 *et seq.*), the characters of the seeds of this plant have given rise to some discussion. I find them to be as above described. The late Mr. Kurz (in Journ. As. Soc. Beng., Vol. 42, p. 65) described them thus: "*semina obtuse carinata, lateribus tuberculato-costatis*," which is a fairly accurate account of them. In a later number of the same *Journal*, (Vol. 44, p. 178) however, he described them in these words "seeds tubercled-keeled, the edges tubercled-ribbed," which is inaccurate. Mr. Clarke, disregarding Kurz's earlier description, and not finding the seeds of this species to agree with his later description, assumed that Kurz must have had another plant before him, and for this plant Mr. Clarke has proposed the name (Trimen's Journ. *l. c.*) *L. tuberculo-semen*. The very specimens described by Kurz as *L. gigantea*, Griff. are however, in the Calcutta Herbarium, and they bear that name in his own handwriting. These specimens undoubtedly agree with all the sheets of Wall. Cat. 6823B. in the same Herbarium, which Mr. Clarke regards as true *L. gigantea*. The truth probably is that the markings on the sides of the seeds which Kurz described in two ways in the *Journal* of the Asiatic Society are *post mortem* appearances—an explanation which is supported by the facts that, in his Flora of Burma, Kurz describes them in still another way as "bluntish-keeled and tubercled-ribbed;" and that nobody's description agrees with Griffith's figure (Ic. Pl. Asiat. t. 645, fig. 3) which was probably drawn from fresh seeds! Dry seeds taken from Herbarium specimens moreover vary in appearance according as they are examined immediately after having been boiled, or after some delay: and this is no doubt the explanation of Kurz's three differing descriptions. The nearest ally of this species is undoubtedly *L. sambucina*, Willd; but that species has much smaller leaves, leaflets and panicles, and it has green not red flowers.

6. Leea angulata, Korth. ex Miq. in Ann. Mus. Lugd. Bat. I, 97. A bushy tree 20 to 30 feet high, the stem with many sharp thorns, the branches and lower part of the petioles and peduncles with a few scattered short thorns. *Leaves* about 1 foot long, 2- rarely 3-pinnate: the rachis angled, channelled on the upper surface, and the common petiole dilated at the base: *leaflets* 5, rarely 7, glabrous, narrowly oblong-lanceolate, shortly acuminate, distantly serrate-crenate, the terminal one equal-sided at the base, the laterals oblique, all crenate; main nerves 5 or 6 pairs in the lateral, and 9 to 12 pairs in the terminal leaflet, spreading, slightly prominent on the lower surface but not winged or crisped; length of the laterals 1·5 to 2·5 in., of the terminal 3 to 4·5 in.; breadth ·85 to 1·25 in.; *petiolules* ·1 to ·25 in. *Cymes* on glabrous slightly prickly peduncles 2 to 3·5 in. long, open, branching, measuring 3 in. across, almost glabrous; *bracteoles* minute, lanceolate, in pairs. *Flowers* dull white. *Staminal tube* 5-toothed. *Berries* depressed-globose, black and juicy when ripe, ·35 in. in diam. *L. horrida*, Teysm. and Binn. (name only) Cat. Hort. Bot. Bogor. ed. 1866, p. 169. *L. Malayana*, Scortechini MSS. *L. aculeata*, C. B. Clarke (not of Blume) in Trimen's Journ. Bot. for 1881, p. 105.

Perak: Wray, Nos. 3325, 3803; Scortechini, No. 1829; King's Collector, Nos. 1145, 7066. Pahang: Ridley, No. 2583. Nicobar Islands: Kurz, King's Collector.—Distrib. Java.

This differs from *L. aculeata*, Bl. in being a larger plant and in having white, not red, flowers. *L. aculeata* has moreover simply pinnate leaves with about seven leaflets of larger size than in this; the rachis in the leaves of that moreover is not winged, nor is the base of the petiole dilated.

7. Leea sambucina, Willd. Sp. Pl. I, 1177. A shrub 4 to 10 feet high; young branches deciduously adpressed-rusty-puberulous. *Leaves* 15 to 20 in. long, 2- rarely 3-pinnate, the rachis and petiole not winged: *leaflets* oblong or elliptic, shortly and sharply acuminate, coarsely and sometimes rather unequally serrate, the base slightly cuneate; both surfaces quite glabrous; main nerves 7 to 12 pairs, rather prominent beneath, spreading; veins not prominent, transverse; length 3 to 6 or even 9 in., breadth 1·5 to 3 in.; petiolules of the lateral leaflets ·2 to ·4 in., the terminal one two or three times as long. *Cymes* on stout peduncles several inches long, (sometimes 6 in.), spreading, rather lax, almost glabrous, not usually more than 8 or 9 in. across. *Flowers* greenish-white, the buds sub-globular: *staminal tube* yellowish-white, its lobes notched. *Fruit* depressed-globular, smooth, black, pulp scanty, ·3 in. in diam. Roxb. Hort. Beng. 18; Fl. Ind. ed. Carey II, 470; DC. Prodr. I, 633; Wall. Cat. 6823, A, C, and part of B; Blume Bijd.

196; Griff. Notul. IV, 698; Ic. Pl. Asiat. t. 644, fig. 1, t. 645, figs. 6, 8; Decne in Ann. Mus. d' Hist. Nat. III, 445; Miq. Fl. Ind. Bat. I, pt. 2, 611; in Ann. Mus. Lugd. Bat. I, 98, (*only in part, and perhaps not at all*); Laws. in Fl. Brit. Ind. I, 666, (*partly*); Brand. For. Fl. 102; Kurz in Journ. As. Soc. 44, II, 179; For. Fl. Burma I, 279; (*not of Benth. nor of Baker.*); C. B. Clarke in Trimen's Journ. Bot. for 1881, p. 139. *L. Staphylea*, Roxb. Hort. Beng. 18; Fl. Ind. ed. Carey II, 471; Wall. Cat. 6824, F. I.; W. and A. Prodr. 132; Wight Ic. t. 78; Dalz. and Gibs. Bomb. Fl. 41; Thwaites Enum. Pl. Zeyl. 64. *L. Ottilis*, DC., Prodr. I, 636. *Leea viridiflora*, Planch. Hort. Donat. 6. *Aquilicia Sambucina*, Linn. Mant. 211; Cav. Dissert. VII, t. 218. *Staphylea indica*, Burm. Fl. Ind. 75, t. 24, fig. 2. *Aquilicia Ottilis*, Gaertn. Fruct. I, 275. *Ottilis zeylanica*, Gaertn. Fruct. t. 57. *Gastonia Naluga*, Lamk. Dict. II, t. 611. *Gilibertia Naluga*, DC. Prodr. IV, 256. Rumph. Herb. Amb. IV, t. 45. Rheede Hort. Mal. II, t. 26.

Penang: Wallich, Curtis. Singapore: Hullett. Malacca: Maingay (Kew Distrib.), No. 433. Andaman Islands: very common.—Distrib. British India.

This species is rare in the Malayan Peninsula, but very common in the Andamans. It forms a bush of about the same size as *L. gigantea*, Griff., from which it is readily distinguished by its smaller leaves and panicles and by its green flowers. I have followed Mr. C. B. Clarke implicitly as to the synonymy of this species as given in his excellent paper in Trimen's Journal of Botany.

Var. *biserrata*, Miq. Ann. Mus. Lugd. Bat. I, 99. Serrations of the leaves very unequal, sometimes alternately large and small. *L. biserrata* Miq. Fl. Ind. Bat. Suppl. 518.

Perak: King's Collector, No. 3282. Singapore: Ridley, No. 4746. Distrib. Bangka.

8. Leea acuminata, Wall. Cat. 6830. An under-shrub 2 to 3 feet high; young branches glabrous. *Leaves* usually pinnate, but one of the lower pinnae often pinnulate; the *rachis* not winged, the petiole very slightly dilated at the base; *leaflets* oblong, rarely ovate-oblong, sharply acuminate, slightly and unequally serrate, the base rounded or slightly cuneate: both surfaces glabrous, sometimes dotted; main nerves 10 to 12 pairs, rather prominent beneath, the veins sub-horizontal: length 2·5 to 8 in., breadth ·75 to 2 in. *Cymes* compact, 1·25 to 2·25 in. across, many-flowered, the branches short, minutely rusty-pubescent, on peduncles varying from 1 to 3 in. long. *Flowers* coral-red, sub-globular, bracts and bracteoles usually absent; *lobes* of the staminal tube broad, emarginate. *Fruit* depressed-globular, red when ripe, ·25 in. in diam. C. B. Clarke in Trimen's Journ. Bot. for 1881, 102. *L. sambucina*, Laws.

(not of Willd.) in Hook. fil. Fl. Br. Ind. I, 666 (in part). *L. laeta*, Wall. Cat. 6831 A and B; Kurz in Journ. As. Soc. Beng., Vol. 42, pt. 2, p. 65; Vol. 44, pt. 2, p. 179: For. Flora Burma, I, 278; C. B. Clarke *l. c.*, p. 103. *L. sanguinea*, Wall. Cat. 6824.

Andaman Islands: common.—DISTRIB. Along the base of the Eastern Himalaya, the Assam Range and Burma.

I cannot see how Wallich's two sets of specimens named *L. acuminata* and *L. laeta* are to be distinguished as species—the solitary difference which I can find between them being that, in *L. laeta* the cymes are more condensed and have shorter peduncles than in *L. acuminata*. I have therefore, in spite of the high authority of Mr. C. B. Clarke who keeps them distinct, ventured to unite them. The species, as I understand it., is allied to *L. sambucina*, Willd., but is a much smaller plant and has coral-red, not green, flowers in rusty-pubescent condensed cymes, and red fruit.

9. LEEA CURTISII, King n. sp. An erect shrub 4 to 5 feet high: young shoots deciduously puberulous. *Leaves* 2·5 to 3 feet long, bipinnate, the rachises channelled, the petiole terete; *leaflets* elliptic or oblong-elliptic, shortly caudate-acuminate, remotely crenate, the bases cuneate; both surfaces glabrous, the lower transversely reticulate; main nerves 5 or 6 pairs, curved, sub-ascending, prominent on the lower surface; length 3·5 to 4·5 in., breadth 1·5 to 2 in.: *petiolules* of the lateral leaflets about ·3 in., of the terminal 1·5 in. *Cymes* on a long stout peduncle, umbellate, branched; the branches lax, spreading, few-flowered. *Flowers* large, obovoid, in pairs with deciduous bracteoles at the base. *Calyx* glandular-hairy, pure white, its lobes spreading. *Petals* reflexed, whitish-yellow, teeth of staminal tube entire. *Fruit* unknown.

Perak: on Waterloo Peak, alt. 1500 feet; Curtis, No. 2872.

Collected only by Mr. Curtis who describes the young leaflets as beautifully marked with silvery-grey variegations along both sides of their midribs. This appears in its foliage to resemble the imperfectly known Bornean species *L. amabilis* the leaflets of which, however, have more nerves and more serrations.

10. LEEA RUBRA, Blume Bijdr. 197. A shrub 1 to 6 feet high; young branches minutely scaly-pubescent, ultimately glabrous. *Leaves* 2- to 3-pinnate, the main rachis angled and sometimes slightly winged: *leaflets* 3 to 5, ovate to ovate-oblong, shortly acuminate, coarsely serrate, rounded or sub-cuneate at the base, sub-sessile; main nerves 6 to 10 pairs, winged and crisped and, in young leaves, with minute black hair along their sides, otherwise glabrous on both surfaces. *Cymes* on peduncles ·5 to 2·5 in. long, furfuraceous rusty-puberulous, condensed

but much branched, 2 to 3 in. in diam., bracts and bracteoles absent. *Flowers* red. *Lobes of* the staminal tube notched. *Berries* ·25 in. in diam. Dene. in Ann. Mus. d'Hist. Nat. III, 445; Hassk. Pl. Jav. Rar. 453; Miq. Fl. Ind. Bat. I, pt. 11, 610; Ann. Mus. Lugd. Bat. I, 96; Kurz in Journ. As. Soc. Beng., Vol. 44, II, 180; For. Flora Burma, I, 279; C. B. Clarke Journ. Bot. for 1881, p. 104. *L. sanguinea*, Kurz in Journ. As. Soc., Vol. 42, II, 66? *L. coccinea*, Kurz (not of Planch.) ? *L. polyphylla*, Miq. Fl. Ind. Bat. Vol. I, pt. 2, p. 610.

Singapore: Ridley, No. 1928. Pahang: Ridley, No. 2433. Penang: Curtis, No. 1107. Quedah: King's Collector, No. 1716; Curtis, Nos. 2601 and 2645.—Distrib. Burma, Eastern Bengal.

This, as his specimen in Herb. Calcutta shows, is what Kurz referred to *L. coccinea*, Planch. (For. Flora Burmah, I, 278.)

11. Leea robusta, Roxb. Hort. Beng. 18; Fl. Ind. ed. Carey II, 468; ed. 1832 II, 655. A shrub 5 or 6 feet high: young branches with coarse rusty deciduous pubescence. *Leaves* from pinnate to tripinnate, the rachis and petioles angled, minutely lepidote, not winged or dilated; *leaflets* oblong to elliptic-oblong, acuminate, remotely and unequally serrate (sometimes obsoletely serrate); the lower broad and rounded at the base, the terminal one cuneate: main nerves 8 to 12 pairs, ascending, the connecting veins faint; upper surface sparsely strigose; the lower shortly pubescent, eglandular, the nerves sparsely strigose. *Cymes* on long peduncles, sparsely umbellate, minutely tomentose; *bracteoles* linear, deciduous. *Flowers* greenish, lobes of staminal tube grooved outside but not bifid at the apex. *Fruit* depressed-globose, ·25 in. in diam., black when ripe, the pulp very scanty. Wall. Cat. 6826; W. and A. Prod. 132; Kurz in Journ. As. Soc. Beng., Vol. 44, pt. 2, pp. 178, 180; For. Flora Burma, I, 279; C. B. Clarke in Trimen's Journ. Bot. for 1881, p. 164. *L. aspera*, Wall. Cat. (not of Edgew.) 6825. *L. diffusa*, Laws. in Hook. fil. Fl. Br. Ind. I, 667.

Singapore: Ridley, No. 3788. Andaman Islands: King's Collectors.—Distrib. British India.

Roxburgh founded this species on specimens collected in the Northern Circars, but none of his original material is now extant. Specimens collected within recent years by Mr. J. S. Gamble in Ganjam (which is practically Roxburgh's Northern Circars) dry of a very pale colour, and have narrowly oblong leaflets with a few short hairs on the nerves beneath. In shape and colour they are distinguished from Wallich's own specimens of his *L. parallela* from Burma by a single character, which is that the adult leaves of *L. parallela* are quite glabrous beneath. But specimens recently obtained from Wallich's collecting ground in Upper Burma show that the leaflets of *L. parallela* are, when

young, pubescent beneath. As the only distinguishing character thus breaks down, I cannot see how *L. parallela* is to be kept up as a species. After examining with great care a very large suite of Indian Leeas, I cannot see how *L. aspera*, Edgew. and *L. herbacea*, Ham., are to be kept up as more than varieties of *L. robusta*. Mr. Curtis collected in Selangor (Herb. Curtis, No. 2329) specimens without flowers which may belong to this species. The fruit is however larger than in typical *L. robusta* and has the appearance of having been also more pulpy.

12. Leea javanica, Blume Bijd. 197. A large shrub: young branches slightly scaberulous. *Leaves* pinnate, the lower bi-pinnate; the rachises channelled above, not winged; petiole not dilated at the base, all deciduously and minutely tomentose: *leaflets* oblong or elliptic-oblong, shortly acuminate, shortly serrate-dentate, the bases rounded: upper surface glabrous, the midrib and nerves puberulous: lower surface rusty-pubescent especially on the nerves, dark-red when dry: main nerves 10 to 12 pairs, spreading, curving, prominent beneath; connecting veins distinct, sub-horizontal; length 3·5 to 10 in., breadth 1·75 to 3 in.; petiolules of the lateral leaflets ·15 to ·25 in., of the terminal 1 in. or more. *Cymes* on rather short peduncles, umbellate, spreading, many-flowered, 3 or 4 in. across, minutely rusty-tomentose; *bracteoles* minute, deciduous. *Flowers* greenish-white; lobes of staminal tube broad, emarginate. *Fruit* depressed-globular, bluish-black when ripe, ·3 in. in diam. Miq. Fl. Ind. Bat. Vol. I, pt. 2, p. 610: Ann. Mus. Lugd. Bat. I, 100; C. B. Clarke in Trimen's Journ. Bot. for 1881. p. 165.

Perak: King's Collector, Nos. 552 and 8368. Singapore: Schomburgh.—Distrib; Java, Celebes. Sumatra, Forbes, No. 1395.

This is closely allied to *L. sundiaca*, Miq. which however has red flowers. It is also allied to *L. aequata* Linn. and to *L. robusta*, Roxb.

13. Leea aequata, Linn. Mant. 124. A shrub 4 to 10 feet high: young shoots deciduously pubescent, scaberulous. *Leaves* bi-pinnate, the rachises angled and pubescent, not winged, and the base of the petiole not dilated; *leaflets* narrowly oblong, rarely ovate-oblong, sharply acuminate, distantly and rather unequally serrate, the base usually rounded, rarely cuneate but sometimes oblique; upper surface with scattered setae especially on the midrib and nerves, otherwise glabrous; the lower surface setose-pubescent especially on the nerves, and with numerous circular discs; main nerves 7 to 12 pairs, spreading, ascending, curved; connecting veins horizontal, distinct; length 3 to 7 in., breadth 1 to 1·75 in.; petiolules of the lateral leaflets ·15 to ·3 in., of the terminal about 1 in. *Cymes* sessile or on peduncles up to 1·5 in. long, tomentose; bracts broad, caducous. *Flowers* white, teeth of staminal tube bifid. *Fruit* depressed-globular, black when ripe, pulp

...n. in diam. Miq. in Ann. Mus. Lugd. Bat. I, 98: Kurz in ... Soc. Beng. Vol. 44, pt. 2, pp. 178, 180; Flora Burma I, 281; ...larke in Trimen's Journ. Bot. for 1881, 163. *L. hirta*, Hornem. Hort. Hafn. I, 237: Roxb. Fl. Ind. ed. Carey II, 469: ed. 1832 II, 656; Blume Bijdr. 197; Miq. Fl. Ind. Bat. Vol. I, pt. 2, p. 612; Wall. Cat. 6822; Dene in Ann. Mus. d'Hist. Nat. III, 446; Miq. Fl. Ind. Bat. I, pt. 2, p. 612; Lawson in Hook. fil. Fl. Br. Ind. I, 668. *L. hirsuta*, Bl. Bijdr.; Miq. Fl. Ind. Bat. I, pt. 2, p. 612.

Perak: Scortechini, King's Collector, No. 4387. Quedah: King's Collector, No. 1725. Andamau Islands: Kurz, King's Collector.—DISTRIB. Java, Sumatra.

This species is, as Mr. C. B. Clarke has well pointed out, at once recognisable by the curious glandular discs on the under surface of the leaf—a character found in no other species of the genus.

Order XXXIV. SAPINDACEÆ.

Trees, shrubs, or rarely climbing herbs. *Leaves* alternate, rarely opposite, exstipulate or occasionally stipulate, pinnate, palmate-trifoliolate or simple; *leaflets* opposite or alternate, entire or dentate, rarely lobed. *Flowers* mostly polygamo-dicœcious and small, usually either irregular or unsymmetrical. *Calyx* mostly 4–5-lobed, or with 4–5 sepals, sepals or lobes often unequal, imbricate or valvate in the bud. *Petals* free, equal or unequal, usually 4–5 or 0, often bearded or squamate at the base within. *Disc* annular or unilateral, rarely (in ♂ flowers) deficient. *Stamens* 5–10, inserted inside the disc at the base of the ovary or outside or on the disc, sometimes unilateral; *anthers* 2-celled, basifixed or versatile; *filaments* often pubescent, almost always free. *Ovary* centric or excentric, entire or lobed, or sometimes divided nearly to the base, 1-3-celled. *Style* simple or divided, usually terminal; *stigma* usually simple. *Ovules* usually 1 rarely 2 or more in each cell, affixed to the axis of the ovary, ascending. *Fruit* capsular or indehiscent, entire or lobed, sometimes winged. *Seeds* globose or compressed, arillate or naked, exalbuminous, rarely albuminous. *Embryo* usually thick, sometimes plicate or spirally convolute.—DISTRIB. About 550 to 800 species scattered over the whole world.

Ovules solitary in each loculus of the ovary.

Leaves trifoliolate; inner cotyledon transversely bi-plicate; disc unsymmetrical.

Scandent tendril-bearing herbs or shrubs with 3-foliolate leaves; petals with cucullate crested scales; fruit a membranous 3-celled capsule ... ... 1. CARDIOSPERMUM.

Erect shrubs or trees without tendrils; leaves 1- to 3-foliolate; scales of petals emarginate; fruit (by abortion) with 2 or 1 globose indehiscent baccate cocci ... 2. ALLOPHYLUS.

Leaves (except in *Paranephelium*) equally pinnate (simple in one *Aphania*); cotyledons curved or sub-circinate, rarely sub-diplicolobate; disc symmetrical or unsymmetrical.

Fruit indehiscent.

Seeds without arillus.

Fruit 1- to 3-coccous, two of the segments small and imperfect or obsolete, the developed one sub-globose and fleshy, testa of seed bony; sepals and petals oblong, the basal scales of the petals entire 3. DITTELASMA.

Fruit 1- to 3-lobed to the base, the lobes diverging, oblong; the testa of the seed membranous; sepals orbicular; petals obovate, their basal scale lobed... 4. ERIGOLOSSUM.

Fruit deeply divided into 2 rarely 3 ellipsoid or sub-3-gonous divergent lobes united only at their bases; sepals more or less orbicular; petals smaller with 2 infolded basal auricles or with 2 basal scales 5. APHANIA.

Fruit sulcate, never lobed: inflorescence often from the branches.

Fruit sub-ligneous, 3-celled, 3-angled; flowers symmetrical, scales of petals crested: lower pinnules of leaves not stipule-like ... ... 6. LEPISANTHES.

Fruit baccate, fleshy, incompletely septate; scales of petals not crested; lower pinnules of leaves stipule-like ... ... 7. OTOPHORA.

Seeds arillate.

Fruit coccate or deeply sulcate, arillus adnate to the testa with a free edge round the micropyle.

Micropyle near the hilum; calyx-lobes 4 to 5, petaloid, concave, broadly imbricate; fruit muricated ... ... 8. XEROSPERMUM.

Micropyle remote from the hilum: calyx lobes small, valvate, petals sometimes 0; fruit muricated or tubercled or obsoletely so ... ... 9. NEPHELIUM.

Micropyle intermediate between the base and apex of the seed; lower leaflets stipule-like; fruit quite smooth ... ... 10. POMETIA.

Fruit dehiscent, often produced into false wings; seeds usually arillate.

Calyx polysepalous, imbricate in two series, buds sub-globose; petals with 2 crested basal scales; fruit 3-winged or 3-lobed, arillus caudate ... ... 11. GUIOA.

Calyx gamosepalous, dentate or lobed; petals with two crested basal scales; fruit large, pyriform, with thick pericarp, obtusely 3-angled, not lobed ... 12. TRIGONACHRAS.

Petals with 2 crestless basal scales, or sometimes absent; fruit with the cocci quite distinct and divaricate; disc sub-entire, annular.

Arillus enclosing the whole or nearly the whole of the seed, not appendiculate at the base ... 13. ARYTERA.

Arillus with 2 spur-like processes at its base; fruit pyriform or globose, 3-lobed ... ... 14. MISCHOCARPUS

Petals peltate-infundibuliform, the single large basal scale being connate with each petal by its edges.

Ovary 2-celled; fruit obovate, the pericarp coriaceous, the arillus fleshy, basal; the leaves equally pinnate, flower buds oval, pointed ... ... 15. LEPIDOPETALUM.

Ovary 3-celled; fruit with the pericarp woody, tubercular or echinate; flower-buds sub-globose .. 16. PARANEPHELIUM.

Ovules 2 or more in each loculus of the ovary.

Leaves simple, exstipulate: stamens inserted outside the disc; the capsule much compressed, membranous, winged, seeds ex-arillate ... ... 17. DODONAEA.

Leaves pinnate, exstipulate; stamens inserted inside the disc; capsule coriaceous, inflated, sub-compressed, reniform, 2-celled, not winged; seeds arillate ... ... 18. HARPULLIA.

Leaves pinnate, stipulate; stamens inserted outside the lobed disc; fruit more or less fleshy, sub-globose, 3-celled, indehiscent; seeds without arillus ... ... 19. TURPINIA.

1. CARDIOSPERMUM, Linn.

Climbing tendril-bearing herbs with alternate exstipulate leaves, biternate coarsely dentate leaflets, axillary racemes, and irregular polygamo-dioecious flowers. *Sepals* 4, imbricate, concave, the 2 outer small. *Petals* 4, in pairs, the larger two with a scale above the base; the two smaller inferior, remote from the stamens, each furnished with a small crested scale. *Disc* unilateral, undulate, almost reduced to 2 round or linear glands opposite the lower petals. *Stamens* 8, excentric; filaments free or connate at base; the 4 nearest to the glands shorter than the rest. *Ovary* sessile or sub-sessile, 3-celled; *style* short, trifid; *ovules* solitary, ascending. *Capsule* membranous, 3-celled, 3-valved, inflated, loculicidal. *Seeds* globose, usually arillate at the base, exalbuminous, testa crustaceous; *cotyledons* large, transversely conduplicate.—DISTRIB. About 30 species, mostly Tropical American and Tropical African.

CARDIOSPERMUM HALICACABUM, Linn. Sp. Pl. ed. I. 366. Annual or perennial; the branches slender, striate, sparsely pubescent or subglabrous. *Leaflets* deltoid, acuminate, deeply and sharply lobed,

glabrous or sparsely pubescent. *Flowers* white, ·15 in. long. *Capsule* globose or pyriform, much inflated, veined, ·75 to 1·25 in. broad. W. & A. Prodr. I, 109; Wall. Cat. 8030; Griff. Notul. IV, 546; Ic. Pl. Asiat. IV, t. 599, f. 3; Dalz. & Gibs. Bomb. Fl. 34; Wight Ic. t. 508; Thwaites Enum. 54; Roxb. Fl. Ind. II, 292; Bot. Mag. t. 1049; Grah. Cat. Bomb. Pl. 28; Boiss. Fl. Orient. I, 945; Benth. Fl. Austral. I, 453; Hiern in Hook. fil. Fl. Br. Ind. I, 670. *C. microcarpum*, H. B. K. Nov. Gen. & Sp. Pl. V, 104; Baker *l. c.* 418, with syn.—Rheede Hort. Mal. VIII, V, 28; Rumph. Herb. Amboin. VI, t. 24, f. 2.

In all the provinces, but usually only near settlements. DISTRIB. British India, Ceylon, and most tropical countries.

A form of this with rather small and ob-deltoid capsules has been kept up as a species by some authors under the name *C. microcarpum*, H. B. K.; but, as there are innumerable gradations from the globular capsule besides much difference in size, I do not consider that it deserves even varietal rank. The allied species *C. canescens*, Wall. grows in the south of India and in Burmah along with this, but is always distinguishable by its more bluntly lobed leaflets canescent beneath.

2. ALLOPHYLUS, Linn.

Erect shrubs or trees. *Leaves* alternate, exstipulate, 1- to 3-foliolate. *Racemes* simple or branched, axillary. *Flowers* irregular, small, polygamo-dicecious, globose, sub-sessile. *Sepals* 4, in pairs, much imbricate, concave, unequal. *Petals* 4, small, glabrous, with a villous emarginate scale above the claw. *Disc* one-sided, with a gland opposite each petal. *Stamens* 8, inserted inside the disc. *Ovary* 2-lobed, with 2 cells and a solitary ovule in each. *Style* stout, stigma 2–3-lobed. *Fruit* bi-coccous (usually one suppressed), ovoid, epicarp dry and coriaceous. *Seed* with a small fleshy arillus, *embryo* curved, *cotyledons* plicate. DISTRIB:—about twenty-five species all tropical and mostly American.

ALLOPHYLUS COBBE, Blume Rumphia III, 131. A small tree or shrub; young branches glabrous to tomentose. *Leaves* 3-foliolate; *leaflets* ovate-lanceolate to elliptic-ovate, acute or acuminate, remotely serrate or almost entire, rarely crenate, the base cuneate often oblique and always entire: upper surface glabrous to sparsely pubescent, the lower glaberulous to tomentose; length 1 to 10 in., breadth ·5 to 4 in.; lateral petiolules ·2 to ·3 in., the central twice as long or longer. *Inflorescence* 3 to 9 in. long; the *flowers* small, yellowish or whitish, on short pedicels. *Fruit* globose, ·25 in. in diam., red, shining. Hiern in Hook. fil. Fl. Br. Ind. I, 673: Kurz For. Flora, Burma. I, 299. *Rhus Cobbe*, Linn. Sp. Pl. ed. I, 267. *Ornitrophe Cobbe*, Willd. Sp. Pl. II, 322; Roxb. Fl. Ind. II, 268. *Usubis*

triphylla, Burm. Fl. Ind. 89, t. 32, f. 1. *O. Schmidelia*, Pers. Syn. I, 412. *Schmidelia Kobbe*, Lamk. Ill. II, 443, t. 312, f. 2. *S. Cobbe*, DC. Prodr. I, 610; W. and A. Prodr. 109; Grah. Cat. Bomb. Pl. 29; Wight Ill. I, 141; Wight Ic. t. 964; Thwaites Enum. 55. *Toxicodendrum Cobbe*, Gærtn. Fruct. I, 207, t. 44, f. 5. *O. serrata*, Roxb. Cor. Pl. I, t. 61; Fl. Ind. II, 266. *O. serrata*, DC. *l.c.*; Wight Ill. I, 141; W. and A. Prodr. 110; Benth. Fl. Austral. I, 455; Wall. Cat. 8061 (*O. Malabarica*, Hb. Madr.). *S. racemosa*, Linn. Mant. 67; Wall. Cat. 8059. *O. Aporetica*, Roxb. Hort. Beng. 28; Fl. Ind. II, 264. *Aporetica ternata*, J. R. and G. Forst. Charact. Gen. Pl. 132, t. 66. *O. villosa*, Roxb. Hort. Beng. 28; Fl. Ind. *l.c.* 265. *S. villosa*, Wight Ic. t. 401; Thwaites, *l.c.*; Wall. Cat. 8060. *S. Rheedii*, Wight Ic. t. 964; Spic. Neilgh. Bot. 33. *O. glabra*, Roxb. Hort. Beng. 28; Fl. Ind. *l.c.* 267. *Allophyllus lanatus*, Roxb. Hort. Beng. 88; Fl. Ind. II, 263. *S. distachya*, DC. l.c. 610. *S. Aporetica*, Wall. Cat. 8058; Kurz in Journ. As. Soc. Beng. 1870, II, 74. *S. glabra*, Wall. Cat. 8057; Steud. Nom. ed. 2, II, 531. *Pometia ternata*, G. Forst. Fl. Ins. Austr. Prodr. 74 (1786). ? *S. dentata*, Wall. ex Voigt Hort. Sub. Calc. 93. *Schmidelia* (*Allophyllus*) *ornitrophioides*, Herb. Roxb.; Wall. Cat. 8055. *S. adenophylla*, Wall. Cat. 8063. *S. vestita*, Wall. Cat. 8066. *S. timorensis*, DC. Prodr. I, 611. *S. orientalis*, Sw. Fl. Ind. Occ. II, 666. *S. ternata*, Cambess. in Mém. Mus. Par. XVIII, 24. *O. asiatica*, Hort. ex Steud. Nom. ed. 2, II, 230.—Rheede, Hort. Mal. V, t. 25.

In all the Provinces.—Distrib. British India, the Malayan Archipelago.

A widely distributed and, within certain limits, a variable species to which a variety of names have been given. The synonymy has been most carefully gone into by Mr. Hiern, whose summary of it I have copied bodily from the Flora of British India.

Mr. Hiern has prepared the following table of varieties, which I also copy:—

"Leaflets oval or ovate.

Glabrescent or somewhat hairy.

Leaflets crenate-dentate. Bracts short ... ... *racemosa.*

Leaflets serrate-denticulate. Bracts subulate ... *serrata.*

Shoots and leaves very hairy ... ... *villosa.*

Leaflets oval-oblong or lanceolate-acuminate.

Leaflets subentire or serrulate. Bracts short ... *glabra.*

Leaflets acutely serrate. Bracts long, linear ... *Aporetica.*

Racemes simple, 2 together. Petals not declinate, but the place of the fifth petal vacant ... *distachya.*

Racemes branched, solitary ... ... *Rheedii.*"

3. Dittelasma, Hook. fil.

A tree. *Leaves* alternate, pinnate, exstipulate; *leaflets* subopposite or alternate, entire. *Panicles* terminal, bracteate. *Flowers* polygamo-monœcious. *Sepals* 5, oblong, rounded at the apex, unequal. *Petals* 4, erect, oblong, concave, tomentose outside, the place of the fifth vacant; *scale* large obovate-oblong, densely shaggy-crested, incurved at the apex. *Disc* semilunate-annular, much wider at one side, glabrous. *Stamens* 8, inserted around the base of the ovary, unequal; *filaments* villous, slender at the tip; *anthers* small, shortly exserted. *Ovary* sub-globose, glabrous, 3-lobed, 3-celled, contracted at the apex into a short erect style, stigma shortly 3-lobed; *ovule* solitary in each cell. *Fruit* 1–3-coccous, 2 segments usually smaller or obsolete, rather fleshy, indehiscent. *Seed* globose, exarillate, exalbuminous; testa thick, bony; embryo curved; *cotyledons* large, unequal, incurved; *radicle* short, incumbent.—Distrib. A single species.

Dittelasma Rarak, Hook. fil. in Benth. and Hook. fil. Gen. Plantar. I, 396. A tree 50 or 60 feet high; young branches stout, with pale puberulous bark. *Leaves* 10 to 18 in. long; *leaflets* 6 to 12 pairs, usually oblong-lanceolate, rarely oblong-oblanceolate, often slightly oblique, the apex acute, the base cuneate, quite glabrous; main nerves numerous, faint; length 3 to 4 in., breadth ·75 to 1·5 in., petiolule ·1 in. or less. *Panicles* terminal, erect, many-branched, puberulous, usually shorter than the leaves. *Flowers* ·2 in. long, pale yellow or white. Hiern in Hook. fil. Fl. Br. Ind. I, 672; Kurz For. Flora Burma, I, 297. *Sapindus Rarak*, DC. Prodr. I, 608; Blume Rumph. III. 93, t. 197. ? *S. pinnatus*, Mill. Gard. Dict. No. 3. *S. saponaria*, Lour. Fl. Cochinch. 238 (not of Linn.)—Rumph. Herb. Amboin. II, 134.

Malacca: Griffith, Maingay.—Distrib. Burma, Cochin-China, Java.

4. Erioglossum, Blume.

Trees or shrubs. *Leaves* unequally-pinnate, exstipulate, alternate. *Leaflets* opposite or subopposite, entire. *Panicles* terminal, erect, with elongated racemose branches. *Flowers* polygamo-dicecious, irregular, white. *Sepals* 5, unequal, orbicular, concave, imbricated, the two outer ones smaller. *Petals* 4, unequal, obovate, clawed, the place of the 5th vacant; scale hairy, hooded, with an apical lobed appendage. *Disc* one-sided, lobed. *Stamens* 8, turned to one side; *filaments* unequal, hairy, anthers sub-exserted. *Ovary* stipitate, obcordate, 3-lobed, 3-celled; *style* slender, stigma obscurely 3-lobed; *ovules* solitary in the cells of the ovary, ascending. *Fruit* 1–3-lobed to the base; the lobes oblong, indehiscent, diverging. *Seeds* oblong, exarillate, exalbuminous, testa mem-

branous; *embryo* straight; *cotyledons* thick.—DISTRIB. Species 4, three tropical Asiatic and one African.

ERIOGLOSSUM EDULE, Blume Bijdr. 229. A large shrub or tree; young shoots petioles and rachises of leaves and inflorescence more or less rusty-pubescent. *Leaves* 8 to 20 in. long; *leaflets* 4 to 13, oblong-lanceolate to elliptic, acute or acuminate, slightly oblique especially at the cuneate base, upper surface sparsely puberulous to glabrescent, the midrib tomentose; the lower softly tomentose to glaberulous and usually dark-coloured; main nerves 6 to 10 pairs, length 2·5 to 7 in., breadth ·75 to 2·25 in. *Panicles* sometimes longer than the leaves. *Flowers* on short pedicels, clustered, sub-globular, ·1 to ·15 in. in diam. *Fruit* glabrous, the lobes oblong, ·4 in. long. Benth. Fl. Austral. I, 454; Hiern in Hook. fil. Fl. Br. Ind. I, 672. *E. rubiginosum*, Brand. For. Fl. 108. *Pancovia rubiginosa*, Baill. Kurz For. Flora Burma, I, 296. *Moulinsia cupanioides*, Cambess. in Mém. Mus. Par. XVIII. 27, 40, t. 2. *Sapindus rubiginosa*, Roxb. Cor. Pl. I, 44, t. 62; Fl. Ind. II, 282; W. and A. Prodr. I, 112; Grah. Cat. Bomb. Pl. 29; Wall. Cat. 8041; Griff. Notul. IV, 548; Dalz. and Gibs. Bomb. Fl. Suppl. 14; Wall. Cat. 8041D. *S. fraxinifolius*, DC. Prodr. I, 608. *M. rubiginosa*, G. Don. Gen. Syst. I, 667. *S. longifolius*, Wall. Cat. 8046.

In all the Provinces: rather common.

5. APHANIA, Blume.

Trees or shrubs with pinnate (usually equally) exstipulate rarely with simple leaves; *leaflets* 1 to 6 pairs. *Flowers* in panicles or racemes. *Sepals* 4 or 5, widely imbricate. *Petals* 4 to 6, small, with infolded basal auricles or with a basal scale. *Disc* regular, slightly lobed. *Stamens* 5, rarely 3. *Fruit* deeply divided into 2 (rarely into 3) ellipsoid or sub-3-gonous divergent lobes united only at the base; the endocarp thin cartilaginous or crustaceous.—DISTRIB. about 12 species, tropical Asiatic and African, one in New Guinea.

Leaves pinnate.

Inflorescence racemose ...	...	1. *A. paucijuga.*
Inflorescence paniculate ...	...	2. *A. montana.*
Leaves simple	...	3. *A. Danura.*

1. APHANIA PAUCIJUGA, Radlk. in Sitzb. Bayer. Akad. Math. Phys. IX, (1878), 239. A tree 60 feet high; young branches cinereous-puberulous or glabrous. *Leaves* 5 to 8 in. long, their rachises with 3 faint ridges on the upper surface: *leaflets* 2 to 4, opposite, oblong-lanceolate or elliptic-lanceolate, bluntly acuminate, much narrowed at the base; both surfaces quite glabrous, the upper shining, the lower paler and dull; main nerves 6 to 8 pairs, spreading, not conspicuous:

length 3·5 to 8·5 in., breadth 1·2 to 3 in., petiolules ·2 in. *Racemes* solitary or in pairs, axillary, usually longer than the leaves, slender, adpressed-puberulous, sparsely flowered: *pedicels* slender, bracteoles minute. *Flowers* globular before expansion, ·15 in. in diam. *Sepals* 5, red, orbicular, slightly concave, much imbricate. *Petals* smaller than the sepals, the edges infolded at the base so as to simulate 2 scales, sometimes absent. *Stamens* 8, inserted inside the pentagonous disc; *filaments* hairy at the base; *anthers* short, ovate, obtuse. *Ovary* stalked, compressed, broadly ovate, with short glabrous sub-connate styles, 2-celled. *Fruit* deeply 2-lobed; the *lobes* divergent, obovate, each ·35 in. long, style persistent between the bases of the lobes. *Otophora paucijuga*, Hiern in Hook. fil. Fl. Br. Ind. I, 680.

Malacca: Maingay, No. 462. Perak: Scortechini, No. 1674.

The leaflets in Scortechini's specimens are rather larger than in Maingay's; in other respects they agree.

2. Aphania montana, Blume Bijdr. 236. A shrub; young branches glabrous, minutely lenticellate. *Leaves* 6 to 12 in. long, unequally pinnate: *leaflets* 3 to 5, elliptic to oblong, sub-acute, the base cuneate, both surfaces glabrous and minutely reticulate; main nerves 8 to 10 pairs; length 4·5 to 6 in., breadth 1·75 to 3 in., petiolules ·25 in. *Panicles* axillary, 4 to 9 in. long, solitary or in fascicles of 2 or 3, each with a few lax raceme-like branches, rusty-puberulous. *Flowers* about ·25 in. in diam. *Sepals* 4, in decussate pairs, ovate-rotund. *Petals* 4, ovate, glabrous, the edges fimbriate like those of the sepals; each with a short fimbriate basal scale. *Disc* fleshy, lobed, sub-pubescent. *Stamens* 8, with short thick pubescent filaments inserted inside the disc: *anthers* ovate, slightly sagittate. *Ovary* 2-celled; *style* short, glabrous. *Fruit* 1- usually 2-coccous, fleshy, glabrous: the cocci divaricate, ellipsoid, about ·5 in. long. *Sapindus montanus*, Blume Rumphia, 197: Miq. Fl. Ind. Bat. I, pt. 2. p. 552.

Nicobar and Andaman Islands: King's Collectors. Nicobars: Jelinek.

3. Aphania Danura, Radlk. über die Sapind. Holländ-Indiens, 69. A shrub, all parts except the inflorescence glabrous. *Leaves* simple, sub-verticellate or alternate, sub-coriaceous, oblong, elliptic, oblanceolate or obovate, acute or acuminate, narrowed to the sometimes cordate base: both surfaces reticulate and shining; main nerves 10 to 16 pairs, faint, spreading; length 8 to 12 in., breadth 1·5 to 3·5 in.; petiole ·3 in. to ·1 in., stout. *Panicle* terminal, on a long peduncle, puberulous; the branches spreading, divergent. *Flowers* numerous, pink, bracts minute. *Sepals* 5, unequal, sub-rotund, concave. *Petals* 5, equal, ovate, emarginate, each with a bifid woolly scale at its base. *Disc* annular. *Sta*

6 to 8. *Ovary* 2-celled, stigma bifid. *Fruit* 2-coccous; each coccus ellipsoid, pulpy, ·35 to ·5 in. long. *Sapindus Danura*, Voigt Hort. Bot. Suburb. Calc. 94: Hiern in Hook. fil. Fl. Br. Ind. I, 684; Kurz For. Flora, Burma, I, 298. *Scytalia Danura*, Roxb. Hort. Beng. 29; Fl. Ind. II, 274. *Sc. verticillata*, Roxb. Hort. Beng. 29; Fl. Ind. II, 273. *Euphoria verticillata*, Lindl. Bot. Reg. t. 1059; Wall. Cat. 8052 A, B, C. *Dimocarpus verticillata*, Hb. Roxb. ex Wall. *l.c.* A. *Nephelium verticillatum*, G. Don Gen. Syst. I, 670. *E. Danura*, Wall. Cat. 8051. *Didymococcus Danura*, Blume Rumph. III, 103. *D. verticillatus*, Blume *l.c.*

Nicobar Islands; Kurz.—Distrib. British India.

6. Lepisanthes, Blume.

Trees or shrubs. *Leaves* pinnate, exstipulate, alternate; *leaflets* entire, subopposite. *Inflorescence* axillary or lateral, in paniculate spikes. *Flowers* regular or irregular, polygamo-dioecious. *Sepals* 5–4, widely imbricated in two rows. *Petals* 5–4, equal, each having at the base one or two short wide inflected scales. *Disc* annular, regular or irregular (one-sided). *Stamens* 8 or 10, erect, inserted within the disc. *Ovary* sessile, 3-sided, 3-celled; *ovules* solitary; *style* simple; *stigma* blunt or trigonous. *Fruit* 3-celled, 3-sided, not lobed. *Seeds* solitary, erect, exalbuminous; *cotyledons* very thick, unequal.—Distrib. about 16 species, tropical Asiatic.

Panicles 9 to 12 in. long.			
Fruit 1·5 in. in diam.	...	...	1. *L. Kunstleri.*
Fruit ·8 in. in diam.	...	...	2. *L. andamanica.*
Panicles 1 to 3 in. long.			
Leaflets 4 to 9 in. long	...	...	3. *L. cuneata.*
Leaflets 12 to 18 in. long.			
Fruit tomentose but not echinate		...	4. *L. Scortechinii.*
Fruit tomentose and echinate		...	5. *L. longifolia.*

1. Lepisanthes Kunstleri, King n. sp. A tree 30 to 60 feet high; young branches stout. *Leaves* 30 to 40 inches long, their rachises glabrous: *leaflets* about 12, subopposite, oblong or elliptic-oblong, shortly cuspidate, the base rounded, both surfaces glabrous and reticulate; main nerves 9 to 13 pairs, spreading slightly, ascending; length 6 to 12 in., breadth 2·5 to 3·5 in.; *petiolules* ·3 to ·4 in., stout. *Panicles* slightly supra-axillary, erect, few-branched, shortly pedunculate, 9 to 12 in. long: ultimate branchlets cymose, 3- to 5-flowered, minutely tomentose. *Flowers* ·4 in. long, globular in bud. *Sepals* 5, concave, minutely tomentose outside. *Petals* 5, sericeous in the lower half externally, glabrous in the upper, each with an inflected glabrous bifid basal scale. *Stamens* 8, the filaments sericeous. *Disc* semi-lunar, glabrous.

Ovary (in male flower) rudimentary. *Fruit* sub-globular, with or 3 broad rounded angles, densely rusty-tomentose, 1·5 in. in diam., the pericarp crustaceous: *seeds* 3, large.

Perak: King's Collector, Nos. 4634, 7359.

This resembles *L. montana* to some extent; but has much larger leaves, a more robust and longer inflorescence and larger flowers and fruit. I have not seen female flowers and therefore cannot describe the ovary.

2. LEPISANTHES ANDAMANICA, King n. sp. A tree? young branches pale when dry, glabrous like all the other parts except the inflorescence. *Leaves* 7 to 12 in. long, equally pinnate: *leaflets* 2 to 4, coriaceous, pale when dry, elliptic-oblanceolate, subacute, slightly oblique and much narrowed to the base, both surfaces minutely reticulate; main nerves 5 to 8 pairs, spreading, slightly prominent beneath: length 4 to 7 in., breadth 1·35 to 2·75 in.; petiolules ·2 to ·5 in., stout. *Panicles* 8 to 10 in. long, with 3 or 5 narrow raceme-like puberulous branches, the ultimate branchlets being few-flowered cymelets. *Flowers* ·25 in. in diam., pedicellate. *Sepals* 5, unequal, obovate, blunt, tomentose outside. *Petals* 5, narrowly obovate-oblong, glabrous with a villous claw and a large oblong basal scale. *Stamens* 8, the anthers glabrous and short, the filaments long and villous. *Fruit* sub-globular, with 3 deep vertical ridges, minutely tomentose, slightly apiculate and with a short thick pseudo-stalk, 3-celled, 3-seeded; the pericarp crustaceous, ·8 in. long, and about as broad.

Andaman Islands: King's Collector.

3. LEPISANTHES CUNEATA, Hiern in Hook. fil. Fl. Br. Ind. I, 680. A shrub; young branches tawny-puberulous. *Leaves* 15 to 30 in. long, the rachises puberulous or minutely tomentose; *leaflets* 10 to 14, sub-opposite or alternate, oblong or elliptic-oblong, the apex bluntly and shortly cuspidate, the base much narrowed; both surfaces reticulate, the lower slightly puberulous towards the base; main nerves 8 to 14 pairs, spreading, curving upwards, rather prominent beneath; length 4 to 9 in., breadth 1·5 to 2·75 in., petiolules ·25 to ·35 in. *Panicles* narrow and spike-like, in fascicles of 3 to 5, axillary or slightly above the leaves, 1 to 3 in. long. *Flowers* ·1 in. in diam.; *bracteoles* subulate, minute. *Sepals* sub-rotund, puberulous. *Petals* 5, glabrous, each with a single inflected scale at its base. *Fruit* broadly ovoid, compressed, with a vertical groove, densely and minutely cinereous-tomentose, crowned by the persistent style and obscurely 2-lobed stigma, two-celled and with a single seed in each cell, ·25 in. broad and about the same in length.

Penang: Porter, Curtis, No. 3009. Perak: Wray, Nos. 1400, 1990, 3563: King's Collector, Nos. 3059, 7072.

4. Lepisanthes Scortechinii, King n. sp. A tree? *Leaves* 2 to 3 feet long, abruptly pinnate: *leaflets* usually 8, sub-opposite, elliptic-oblong, the apex shortly acuminate, the base slightly cuneate; both surfaces glabrous except the midrib and nerves on the lower; main nerves 12 to 14 pairs, spreading, bold beneath and puberulous; length 12 to 18 in., breadth 5 to 7 in.; *petiolules* ·75 to 1 in. long, stout. *Panicles* narrow, raceme-like, axillary, only 2 in. long, pubescent; *bracts* and bracteoles narrow, ·25 in. long; *pedicels* hairy, ·25 in. long: *flower-buds* sub-compressed, ·3 in. in diam. *Sepals* 5, concave, widely imbricate. *Petals* 5, each with a recurved scale at its base. *Disc* glabrous. *Stamens* 8, the filaments hairy, the anthers oblong. *Rudimentary ovary* (in male flower) hairy. *Fruit* sharply 3-angled, with three deep vertical grooves, densely but minutely rusty-tomentose, 1 in. long and about as broad.

Perak: Scortechini, No. 2090.

Fr. Scortechini's specimens are in fruit only. The above description of the flower has been compiled from his field notes on his specimens. The species is notable for its large leaflets.

5. Lepisanthes longifolia, Radlkofer über die Sapindaceen Holländisch-Indiens, p. 35. A shrub 8 to 20 feet high: young parts and inflorescence minutely rusty-tomentose. *Leaves* 2 to 2·5 feet long; *leaflets* about 6, opposite or sub-opposite, narrowly oblong, shortly acuminate or acute, the base narrowed, glabrous on both surfaces; main nerves 14 to 18 pairs, spreading; length 12 to 15 in., breadth 2 to 4 in.; *petiolules* ·4 to ·8 in., puberulous like the rachis. *Racemes* solitary or crowded, sometimes branched, axillary or supra-axillary, 2 to 3 in. long. *Flowers* ·5 in. long, tomentose; *bracteoles* subulate, about ·15 in. long. *Petals* 5, obovate-oblong; the *basal* scale single, short, hairy, flat, entire or bifid. *Fruit* depressed-globular, trigonous and with 3 broad vertical furrows, softly echinate and densely rusty-tomentose, length 1 in., breadth about ·8 in. *Hemigyrosa longifolia*, Hiern in Hook. fil. Fl. Br. Ind. I, 671.

Malacca: Griffith, Maingay, No. 446. Perak: King's Collector, Nos. 5539, 8465, 10220.

An uncommon tree of which only a few specimens exist in collections.

7. Otophora, Blume.

Trees or shrubs. *Leaves* alternate, pinnate, stipulate; *leaflets* entire. *Inflorescence* axillary and terminal. *Flowers* regular, polygamous. *Sepals* 4 or 5, concave, widely imbricated. *Petals* 5, rarely 4, smaller than the sepals, somewhat squamate by inflexion of the subauriculate

base. *Disc* complete, annular, crenulate or entire. *Stamens* 8–9 rarely 5, inserted within the disc; *filaments* very short; *anthers* oblong, included. *Ovary* ovate or elliptic, 2- to 3-celled; *ovules* solitary, ascending; *stigma* subsessile, obtuse, obsoletely 3–4-rayed. *Fruit* baccate, not lobed, indehiscent, 3–4- or by abortion 2–1-celled; *seeds* arillate; *embryo* straight; *cotyledons* thick.—Distrib. Species about 12, confined to the Malay Peninsula and Archipelago.

Leaflets sessile ... ... 1. *O. sessilis.*
Leaflets petiolulate ... ... 2. *O. erythrocalyx.*

1. Otophora sessilis, King n. sp. A shrub or small tree. *Leaves* 30 or 40 in. long, the base of the petioles slightly swollen: *leaflets* about 10 or 12, sessile, alternate or sub-opposite, coriaceous, broadly oblong or elliptic-oblong, shortly cuspidate, the base slightly narrowed and often minutely cordate: both surfaces glabrous and reticulate, the upper olivaceous when dry, the lower pale brown: main nerves 9 to 15 pairs, spreading, slightly prominent on both surfaces; length 8 to 12 in., breadth 2·75 to 4 in.; *stipules* at the very base of the petiole, ovate-rotund, 2 to 2·5 in. long. *Panicles* axillary, 8 to 10 in. long, consisting of 2 or 3 narrow raceme-like branches. *Flowers* ·25 in. in diam., polygamous. *Sepals* 4, obovate or sub-rotund. *Petals* 4, elliptic, with inflexed scale-like sericeous bases. *Stamens* 6, with short glabrous filaments. *Fruit* ellipsoid, compressed, glabrous, not lobed, nearly 1 in. long and about half an inch broad.

Perak; King's Collector, Nos. 2460, 5043.

This resembles *O. erythrocalyx*, Hiern, but has sessile leaflets which, as well as the stipules, are moreover larger than those of *O. erythrocalyx*.

2. Otophora erythrocalyx, Hiern in Hook. fil. Fl. Br. Ind. I, 680. A small glabrous tree. *Leaves* 30 to 45 in. long, the petioles thickened at the base: *leaflets* 14 to 19, coriaceous, opposite or alternate, elliptic-oblong to elliptic, shortly cuspidate, the base cuneate, both surfaces glabrous and reticulate, the upper olivaceous, the lower brown when dry; main nerves 10 to 13 pairs, spreading, prominent beneath: length 5 to 8 in., breadth 1·5 to 3 in.; petiolules ·4 in., stout: *stipules* ovate, 6 in. long. *Panicles* large, many-branched, 20 to 30 in. long (or even longer), *pedicels* slender. *Flowers* ·15 to ·2 in. long, on slender pedicels. *Sepals* 5, red. *Petals* 5, pale-rose-coloured, each with short inflexed basal scales. *Stamens* 8, filaments thick and hairy; *anthers* pointed, hairy. *Disc* glabrous. *Ovary* 3-gonous, glabrous, the stigma sessile, 3-grooved. *Fruit* ovoid, 3-gonous, glabrous, 1·5 in. in diam., 3-celled; *seeds* arillate.

Malacca: Maingay, No. 447.

8. Xerospermum, Blume.

Trees. *Leaves* alternate, exstipulate, abruptly pinnate; *leaflets* opposite, entire. *Racemes* axillary and terminal. *Flowers* regular, polygamo-dioecious. *Sepals* 4–5, imbricated in 2 rows. *Petals* 4-5, equal, spathulate, shorter or but little longer than the sepals, without basal scales. *Stamens* 8–7, included, inserted within the annular glabrous disc. *Ovary* sessile, didymous, muricated, 2-celled; *ovules* solitary in each cell, ascending. *Style* short, thick; *stigma* thick, hairy. *Fruit* 1–2-lobed; the *lobes* ellipsoidal, diverging, muricated with pyramidal tubercles, indehiscent, glabrous inside. *Seeds* exarillate; *testa* coriaceous outside, fleshy, pilose, simulating an aril; *embryo* curved; *cotyledons* very large, thickly fleshy, superposed.—Distrib. 3 or 4 species all Malayan.

Sepals and petals 5; leaflets only a single pair ... ... 1. *X. laevigatum.*

Sepals and petals 4; leaflets 1 or 2 pairs.

Leaflets 3 to 6 in. long, minutely reticulate; fruit ellipsoid, muricate, not compressed 2. *X. muricatum.*

Leaflets 4·5 to 8 in. long, transversely reticulate; fruit obliquely elliptic, compressed 3. *X. Wallichii.*

1. Xerospermum laevigatum, Radlk. in Sitzb. Bayer. Akad. Math. Phys. 1878, p. 305. A perfectly glabrous tree. *Leaves* about 4 in. long, with only a single pair of coriaceous elliptic-oblong minutely reticulate shortly acuminate leaflets, 2·25 to 3 in. long and 1 to 1·25 in. broad; their *petiolules* about ·2 or ·25 in. long, slender. *Racemes* terminal and axillary, usually in fascicles of 2 or 3, often with a few branchlets. *Flowers* about ·15 in. in diam., or slender pedicels. *Sepals* 5, rotund, glabrous. *Petals* 5, spathulate, the limb densely woolly, the claw slender. *Stamens* 5; the *filaments* long and woolly, the anthers small and glabrous. *Disc* annular, fleshy, glabrous, waved. *Ovary* tomentose, 2-celled. *Fruit* with 2 or usually only with 1 sharply muricate obovate-ellipsoid compressed coccus, 1·35 in. long and ·85 in. broad.

Malacca: Griffith (Kew Distrib.), No. 1006/1. Penang: Curtis, No. 846. Perak: Scortechini, No. 1019. Pahang: Ridley, No. 2641.

2. Xerospermum muricatum, Radlk. über die Sapind. Holländ.-Indiens, 37, 70. A tree 50 to 80 feet high: *branches* glabrous, dark-coloured when dry. *Leaves* 4 to 9 in. long, equally pinnate: *leaflets* 2 or [illegible], elliptic-oblong to elliptic, shortly acuminate, the base cuneate; both [illegible]rfaces glabrous and minutely reticulate: main nerves 7 to 9 pairs, [illegible]cending, depressed on the upper, prominent on the lower surface:

length 3 to 6 in., breadth 1·35 to 2 in., petiolules ·35 in. *Racemes* axillary, usually with a few short branchlets, bracteoles small, pedicels as long as the flower-buds. *Flowers* ·2 in. in diam. *Sepals* 4, rotund, nearly glabrous but with ciliate edges. *Petals* 4, shorter than the sepals, the limb rusty-villous. *Disc* fleshy, waved. *Stamens* 8, the filaments pubescent towards the apex, the anthers glabrous. *Fruit* usually reduced by abortion to only one lobe, sharply muricate, 1·25 in. long and ·75 in. in diam. *Xerospermum Norhonianum*, Hiern (not of Blume) in Hook. fil. Fl. Br. Ind. I, 686 (in part); Kurz For. Flora Burma, I, 295. *Nephelium muricatum*, Griffith MSS.

Malacca: Griffith, No. 1004; Maingay, Nos. 444 and 458 also 443 in part; Derry. Perak: very common, King's Collector, Scortechini. Singapore: Ridley.—Distrib. Burma.

Though closely allied to *X. Norhonianum* Radlk. this has more sharply muricated fruit.

2. Xerospermum Wallichii, King, n. sp. A tree 30 to 40 feet high; young branches glabrous, dark-coloured when dry. *Leaves* 12 to 18 in. long, equally pinnate; *leaflets* two pairs, coriaceous, elliptic or obovate-elliptic, shortly and bluntly cuspidate, much narrowed below the middle to the base, both surfaces glabrous and transversely reticulate: main nerves 5 to 7 pairs, depressed on the upper prominent on the lower surface, ascending; length 4·5 to 8 in., breadth 2·25 to 4 in.; petiolules ·25 to ·45 in., stout. *Racemes* axillary, 2 to 4 together, 1 to 2 in. long. *Flowers* ·15 in. in diam. when open, pedicellate. *Sepals* 4, rotund, concave, glabrous but with minutely ciliate edges. *Petals* 4, smaller than the sepals, sub-rotund, with very short claws, densely lanate. *Stamens* 8; *filaments* short and lanate, anthers short and glabrous. *Disc* annular, glabrous, fleshy. *Ovary* broad, compressed, 2-lobed and 2-celled, pubescent. *Fruit* usually with 2 cocci but often with only one, obliquely elliptic, slightly compressed, rarely sub-globular, minutely rugulose, not muricate, when ripe 1·25 in. long and ·75 in. broad. Wall. Cat. Nos. 8083, 8084.

Singapore and Penang: Wallich. Perak: Wray, Nos. 3419, 3580: King's Collector, Nos. 8725, 10611, and 10945. Pahang: Ridley, No. 2570.

Ridley's Pahang specimen has nearly globular fruit. But in other respects it exactly resembles those from the other provinces.

9. Nephelium, Linn.

Trees or shrubs. *Leaves* alternate, exstipulate, pinnate, the leaflets entire. *Inflorescence* terminal and axillary, paniculate or panicula racemose or racemose. *Flowers* regular, polygamous. *Calyx* 4- to

lobed, usually cupular, sub-valvate in bud. *Petals* small, villous, rarely with 2 scales, often absent. *Stamens* 6 to 8, inserted within the fleshy glabrous or pubescent disc; *filaments* usually pubescent. *Ovary* pubescent, often verrucose or setose, 1–2- or rarely 3-lobed, the lobes with 1 cell and 1 ovule. *Fruit* 1- rarely 2-coccous, indehiscent, oblong or globose, echinate, tubercled or smooth. *Seed* ellipsoid or globose, covered by a pulpy arillus; *cotyledons* fleshy, not folded.—Distrib. About twenty species chiefly Malayan.

Besides the ten species described below, there are in the Calcutta Herbarium specimens of six other species which I am unable to identify with any published species but which, for want either of flowers or of fruit, I am unable to describe.

Leaflets quite glabrous on both surfaces.
- Fruit rugulose but not at all spiny.
  - Leaflets elliptic, fruit gibbous at the base — 1. *N. glabrum.*
  - Leaflets oblong or ovate-lanceolate, fruit not gibbous at the base ... ... — 2. *N. Longana.*
- Fruit with short glabrous spines ... — 3. *N. rubescens.*
- Fruit with long sub-compressed puberulous flexuose stout setae ... ... — 4. *N. lappaceum.*

Leaflets glabrous on the upper surface, subglaucous and minutely puberulous on the lower surface, never rusty; fruit covered with stout woody spines.
- Petals 5... ... ... — 5. *N. costatum.*
- Petals 0.
  - Leaflets with 9 to 13 pairs of main nerves — 6. *N. chryseum.*
  - Leaflets with 16 to 24 pairs of main nerves — 7. *N. hamulatum.*

Leaflets glabrous on the upper surface, the lower surface more or less rusty-puberulous or pubescent.
- Petals 0; fruit densely covered with flexuose compressed soft spines ... ... — 8. *N. ophiodes.*
- Petals 5.
  - Leaflets oblong, rarely obovate-oblong; fruit densely covered with flexuose compressed soft spines ... ... — 9. *N. eriopetalum.*
  - Leaflets elliptic, fruit slightly tubercled or almost smooth ... ... — 10. *N. malaiense.*

Doubtful species ... ... — 11. *N. sufferugineum.*

1. Nephelium glabrum, Noronha in Batav. Genootsch. Nerh. V, 80. A tree 60 to 80 feet high; young branches glabrous. *Leaves* 7 to 11 in. long: *leaflets* 4 to 6, coriaceous, elliptic, acute or very shortly and

bluntly acuminate, entire, the base cuneate: both surfaces glabrous and reticulate; main nerves 8 to 10 pairs, spreading and curving upwards; length 3 to 4·5 in., breadth 1·5 to 2·25 in., petiolules ·4 to ·6 in. *Panicles* shorter than the leaves, formed of several slender puberulous raceme-like branches bearing the flowers in few-flowered cymules. *Flowers* less than ·1 in. in diam., diœcious. *Male flower: sepals* 5, rotund, pubescent; *petals* 0; *stamens* 6 or 7, the filaments pubescent, exserted; the *ovary* rudimentary. *Female flower: calyx* 5-toothed, pubescent; *stamens* not exserted, the filaments very short; *ovary* obovate-oblong, 1-celled (the other cell aborted) rugulose, pubescent; the style from the base of one side of it, recurved at the apex, not bifid. *Fruit* narrowly oblong or clavate, slightly gibbous at the base, sub-glabrous, rugulose but not echinate, 1 in. or more in length, and ·6 or ·7 in. broad. Reinw. in Blume's Cat. Hort. Bot. Bogor.; Hassk. Pl. Jav. Rar. 290; Hiern in Hook. fil. Fl. Br. Ind. I, 687. *Euphoria glabra*, Bl. Bijdr. 233. *Nephelium Maingayi*, Hiern in Hook. fil. Fl. Br. Ind. I, 688. *N. lappaceum*, Linn. var. *glabrum*, Bl. Radlk. über die Sapindac. Holländisch-Indiens, 73, 74.

Malacca: Griffith, Maingay, Derry, Nos. 60, 1171. Singapore: Ridley, Nos. 6210, 6212, 6531, 6070. Perak: Scortechini; King's Collector, Nos. 1058, 3789, 5346, 10621.

This species differs from *N. lappaceum* in so many respects that I cannot at all agree in the view, even although it be held by so great a master of the order as Professor Radlkofer, that it is a mere variety of that species. The one-celled ovary, single style and stigma appear to me to distinguish it at once, not to mention the absence of setae on the ripe fruit and the more slender inflorescence and smaller flowers.

2. Nephelium Longana, Camb. in Mém. Mus. Par. XVIII, 30. A tree 30 to 40 feet high: young shoots rusty puberulous. *Leaves* 4 to 18 in. long, equally or unequally pinnate, the rachis rusty-puberulous when young afterwards glabrous: *leaflets* coriaceous, oblong or ovate-lanceolate sometimes slightly oblique, shortly acuminate, the base cuneate: both surfaces glabrous and reticulate, the lower glaucous; main nerves 10 to 14 pairs, spreading, rather prominent beneath; length 2·5 to 7 in., breadth 1 to 2 in., petiolules ·3 to ·5 in. *Panicles* terminal and axillary, many-branched, puberulous; branches raceme-like, with ultimate lateral condensed cymules. *Flowers* pedicelled, about ·15 in. in diam. *Calyx* tomentose, deeply 5- to 6-lobed. *Petals* 5 or 6, linear-spathulate, pubescent, nearly as long as the calyx-lobes. *Stamens* 6 to 10, included in the female exserted in the male flowers, the filaments pilose towards the base; *anthers* short and glabrous. *Ovary* 2-3-lobed, tubercled. Fruit-lobe usually solitary by abortion, globular or (in var. *hypoleuca*) ovoid, the epicarp yellowish-red and muricate-areolate, when globose ·5 to ·75

in. in diam. *Seed* solitary, enveloped in a fleshy pale sub-acid arillus. Bot. Mag. t. 4096; W. and A. Prodr. 113; Grah. Bomb. Pl. 29; Blume Rumph. III, 108; Dalz. and Gibs. Bomb. Fl. 35; Thwaites Enum. 58; Miq. Fl. Ind. Bat. I, Pt. 2, 556; Hiern in Hook. fil. Fl. Br. Ind. I, 688, (in part); Trimen Flora Ceylon, I, 309. *N. Mora*, Gardn. ex Thwaites *l. c.* *N. Bengalense*, G. Don Gen. Syst. I, 570. *Scytalia bengalensis*, Roxb. ex G. Don *l. c.* *Sc. Longan*, Roxb. Hort. Beng. 29; Fl. Ind. II, 270. *Dimocarpus Longan*, Lour. Fl. Cochinch. 233; Trans. Hort. Soc. II, t. 28. *Euphoria Longana*, Lamk. Dict. III, 574; Bot. Reg. t. 1729; Bedd. Fl. Sylv. t. 156; Wall. Cat. 8049. *Sapindus bengalensis*, Roxb. ex W. and A., *l. c.* *Dimocarpus undulatus*, Wight ex W. and A., *l. c.* *E. undulata*, Hb. Heyne ex Wall. *l. c.* *S. monogyna*, Hb. Heyne *l. c.* *D. pupilla*, Moon Cat. 31. *N. pupillum*, Wight Ill. I, 141. *Euphoria pupillum*, Steud. Nom. ed. 2, II, 192.

In most of the Provinces, but probably cultivated.—Distrib. The Tropics generally.

Var. *hypoleuca*, King. Fruit ovoid, 1 to 1·5 in long. *N. hypoleucum*, Kurz in Journ. As. Soc. Bengal for 1871, II, 50: for 1874, II, p. 183: and for 1875, II, p. 187; For. Flora Burma, I, 293: Radlk. Sapind. Holl.-Ind. 28.

Malacca: Maingay, No. 440.—Distrib. Burma.

Hiern reduces *N. hypoleucum* without recognising it as even a variety. Radlkofer, on the other hand regards it as a distinct species. But beyond its oval fruit, I do not see how it differs from typical *N. Longana*, L., and I therefore treat it as a variety of the latter.

3. Nephelium rufescens, Hiern in Hook. fil. Fl. Br. Ind. I, 688. A tree 50 to 60 feet high: young branches cinereous-puberulous, soon becoming glabrous. *Leaves* 6 to 12 in. long: *leaflets* 6 to 10, coriaceous, narrowly oblong or lanceolate-oblong, shortly and bluntly acuminate, entire, the base cuneate or rounded; both surfaces quite glabrous and finely reticulate; main nerves 8 to 14 pairs, faint, spreading; length 2 to 5·5 in., breadth ·75 to 1·65 in., petiolules ·15 to ·25 in. *Panicles* axillary or terminal; the branches racemose, puberulous. *Flowers* rather crowded, pedicellate, ·2 in. in diam. *Calyx* with 5 deep ovate segments with broad bases and acute apices, pubescent. *Petals* 5, narrowly lanceolate, hairy. *Disc* small, glabrous. *Stamens* about 8, exserted, the anthers short and broad, the filaments pubescent. *Ovary* with 2 ovate lobes, villous, 2-celled; *style* stout, shortly divaricate at the apex. *Fruit* with usually only one narrowly-ellipsoid stoutly-echinate glabrous lobe 1·25 in. long and ·5 in. in diam.: the spines short and hollow, compressed and glabrous. Radlk. Sapind. Holl.-Ind. 76. *Euphoria Litchi*, Wall. Cat. 8048 G. and H.

Malacca: Griffith, No. 996; Maingay, No. 452. Singapore: Wallich, Ridley, Nos. 5095, 6211. Perak: King's Collector, Nos. 6523, 6750.

4. NEPHELIUM LAPPACEUM, Linn. Mant. I, 125. A tree 30 to 60 feet high: young branches rusty-pubescent. *Leaves* 4 to 10 in. long: *leaflets* 4 to 6, elliptic, sub-obovate-elliptic or elliptic-oblong, sub-acute, entire, the base cuneate: both surfaces glabrous and minutely reticulate; main nerves 7 to 9 pairs, ascending, prominent beneath; length 2·5 to 6 in., breadth 1·25 to 3 in., petiolules ·2 to ·25 in. *Panicles* shorter than the leaves, tomentose, terminal and axillary, with numerous racemose branches. *Flowers* ·1 in. in diam., in cymose fascicles on the branches. *Sepals* 4 to 6, sub-valvate. *Petals* 0. *Stamens* 5 to 8, exserted, the filaments pubescent. *Ovary* 2–3-lobed and 2–3-celled, pubescent and echinate. *Style* stout, deeply 2–3-lobed; the *lobes* divergent, recurved. *Fruit* usually with 1 or 2 lobes, each elliptic and densely covered with long sub-compressed recurved soft puberulous setae with broad bases, yellowish-orange to dark purple when ripe, 1 in. long, and ·75 in. in diam. (excluding the setae); aril of the seed pale, fleshy, edible. Gærtn. Fruct. II, 272, t. 140, f. 1; Blume Rumph. III, 103: Lamk. Ill. t. 764; Hassk. Pl. Jav. Rar. 287; Miq. Fl. Ind. Bat. I, pt. 2, p. 554; Hiern in Hook. fil. Fl. Br. Ind. I, 687. *Euphoria Nephelium*, DC. Prodr. I, 612; Bl. Bijdr. 235; Wall. Cat. 8053 (excl. part of B). *Scytalia Ramboutan*, Roxb. Hort. Beng. 29; Fl. Ind. II, 271. *Dimocarpus crinita*, Lour. Fl. Cochinch. 234. *N. echinatum*, Noronh. in Batav. Genootsh. Verh. V, 80.

In all the Provinces except the Nicobars and Andamans: often cultivated for its fruit which is known as the *Ram Boutan*.

5. NEPHELIUM COSTATUM, Hiern in Hook. fil. Fl. Br. Ind. I, 688. A tree 50 to 60 feet high: young branches puberulous, slightly lenticellate. *Leaves* 6 to 12 in. long, equally pinnate: *leaflets* 4 to 10, coriaceous, oblong-lanceolate to elliptic, the apex sub-acute or shortly and bluntly acuminate, the base slightly narrowed but rounded, upper surface glabrous, the lower minutely puberulous near the nerves but becoming glabrescent, sub-glaucous; main nerves 10 to 18 pairs, spreading, prominent beneath: length 2·75 to 5·5 in., breadth 1·25 to 1·75 in., petiolules ·25 in. *Panicles* usually 3 or 4 together, mostly axillary, 4 to 6 in. long, puberulous, the branches short, racemose. *Flowers* ·2 in. in diam., pedicelled, in short cymules. *Sepals* 5, sub-rotund, thick, minutely tomentose outside and pubescent inside. *Petals* 5, much smaller than the sepals, spathulate, villous. *Disc* large, flat, glabrous. *Stamens* 8 to 12, exserted, the filaments hairy at the base, the anthers glabrous. *Ovary* broadly ovate, 2-lobed, covered with course villi; *style* short, stout, simple. *Fruit* of two or usually of only one sub-globular lobe densely covered with long stout curved puberu-

lous blunt setae, diam. (when not quite ripe and to the ends of the setae) ·75 in. Radlkofer Sapind. Holl.-Ind. 76.

Malacca, Maingay, No. 454. Perak: Scortechini, Nos. 30, 1992.

6. NEPHELIUM CHRYSEUM, Blume Rumphia, III, 105. A tree 30 to 50 feet high: young branches puberulous or glabrescent. *Leaves* 6 to 12 in. long; their rachises slender, cinereous-puberulous: *leaflets* 4 to 8, sub-coriaceous, oblong to elliptic-oblong, shortly and often rather bluntly acuminate; the base much narrowed and sometimes oblique; upper surface glabrous and shining, the lower sub-glaucous and sparsely puberulous; main nerves 9 to 13 pairs, spreading and curving: length 2·5 to 5 in., breadth 1·25 to 1·75 in., petiolules ·15 in. *Panicles* axillary, solitary or several together, 3 to 4 in. long, with few raceme-like branches; the flowers shortly pedicelled and in small clusters, ·15 in. in diam. *Calyx* deeply cut into 5 or 6 broadly-oblong blunt teeth, minutely tomentose. *Petals* 0. *Stamens* 7 or 8, exserted or not; the anthers broadly ovate, sparsely pubescent; the filaments short, pubescent. *Disc* sub-glabrous, sulcate. *Ovary* compressed, reniform, bilobed, rusty-pubescent; the style stout, pubescent, longer than the ovary, bifid at the apex, the lobes recurved. *Fruit* usually 1-lobed, sub-globose, densely covered with conical compressed striate woody spines, diam. to the tips of the spines about 2 in.: *seed* with a large succulent aril. Miq. Fl. Ind. Bat. Vol. I, pt. 2, p. 554. *Euphoria chrysea* Korth. MSS.

Perak: King's Collector, Scortechini. Selangor; Ridley No. 407. Singapore: Ridley, Nos. 6358, 6374.—DISTRIB. Borneo.

7. NEPHELIUM HAMULATUM, Radlk. üb. Sapind. Holl.-Ind. 78. A tree; young branches rusty-puberulous. *Leaves* 10 to 15 in. long, their rachises rusty-puberulous: *leaflets* 6 to 10, oblong, shortly acuminate, rarely acute, the base cuneate; upper surface minutely reticulate and glabrous except the puberulous midrib; the lower sub-glaucous, covered with very minute pale pubescence, the 16 to 24 pairs of spreading nerves rusty-pubescent and very prominent; length 2·5 to 4·5 in., breadth 1 to 1·75 in., petiolules ·15 in. *Panicles* terminal or axillary, 4 to 6 in. long; the branches few, slender and raceme-like, densely tomentose. *Flowers* ·1 in. in diam., numerous, in small cymules, on pedicels a little longer than themselves. *Calyx* tomentose outside, deeply divided into 4 broad rather unequal blunt segments. *Petals* 0. *Stamens* 6 or 7, exserted, the anthers broadly-ovate and sub-glabrous, the filaments long and pubescent. *Ovary* 2-lobed, rusty-villous. *Fruit* with only a single lobe developed, ovoid, densely covered with stout rusty-puberulous woody spines with broad slightly compressed sub-glabrous bulbous bases, nearly 1·5 in. long to the tips of the spines, and 1 in. or more in diam.

Malacca: Maingay, No. 450; Derry, Nos. 1094, 1304, 1882.

8. Nephelium ophiodes, Radlk. Sapind. Holl.-Ind. 78. A tree 50 to 80 feet high: young branches rusty-puberulous. *Leaves* 12 to 18 in. long, their rachises 3-angled; *leaflets* 6 to 10, very coriaceous, oblong, rarely elliptic-oblong, very shortly and bluntly acuminate, the base slightly narrowed and oblique; upper surface glabrous, the lower minutely scaly and rusty-puberulous; main nerves 15 to 18 pairs, spreading and curving upwards, slightly depressed on the upper bold and prominent on the lower surface; length 6 to 8 in., breadth 2 to 2·5 in., petiolules ·2 to ·25 in. *Panicles* axillary or terminal, sometimes pedunculate, 8 to 16 in. long, much branched, rusty-tomentose. *Flowers* ·15 in. in diam., shortly pedicelled. *Calyx* tomentose, deeply divided into 5 or 6 broadly triangular acute lobes. *Petals* 0. *Disc* glabrous. *Stamens* 6 to 8, slightly if at all exserted: *filaments* subulate, pubescent; *anthers* short and puberulous. *Ovary* abortive on one side, broadly ovoid, densely setose-pubescent, 1-celled. *Fruit* with only one lobe developed, oblong-ovoid, densely covered with long flexuose puberulous setae, 1·5 in. long and 1 in. in diam. *N. eriopetalum*, Hiern in Hook. fil. Fl. Br. Ind. I, 689 (in part).

Malacca: Maingay, No. 453. Perak: King's Collector, Nos. 5481, 7140.

9. Nephelium eriopetalum, Miq. in Fl. Ind. Bat. Suppl. 508. A large tree: the young parts, the rachises of the leaves, the under surfaces of the leaflets and the inflorescence minutely rusty- or fulvous-tomentose or pubescent. *Leaves* 12 to 24 in. long: *leaflets* 6 to 10, thickly coriaceous, oblong, rarely obovate-oblong, sub-acute, slightly narrowed to the rounded or cuneate base: upper surface glabrous and shining except the tomentose midrib; the lower brown, tomentose or pubescent, with the 16 to 24 pairs of spreading main nerves and the transverse reticulations prominent; length 4 to 12 in., breadth 1·65 to 4 in., petiolules ·25 to ·35 in., tomentose, stout. *Racemes* in small clusters in the leaf-axils, pendent, 4 to 10 in. long (longer in fruit); the flowers in glomeruli, shortly pedicelled, ·25 in. in diam. *Calyx* with 5 deep triangular sub-acute spreading teeth, pubescent externally, glabrescent internally. *Petals* 5 or fewer, oblong and blunt, or subspathulate, much narrower than the calyx-teeth, pubescent. *Disc* lobulate, pubescent. *Stamens* about 10, not exserted, anther oblong, filament short, both sparsely pubescent. *Ovary* slightly compressed, 2-lobed, rusty-setose: *styles* 2, longer than the ovary, pubescent, divaricating, recurved. *Fruit* ovoid, densely covered with flexuose compressed puberulous soft spines, about 2 in. long (measured to the ends of the spines) and about 1·5 in. in diam. Hiern in Hook. fil. Fl. Br. Ind. I, 689.

Malacca: Maingay, No. 448. Singapore: Ridley, Nos. 4584, 6022. Perak: Scortechini, No. 143: Wray, No. 1300.—Distrib. Sumatra.

10. Nephelium Malaiense, Griff. Notul. IV, 549. A tree; young branches with much scurfy tawny minute pubescence and elongated lenticels in rows. *Leaves* 10 to 14 in. long, their rachises angled and covered with minute tawny scurfy tomentum; *leaflets* 6 to 8, sub-opposite, thinly coriaceous, usually elliptic, sometimes elliptic-oblong, shortly cuspidate, very slightly narrowed to the rounded slightly oblique base; upper surface glabrous, the lower with small hairs on the nerves and prominent reticulations; main nerves 15 to 18 pairs, spreading; length 3·5 to 5 in., breadth 2 to 2·5 in.; petiolules ·15 in., tomentose. *Panicles* terminal, minutely rusty-glandular-tomentose, 6 to 9 in. long, branches rather numerous. *Flowers* in fascicles on the raceme-like branches, shortly pedicelled, ·25 in. in diam. *Calyx* pubescent, with 5 deep ovate-rotund obtuse lobes. *Petals* 5, about as long as the calyx-lobes but narrower, obovate, villous inside. *Stamens* 8, short, scarcely exserted; *anthers* glabrous, shorter than the filaments. *Ovary* 2-lobed, rusty-setose, the style about as long as the ovary; the *stigma* capitate, 2-lobed. *Fruit* (*fide* Hiern) slightly tubercled or almost smooth, globose, ·65 to ·75 in. in diam. *Seed* globular, its arillus fleshy.

Malacca: Griffith, No. 999; Maingay, No. 455.

I have not seen the fruit of this, and the description above given is copied from Hiern.

Doubtful species.

11. Nephelium sufferugineum, Radlk. üb. Sapind. Holländ.-Ind. 77. A tree: young branches minutely rusty-tomentose. *Leaves* 6 to 8 in. long, the rachises puberulous: *leaflets* 2 pairs, thinly coriaceous, elliptic or obovate-elliptic, sub-acute, the base cuneate; upper surface glabrous and minutely reticulate, the lower minutely densely adpressed-puberulous; main nerves 9 to 11 pairs, ascending, rather straight, prominent on the lower surface; length 2·75 to 4 in., breadth 1·75 to 2·25 in., petiolules ·2 in. *Panicles* about as long as or shorter than the leaves, crowded, axillary, rusty-pubescent, their branches racemose. *Flowers* ·2 in. in diam., shortly pedicelled. *Calyx* rusty-tomentose, deeply cut into 5 broadly ovate sub-acute lobes. *Petals* 0. *Disc* glabrous. *Stamens* about 8, the anthers glabrous, the filaments subulate and hairy. *Ovary* not lobed, sub-globular, rusty-pubescent, much shorter than the simple sub-glabrous style.

Malacca: Griffith, No. 1000.

I have not seen fruit of this; but Radlkofer describes it as follows: "fructus aculeis brevioribus e basi obconica filiformibus hamato-gatis glabris laxius muricatis." The fruit thus attributed to the cies is however not attached to the branches in Griffith's specimens,

which are the only ones known. It is therefore doubtful whether they really belong to the former which, but for the pubescence on the under surface of the leaves, might belong to *N. glabrum*, Noronha.

10. Pometia, J. R. & G. Forst.

Tall trees. *Leaves* alternate, pinnate; leaflets subopposite, entire or serrate (the lowest pair usually stipuliform). *Racemes* simple or panicled, elongated, slender. *Flowers* regular, polygamous, fascicled, small, shorter than their pedicels. *Calyx* cup-shaped, 5-4-fid, valvate in bud. *Petals* 5–4, small, usually without scales. *Disc* complete, annular, lobed. *Stamens* 4–8, usually 6–4, inserted within the disc, at length much exserted; *anthers* small. *Ovary* 2–3-coccous and -celled; *ovules* solitary. *Style* elongated; *stigma* obtuse, emarginate. *Fruit* 1–2-coccous; *lobes* subglobose or ellipsoidal, indehiscent, smooth. *Seeds* exalbuminous, covered with a mucilaginous aril.—Distrib. Species about 4, in Malaya Ceylon and Australasia.

Calyx and leaflets quite glabrous, panicles subglabrous...	1. *P. macrocarpa.*
Calyx always pubescent, leaflets glabrous or pubescent; inflorescence puberulous or pubescent.	
Leaves 12 to 24 in. long	2. *P. pinnata.*
Leaves 3 to 8 in. long	
Leaflets oblanceolate, caudate-acuminate; petals oblong, much longer than the calyx; panicles much longer than the leaves ...	3. *P. gracilis.*
Leaflets oblong or oblong-oblanceolate, not caudate-acuminate; petals often absent, if present rotund and not much exceeding the calyx; panicles not longer than the leaves	4. *P. alnifolia.*

1. Pometia macrocarpa, Kurz in Journ. As. Soc. Bengal, Vol. XLIV, pt. II, (1875), p. 205. A glabrous tree; *leaves* 9 to 12 in. long, the rachises glabrous and the petioles thickened at the base: *leaflets* coriaceous, oblong or elliptic-oblong, slightly unequal-sided, shortly acuminate, the edges with remote glandular teeth, the base rounded; both surfaces quite glabrous, the lower paler and with the reticulations distinct, the midrib prominent on both; main nerves 15 to 18 pairs, spreading, depressed on the upper, prominent on the lower surface; length 4·5 to 6 in., breadth 1·75 to 2 in; petiolules ·2 in., stout. *Panicles* axillary about as long as the leaves, with several sub-glabrous racemoid branches bearing the flowers in cymules. *Flowers* ·1 in. in diam., on glabr pedicels twice as long as themselves. *Calyx* glabrous, 5-lobed. *Pe*

0. *Stamens* 5; *anthers* broadly ovate, glabrous; filaments pubescent and thickened towards the base. *Ovary* sparsely pubescent, 2-lobed. *Fruit* ovoid, glabrous, 1·5 to 2 in. long; the pericarp thick, spongy inside. *Seed* single with a short arillus. Radlk. üb. Sapind. Holl.-Ind. No. 82.

Malacca: Maingay, No. 463.

A species known only by Maingay's scanty and imperfect specimens.

2. POMETIA PINNATA, Forst. Char. Gen. 110. A tree 30 to 50 feet high; young branches puberulous or glabrescent. *Leaves* 12 to 36 in. long, equally pinnate, the rachises angled, the petioles swollen at the base, glabrous or glabrescent; *leaflets* 4 to 12 pairs, sub-opposite, thinly coriaceous, oblong or oblanceolate-oblong, acute or shortly acuminate, the edges coarsely and remotely serrate, the base rounded sub-cordate or cuneate; the lower leaflets smaller than the upper: the lowest very small, sub-rotund, and sometimes less than 1 in. long: the upper varying in length from 4 to 12 in. and in breadth from 1·75 to 4 in.; petiolules ·15 in., stout: both surfaces glabrous or puberulous, often pubescent on the midrib and nerves, the reticulations minute; main nerves numerous, parallel, prominent beneath. *Panicles* axillary or terminal, spreading, puberulous, shorter than the leaves, their branches spreading and often with auricled bracts at their bases. *Flowers* numerous, pedicellate, ·1 in. in diam., polygamous. *Calyx* pubescent, deeply divided into 4 or 5 triangular teeth. *Petals* 4 or 5, small, glabrous or slightly pubescent, without a basal scale. *Disc* fleshy, lobed, glabrous. *Stamens* 5 or 6, the anthers glabrous, the filaments subulate and puberulous. *Ovary* obcordate, bilobed: *style* longer than the ovary, bifid at the apex. *Fruit* usually reduced to a single lobe, ellipsoid, blunt, glabrous, 1-seeded, variable in size; length from ·75 to 1·25 in.; diam. from ·5 to ·8 in. *P. tomentosa*, Kurz Andaman Report, ed. 2, p. 34; For. Flora Burma, I, 295; Hiern in Hook. fil. Fl. Br. Ind. I, 691. *Irina glabra*, Blume Bijdr. 230; Rumphia, III, 113; Hassk. Pl. Jav. Rar. 284; Miq. Fl. Ind Bat. I, pt. 2, 558. *Irina diplocardia*, Blume Rumphia, III, 115. *Pometia eximia*, Bedd. Fl. Sylv. t. 157. *Eccremanthus eximius*, Thwaites in Hook. Kew Journ. VII, 272, t. 9. *Nephelium eximium*, Thwaites Enum. 57.—Rumph. Herb. Amboin. III, 31, t. 17.

Malacca: Maingay, No. 459. Perak: very common; King's Collector.—DISTRIB. Ceylon.

3. POMETIA GRACILIS, King n. sp. A tree 40 to 50 feet high; the *branches* slender, drooping, the youngest cinereous-puberulous, minutely lenticellate. *Leaves* 5 to 8 in. long, their rachises minutely rusty-pubescent; *leaflets* 5 to 8, opposite, membranous, the upper ones the

largest and oblanceolate, the lower often oblong, all caudate-acuminate, the edges with small remote glandular teeth; the base much narrowed in the upper leaflets oblique and rather rounded in the lower: upper surface reticulate, shining, glabrous except the pubescent midrib, the lower reticulate and glabrous but pubescent on the midrib and nerves; length 3 to 6 in., breadth 1 to 1·6 in.; petiolules ·1 in. or less, pubescent. *Panicles* much longer than the leaves, axillary or terminal, slender, with a few raceme-like branches bearing the flowers in small uniparous lateral cymules. *Flowers* ·05 in. in diam. *Calyx* campanulate, deeply divided into 5 ovate sub-acute pubescent teeth. *Petals* 5, longer than the calyx, oblong, truncate, pubescent inside. *Stamens* 5, exserted, the anthers broadly ovate, glabrous: filaments long, pubescent and thickened at the base. *Disc* cupular, fleshy, glabrous. *Ovary* bilobed, rusty-pubescent; *style* short, glabrous. *Fruit* with 2 or more often with 1 ellipsoid glabrous shining lobe, ·75 in. long and ·5 in. in diam.

Perak: King's Collectors, Nos. 3479, 3607, 3781, 4514, 7255; Wray, No. 2912. Singapore: Ridley, No. 6373.

This differs from *P. alnifolia* in having its leaflets caudate-acuminate at the apex and much more narrowed at the base, and in the midribs and nerves on the lower surface being pubescent as well as the midrib on the upper. The panicles are besides very much longer, and the flowers have longer pedicels than in *P. alnifolia*; while the petals, which seem to be always present, much exceed the calyx-lobes.

4. Pometia alnifolia, Radlk. über Sapind. Holl.-Ind. 30. A tree 50 to 70 feet high: young branches pubescent, reddish when young. *Leaves* 3 to 8 in. long, equally or unequally pinnate, the rachises slender and pubescent, the petiole not swollen at the base but often with a minute stipule-like leaflet. *Leaflets* 6 to 9, opposite or alternate, oblong or oblanceolate-oblong, sub-coriaceous, shortly acuminate, the edges with remote minute glandular teeth, slightly narrowed to the rounded or cuneate base; upper surface glabrous, shining; the lower pale and with a few scattered hairs; main nerves spreading, numerous, parallel, prominent below, length of the upper leaflets 3 or 4 in., breadth ·9 to 1·25 in., the lower leaflets smaller and the lowest of all minute. *Panicles* terminal, axillary, minutely tomentose, about as long as the leaves, with a few racemoid branches bearing the flowers in lateral cymules. *Flowers* less than ·1 in. in diam.; *bracts* linear, pubescent, pedicels short. *Calyx* with 5 deep valvate puberulous tri- angular segments. *Petals* 5, usually shorter than the calyx, sub-rotun- villous at the apex inside, or absent. *Stamens* 5, slightly exserted, anthers short, the filaments glabrous. *Disc* cupular, fleshy, glabro-

Ovary obcordate, 2-lobed, pubescent, style glabrous. *Fruit* usually with only one properly developed lobe (the other sub-aborted) oval and blunt, or sub-globose, glabrous, 1 in. long and ·5 in. in diam.; when globular ·5 to ·6 in. in diam. *Irisa alnifolia*, Blume Rumphia III, 117.

Perak: King's Collector, Nos. 3790, 6949, 7774, 7983, 8212; Scortechini, No. 113; Wray, No. 1336. Singapore: Ridley, 6372. Penang: Curtis, No. 1600.

A species with much smaller leaves leaflets and inflorescence than *P. pinnata*, Forst. Miquel (Fl. Ind. Bat. Vol. I, pt. 2, 558) reduces it to *T. tomentosa*, Bl. which is in my opinion doubtfully distinct from *T. glabra*, Blume. But *P. alnifolia* appears to me a perfectly good distinct species recognisable at a glance from every form of *P. pinnata*, Forst.

Besides the preceding there are in the Herbarium Calcutta two species of *Pometia* which, for want of complete material, I do not describe. One of these is from Penang (Curtis, No. 1668). It has entire leaflets somewhat like those of *P. alnifolia* and globular fruit. *Flowers* are quite wanting. For it I propose the name *P. Curtisii*. The other is from Negri Sembilan, communicated by Mr. H. N. Ridley. It also has leaflets somewhat like those of *P alnifolia*, but broader and with entire undulate edges. The inflorescence and flowers are quite glabrous. Fruit is wanting. To this I have given the MSS. name *P. Ridleyi*.

11. Guioa, Cav.

Erect shrubs or trees. *Leaves* alternate, exstipulate; *leaflets* 1 to 6 (rarely 10) pairs; more or less lanceolate, oblique, entire, often coriaceous. *Flowers* in simple or branched racemes, axillary or from the axils of fallen leaves, sub-globose in bud. *Sepals* 5, ovate-rotund, thick, concave, imbricate in 2 rows, pubescent at the edges. *Petals* 5, each with 2 pectinate scales. *Disc* entire, annular, or semilunar, or crescentic. *Stamens* 8. *Ovary* 3-angled, with a single curved style and 3-lobed stigma. *Fruit* sessile or pedicelled, obliquely obcordate, boldly 3-winged, glabrous, the interior of the pericarp cartilaginous. *Seeds* wholly or partly enveloped in a thin arillus with 2 flexuose appendages. *Cotyledons* fleshy and oily, the inner obliquely conduplicate; the radicle inferior.—Distrib. About 33 species Malayan and Australian.

Rachises of the leaves narrowly winged ...	1.	*G. pleuropteris.*
Rachises of the leaves terete		
Leaflets glabrous on both surfaces ...	2.	*G. squamosa.*
Leaflets sparsely pubescent on the upper, pubescent on the lower surface... ...	3.	*G. fuscidula.*
Leaflets densely tomentose on the lower surface	4.	*G. pubescens.*

1. Guioa pleuropteris, Radlk. in Sitzb. Bayer. Akad. Math. Phys. IX (1839), p. 611. A shrub or sometimes a tree: young branches minutely rusty-pubescent. *Leaves* 4 to 7 in. long, their rachises narrowly winged and puberulous, usually unequally pinnate: *leaflets* 3 to 7, ovate-lanceolate or ovate-oblanceolate, acute or broadly and shortly cuspidate, the base cuneate: upper surface with short scattered hairs; the lower pale, minutely punctate and more pubescent than the upper: main nerves about 5 pairs, rather distinct beneath: length 2·5 to 4·5 in., breadth 1 to 1·75 in., petiolules ·1 in. *Racemes* branched, 2 to 4 in. long. *Fruit* ·75 in. broad, the wings narrow, contracted below into a short pseudostalk, pedicel ·3 in. long. *Cupania pleuropteris*, Blume Rumphia III, 158; Miq. Fl. Ind. Bat. Vol. I, pt. 2, 564; *C. pleuropteris* var. *apiculata*, Hiern in Hook. fil. Fl. Br. Ind. I, 677. *Cupania Griffithiana*, Kurz in Journ. As. Soc. Beng. Vol. XLIV, pt. 2, (1875), p. 188, in part; For. Flora Burma, I, 284.

Malacca: Maingay, No. 442. Johore: Ridley, No. 4064. Pahang: Ridley. Perak: King's Collector, Nos. 311, 1136.—Distrib. Sumatra Riau, Borneo.

Var. *bijuga*. Leaflets 2 pairs, the rachis slightly dilated towards the apex. *G. bijuga*, Radlk. *l. c.* 611. *Cupania pleuropteris*, var. *bijuga*, Hiern in Hook. fil. Fl. Br. Ind. I, 677. *C.* (*indeterminata*) Wall. Cat. 8094. *C. Griffithiana*, Kurz in Journ. As. Soc. Beng. XLIV, pt. 2, (1875), p. 188.

Malacca: Griffith, No. 984. Maingay, No. 437.

2. Guioa squamosa, Radlk. in Sitzb. Bayer. Akad. Math. Phys. IX (1879), p. 609. A slender tree from 20 to 30 feet high; young branches rusty-puberulous, dark-coloured when dry. *Leaves* 6 to 10 in. long, sometimes foveolate or punctate beneath; *leaflets* 4 to 8 pairs, lanceolate to ovate-lanceolate, shortly and bluntly acuminate, sub-falcate, the base narrowed and oblique; both surfaces glabrous; main nerves 8 to 10 pairs, rather distinct beneath, curving, the secondary nerves and reticulations distinct. *Panicles* raceme-like, 2 or 3 in. long, almost glabrous. *Fruit* 1 in. across, the wings broad, subundulate, suddenly narrowed to a short stout pseudo-stalk; the *style* persistent, broad at the base; *pedicel* ·25 in. long. *Cupania regularis*, Kurz (not of Blume) Journ. As. Soc. Bengal, Vol. XLIV, pt. 11 (1875), 188. *Cupania glabrata*, Hiern (not of Kurz), Hook. fil. Fl. Br. Ind. I, 676. *Sapindus squamosus*, Wall. (not of Roxb.) and Cat. No. 8097; "*Connaracea?*" Wall. Cat. 8550.

Penang: Wallich, King's Collector, No. 1516. Singapore: Ridley, No. 6209*a*. Malacca: Griffith.—Distrib. Java; Burma, Helfer, No. 983.

3. Guioa fuscidula, Radlk. in Sitzb. Bayer. Akad. Math. Phys. IX (1879), p. 609. A tree 30 to 40 feet high: young branches puberulous, dark-coloured. *Leaves* 4 to 12 in. long; *leaflets* usually equally pinnate (3 to 4 pairs), elliptic, oblique, sub-acute, slightly narrowed at the base: the upper surface sparsely puberulous, the midrib pubescent; the lower pubescent, becoming glabrescent when old: main nerves 6 or 7 pairs, distinct beneath as are the reticulations; length 2 to 3 in., breadth 1 to 1·5 in., petiolules 2 in. *Racemes* about 2 in. long, pubescent. Scales of petals woolly. *Fruit* about ·5 in. broad, narrowed to a long pseudo-stalk, *pedicel* ·25 in. long. *Cupania fuscidula*, Kurz in Journ. As. Soc. Bengal, for 1872, p. 302; For. Flora Burma, I, 284; Hiern in Hook. fil. Fl. Br. Ind. I. 677.

Perak: King's Collector, Nos. 2452, 3818. Burmah (Tenasserim): Helfer, No. 993.

Var. *glabrescens*, Leaflets, except the midrib, almost glabrous.

Perak: Scortechini, No. 1714.

4. Guioa pubescens, Radlk. in Sitzb. Bayer. Akad. Math. Phys. IX (1879), p. 612. A small tree; young shoots tawny-puberulous. *Leaves* 6 to 9 in. long, usually equally pinnate, their rachises terete and puberulous; *leaflets* 4 to 5 pairs, alternate, narrowly oblong-lanceolate, falcate, acuminate, the bases much narrowed and oblique; upper surface with a few minute adpressed scattered hairs, the lower densely covered with minute tawny tomentum; main nerves 5 to 7 pairs, faint, curving; length 2 to 3 in., breadth ·65 to 1·1 in., petiolules ·15 in. *Panicles* racemose, about 3 in. long, puberulous. *Fruit* ·6 in. broad, the wings narrow, pseudo-stalk shorter than the pedicel, pedicel ·25 in. *Cupania pallidula*, Hiern in Hook. fil. Fl. Br. Ind. I, 676. *C. Griffithiana*, Kurz in Journ. As. Soc. Beng. XLIV, pt. 2 (1875), p. 188; For. Flora Burma, I, 284 (in part).

Malacca: Griffith, No. 982; Maingay, No. 436. Singapore: Hullett, Ridley, No. 1912.—Distrib. Java, Sumatra, Bangka.

12. Trigonachras, Radlk.

Trees with pinnate 5- to 10-jugate narrowly lanceolate somewhat falcate entire eglandular leaflets. *Panicles* racemose, terminal or axillary. *Calyx* small, cupular, with 5 spreading imbricate segments. *Petals* 5, each with 2 pectinate scales. *Disc* entire, swollen, annular. *Stamens* 8. *Fruit* large, clavate-pyriform, the pericarp thick, crustaceous, bluntly 3-angled, minutely tomentose, 3-celled, usually (by abortion) only 1-seeded. *Seed* pyriform-ovoid, exarillate.

Trigonachras acuta, Radlk. in Sitzb. Bayer. Akad. Math. Phys. IX (1879), p. 672. A tree; young shoots rusty-puberulous. *Leaves* 8 to 12

in. long; their rachises terete, glabrous; *leaflets* 11 to 15, narrowly oblong-lanceolate, shining on both surfaces: main nerves 8 to 10 pairs, faint, spreading; length 2 to 3·5 in., breadth ·6 to ·8 in., petiolules ·2 in. *Racemes* paniculate, erect, terminal or axillary, tawny-tomentose, the flowers on long tomentose bracteolate pedicels. *Calyx* tomentose externally. *Stamens* long-exserted, the filaments hairy. *Fruit* apiculate, nearly 2 in. long and 1·2 in. in diam. *Cupania acuta*, Hiern in Hook. fil. Fl. Br. Ind. I, 676. *Sapindacea*, Wall. Cat. 9036.

Singapore: Wallich, Hullett; Ridley, No. 4648. Pahang: Ridley. Malacca: Maingay, No. 445.

13. Arytera, Blume.

Shrubs or trees with pinnate 1–5-jugate leaves: the *leaflets* elliptic or lanceolate, entire, sometimes foveolate in the nerve-axils underneath. *Panicles* axillary or terminal. *Calyx* small, cupular; the sepals 5, imbricate. *Petals* 5, each with 2 pectinate basal scales. *Disc* entire, annular. *Stamens* 8. *Fruit* 2- to 3-celled, shortly stipitate, lobed; the lobes elliptic, obcordate or obovate, always divaricate: the pericarp fleshy outside, sclerenchymatous inside. *Seed* entirely or almost entirely enveloped in an inappendiculate arillus; *cotyledons* thick, fleshy, superposed, radicle short.—Distrib. Malayan Archipelago and Peninsula, S. China and Australasia; about twenty species.

Arytera littoralis, Blume Rumphia, III, 170. A tree 25 to 30 feet high: young branches rusty-puberulous. *Leaves* abruptly pinnate, 6 to 13 in. long, their rachises rusty-puberulous becoming glabrescent, not winged; *leaflets* 2 or 3 pairs, elliptic to elliptic-oblong, sub-acuminate, the base cuneate, both surfaces glabrous; main nerves 8 to 10 pairs, slightly prominent beneath, ascending, curved; length 3 to 6 in., breadth 1·5 to 3 in.; petiolules ·25 in., stout. *Panicles* axillary, short, many-branched, rusty-puberulous. *Flowers* minute. *Calyx* with 5 short teeth, pubescent outside. *Petals* 5, slightly longer than the calyx, broadly cuneate, obliquely emarginate or bifid at the apex, pubescent on the upper surface. *Anthers* puberulous, filaments hairy. *Fruit* coriaceous, glabrous, 2-lobed; the lobes usually compressed, oblong, blunt, one of them often smaller than the other. Radlkofer in Sitzb. Bayer. Akad. Math. Phys. IX, (1875), p. 552. *Cupania adenophylla*, Planch. ex Hiern in Hook. fil. Fl. Br. Ind. I, 677; Kurz For. Flora Burma, I, 285. *Sapindus adenophyllus*, Wall. Cat. 8044.

Malacca: Griffith, Maingay, No. 439. Andamans: King's Collectors. Nicobars: Jelinek. Pahang: Ridley, No. 2162.—Distrib. Burma: Helfer, 989; Griffith, 988. Sumatra: Forbes, No. 2624.

Var. *major*. A tree 30 to 70 feet high; *leaflets* with 12 to 14 pairs of nerves: *lobes* of fruit oblong, only slightly compressed.

Perak: King's Collector, Nos. 695, 885, 4456; Scortechini, No. 20; Wray, No. 316. Singapore: Ridley, No. 5995. Selangor: Ridley, No. 1609.

14. Mischocarpus, Bl.

Trees with alternate exstipulate unequally pinnate leaves: *leaflets* 1 to 5 pairs, ovate-lanceolate or elliptic, entire, usually glabrous. *Racemes* axillary, simple or branched. *Calyx* small, cup-shaped, 5-partite, the segments imbricate. *Petals* 5, each with 2 large pectinate scales, or absent. *Disc* entire, annular. *Stamens* 8 or fewer. *Fruit* pyriform, blunt, 3-angled or 3-grooved, or smooth, pedicelled, rarely sessile, 3-celled; the pericarp thin, fleshy, sclerenchymatous inside. *Seeds* more or less completely enveloped in a thin arillus with 2 spur-like processes near its base. *Cotyledons* lying above each other, radicle short.—Distrib. About a dozen species, Malayan and Australasian.

Petals 5, minute, caducous ... ... 1. *M. fuscescens.*
Petals 0.
Fruit truncately pyriform, boldly 3-angled ... 2. *M. sundiacus.*
Fruit pyriform, not truncate, not angled ... 3. *M. sumatranus.*

1. Mischocarpus fuscescens, Blume Rumphia III, 166. A tree 50 to 70 feet high: all parts except the inflorescence glabrous. *Leaves* 9 to 12 in. long, equally or unequally pinnate; *leaflets* 4 to 6, elliptic-oblong or oblong-lanceolate, sub-acuminate, cuneate at the base, both surfaces shining and finely reticulate, foveolate in the axils beneath; main nerves 12 to 15 pairs, slightly conspicuous beneath, curving: length 4 to 8 in., breadth 1·5 to 2 in.; petiolules ·25 in., stout. *Panicles* axillary or terminal, erect, puberulous; the branches few, racemose with the flowers in small cymes. *Calyx* sub-valvate. *Petals* 5, minute. *Stamens* 8. *Disc* hairy. *Ovary* pyriform, entire, stipitate. *Fruit* obovoid, with a faint vertical ridge, glabrous, ·4 in. long, its pseudo-stalk ·25 in. long. Radlk. *l. c.* 646. *Cupania fuscescens*, Miq. Fl. Ind. Bat. Vol. I, pt. 2, 567; *C. Helferi*, Hiern in Hook. fil. Fl. Br. Ind. I, 679.

Selangor: Ridley, No. 1916. Perak: King's Collector, No. 2689; Scortechini.—Distrib. British India: Sylhet, Wall. Cat. 8018, 9035. Burma: Griffith, 987; Helfer, 982/1.

2. Mischocarpus sundiacus, Blume Bijdr. 238; Rumphia III, 167. A tree 25 to 50 feet high; young branches slightly puberulous or glabrous. *Leaves* 6 to 10 in. long, equally or unequally pinnate; *leaflets* 3 to 6, elliptic-oblong or oblong-lanceolate, sub-acuminate, cuneate and sometimes slightly oblique, at the base: both surfaces glabrous, shining and very minutely reticulate; the lower paler, foveolate in the axils of the 8 to 10 pairs of faint ascending curving main nerves: length 2·5 to

6 in., breadth 1·5 to 2 in., petiolules ·15. *Panicles* of a few racemose branches on which the flowers are arranged as shortly stalked cymes, slightly puberulous. *Fruit* ·25 in. in diam. truncately pyriform, boldly 3-angled, crowned by the short style and narrowed at the base into a thin pseudo-stalk longer than itself, pedicel ·15 in. long. *Cupania Lessertiana*, Camb. Mèm. Mus. XVIII, 46 t. 3; Hasskarl Pl. Jav. Rar. 285; Miq. Fl. Ind. Bat. Vol. I, pt. 2, 566; Hiern in Hook. fil. Fl. Br. Ind. I, 678; Radlk *l. c.* 646. *Meliniaca ?* Wall. Cat. 8092.

Singapore: Wallich. Malacca: Maingay, No. 438; Ridley, No. 1908. Perak: King's Collector, Nos. 4186, 7265; Scortechini, Nos. 953, 1458. Andamans: King's Collector. Penang: Curtis, No. 2433.—DISTRIB. Burma (Helfer, No. 991); Assam, Khasia, Chittagong.

This species differs very little from *M. fuscescens*. It has, however, a less pubescent inflorescence, three petals are often present in the flowers and the fruit is sharply 3-angled. The young branches in this are puberulous whereas those of *M. fuscescens* are quite glabrous.

The fruit of this while young is sharply 3-angled; but as it ripens the angles become obliterated and it closely resembles that of *M. Sumatranus* and *M. fuscescens*. This species may, however, be distinguished from these by its smaller leaflets with fewer nerves.

3. MISCHOCARPUS SUMATRANUS, Blume, Rumphia III, 168. A tree 30 to 50 feet high: all parts except the inflorescence glabrous. *Leaves* 5 to 12 in. long, with angled rachises: *leaflets* 4 to 8, elliptic-oblong, sub-acuminate, the base cuneate, both surfaces minutely reticulate and shining; main nerves 9 to 12 pairs, curved, the secondary almost as prominent; length 4 to 8 in., breadth 1·15 to 2·25 in., petiolules ·2 to ·25 in. *Panicles* as in *M. fuscescens*. *Petals* 0. *Fruit* pyriform, ·3 in. in diam., not angled, pseudo-stalk shorter than the fruit and also than the pedicel, pedicel ·2 in. Radlk. *l. c.* 646. *Cupania sumatrana*, Miq. Fl. Ind. Bat. Vol. 1, pt. II, 566; Hiern in Hook. fil. Fl. Br. Ind. I, 678.

Perak: Scortechini, Nos. 97, 484; King's Collector, Nos. 3933, 5278, 5391, 5397, 5727, 8307, 8329, 8374, 8403.

This is very closely allied to *M. fuscescens* which differs in having 5 minute caducous petals. In all other respects the two agree; and, in my own opinion they ought not both to rank as species. I keep both up however out of deference to Radlkofer whose monograph is a signal example of careful work.

15. LEPIDOPETALUM, Blume.

Small trees with 2- to 4-jugate pinnate leaves, the leaflets ovate-lanceolate, entire. *Racemes* axillary, a few inches long, or thyrsiform. *Sepals* 4, united at the base, valvate. *Petals* 4, smaller than the sepals,

each with one large scale connate to its margins. *Stamens* 8, the filaments glabrous. *Ovary* 2-celled, with a solitary ovule in each cell. *Fruit* capsular, coriaceous, obovate, compressed, 2-celled, reddish-brown when ripe, pericarp fleshy, the endocarp bright scarlet. *Seed* black with a mucilaginous coating and a basilar pink fleshy cupular arillus.—Distrib. 6 species from the Nicobars, Sumatra, Philippines and New Guinea.

Lepidopetalum Jackianum, Radlk. in Sitzb. Bayer. Acad. IX, 623. A small tree: young branches puberulous, soon becoming glabrous. *Leaves* 6 to 12 in. long; *leaflets* 2 to 10, sub-alternate, oblong or ovate-oblong, sub-acuminate, the base rounded or cuneate, both surfaces quite glabrous and finely reticulate; main nerves 7 or 8 pairs, bold beneath, spreading: length 3 to 5 in., breadth 1·15 to 2 in., petiolules ·15 in. *Racemes* under 2 in. long. *Flower-buds* oval, pointed; sepals lanceolate. *Petals* less than a third of the size of the sepals and alternate with them. *Stamens* short, inserted at the base of the ovary, filaments glabrous; *anthers* hirsute, oblong. *Capsule* not lobed, coriaceous, compressed, obovate, glabrous outside, hairy inside, minutely apiculate, 1·25 in. long and about ·8 in. broad, pedicel ·25 in. long. *Seed* solitary, black; arillus pale pink or white, viscous. *Cupania Jackiana*, Hiern in Hook. fil. Fl. Br. Ind. I, 678. *Connarus? Jackianus*, Wall. Cat. 8552. Prain in Proceed. As. Soc. Beng. 1891, p. 167.

Nicobar Islands; Jack, Kurz, Prain. Batti Malv, Prain.

Dr. Prain has given in the *Journal* above quoted an excellent account from the living plant of this previously little known species, and from his description mine is largely taken.

16. Paranephelium, Miquel.

Trees with alternate exstipulate unequally pinnate leaves: *leaflets* opposite or sub-opposite. *Flowers* panicled, regular, hermaphrodite (or polygamous?) 4-6-merous. *Calyx* deeply lobed, the lobes slightly imbricate. *Petals* usually 5, small, each bearing a single scutiform scale larger than itself (the two forming a pouch). *Disc* deeply excavated, entire. *Stamens* 6 to 10, the filaments subulate, glabrous; the *anthers* short, 2-celled, basifixed. *Ovary* 3-celled, obtusely 3-angled. *Fruit* a ligneous 3-valved capsule, externally tubercled, lobulate or spinose, imperfectly 3-celled, 1- to 3-seeded. *Seed* large, angled, partly covered by a thin arillus. *Cotyledons* fleshy, oily, conduplicate.—Distrib. Malaya and Burma, 3 or 4 species.

Leaflets entire, fruit lobulate ... ... 1. *P. nitidum.*
Leaflets serrate, fruit echinate ... ... 2. *P. macrophyllum.*

Hiern's genus *Scyphopetalum* (1875) is exactly the same as *Para-*

nephelium which dates from 1860. Miquel's genus *Mildea* (published in 1867), appears also to be reducible to this. The still older genus of *Compositae* bearing the name *Paranephelius*, Poepp. et Endl. dates from 1842: but it has been found to be reducible to *Liabum*, Adans.

1. Paranephelium nitidum, King n. sp. A tree 40 to 60 feet high: young branches slender, terete, glabrous, lenticellate. *Leaves* 15 to 18 in. long, their rachises grooved: *leaflets* 5 to 9, coriaceous, oblong-lanceolate or oblong-oblanceolate, bluntly acuminate, entire, much narrowed to the base; both surfaces glabrous and shining; main nerves 14 to 16 pairs, curving, slightly prominent beneath; length 4·5 to 6·5 in., breadth 1·5 to 1·75 in., petiolules ·25 in. *Panicles* axillary, 3 or 4 in. long, few-branched, very lax; the ultimate branchlets few-flowered, cymulose. *Flowers* ·2 in. in diam., the style long-projecting, *ovary* rusty-pilose; stigmas 3, short, recurved. *Fruit* woody, depressed-globular, the surface deeply and irregularly lobulate, shortly apiculate, covered with brown scurf, 3-seeded; depth ·75 in., breadth 1 in. (unripe).

Perak: King's Collector, Nos. 7410, 7416.

2. Paranephelium macrophyllum, King n. sp. A tree 20 to 40 feet high: all parts except the inflorescence glabrous. *Leaves* 18 to 30 in. long, the rachises terete; *leaflets* 5 to 9, sub-opposite, coriaceous, oblong, shortly and abruptly cuspidate, the edges with few remote serrations, cuneate at the base; main nerves 18 to 28 pairs, spreading, depressed on the upper and prominent on the lower surface; length 6 to 15 in., breadth 2·5 to 4·5 in.; petiolules ·35 in., stout. *Panicles* pubescent, axillary, erect, few-branched, about 12 in. long, the ultimate branchlets cymose. *Flowers* ·2 in. in diam. *Stamens* 8, inserted on the edge of the cupular glabrous lobulate disc. *Ovary* sub-globular, rusty-pilose. *Fruit* globular, woody, the whole surface covered with thick spines, 3-celled, 1–3-seeded; diam. to end of spines 1 to 1·5 in. (unripe).

Perak: Scortechini; King's Collector, Nos. 3157, 3204, 6436, 7027; Wray, No. 2675.

17. Dodonæa, Linn.

Shrubs rarely trees. *Leaves* simple (in the only Malayan species) alternate, exstipulate. *Inflorescence* lateral and terminal. *Flowers* polygamous, inconspicuous, *Sepals* 5–2, imbricated or valvate. *Petals* 0. *Stamens* 10–5, usually 8, inserted on the outer side of the disc; *filaments* short; *anthers* linear oblong. *Disc* obsolete in the male flower, small in the female. *Ovary* 3–6-sided and -celled; *style* 3–6-sided, its apex 3–6-cleft. *Ovules* 2 together, collateral or superposed. *Capsule* compressed, membranous, septicidally 2-valved; *valves* winged at the

back; *cells* 1–2-seeded. *Seeds* lenticular or subglobose, compressed, exalbuminous, exarillate, funicle thickened; *embryo* spirally involute.—Distrib. A genus of about 65 species mostly endemic in Australia.

Dodonæa viscosa, Jacq. Enum. Pl. Carib. 19. A shrub or small tree: the leaves simple, oblanceolate, sub-acute or very shortly apiculate, with sub-entire revolute margins, much narrowed to the base, both surfaces shining and sub-viscid; main nerves faint, numerous; length ·75 to 4 in., breadth ·5 to 1·25 in., petiole ·1 in. *Flowers* ·25 in. in diam., in short few-flowered axillary spreading cymes. *Sepals* oblong, about ·1 in. long as are the stamens. *Capsule* membranous, compressed, with a broad marginal wing notched at base and apex, about ·75 in. long and slightly broader. Linn. Mant. 228; Hiern in Fl. Br. Ind. I, 697; Kurz For. Flora Burma I, 287; Baker in Oliv. Fl. Trop. Afr. I, 433; Benth. Fl. Austral. I, 475; Brand. For. Fl. 113: Boiss. Fl. Orient. I, 953. *D. angustifolia*, Linn. f. Suppl. Pl. 218; Roxb. Fl. Ind. II, 256. *D. dioica*, Roxb. Hort. Beng. 28; Fl. Ind. II, 256; Miq. Fl. Ind. Bat. Vol. I. pt. 2, p. 580. *D. Burmanniana*, DC. Prodr. I, 616; Wight Ill. I, t. 52; W. & A. Prodr. 114; Grah. Cat. Bomb. Pl. 30; Dalz. & Gibs. Bomb. Fl. 36; Thwaites Enum. 59; Miq. Fl. Ind. Bat. Vol. I, pt. 2, p. 580. *D. microcarpa*, DC. Prodr. I, 617. *D. Wightiana*, Blume Rumph. III, 189. *D. pentandra*, Griff. Notul. IV, 548. *D. heterophylla*, Hortul. ex G. Don. Gen. Syst. I, 674; Wall. Cat. 8081. *Ptelea viscosa*, Linn. Sp. Pl. ed. I, 118; Burm. Fl. Ind. 36. *D. spathulata*, Sm. in Rees Cycl. XII, n. 2. *D. arabica*, Hochst. & Steud. in Herb. Arab. Schimp. n. 766. —Burm. Fl. Zeyl. t. 23. Rumph. Herb. Amboin. IV, t. 50.

In all the provinces; but usually planted.—Distrib. Warm countries generally.

18. Harpullia, Roxb.

Erect trees. *Leaves* alternate, exstipulate, pinnate; *leaflets* alternate, entire, acuminate, sub-glabrous. *Flowers* dioecious or polygamous, in racemes or panicles, regular. *Sepals* 4–5, erect, equal, imbricated. *Petals* 4–5, narrowly obovate, exceeding the calyx, sometimes clawed, without either glands or scales, but sometimes with inflected lobes at the base of the lamina. *Stamens* 5–8, inserted within the obscure disc. *Ovary* pubescent, ellipsoidal or oblong, 2-celled; *ovules* usually 2 together, superposed. *Style* elongated; *stigma* linear, usually more or less twisted. *Capsule* coriaceous, inflated, 2-lobed, 2-celled, loculicidally 2-valved; *cells* 1–2-seeded. *Seeds* sub-globose, exalbuminous, usually arillate.—Distrib. About 6 species, tropical Asiatic, Australian and Madagascarian.

Harpullia cupanioides, Roxb. Hort. Beng. 86; Fl. Ind. ed.

Wall. II, 442: ed. 1832 I, 645. A tall tree: young parts minutely tawny, puberulous. *Leaves* 12 to 18 in. long, the rachises slightly puberulous; *leaflets* 6 to 12, opposite or alternate, oblong to elliptic-lanceolate, acute or shortly acuminate, the base obliquely cuneate, both surfaces glabrous; main nerves 8 to 12 pairs, curving upwards, puberulous or glabrous: length 2·5 to 8 in., breadth 1·35 to 2·75 in., petiolule ·15 in. *Panicles* with few short branches, terminal or axillary, puberulous. *Flowers* large, ·3 in. in diam. *Sepals* 5, free, unequal, broadly oblong or sub-rotund, minutely pubescent outside. *Petals* 5, narrower than the sepals but longer. *Stamens* 5, shorter than the petals, the anthers oblong. *Disc* small, puberulous. *Ovary* broadly ovoid, compressed, grooved, pubescent; *style* short, reflexed; *stigma* small, 2-lobed. *Fruit* capsular, broadly reniform, compressed, 2-lobed, glabrous. *Seed* semioval, the aril orange-coloured and covering the whole seed. Hiern in Hook. fil. Fl. Br. Ind. I, 692; Miq. Fl. Ind. Bat. Vol. I, pt. 2, 570: Kurz For. Flora Burma, I, 287: Wall. Cat. 8078. *Harpullia rupestris*, Bl. Rumphia, III, 175. *H. fruticosa*, Bl. *l. c.* 179. *H. fraxinifolia*, Bl. *l. c.* 176. *H. thanatophora*, Bl. *l. c.* 178. *Streptostigma viridiflorum*, Thwaites in Hook. Kew Journ., VI, 298, t. 9.

Perak: King's Collector, Nos. 1015, 7074; Scortechini. Andamans: King's Collector.

19. Turpinia, Vent.

Trees or shrubs with glabrous and shining leaves, and smooth terete branches. *Leaves* opposite, stipulate, usually odd-pinnate; *leaflets* opposite, stipellate, serrulate, sub-coriaceous. *Panicles* terminal and axillary; *flowers* small, regular, hermaphrodite. *Calyx* 5-partite, imbricated. *Petals* 5, imbricated. *Stamens* 5, inserted outside the lobed or crenulate raised disc; *filaments* flattened; *anthers* short. *Ovary* sessile, 3-lobed and -celled; *styles* 3, combined or distinct; *stigmas* sub-capitate; *ovules* 2 together or more and then in two rows. *Fruit* sub-globose, indehiscent, 3-celled. *Seeds* angular; *testa* hard, shining; *hilum* large; *albumen* fleshy; *aril* 0. *Embryo* straight.—Distrib. About ten species in sub-tropical Asia and America.

Turpinia pomifera, DC. Prod. II, 3. A tree 30 to 40 feet high, all parts glabrous. *Leaves* stipulate, 8 to 15 in. long, mostly unequally pinnate; *leaflets* 5 to 10, thinly coriaceous, oblong or oblong-lanceolate, shortly acuminate, the edges serrate, the base cuneate; main nerves 5 or 6 pairs, remote, ascending; length 2·5 to 8 in., breadth 1 to 3 in., petiolules of the lateral leaflets ·25 to ·35 in., of the terminal one varying from 1 to 2 in.; stipules interpetiolar or triangular, caducuous. *Panicles* spreading, shorter than the leaves; the branches diverging, brac-

teolate at the base, puberulous. *Flowers* numerous near the ends of the branches, ·15 in. in diam., greenish-white. *Calyx* with 5 deep oblong obtuse lobes, puberulous or glabrescent. *Petals* oblong, longer than the calyx, puberulous. *Stamens* about as long as the petals, the filaments glabrous. *Ovary* broadly ovoid, furrowed, almost separable into 3 loculi, glabrous, tapering into the stout stylar column. *Fruit* globose, with fleshy smooth pericarp, slightly trigonous, 3-celled, 3-seeded. Miq. Fl. Ind. Bat. Vol. I, pt. 2, 593; Hiern in Hook. fil. Fl. Br. Ind. I, 698: Kurz For. Flora Burma I, 292; Wall. Cat. 4276. *Dalrymplea pomifera*, Roxb. Hort. Beng. 17; Cor. Pl. t. 299; Fl. Ind. I, 633. *T. nepalensis*, Wall. Cat. 4277; W. and A. Prodr. 156; Wight Ic. t. 972; Bedd. Fl. Sylv. t. 159; Thwaites Enum. 71. *T. microcarpa*, W. and A. Prodr. 156. *T. martabanica*, Wall. Cat. 4278. *T. latifolia*, Wall. Cat. 4939. *Canarium Sajiga*, Ham. ex W. and A. Prodr. 175.—Wall. Cat. 8104.

Perak: King's Collector, No. 4243.—Distrib. Java, Sumatra. British India.

Var. *sphaerocarpa*, King. *Leaflets* broadly ovate or ovate-rotund, only slightly and shortly acuminate. *Panicles* often longer than the leaves. *Fruit* not more than about ·5 or ·6 in. in diam., depressed. *Turpinia sphaerocarpa*, Hassk. Cat. Hort. Bat. Bogor. 228; Flora Vol. XXV (1842), Bibl. II, p. 42; Miq. Fl. Ind. Bat. Vol. I, pt. II, 593. *Turpinia latifolia*, Wall. Cat. No. 4939. *Dalrymplea javanica*, Hassk. Pl. Jav. Rar. 439.

In all the provinces except the Andamans and Nicobars.

This is the common form in the Malayan Provinces.

Order XXXV.—Sabiaceæ.

Climbing or erect shrubs or erect trees, glabrous or with simple hairs. *Leaves* alternate, exstipulate, simple or compound. *Flowers* small or minute, hermaphrodite or polygamous, usually panicled. *Calyx* 4–5-partite, imbricate. *Petals* 4–5, equal or unequal, opposite or alternate with the sepals, imbricate. *Disc* usually small, annular. *Stamens* 4–5, opposite the petals, inserted at the base of or on the disc, all perfect or two only perfect and three without anthers; *filaments* clavate, flattened or subulate; *anthers* didymous, cells distant bursting transversely or by a deciduous cap. *Ovary* 2–3-celled, compressed or 2–3-lobed; *styles* 2–3, free or connate, or 0, stigmas panctiform; *ovules* 1–2 in each cell. *Ripe carpels* 1–2, dry or fleshy, indehiscent. *Seeds* compressed or globose, basilar, hilum broad, testa membranous or coriaceous, albumen 0; *embryo* various, cotyledons often contorted, radicle deflexed. Distrib. A small chiefly Indian order, with 4 genera and about 35 species.

Stamens 4–5, all perfect and equal	...	...	1. SABIA.
Stamens 5, very unequal	...	...	2. MELIOSMA.

1. SABIA, Coleb.

Climbing or sarmentose shrubs; branches with the bud-scales persistent at their bases. *Leaves* quite entire. *Flowers* axillary, solitary, cymose or panicled, usually hermaphrodite, 2-bracteate; bracts, calyx, corolla, stamens and carpels all opposite. *Calyx* 4–5-partite. *Petals* 4–5, with transparent lines, green, purplish or yellow. *Disc* annular, 4–5-lobed. *Stamens* 4–5, inserted at the base of the disc; *anthers* extrorse or introrse. *Carpels* 2, rarely 3, cohering slightly; *styles* 2, erect, terminal, cohering slightly; *ovules* 2 in each carpel, collateral or superposed, horizontal. *Ripe-carpels* 1 or 2, gibbous, with a sub-basal style, dry or drupaceous. *Seed* reniform, testa coriaceous, dotted; *embryo* curved, cotyledons straight or incurved, flat, rugose or undulate, radicle cylindric.—DISTRIB. About 16 species, natives of tropical and temperate India.

Flowers solitary, axillary	...	...	1. *S. sumatrana.*
Flowers in racemes or panicles	...	...	2. *S. limonacea.*

1. SABIA SUMATRANA, Blume Mus. Bot. Lugd. Bat. I, 370. A woody climber: young shoots with cinereous bark, sub-glabrous. *Leaves* ovate-lanceolate to elliptic, acuminate, entire, the base cuneate; upper surface glabrous, the lower minutely puberulous and sub-lepidote; main nerves about 5 pairs, much curved, the reticulations wide; length 3·5 to 7 in., breadth 1·25 to 3·5 in., petiole ·35 to ·75 in. *Peduncle* solitary, axillary, ·35 in. long (longer in fruit). *Sepals* broadly triangular, pubescent at the edges. *Petals* much longer than the sepals, lanceolate, glabrous. *Stamens* nearly as long as the petals, but shorter than the cylindric glabrous style. *Fruit* compressed, obliquely ovoid, glabrous, when ripe bright blue with dark spots. Miq. Fl. Ind. Bat. Vol. I, pt. 2, 619.

Perak: Scortechini; King's Collector, Nos. Nos. 2117, 5053, 8205. DISTRIB. Sumatra.

2. SABIA LIMONACEA, Wall. Cat. 1000. A lofty climber: young branches slender, glabrous. *Leaves* coriaceous, oblong or lanceolate, acute or acuminate, entire; the base cuneate, rarely rounded; both surfaces glabrous, the upper shining and reticulate, the lower paler and tesselate-reticulate; main nerves 5 or 6 pairs, curved, faint; length 2·5 to 6 in., breadth 1 to 1·75 in.; petiole ·6 in. *Flowers* ·15 in. in diam., in axillary or slightly supra-axillary racemes or racemoid panicles usually shorter than the leaves, glabrous; *pedicels* longer than the flowers. *Sepals* 5, green, oblong, blunt. *Petals* 5, larger than the sepals,

obovate. *Stamens* included, the filaments clavate, the anthers short with broad connective. *Fruit* solitary or paired, compressed, obliquely orbicular or elliptic, ·5 in. long. Hook. fil. and Thoms. Fl. Ind. I, 210; Hook. fil. Fl. Br. Ind. II, 3. *Celastrina*, Wall. Cat. 9015; *Sabia sp.* Griff. Notul. IV, 423; Ic. Pl. As. t. 568. p. 2.

Penang: Curtis, Nos. 1221, 2158. Perak: Scortechini, No. 628.—Distrib. British India at the base of the Eastern Himalayan and Assam Range, Chittagong.

Sabia viridissima, Kurz in Journ. As. Soc. Bengal, Vol. XLI, Pt. 2, (1872), p. 304, is, as Kurz's type specimens in the Calcutta Herbarium clearly prove, a mixture of *Erythropalum scandens*, Blume, and an undescribed species of *Blachia* which I propose to name *B. viridissima*.

2. Meliosma, Blume.

Trees or shrubs, pubescent or glabrous. *Leaves* simple or unequally pinnate; *leaflets* sub-opposite, the terminal one rarely wanting. *Flowers* in branched terminal or terminal and axillary panicles, small or minute, hermaphrodite, rarely unisexual; bracts caducous. *Bracteoles* and *sepals* 5–9, persistent, forming an uninterrupted whorl round the petals. *Petals* 5; 3 large, nearly orbicular, valvate; 2 smaller, interior, placed behind the fertile stamens, either membranous and nearly free or reduced to a bifid scale adnate to the filament. *Stamens* 5; 2 fertile, opposite the smaller petals; filament short, flattened, incurved, expanded at the top into a cup which bears two globose cells that burst transversely, springing back elastically; 3 deformed, broad, opposite the larger petals, 2-fid with 2 empty cells, together forming a cup over the pistil. *Disc* cupular or annular, with 2–5 simple or dentate teeth. *Ovary* sessile, 2- rarely 3-celled, contracted into a simple or 2-partible style, stigma simple; *ovules* 2 in each cell. *Drupe* small, oblique, sub-globose; *stone* crustaceous, 1-celled, with usually a basilar rounded projection over which the seed is curved. *Seed* globose, testa membranous; *cotyledons* conduplicate, radicle incurved.—Distrib. Species about 32; natives of Tropical Asia and Malay Archipelago, with a few in S. America.

Leaves simple.

Petals 5; flowers ·05 in. in diam. ... ... 1. *M. elliptica.*

Petals 0; flowers ·1 in. in diam. ... ... 2. *M. lancifolia.*

Leaves pinnate.

Leaflets quite glabrous.

A shrub; leaves 12 to 18 in. long; leaflets 7 to 13; main nerves 7 to 10 pairs ... ... 3. *M. nitida.*

A tree; leaves 30 to 40 in. long; leaflets 21 to 25; main nerves 14 to 16 pairs ... ... 4. *M. levis.*

Leaflets hairy, especially on the under surface.
Flowers in clusters, sessile, buds globose ... 5. *M. lanceolata.*
Flowers solitary, shortly pedicelled, buds oblong ... ... 6. *M. Ridleyi.*

1. MELIOSMA ELLIPTICA, Hook. fil. Fl. Br. Ind. II, 5. A tree 20 to 40 feet high; young branches, petioles, the midribs of the leaves on both surfaces, and the lower surface especially on the nerves densely rusty-pubescent or tomentose. *Leaves* elliptic or oblanceolate, shortly caudate-acuminate, the edges entire or remotely serrate, gradually narrowed from above the middle to the petiole: upper surface glabrous except the midrib and puberulous nerves; main nerves about 10 pairs, curving upwards, the transverse veins distinct; length 4 to 9 in., breadth 1·25 to 3 in.; petiole ·5 to 1·5 in. *Panicle* terminal, usually on rather a long peduncle, longer than the leaves, the branches rather few and short. *Flowers* crowded, sessile, ·05 in. in diam. *Bracteoles* pubescent. *Sepals* 4, sub-coriaceous, orbicular, very concave, shining, sub-ciliolate. *Petals* 5, darker in colour than the sepals but of similar shape, thick, opaque and dotted, glabrous. *Fertile* stamens 2 to 4. *Fruit* sub-globular, ridged, sub-gibbous at the base, glabrous, ·2 to ·25 in. in diam. *Sabia floribunda*, Miq. Fl. Ind. Bat. Suppl. 521.

Malacca: Griffith, No. 1025; Maingay, Derry. Perak: King's Collector, Nos. 4051, 5468, 5469, 6150, 8103, and 10659.—Singapore. DISTRIB. Sumatra.

This is closely allied to *M. simplicifolia* which has however its flowers in ultimate cymlets of 3, whereas in this the flowers are single. The sepals moreover in *M. simplicifolia* are thinner and more pubescent than in this. As a rule the leaves in this species are quite entire; but in several of the Perak specimens they are coarsely serrate, without in any other respect departing from the typical form.

2. MELIOSMA LANCIFOLIA, Hook fil. Fl. Br. Ind. II, 5. A tree: young branches petioles and inflorescence rusty-villous. *Leaves* thinly coriaceous, oblanceolate-acuminate, entire, gradually narrowed from above the middle to the petiole; both surfaces distinctly reticulate, the upper shining, glabrous except the tomentose midrib and nerves; lower villous on the midrib and nerves, otherwise with scattered hairs; main nerves 20 to 24 pairs, spreading, curved, interarching freely; length 12 to 18 in., breadth 3·5 to 4 in., petiole ·75 in. *Panicle* shorter than the leaves, pedunculate, the branches few and short and the flowers sessile and crowded. *Flowers* about ·1 in. in diam.; bracteole oblong, pubescent, shorter than the 4 ovate glabrous sepals: *petals* 0; fertile; *stamens* 2 or 3, shorter than the sepals. *Ovary* elliptic; *style* short, terminal. *Fruit* transversely ovoid-globose, keeled, glabrous, ·3 in. in diam.

Malacca: Maingay, No. 463/2. Perak: Scortechini.

3. MELIOSMA NITIDA, Blume Cat. Hort. Bot. Bogor. 32; Rumphia, III, 202, t. 169. A shrub or small tree: young branches glabrous, lenticellate. *Leaves* 12 to 18 in. long, unequally pinnate, quite glabrous, the rachises deeply channelled on the upper surface; *leaflets* coriaceous, 7 to 13, opposite or alternate, elliptic-ovate or obovate-lanceolate, acute or shortly acuminate, entire, the base more or less cuneate, rarely rounded; both surfaces quite glabrous, the lower paler and prominently reticulate; main nerves 7 to 10 pairs, spreading, curving upwards, interarching at some distance from the margin; length 4 to 12 in., breadth 1·75 to 4·25 in.; petiolules ·35 to ·75 in. *Panicles* terminal or axillary, rather shorter than the leaves, scurfy-puberulous, the branches short and the flowers densely crowded. *Flowers* ·1 in. in diam., shortly pedicelled; the buds pointed, the bracteole single and coriaceous. *Sepals* 4, sub-rotund, concave, spreading. *Petals* 5; the 3 outer rotund, valvate, the sutures of their edges prominent; the two inner completely enclosed, small, each with a stamen opposite it. *Stamens* 2; the hooded anther broad, expanded and with two rotund diverging lobes separated by a wide connective, the filament tapering to a narrow base. *Ovary* ovoid. *Fruit* obliquely elliptic when young, slightly flattened on one side and keeled on the other; when ripe ovoid-rotund, about 1 in. long and ·8 in. in diam. Blume Rumphia III, 202. t. 169; Miq. Fl. Ind. Bat. I, pt. 2. 617. *Meliosma sumatrana*, Hook fil. Fl. Br. Ind. II, 6. *Millingtoma sumatrana*, Jack in Mal. Misc. II, 39; Nees in Flora for 1825, 106; Miq. Fl. Ind. Bat. *l.c.* *Irina integerrima*, Blume Bijdr. 231.

Malacca: Griffith, Maingay, No. 461. Penang: Curtis, No. 2836. Perak: (very common) King's Collector.—DISTRIB. Sumatra.

4. MELIOSMA LEVIS, King n. sp. A tree 40 to 50 feet high: *leaves* 30 to 40 in. long; the rachises and petioles puberulous and terete, the latter swollen at the base; *leaflets* 10 to 12 pairs, coriaceous, narrowly oblong-lanceolate, caudate-acuminate; the edge entire, recurved when dry, the base rather abruptly cuneate: both surfaces glabrous; the upper dull, opaque, olivaceous when dry, the lower pale brown, tesselate-areolate; main nerves 14 to 16 pairs, spreading, curving, interarching far from the edge: length 5 to 7 in., breadth 1 to 1·25 in.; *petiole* ·35 in. *Panicles* about as long as the leaves with lax raceme-like branches, sparsely covered with very short coarse rusty hairs. *Flowers* less than ·1 in. in diam., sessile on very short woody lateral branchlets; *bracteoles* two, unequal, broadly oblong, pubescent. *Sepals* 2, sub-orbicular, concave, erect, thick, puberulous outside. *Petals* 5; the three outer larger than the sepals, very concave, glabrous, the two inner small and irregular. *Stamens* 2, or sometimes 3, the anther with wide hooded connective. *Fruit* unknown.

Malacca: Maingay, No. 463/2. Perak: Scortechini.

3. MELIOSMA NITIDA, Blume Cat. Hort. Bot. Bogor. 32; Rumphia, III, 202, t. 169. A shrub or small tree: young branches glabrous, lenticellate. *Leaves* 12 to 18 in. long, unequally pinnate, quite glabrous, the rachises deeply channelled on the upper surface; *leaflets* coriaceous, 7 to 13, opposite or alternate, elliptic-ovate or obovate-lanceolate, acute or shortly acuminate, entire, the base more or less cuneate, rarely rounded; both surfaces quite glabrous, the lower paler and prominently reticulate; main nerves 7 to 10 pairs, spreading, curving upwards, interarching at some distance from the margin; length 4 to 12 in., breadth 1·75 to 4·25 in.; petiolules ·35 to ·75 in. *Panicles* terminal or axillary, rather shorter than the leaves, scurfy-puberulous, the branches short and the flowers densely crowded. *Flowers* ·1 in. in diam., shortly pedicelled; the buds pointed, the bracteole single and coriaceous. *Sepals* 4, sub-rotund, concave, spreading. *Petals* 5; the 3 outer rotund, valvate, the sutures of their edges prominent; the two inner completely enclosed, small, each with a stamen opposite it. *Stamens* 2; the hooded anther broad, expanded and with two rotund diverging lobes separated by a wide connective, the filament tapering to a narrow base. *Ovary* ovoid. *Fruit* obliquely elliptic when young, slightly flattened on one side and keeled on the other; when ripe ovoid-rotund, about 1 in. long and ·8 in. in diam. Blume Rumphia III, 202. t. 169; Miq. Fl. Ind. Bat. I, pt. 2. 617. *Meliosma sumatrana*, Hook fil. Fl. Br. Ind. II, 6. *Millingtoma sumatrana*, Jack in Mal. Misc. II, 39; Nees in Flora for 1825, 106; Miq. Fl. Ind. Bat. *l.c.* *Irina integerrima*, Blume Bijdr. 231.

Malacca: Griffith, Maingay, No. 461. Penang: Curtis, No. 2836. Perak: (very common) King's Collector.—DISTRIB. Sumatra.

4. MELIOSMA LEVIS, King n. sp. A tree 40 to 50 feet high: *leaves* 30 to 40 in. long; the rachises and petioles puberulous and terete, the latter swollen at the base; *leaflets* 10 to 12 pairs, coriaceous, narrowly oblong-lanceolate, caudate-acuminate; the edge entire, recurved when dry, the base rather abruptly cuneate: both surfaces glabrous; the upper dull, opaque, olivaceous when dry, the lower pale brown, tesselate-areolate; main nerves 14 to 16 pairs, spreading, curving, interarching far from the edge: length 5 to 7 in., breadth 1 to 1·25 in.; *petiole* ·35 in. *Panicles* about as long as the leaves with lax raceme-like branches, sparsely covered with very short coarse rusty hairs. *Flowers* less than ·1 in. in diam., sessile on very short woody lateral branchlets; *bracteoles* two, unequal, broadly oblong, pubescent. *Sepals* 2, sub-orbicular, concave, erect, thick, puberulous outside. *Petals* 5; the three outer larger than the sepals, very concave, glabrous, the two inner small and irregular. *Stamens* 2, or sometimes 3, the anther with wide hooded connective. *Fruit* unknown.

Perak: King's Collector, No. 7893.

This is allied to *M. lanceolata*, Bl., but it appears to me to differ from that and from every other described species. From *M. lanceolata* it is readily distinguished by its more numerous perfectly smooth leaflets tesselate-reticulate beneath; by its flowers on short ultimate branchlets; by its double bracteole and concave petals.

5. Meliosma lanceolata, Blume Cat. Hort. Bot. Bogor. 32; Rumphia III, 200, t. 168. A tree: young branches stout, more or less covered with short deciduous rusty tomentum. *Leaves* 12 to 24 in. long; the petiole stout, terete, swollen at the base, the rachis glabrescent or puberulous; *leaflets* 6 to 8 pairs with one odd, very coriaceous, oblong, shortly acuminate; the edges entire, recurved when dry: the base rounded or slightly cuneate, sometimes oblique; upper surface smooth and shining, usually very rugulose from the depression of the nerves and reticulations: lower surface dull, the midrib nerves and reticulations very prominent and with numerous flexuose sub-adpressed hairs: length 3 to 6 in., breadth 1·25 to 2 in.; petiolules ·2 to ·35 in. long, stout, pubescent. *Panicles* very large, with long raceme-like branches, rusty-pubescent. *Flowers* in rather close clusters, sessile, ·1 in., in diam.; bracteole single. *Sepals* 3, orbicular-triangular, blunt, sub-glabrous. *Petals* 5; the three outer orbicular, flat and much larger than the sepals; the two inner small, irregular, shorter than the stamens. *Stamens* 2, shorter than the outer petals, the anthers very broad. *Fruit* sub-globular, compressed, boldly keeled, glabrous, ·3 in. in diam. Hook. fil.-Fl. Br. Ind. II, 7.

Malacca: Griffith, No. 1022; Maingay, No. 361; Derry, Nos. 21 and 1122. Singapore: Ridley, Nos. 347, 1892, 3876.

Var. *pubescens*, Hook. fil. Fl. Br. Ind. II, 7. Under surfaces of the leaves and inflorescence densely and softly rusty-tomentose: fruit ·4 in. in diam.

Singapore: Ridley, No. 6341.

6. Meliosma Ridleyi, King n. sp. A medium tree: *leaves* 15 in. or more in length, their rachises densely and minutely rufous-tomentose: *leaflets* 11 to 15, opposite or alternate, thinly coriaceous, oblong or oblong-lanceolate, shortly acuminate, the base abruptly and obliquely cuneate; upper surface not rugulose, sparsely adpressed-pubescent, the midrib and nerves tomentose: under surface minutely rufous-pubescent, the midrib and nerves with dense long shining hairs: main nerves 7 or 8 pairs, ascending, curving, the reticulations distinct: length 2·5 to 5 in., breadth ·9 to 1·2 in.; petiolules ·1 to ·2 in., tomentose. *Panicle* longer than the leaves, densely rufous-tomentose, with short branches bearing the ultimate spikes of flowers. *Flowers* solitary, oblong, not globular

even in bud, under ·1 in. long. *Bracteoles* two, unequal, ovate, acute, pubescent; pedicel of flower very short. *Sepals* 5, ovate, blunt, concave, erect, shortly ciliolate at the edges. *Petals* and *stamens* absent. *Ovary* broadly ovoid, tomentose; *style* thick, conical, glabrescent. *Fruit* unknown.

Singapore: Ridley, No. 6342.

The only specimens of this are in flower; and, the ovaries having been fertilised, the petals and stamens (as is the case in other species of *Meliosma*) have fallen off. The only specimens known are Mr. Ridley's. They were collected in the little patch of forest which forms an adjunct to the Botanic Garden of Singapore, which is one of the few pieces of the original vegetation of the island which have escaped the ravages of axe and spade. In leaf this plant is not unlike *M. lanceolata*, Bl., but the nervation and pubescence of the leaflets are different.

Note.—Besides the foregoing, there are in the Calcutta Herbarium specimens from Singapore (Herb. Ridley, without a number) of a pinnate-leaved *Meliosma*. None of these are in fruit, but there are plenty of flowers, and these closely resemble the flowers of *M. lanceolata*, Bl. The leaflets of this plant are narrowly oblong, of rather thinner texture than those of *M. lanceolata*, and their upper surfaces are not glabrous (except the pubescent midrib), and they are not at all rugulose; the under surfaces are densely covered with unequally long shining hairs.

Nat. Ord. XXXVI, Anacardiaceae.

Trees or shrubs usually with oleo-resinous often acrid juice. *Leaves* alternate (opposite in *Bouea*), simple or compound. *Flowers* small, regular, unisexual, polygamous, sometimes hermaphrodite, usually in panicles, the ultimate branchlets being cymose. *Calyx* 3–5-partite, sometimes accrescent (spathaceous in *Gluta*, calyptrate in *Melanorrhoea*). *Petals* 3 to 5, alternate with the segments of the calyx, free, imbricate or valvate in bud, sometimes accrescent, rarely absent. *Disc* flat, cupular or annular, entire or lobed, rarely obsolete. *Stamens* equal in number to the petals, or fewer, or more numerous, often abortive, inserted beneath the disc, rarely on it: *filaments* often subulate; the anthers 2-celled, basi- or dorsi-fixed. *Pistil* in the male flower usually absent, in the female solitary, or pistils 4 or 6 and apocarpous, or 2 to 5 and syncarpous: *ovary* mostly superior (half-inferior in *Holigarna*) the loculi with a single ovule pendulous from the top of the cell or from its side, or from an ascending funicle rising from the base: *styles* 1 to 5 and free, or the stigma sub-sessile, or simple or lobed. *Fruit* superior (except in *Holigarna* and *Drimycarpus*) and drupaceous, with one cell and one seed, and sometimes with accrescent sepals or petals; or a false drupe with a 2- to 5-celled stone covered by pulp. *Seed* exalbuminous: the *embryo* straight or curved: *cotyledons* plano-convex, radicle short.—Distrib. chiefly tropical: about 430 species in 55 genera.

Sub-Order I. ANACARDIAE. Ovary 1-celled (in all the Asiatic species).

Tribe I.—*Mangiferae.* Carpels solitary, or 5 with only one fertile; style usually lateral or gynobasic, ovules pendulous, or semi-pendulous (in *Anacardium*) from a basal funicle; ovary often with a gynophore; stamens in one or more whorl, sometimes reduced to a single individual; leaves simple.

Neither sepals nor petals accrescent.

Carpels 5, rarely 4 or 6; stamens 10 ... 1. BUCHANANIA.

Carpel solitary.

Leaves opposite ... ... 2. BOUEA.

Leaves alternate.

Calyx 4–5-partite, stamens 1 to 5; drupe with succulent mesocarp, the endocarp hard and fibrous, the peduncle not enlarged ... ... 3. MANGIFERA.

Calyx 4–5-partite, stamens 8 to 10 all or only a few perfect; drupe reniform, compressed, the peduncle much enlarged ... ... 4. ANACARDIUM.

Calyx spathaceous, petals 4 to 6; torus stipitate, drupe sub-ligneous, tubercled or ridged, the endocarp leathery ... ... 5. GLUTA.

Petals accrescent.

Calyx calyptriform; stamens 5 or numerous ... ... 6. MELANORRHOEA.

Calyx 5-partite; stamens 5, drupe stalked ... ... 7. SWINTONIA.

Tribe II.—*Rhoideae.* Carpels solitary or 3 and united; styles terminal or lateral, free or connate below; ovary 1-celled; ovule solitary, rising by a short funicle from the base or from near the base of the cell, or suspended from the wall near the apex; stamens in 1 or 2 whorls; fruit drupaceous, 1-celled, 1-seeded, sometimes with the accrescent calyx-segments at its base (obscurely 2-celled in *Drepanospermum*); embryo usually curved, rarely straight: leaves simple, trifoliolate or pinnate.

Leaves simple.
Sepals accrescent, fruit sessile; flowers 4-merous, embryo straight ... ... 8. PARISHIA.
Sepals not accrescent; flowers 5-merous; stamens 6 to 10, style 1, embryo curved .. 9. CAMPNOSPERMA.
Leaves pinnate; petals imbricate.
Stamens 5, alternating with 5 staminodes.
Stigma erect, 3-lobed ... ... 10. MICROSTEMON.
Stigma flat, much bent, not 3-lobed ... 11. PENTASPADON.
Stamens 4 to 10; staminodes none.
Stamens 4 to 10; styles 3; drupe solitary, small, compressed, 1-celled, 1-seeded, not crowned by the styles ... 12. RHUS.
Stamens 8 to 10; styles 3 or 4; drupe reniform, compressed, 1-celled, 1-seeded, crowned by the distant styles ... 13. ODINA.

Tribe III.—*Semecarpeae.* Ovary consisting of three united carpels, unilocular, free or immersed in and adnate to the cupular or tubular disc; ovule solitary, suspended by a funicle from the side of the loculus above its middle or just below the apex, stamens in a single row; styles 3; drupe large, usually connate with the enlarged more or less fleshy peduncle, inferior in *Drimycarpus*.
Drupe superior.
Petals valvate, stamens 5, style 1; calyx-tube persistent, much enlarged in the fruit and adnate to the base of the drupe 14. MELANOCHYLA.
Petals imbricate, stamens 5, styles 3, drupe on a much enlarged fleshy receptacle... ... ... 15. SEMECARPUS.
Drupe inferior.
Petals imbricate, stamens 5, style 1, ovary inferior, drupe transversely ovoid ... 16. DRIMYCARPUS.

Sub-Order II. SPONDIAE. Ovary and drupe 2- to 5-celled, ovules pendulous.
Flowers bisexual, 5-merous, stamens 10; styles 5, thick, connate by their apices; drupe 5-celled, sometimes fewer-celled by abortion ... 17. DRACONTOMELUM.

1. Buchanania, Roxb.

Trees. *Leaves* alternate, petioled, simple, quite entire. *Panicles* terminal and axillary, crowded. *Flowers* small, white, hermaphrodite. *Calyx* short, 3–5-toothed or -lobed, persistent, imbricate. *Petals* 4–5, oblong, recurved, imbricate. *Disc* orbicular, 5-lobed. *Stamens* 8–10, free, inserted at the base of the disc. *Carpels* 5–6, free, seated in the cavity of the disc, one fertile, the rest imperfect; *style* short, stigma truncate; *ovule* 1, pendulous from a basal funicle. *Drupe* small, flesh scanty; *stone* crustaceous or bony, 2-valved. *Seed* gibbous, acute at one end; *cotyledons* thick; *radicle* superior.—Distrib. A tropical Asiatic, Australian and Polynesian genus; species about 25.

Anthers not sagittate at the base ... ... 1. *B. platyneura.*
Anthers sagittate at the base.
Leaves always sharply acuminate at the apex, the lower surface of the midrib pubescent; panicles pubescent ... ... 2. *B. sessilifolia.*
Leaves rounded or obtuse at the apex, sometimes shortly and bluntly acuminate, everywhere glabrous: panicle glabrous ... ... 3. *B. florida.*

1. Buchanania platyneura, Kurz in Journ. As. Soc. Bengal XLV (1876), pt. 2, p. 125. A tree 40 to 60 feet high, the young shoots deciduously puberulous. *Leaves* coriaceous, narrowly elliptic to elliptic-lanceolate, shortly and bluntly acuminate, the base cuneate and sometimes slightly unequal; both surfaces glabrous and shining, the reticulations when dry distinct or not, the midrib broad on both surfaces; main nerves 11 to 13 pairs, spreading, curving; length 4 to 9 in. or even 11 in., breadth 1·75 to 2·5 in., petiole ·5 to 1 in. *Panicles* crowded at the ends of the branches, axillary, erect, shorter or longer than the leaves, shortly pedunculate, puberulous; their branches short, slender, horizontal, cymosely few-flowered. *Flowers* ·1 in. in diam., on minutely bracteolate pedicels longer than themselves. *Sepals* 4, thick, ovate or elliptic, obtuse, much shorter than the petals. *Petals* 4, oblong, very blunt, spreading and reflexed. *Stamens* 8; the anthers narrow, elongate, the bases not sagittate, the apices recurved; *filaments* longer than the anthers, flat. *Pistils* several, one only ripening. *Drupe* sub-globular, with 4 vertical ridges, two prominent and two obscure, glabrous, purplish-black when ripe; the stone hard, ·4 in. in diam. Engler in DC. Mon. Phan. IV, 193.

The Andaman and Nicobar Islands: very common.

This is put by Engler amongst doubtful species—no doubt as the result of his not having seen good specimens; for the species is a very well-marked one. Its nearest ally is the Sumatran species *B. splendens*, Miq.

2. Buchanania sessilifolia, Blume Mus. Bot. Lugd. Bat. I, 184. A shrub or small tree, the young branches puberulous and not swollen, ultimately glabrous. *Leaves* thinly coriaceous, oblanceolate, always abruptly acuminate at the apex and much narrowed to the base, either with a short petiole or sessile; the upper surface glabrous and rather dull, the lower pale-brown when dry and glabrous except often the sparsely adpressed-pubescent midrib; main nerves 13 to 15 pairs, spreading, slightly prominent on the lower surface; length 3·5 to 7 in., breadth 1·5 to 2·5 in.; petiole none or from ·1 to ·6 in. long. *Panicles* pedunculate, exceeding the leaves, slender; the branches divaricate, and with the flowers crowded towards their apices, sparsely pubescent. *Flowers* ·15 in. in diam., on short pedicels. *Sepals* 5, sub-rotund, puberulous. *Petals* 5 or 6, much larger than the sepals, oblong, blunt with the apices recurved, glabrous. *Stamens* 8 or 10: the *anthers* sagittate, the basal lobes rounded and swollen; the filaments short, thick, compressed. *Pistils* several. *Drupe* sub-cordate, rotund, compressed, glabrous, about ·35 in. long. Miq. Fl. Ind. Bat., Vol. I, pt. 2, 637; Suppl. 523; Engler in DC. Mon. Phan. IV, 191. *B. acuminata*, Turcz. in Bull. Mosc. (1858), I, 472; Hook. fil. Fl. Br. Ind. II, 24; Kurz For. Flora Burma, I, 308. *Hypericinea lucida*, Wall. Cat. 4827. *Terebinthacea*, Wall. Cat. 8505, (*fide* Hook. fil.)

In all the Provinces except the Andamans and Nicobars: very common.—Distrib. the Malayan Archipelago.

This differs from all the forms of *B. florida*, Schauer, in having more acuminate leaves of thinner texture, with the midrib pubescent on the lower surface, and with rather more numerous nerves: and also in having a pubescent panicle and larger fruit. There is considerable variation as to the petiole. In some specimens there is no petiole at all, and it is to these which Blume gave the name *B. sessilifolia*, Turczaninoff's name *B. acuminata*, being applicable to all the forms, is a far more appropriate one; and Sir Joseph Hooker adopts it although the procedure is, as he admits, "against the laws of priority;" for Turczaninoff's species was not published until 1858, whereas Blume dates from 1851.

3. Buchanania florida, Schauer in Nov. Act. Caes. Leop. Carol. XIX, Suppl. I, 481. A small glabrous tree, young branches close to the leaves, thick and with many cicatrices. *Leaves* thinly coriaceous, oblong-lanceolate to obovate-oblong, the apex rounded or obtuse; narrowed from below the middle to the broad channelled somewhat winged petiole; both surfaces shining, reticulate; main nerves about 12 pairs, intermediate veins very distinct; length 4 to 5·5 in., breadth 1·25 to ·75 in.; petiole ·5 to ·75 in. *Panicles* crowded about the ends of the

branches, axillary, longer than the leaves, narrow, lax, the branches short, bracteoles minute. *Flowers* on pedicels longer than themselves, ·25 in. in diam. *Sepals* 4 or 5, orbicular, slightly unequal. *Petals* 4 or 5, larger than the sepals, elliptic, obtuse. *Stamens* 8, the anthers elongate, cordate at the base; the filaments shorter, subulate. *Pistils* 3 or 4, but one only fertile. *Drupe* broadly ovoid or sub-globular, slightly compressed, about ·25 in. long. Engl. in DC. Mon. Phan. IV, 188.

Var. *lucida*, Engler *l. c.* 189: *Leaves* oblong-lanceolate, sometimes shortly and obtusely acuminate, the nerves and veins very prominent. *B. lucida*, Blume Mus. Bot. Lugd. Bat. I, 184; Hook. fil. Fl. Br. Ind. II, 24; Miq. Fl. Ind. Bat. I, pt. 2, p. 637. *B. palembanica*, Blume *l. c.* 186; *B. subobovata*, Griff. Not. IV, 413. *B. polybotrya*, Miq. Fl. Ind. Bat. I, pt. 2, p. 638. *Hypericinea angustata*, Wall. Cat., No. 4830. *B. arborescens*, Blume Mus. Bot. Lugd. Bat. I, 183; Kurz For. Flora Burma, I, 308.

Penang, Kedah, Singapore, Malacca, Perak:—Distrib. Sumatra, Burma.

This, although widely distributed in the Malayan Peninsula, does not appear to be any thing like so abundant a tree as *B. acuminata*, but it is more common than the following variety.

Var. *petiolaris*, Engl. *l. c.* 189: *Leaves* obovate-oblong, contracted at the base into the long cuneate petiole. *B. petiolaris*, Miq. Fl. Ind. Bat. Vol. I, pt. 2, p. 637. *B. bancana*, Miq. Fl. Ind. Bat. Suppl. 523.

Penang: Wallich (Cat. No. 4831). Singapore: Ridley, Nos. 438, 1882.

2. Bouea, Meissn.

Trees. *Leaves* opposite, petioled, coriaceous, glabrous, quite entire. *Flowers* small, in axillary and terminal panicles, polygamous. *Sepals* 3–5, deciduous, valvate. *Petals* 3–5, vertically keeled on the inner face, imbricate. *Disc* very small. *Stamens* 3–5, inserted within the disc, all fertile. *Ovary* sessile; *style* short, terminal, stigma obscurely and unequally 3-lobed; *ovule* ascending from the wall of the cavity. *Drupe* fleshy; *stone* thin, fibrous, 1-celled, 1-seeded. *Seed* suberect; *cotyledons* fleshy; *radicle* very short, inferior.—Distrib. Species 5, natives of Tropical Asia and the Malay Archipelago.

Leaves 3 to 5 in. long; panicles laxly flowered; sepals puberulous; petals oblong, erect; fruit ·6 to ·75 in. long	1. *B. burmanica.*
Leaves 5 to 8 in. long; panicles densely flowered; sepals tomentose; petals oblanceolate-oblong, spreading; fruit more than 2 in. long	2. *B. macrophylla.*

1. Bouea burmanica, Griff. Plant. Cantor. 14. A glabrous tree 50 to 60 or even 90 feet high; young branches slender. *Leaves* thinly coriaceous, oblong-lanceolate, shortly and obtusely acuminate, the base cuneate; main nerves 10 to 15 pairs, spreading, slightly depressed on the upper and slightly projecting on the lower surface; length 3 to 5 in., breadth 1 to 2 in.; petiole ·25 to ·5 in. *Panicles* much shorter than the leaves, terminal or axillary, slender, with a few spreading laxly-flowered puberulous branches, bracteoles absent. *Flowers* oblong, less than ·1 in. in diam., glabrous, on pedicels longer than themselves. *Sepals* 4, unequal, leathery, broadly ovate, puberulous. *Petals* 4, very thick, erect, oblong, obtuse, longer than the sepals, quite glabrous. *Stamens* 3 to 5, shorter than the petals, the anthers linear, the filaments short. *Ovary* obliquely ovoid. *Drupe* obliquely ovoid, slightly apiculate, ·6 to 1 in. long. Hook. fil. Fl. Br. Ind. II, 21; Kurz For. Flora Burma, I, 306; Engler in DC. Mon. Phan. IV, 240. *B. oppositifolia*, Meissn. in Walp. Rep. I. 556; Kurz For. Flora Burma, *l. c.* 306. *B. Brandisiana*, Kurz in Journ. As. Soc. Beng. 1871, II, 50: 1873, II, 66. *Mangifera oppositifolia*, Roxb. Fl. Ind. I, 640; Hort. Beng. 18; Wall. Cat. 8490. *Cambessedea*, W. and A. Prodr. I, 170.

In all the Provinces.—Distrib. Burma.

Var. *microphylla*, Engl. in DC. Mon. Phan. IV, 240. All the parts smaller than in the type. *Bouea microphylla*, Griff. Plant. Cantor. 15; Notul. IV, 423; Hook. fil. Fl. Br. Ind. II, 21. *B. diversifolia*, Miq. Fl. Ind. Bat. Suppl. 522. *B. myrsinoides*, Blume Mus. Bot. t. I, 204; Miquel *l. c.* I, pt. 2, 635.

Malacca: Griffith, 1106; Maingay, 479. Singapore: Ridley; Hullett, No. 660.

2. Bouea macrophylla, Griff. Plant. Cantor. 15: Notulae, IV, 420. A tree, all parts glabrous except the inflorescence. *Leaves* coriaceous, oblong-lanceolate, the apex very shortly and bluntly acuminate, the base cuneate or rounded; both surfaces shining; main nerves 18 to 20 pairs, spreading, slightly depressed on the upper and prominent on the lower surface; length 5 to 8 in., breadth 1·65 to 2·65 in.; petiole ·75 to 1 in. *Panicles* axillary and from the axils of old leaves, 2 to 4 in. long, puberulous; their branches spreading, short, and densely flowered. *Flowers* ·1 in. in diam., on tomentose pedicels shorter than themselves. *Sepals* 3 or 4, ovate, unequal, blunt, spreading, tomentose externally. *Petals* 3 or 4, oblanceolate-oblong, rather thick, glabrous. *Stamens* 3 or 4, about as long as the sepals: *anthers* ovate, slightly longer than the filaments. *Ovary* narrowly ovoid, pubescent. *Drupe* "ovoid-oblong, as large as a hen's egg" (Griff.), pulp abundant; *stone* leathery, fibrous. Hook. fil. Fl. Br. Ind. II, 21; Engler in DC. Mon.

Phan. IV, 239. *B. Gandaria*, Blume Mus. Bot. Lugd. Bat. I, 204, (sub *B. oppositifolia.*)

Malacca: Griffith, No. 1105; Maingay, No. 478. Perak: Scortechini, No. 1938; King's Collector, No. 679.

This species has larger leaves and fruit than *B. burmanica*, and the panicles are much more densely flowered than in that species. The calyx moreover in this is very tomentose, and the petals are narrow oblanceolate and spreading.

3. Mangifera, Linn.

Trees. *Leaves* alternate, petioled, quite entire, coriaceous. *Flowers* small, polygamous, in terminal panicles, pedicel articulate; bracts deciduous. *Sepals* 4 or 5, imbricate, deciduous. *Petals* 4–5, free or adnate to the disc, imbricate; nerves thickened, sometimes ending in excrescences. *Stamens* 1–5, rarely 8, inserted just within the disc, or on it, 1 usually more perfect and much larger than the others; the others with imperfect or smaller anthers, or reduced to teeth or quite absent. *Ovary* sessile, 1-celled, oblique; *style* lateral; *ovule* pendulous, funicle basal, or inserted on the side of the cell above its base, rarely horizontal. *Drupe* large, fleshy; *stone* compressed, fibrous. *Seed* large, compressed, testa papery; *cotyledons* plano-convex, often unequal and lobed.—Distrib. tropical Asiatic, chiefly Malayan; about 30 species.

Disc fleshy, tumid, more or less deeply 4- or 5-lobed, the petals inserted at its base.

Sepals and petals 4, stamen 1.

Panicles puberulous.

Leaves narrowly elliptic or elliptic-oblong, tapering much to each end, thinly coriaceous; petioles 1 to 1·25 in. long ...	1. *M. Griffithii.*
Leaves elliptic, sub-coriaceous, petioles ·25 to ·4 in. long	2. *M. microphylla.*
Leaves broadly elliptic, slightly obovate, thickly coriaceous; petioles ·25 to ·75 in. long	3. *M. sclerophylla.*

Panicles quite glabrous.

Leaves not reticulate, or very indistinctly so on the lower surface only ...	4. *M. Maingayi.*
Leaves distinctly reticulate.	
Leaves broadly oblanceolate or obovate-elliptic	5. *M. andamanica.*
Leaves elliptic-oblong or oblong-lanceolate.	

Petioles of leaves 2 to 4·5 in. long, thickened and dilated near the base; flowers 8 to 12 on the ultimate branchlets, racemose ... 6. *M. longipetiolata.*

Petioles of leaves ·75 to 1·2 in. long, only slightly thickened at the base; flowers on the ultimate branchlets in cymules of 3. ... 7. *M. quadrifida.*

Sepals and petals 5.

Stamens 5 all fertile; panicle as in *M. indica* ... ... 8. *M. pentandra.*

Stamen 1 perfect, with or without abortive ones (staminodes).

Panicle minutely tomentose or pubescent 9. *M. indica.*

Panicle quite glabrous.

Leaves very coriaceous ... ... 10. *M. oblongifolia.*

Leaves thinly coriaceous.

Leaves oblong, or elliptic-oblong, 5 to 8 in. long., with 16 to 20 pairs of prominent main nerves; stamen longer than the petals ... ... 11. *M. longipes.*

Leaves elliptic-lanceolate, 3 or 4in. long, with 10 or 12 pairs of indistinct main nerves; the petals shorter than the stamen ... ... 12. *M. gracilipes.*

Disc minute or absent.

Panicles glabrous (black when dry) stamens attached to the minute disc.

Leaves elliptic-lanceolate, acute or acuminate, reticulate, main nerves about 20 pairs; flowers ·25 in. long, drupe oblong... 13. *M. odorata.*

Leaves elliptic-oblong, obtuse or sub-acute, the reticulations indistinct or obsolete, main nerves 15 to 18 pairs; flowers ·35 in. in diam., disc cylindric; drupe elliptic to globose ... ... 14. *M. foetida.*

Leaves narrowly linear-oblong or linear-lanceolate, with 25 to 35 pairs of main nerves, both surfaces conspicuously reticulate; flowers nearly ·3 in. long; drupe obliquely and broadly oblong-globose ... 15. *M. fragrans.*

Panicles puberulous, flowers ·35 in. long; leaves with obtuse or rounded apices; stamens 5 or 6, all perfect ... ... 16. *M. lagenifera.*

Panicles tomentose or pubescent; petals adnate to the cylindric torus.

Flowers not more than ·3 in. long.

Leaves sessile or sub-sessile, oblanceolate or obovate-oblong, 9 to 15 in. long, panicle 20 to 30 in. long ... ... 17. *M. kemanga.*

Leaves broadly lanceolate or elliptic-oblong, shortly acuminate, 6 to 12 in. long; panicle 12 to 15 in. long. ... 18. *M. caesia.*

Flowers ·75 in. long, with large concave bracts... ... ... 19. *M. superba.*

1. Mangifera Griffithii, Hook. fil. in Trans. Linn. Soc. XXII, 168. A tree with stout glabrous branches. *Leaves* thinly coriaceous, narrowly elliptic or elliptic-oblong, tapering from about the middle to each end, the apex sub-acute or very shortly and bluntly acuminate, the base cuneate, both surfaces glabrous and reticulate; main nerves about 14 to 16 pairs, spreading, slightly raised on both surfaces; length 5 to 7 in., breadth 2 to 2·5 in.; petiole 1 to 2·5 in. *Panicles* coarsely puberulous, axillary, slightly longer than the leaves, raceme-like, with very short few-flowered branches. *Flowers* less than ·1 in. long, on short pubescent pedicels. *Sepals* 4, broadly ovate, obtuse, concave, unequal, pubescent outside. *Petals* 4, a little longer than the sepals, broadly obovate, with 1 or 2 short thickened ridges near the base, glabrous. *Stamen* 1, inserted on the 4-lobed glabrous disc. *Ovary* unknown. *Fruit* oblong, slightly obovoid, obtuse, glabrous, about 1·5 in. long and greenish yellow when ripe, the pulp firm: *stone* less than 1 in. long. Hook. fil. Fl. Br. Ind. II, 14; Engler in DC. Mon. Phan. IV, 203.

Malacca: Griffith, No. 1100/1. Perak: King's Collector, No. 7539.

This species is imperfectly known as yet. The material which I have used in describing it consists of Griffith's specimens on which the species was founded, and they have only male flowers; and of some sent from Perak by the Calcutta Collector which are in fruit and have no flowers. In leaves these two sets agree absolutely, and I have no hesitation in bringing them together as belonging to the same species.

2. Mangifera microphylla, Griff. MSS. ex Hook. fil. Fl. Br. Ind. II, 17. A small tree. *Leaves* sub-coriaceous, elliptic, shortly acuminate, the base narrowed but rounded, both surfaces shining and faintly reticulate; main nerves 10 to 12 pairs, spreading but curving upwards,

slightly prominent; length 2 to 4 in., breadth 1 to 2 in.; petiole ·25 to ·4 in. *Panicles* in fascicles from the apices of the branches, shorter than the leaves, raceme-like with short few-flowered branches, puberulous. *Flowers* ·2 in. in diam., on short stout pedicels. *Sepals* 4, broadly ovate, pubescent. *Petals* 4, twice as long as the sepals, oblong, with 3 distinct vertical ridges. *Stamen* 1, staminodes absent. *Ovary* subglobose, puberulous, the style terminal. *Drupe* "oviform," green. Engler in DC. Mon. Phan. IV, 209.

Malacca: Griffith, Nos. 1102, 1103, (in orchards only.)

Another imperfectly known cultivated species of which only scraps exist in collections.

3. MANGIFERA SCLEROPHYLLA, Hook. fil. Fl. Br. Ind. II, 15. A tree; young branches stout, angled, glabrous. *Leaves* very coriaceous, broadly elliptic, slightly obovate, the apex usually sub-acute but sometimes acute, slightly narrowed to the rounded or sub-cuneate base both surfaces glabrous, the reticulations obscure, the midrib thick; main nerves about 12 pairs, thick, spreading, much curved upwards at the ends, slightly prominent on both surfaces when dry; length 2·5 to 5 in., breadth 1·5 to 2·75 in.; petioles of the upper leaves ·25 in., of the lower ·75 in., all stout. *Inflorescence* consisting of a terminal fascicle of many spikes, some of them with 1 or 2 branches, longer than the leaves, covered with short coarse tawny pubescence. *Flowers* ·1 in. in diam., each sessile in the axil of a reflexed ovate concave pubescent bracteole longer than itself. *Sepals* 4, broadly ovate, sub-acute, concave, pubescent outside. *Petals* 4, about the same size and shape as the sepals, glabrous. *Stamen* 1; disc fleshy, ovary ovoid. *Drupe* ovoid, glabrous, about 1·5 in. long when ripe. Engler in DC. Mon. Phan. IV, 205.

Malacca: Maingay, No. 494. Singapore: Ridley, No. 4772.

This is another species that is poorly represented in collections. The leaves are, as Sir Joseph Hooker justly remarks, unlike those of any other *Mangifera*; for they are comparatively broad in proportion to their length. They vary considerably in size and in the length of their petioles.

4. MANGIFERA MAINGAYI, Hook. fil. Fl. Br. Ind. II, 17. A tree, glabrous in all its parts. *Leaves* coriaceous, elliptic-oblong, acute or acuminate, the base rounded or cuneate; reticulations on the upper surface not visible and on the lower very slightly so; main nerves 15 to 20 pairs, faint, spreading, curving very little; length 4 to 9 in., breadth 1·5 to 3·5 in.; petiole ·8 to 2 in. *Panicle* quite glabrous, pale green (when dry), pyramidal, equal to or rather exceeding the leaves; the branches spreading, rather slender. *Flowers* ·2 in. in diam. their pedicels slender. *Sepals* 4, ovate, obtuse. *Petals* 4, twice as

long as the sepals, oblong, with 3 to 5 confluent vertical ridges. *Stamen* 1, short; the staminodes minute, tooth-like. *Ovary* globose; the style short, subulate, sub-terminal. *Fruit* unknown. Engler in DC. Mon. Phan. IV, 208.

Malacca: Maingay, No. 472.

I have never seen this, and the foregoing description of it is compiled from Sir Joseph Hooker who makes the following note:—

"There appear to be two varieties of this in Maingay's Herbarium; one (called Sapoong or Sampong), with larger leaves not narrowed into the petiole, opaque above, with sunk nerves, tumid between the nerves; the other (marked as truly wild) with brown (when dry) more shining leaves, narrowed into the petiole, more reticulated beneath, and the nerves not sunk; its leaves are like those of *M. indica* from which its glabrous pedicelled flowers and warted petals at once distinguish it; both differ from *M. quadrifida* in the inflorescence. The first variety has, according to Maingay, globose green fruit 3-4 by 2½-3 in."

5. MANGIFERA ANDAMANICA, King n. sp. A perfectly glabrous tree; young branches slender and with pale bark. *Leaves* drying very pale, broadly oblanceolate or obovate-elliptic, the apex rounded or obtuse, gradually narrowed from above the middle to the broad channelled petiole; both surfaces finely reticulate, shining, the lower paler: main nerves 10 or 12 pairs, curving upwards, slightly prominent on the lower surface; length 3·25 to 4·5 in., breadth 1·25 to 2 in.; petiole ·5 to ·75 in., thickened in its lower half. *Panicles* terminal, twice as long as the leaves or even three times as long, branching from the base, the branches spreading, lax, the flowers borne at the extremities of the slender ultimate branchlets. *Flowers* ·3 in. in diam., quite glabrous, on pedicels about as long as themselves; bracteoles if any deciduous. *Sepals* 4, lanceolate, slightly unequal, sub-concave. *Petals* 4, twice as long as the sepals, ovate-elliptic, with 5 sub-confluent ridges on the lower half of the inner surface. *Stamen* 1, shorter than the petals, inserted on the inner edge of the fleshy deeply 4-lobed disc. *Ovary* sub-globose: *style* sub-terminal, nearly as long as the petals. *Drupe* elliptic, glabrous, nearly 1·5 in. long when ripe, the pulp thin.

Andaman Islands: King's Collectors.

A very distinct species allied to *M. Maingayi*, Hook. fil., but with smaller more obtuse leaves and larger flowers than that species.

6. MANGIFERA LONGIPETIOLATA, King n. sp. A glabrous tree 40 to 60 feet high; young branches rather stout, with pale brown bark. *Leaves* coriaceous, oblong to elliptic-oblong, tapering to both ends, the apex shortly acuminate, gradually narrowed in the lower third to the long petiole, both surfaces pale when dry and distinctly reticulate; main nerves 16 to 20 pairs, slender, slightly prominent on both surfaces, spreading, curving, the midrib very prominent and strong on the lower

surface; length 7·5 to 10 in., breadth 2·25 to 3·75 in.; petiole 2 to 4·5 in., thickened and dilated near the base. *Panicles* quite glabrous, axillary and terminal, branching from the very base; the branches few, ascending, and with short lateral racemoid branchlets bearing 8 to 12 pedicellate flowers near their ends. *Flowers* ·15 in. in diam., their pedicels rather longer than themselves, with 1 or 2 minute bracteoles at their bases. *Sepals* 4, ovate-lanceolate, rather unequal. *Petals* 4, larger than the sepals, elliptic, thickened near the base by 3 broad vertical tuberculate ridges. *Stamen* 1, a little shorter than the petals, inserted on the obscurely lobed cupular fleshy disc, the anther elliptic. *Ovary* sub-globular with slightly lateral slender style. *Drupe* unknown.

Perak: at an elevation of about 2,500 feet; King's Collector, No. 7266.

This resembles *M. quadrifida*, Jack, but the ultimate branchlets of the panicle are longer, the flowers are more numerous and are racemose instead of being cymose as in *M quadrifida*. The petioles moreover are longer in this, and are dilated near the base; the main nerves of the leaves are more prominent and the reticulations are larger and more distinct, while the midrib is much stouter and more prominent on the lower surface. This grows at higher elevations than *M. quadrifida*. In the great length of its petioles this resembles *M. longipes*, Griff.; but that has 5-merous flowers, whereas flowers of this are 4-merous.

7. MANGIFERA QUADRIFIDA, Jack in Roxb. Fl. Ind. ed. Carey. II, 440. A tree 40 to 60 feet high, all parts quite glabrous. *Leaves* coriaceous, elliptic-oblong or oblong-lanceolate, tapering from about the middle to the sub-acute apex and much attenuate base; reticulations faint on both surfaces, but specially on the upper: main nerves 16 to 18 pairs, spreading, curved, slightly prominent; length 5 to 7 in., breadth 1·75 to 2·5 in.; petiole ·75 to 2·5 in.; petiole ·75 to 1·2 in. *Panicles* from the uppermost axils, often crowded or terminal, exceeding the leaves, not pedunculate, branching from near the base, the branches semi-erect, with very short lax 3-flowered cymose branchlets. *Flowers* ·15 in. in diam., on pedicels about their own length. *Sepals* 4, broadly ovate, obtuse, minutely puberulous, spreading. *Petals* 4, twice as long as the sepals, elliptic, sub-acute, glabrous, with 3 confluent vertical ridges in the lower half, the middle one thickened at the apex. *Stamen* 1, from the inner side of one of the four deep lobes of the fleshy disc, shorter than the petals, the anther small. *Ovary* broadly ovoid, glabrous; the *style* terminal, as long as the stamen, thickened at the base. *Staminodes* none. *Drupe* roundish (becoming very dark-coloured, Jack). Wall. Cat. 8489; Hook. fil. Fl. Br. Ind. II, 16; Engler in DC. Mon. Phan. IV, 206.

Penang: Jack. Malacca: Maingay, No. 468. Perak: King's Collector, Nos. 2693, 8444.

I have not seen fruit of this, and nothing has been recorded about it except Jack's statement that is roundish and becomes very dark-coloured. The long, laxly-branched, quite glabrous panicles make the species easy of recognition.

8. MANGIFERA PENTANDRA, Hook. fil. Fl. Br. Ind. II, 14. A tree. *Leaves* coriaceous, oblong or oblong-lanceolate, sub-acute, the edges sub-undulate, the base slightly cuneate or almost rounded, the nerves as in *M. indica*, but the reticulations between them finer and more distinct on both surfaces; length 4 to 6 in., breadth 1·5 to 2 in.; petioles ·4 to ·6 in. *Panicles* as in *M. indica*, but more densely hairy. *Sepals* 5, broadly ovate, obtuse, coarsely pubescent outside. *Petals* slightly longer than the sepals and similar in shape, 3-nerved in front to the middle, glabrous. *Stamens* 5, much shorter than the petals, unequal, seated upon the thick lobed disc, all fertile. *Ovary* smooth, style sub-terminal. *Fruit* unknown. Engler in DC. Mon. Phan. IV, 198.

Malacca: Griffith, No. 1095: Maingay (Kew Distrib.), No. 471.

This species is very imperfectly known. Both in its leaves and inflorescence it much resembles *M. indica*, L.; but the flowers have five stamens, the sepals are broader and more coarsely pubescent, the petals are shorter and are situated nearer the edge of the disc. The bases of the leaves are also less cuneate than in *M. indica*. According to Maingay, the petals of this are yellowish-white with yellow-brown edges. The Malay name of it is, he states, "Man ploni."

9. MANGIFERA INDICA, Linn. Spec. Pl. 290. A spreading tree 20 to 30 feet high, all parts except the inflorescence glabrous. *Leaves* coriaceous, narrowly oblong, elliptic-oblong or oblong-lanceolate, usually acute or acuminate, rarely sub-acute, the margins sometimes undulate, the base cuneate; main nerves 12 to 20 pairs, spreading, curving, slightly prominent on both surfaces when dry; length 5 to 10 in., breadth 1·5 to 3 in.; petiole ·5 to 1 in. or even 2 in. *Panicles* longer than the leaves, axillary or terminal, with many spreading branches, many-flowered, minutely tomentose or pubescent, rarely glabrescent; bracteoles ovate, small. *Flowers* ·2 in. in diam., monœcious, on short thick pedicels, yellowish. *Sepals* ovate, concave, pubescent outside, shorter than the petals. *Petals* oblong, sub-acute, glabrous, the inner face with 3 stout nerves. *Stamen* 1, rising from between two of the 5 lobes of the fleshy disc, filament subulate. *Ovary* obliquely ovoid, glabrous. *Drupe* large, fleshy, obliquely pyriform or sub-ovoid, sub-compressed, varying in length from 3 or 4 in. and in some of the cultivated forms as much as 12 inches; *stone* with a fibrous coat, very hard. DC. Prod. II, 63: Blume Mus. Bot. Lugd. Bat. I, 193: Roxb. Fl. Ind. I, 641; W. and A. Prod. 170; Beddome Fl. Sylv. t. 162; Wall. Cat. 8487 (excl. D. G. and

I.); Dalz. and Gibs. Bomb. Flor. 51; Bot. Mag. t. 4510; Brandis For. Flor. 125; Hook. fil. Fl. Br. Ind. II, 13: Kurz For. Flora Burma, I, 304; Engler in DC. Mon. Phan. IV, 199. *M. domestica*, Gaertn. Fruct. t. 100.—Rheede Hort. Mal. IV, t. 1, 2.

In all the Provinces, but planted; truly wild only in hot valleys in the mountain ranges of British India: known as the "Mango" to Europeans in the British India, the commonest vernacular Indian name being *Am*. An immense number of varieties are in cultivation.

10. MANGIFERA OBLONGIFOLIA, Hook. fil. Fl. Br. Ind. II, 15. A very large and perfectly glabrous tree; young branches stout. *Leaves* very coriaceous, oblong-elliptic, or linear-oblong, obtuse or sub-acute, the margins sub-undulate, the base sub-cuneate; main nerves 18 to 25 pairs, spreading, curved, reticulations faint on the upper and obsolete on the lower surface; length 8 to 12 in., breadth 1·5 to 2·5 in.; petiole 1·25 to 2 in. *Panicle* large, the branches widely spreading, bi- or tri-chotomously laxly-branched. *Flowers* ·25 in. in diam., on pedicels ·15 to ·25 in. long, stout. *Sepals* 5, ovate, obtuse, veined. *Petals* 5, twice as long as the sepals, elliptic-oblong, with 3 to 5 short vertical ridges confluent at the base into a tubercle. *Stamens* 5, all bearing anthers, but only one fertile longer than the others. *Ovary* sub-globose, style sub-terminal. *Fruit* ovoid, dull green, 4 in. long. Engler in DC. Mon. Phan. IV, 16.

Malacca: Griffith, No. 1101; Maingay, No. 470. *Cultivated.*

A species, according to Maingay, cultivated under the name of the "Quenee Mango."

11. MANGIFERA LONGIPES, Griff. Notul. IV, 419. A tree: young branches slender, glabrous. *Leaves* thinly coriaceous, oblong or elliptic-oblong, shortly acuminate, the edges minutely sub-undulate, the base narrowly cuneate, both surfaces shining; main nerves 16 to 20 pairs, sub-horizontal, thin but distinct on both surfaces (some of the intermediate towards the apex almost as distinct): length 5 to 8 in., breadth 1·5 to 2 in.; petiole ·75 to 1·75 in., slender. *Panicles* terminal, longer than the leaves, slender, with lax spreading branches, quite glabrous. *Flowers* nearly ·2 in. in diam., in ultimate cymules, on pedicels longer than themselves. *Sepals* 5, ovate, acute, with membranous edges and a few hairs near the midrib on the back. *Petals* 5, longer than the sepals, linear-oblong, blunt, the apices reflexed, the base with a single ridge branching upwards. *Stamen* 1, longer than the petals, staminodes several. *Ovary* broadly ovoid, sub-compressed: *style* sub-lateral, as long as the petals. *Fruit* unknown. Hook. fil. Fl. Br. Ind. II, 15; Engler in DC. Mon. Phan. IV, 201.

Malacca: Griffith, No. 1096; Maingay, No. 467.

12. MANGIFERA GRACILIPES, Hook. fil. Fl. Br. Ind. II, 16. A large perfectly glabrous tree, young branches slender. *Leaves* sub-coriaceous, small, elliptic-lanceolate, acuminate, shining, the edges undulate, the base narrowly cuneate; main nerves 10 or 12 pairs, slightly prominent, the veins and reticulations obscure; length 3 or 4 in., breadth 1 to 1·5 in.; petiole ·75 to 1 in., very slender. *Panicles* quite glabrous, slender, longer than the leaves, terminal, with numerous long very slender raceme-like branches bearing numerous short lateral branchlets. *Flowers* about ·2 in. in diam., their pedicels slender and about as long as themselves. *Sepals* 5, ovate, sub-acute, puberulous. *Petals* 5, lanceolate, much longer than the sepals, with 3 to 5 prominent vertical ridges. *Stamen* 1, shorter than the petals; rudimentary stamens 4, subulate. *Ovary* sub-globose: *style* long, lateral. Engler in DC. Mon. Phan. IV, 203.

Malacca: Maingay, No. 475.

As yet this is known only by Maingay's specimens, not one of which bears fruit.

13. MANGIFERA ODORATA, Griff. Notul. IV, 417. A tree, all parts glabrous. *Leaves* coriaceous, oblong or elliptic-lanceolate, acute or acuminate, both surfaces reticulate but especially the lower; main nerves about 20 pairs, spreading, very prominent beneath: length 6 to 12 in., breadth 2 to 4 in.; petiole 1·25 to 1·75 in., much thickened in the lower half. *Panicle* longer than the leaves, stout, glabrous. *Flowers* about ·25 in. in diam., flesh-coloured. *Sepals* 5, ovate-oblong. *Petals* 5, three times as long as the sepals, oblong, greenish suffused with red, with 3 confluent ridges, the apices reflexed. *Perfect stamens* sometimes 2, nearly as long as the petals; the imperfect ones shorter, subulate and capitate. *Ovary* ovoid, glabrous, tapering into the long filiform sub-lateral style. *Drupe* oblong.

Malacca: Griffith, No. 1098.—DISTRIB. Java; Zollinger, No. 430.

The few specimens of this that I have seen are very poor. Griffith (quoted by Sir J. D. Hooker in F. B. Ind. *l. c.*) gives the following account of the fruit. "*Drupe* oblong, stinking, yellow-green, with yellow spots, filled with a sticky gum; flesh yellow, fibrous, sweet, not turpentiny; *stone* compressed, fibrous; *cotyledons* rugose, equal at the base, one overlapping at the top." Sir Joseph adds the following note. "Malay name "Koeene" or "Kohini," according to Griffith, which is the name Maingay gives to *M. oblongifolia* (a totally different plant). This much resembles *M. Parih*, Miq., of Java, which has a more effuse panicle with long tertiary branchlets and very long pedicels."

14. MANGIFERA FOETIDA, Lour. Fl. Cochinch., 160. A tree 60 to 80 feet high; young branches stout, the bark pale when dry. *Leaves* vast,

coriaceous, elliptic-oblong to broadly-elliptic, sometimes slightly obovate, obtuse or sub-acute, the base slightly cuneate, both surfaces pale when dry and with the reticulations indistinct or obsolete: main nerves 16 to 18 pairs, bold, sub-horizontal; length 8 to 12 in., breadth 3·5 to 6 in.; petiole ·75 to 2·25 in., stout especially in its lower half. *Panicles* terminal or axillary, pedunculate, as long as or longer than the leaves, puberulous or glabrous, blood-red when fresh, black when dry; the branches stout, sub-erect and bearing scattered cymose branchlets, bracteoles minute. *Flowers* ·35 in. in diam., pinkish; pedicels very short, minutely bracteolate at the base. *Sepals* 5, thick, ovate-lanceolate, sub-acute, glabrous. *Petals* 5, linear-oblong, acute, twice as long as the sepals, reflexed from about the middle, with an elongated 2- or 3-fid thickening near the base and a short filiform basal claw. *Stamens* 5, but only 1 perfect and nearly as long as the petals, the others shorter, unequal and imperfect. *Disc* cylindric. *Ovary* sub-ovoid, glabrous; *style* slender, lateral. *Drupe* elliptic to globose, varying in form, oblique, green, 3 or 4 in. long. Roxb. Fl. Ind., ed. Carey, II, 440; Griff. Notul. IV, 419; DC. Prod. II, 63; Blume Mus. Bot. Lugd. Bat. I, 198; Miq. Fl. Ind. Bat. Vol. I, pt. 2, 632; Hook. fil. Fl. Br. Ind. II, 19; Kurz For. Flora Burma, I, 305; Engler in DC. Mon. Phan. IV, 212. *M. Horsfieldi*, Miq. Fl. Ind. Bat. Vol I, pt. 2, 632.

Malacca, Penang, Singapore, and probably in all the other Provinces except the Andamans and Nicobars.—Distrib. Java, Sumatra.

I extract the following note from Sir Joseph Hooker's Flora of British India. "*Drupe* variable in form, not compressed, oblique, green, smooth, very fetid; *flesh* yellow, thick; *stone* almost 2-edged, chartaceous, fibrous; *cotyledons* equal, auricled at the base; *radicle* short. (*Griffith.*)—Maingay describes the fruit as coarse-flavoured, and not unlike Lanjoot (*M. lagenifera*), stringy. Malay name Bachang or Bachong. Rumph and Loureiro describe the drupe as hairy, but no one else does so; possibly the fibres of the stone are alluded to by these authors."

15. Mangifera fragrans, Maingay MSS. ex Hook. fil. Fl. Br. Ind. I, 18. A tree everywhere glabrous; young branches thick, black when dry. *Leaves* coriaceous, narrowly linear-oblong or linear-lanceolate, acute, acuminate or rounded at the apex, the edges undulate, the base acute, abruptly contracted into the very slender petiole, both surfaces conspicuously reticulate; main nerves 25 to 35 pairs, slender, almost horizontal; length 6 to 10 in., breadth 1·25 to 1·5 in.; petiole 1 to 2 in. *Panicle* longer than the leaves, on a long peduncle, spreading; its branches thick, glabrous, black when dry. *Flowers* nearly ·3 in. long, perfect, their pedicels thickened at their apices. *Sepals* 5 ? unequal,

ovate-lanceolate. *Petals* 5? narrowly linear-oblong, erect below but sharply reflexed about the middle, with 1 to 3 vertical ridges. *Stamens* 5, one much longer than the others whose anthers are imperfect (Hooker); *filaments* very slender, shorter than the lateral capillary style. ("*Drupe* obliquely broadly oblong-globose: the flesh yellow, acid and terebinthine: *stone* thin, fibrous, the testa coriaceous." *Maingay.*)

Malacca: Maingay, No. 473.

Concerning the species, Sir Joseph Hooker remarks in a note (*l. c.* 18) as follows:—This in foliage approaches very closely Blume's *M. macrocarpa* of Java, which has still narrower leaves with crimped edges, 40 pairs of nerves, and a bitter-sweet fruit as large as a child's head. Dr. Engler believes that this is *M. macrocarpa* Blume and (Mon. Phan. IV, 211) reduces it to that species. The very long narrow crisped-edged leaves and large fruit distinguish it.

16. MANGIFERA LAGENIFERA, Griff. Notul. IV, 414, t. 567, fig. 3. A tree 50 to 80 feet high; the young branches stout, pale when dry. *Leaves* very coriaceous, oblanceolate or oblong-lanceolate, obtuse or rounded, gradually narrowed below the middle to the stout petiole; both surfaces dull when dry, not reticulate, the 16 to 20 pairs of straight spreading main nerves very faint; length 3 to 6 in., breadth 1 to 1·75 in.; petiole ·5 to ·9 in., flattened. *Panicle* puberulous, (purple in colour when fresh) much exceeding the leaves, on a stout peduncle; the branches lax, ascending, and bearing pedunculate cymose branchlets. *Flowers* ·35 in. in diam., on pedicels shorter than themselves; bracteole large, broad, hooded. *Sepals* 5, (often 6) spreading, broadly ovate, pubescent outside. *Petals* 5, (often 6) two or three times as long as the sepals, erect, oblanceolate or sub-spathulate, obtuse, puberulous outside, slightly concave and thickened in the middle, purple. *Stamens* 5 or 6, all perfect, nearly as long as the petals; *anthers* ovate, short; *filaments* long, slender. *Disc* slender, cylindric. *Ovary* obliquely obovoid, glabrous; the *style* as long as the stamens, sub-terminal. (*Drupe* pyriform, pale green with a pink blush; *pulp* livid or of a purplish flesh-colour: *stone* fibro-coriaceous, adherent to the membranous testa; *radicle* basal, very large," Maingay) length 4·5 in., breadth 2·5 in.

Malacca: Griffith, No. 1104; Maingay, No 469.

The description of the fruit above given was taken by Sir Joseph Hooker from Maingay's notes, and has been by me copied from the Flora of British India. Concerning the fruit Sir Joseph has the following note on Griffith's account of it which I quote verbatim from Fl. Br. Ind. II, 18. "Called Lanjoot by the Malays, according to Maingay and Griffith. The latter describes the drupe as smooth, glaucesc

fleshy, fetid, exuding a black varnish, traversed by innumerable fibres; *stone* ovate-lanceolate, fibro-coriaceous. *Seed* erect, adhering to the black tegument on the one side, on the other smooth; *cotyledons* with one half the surface smooth, the other wrinkled. Maingay describes the disc as hemispherical, but I do not find it so."

17. MANGIFERA KEMANGA, Blume Mus. Bot. Lugd. Bat. I, 202. A large tree with very stout young branches. *Leaves* crowded at the apices of the branches, coriaceous, sub-sessile, oblanceolate or obovate-oblong or cuneate-oblong, sub-acute or shortly and obtusely acuminate, the edges sub-undulate, gradually narrowed from below the middle to the base, glabrous and the reticulations obsolete on both surfaces: main nerves 20 to 22 pairs, slender but distinct on both surfaces, the midrib also broad and distinct; length 9 to 15 in., breadth 2·5 to 4 in.; petiole sometimes ·1 to ·3 in. but usually absent. *Panicle* large, terminal, much longer than the leaves, 20 to 30 in. long, on a stout angled peduncle covered by minute white hairs with a few longer brown ones intermixed: branches of the panicle angled, spreading and dividing, the flowers borne in cymules at the ends of the branchlets; *bracteoles* broadly ovate, concave, pubescent, deciduous. *Flowers* ·25 in. long, of a rich pinkish purple, their pedicels short. *Sepals* 5, erect, linear-lanceolate, thick, concave, pubescent outside, glabrous inside. *Petals* 5, less than twice as long as the sepals, erect, linear-lanceolate, concave, thick, the edges thickened and undulate, glabrous, with a single mesial ridge in front. *Stamen* 1, shorter than the petals: the anther ovate, short. *Disc* narrow, embracing the base of the sub-globose ovary; *style* sublateral, filiform: *stigma* small, terminal. *Drupe* (*fide* Griffith) oblong, a little gibbous at the base, obliquely emarginate near the apex, of a brown colour and with the smell of a dorian or mango: *flesh* and *juice* copious, fibres very abundant. *Stone* in outline lanceolate, rather compressed, not woody but fibro-coriaceous, seed erect. *M. policarpa*, Griff. Notul. IV, 416, t. 567, fig. 2; Hook. fil. Fl. Br. Ind. II, 20; Engler Mon. Phan. IV, 213.

Malacca: Griffith. Sumatra: Forbes, No. 3198.

This is a species closely allied to *M. caesia*, Jack, but the leaves of this are usually quite sessile and the panicle is greatly larger. Griffith's Malacca specimens consist of leaves only, his description extends to the fruit, but not to the flowers. I have described the flowers from Forbes's Sumatra plant, the leaves of which appear to me to resemble perfectly those of Griffith's Malacca specimens; and they agree to the minutest detail with Blume's full description. The vernacular name in Malacca is, according to Griffith, *Camang* which according to Blume varies on the Archipelago to *Kemang*, *Kamang* and *Kamanga*.

J. II. 61

18. MANGIFERA CAESIA, Jack in Roxb. Fl. Ind. ed. Carey, II, 441. A large tree; young branches stout, rather rough from the cicatrices of fallen leaves. *Leaves* thickly coriaceous, broadly lanceolate or elliptic-oblong, shortly and bluntly acuminate, narrowed from about the middle to the short broad petiole; main nerves 20 to 25 pairs, thin, spreading, curving, the midrib stout and the reticulations obscure on both surfaces; length 6 to 12 in., breadth 2 to 3·5; petiole ·35 to ·5 in. long. *Panicle* large, erect, terminal, longer than the leaves, on a stout peduncle, minutely tawny-tomentose and of a glaucous reddish-colour: its branches numerous, spreading, dividing and bearing the flowers near their extremities in densely crowded cymules. *Flowers* ·3 in. long, on stout pedicels shorter than themselves with a broad elliptic bracteole at the base of each. *Sepals* 5, lanceolate, sub-acute, erect, pubescent. *Petals* 5, twice as long as the sepals, adnate to the disc, linear, erect, glabrous, with one central ridge, concave. *Stamen* 1, shorter than the petals, the anther short, staminodes very minute. *Disc* small, sub-5-lobed. *Ovary* obliquely ovoid; *style* sub-terminal. *Drupe* obovate-oblong, reddish-white. Griff. Notul. IV, 415; Hook. fil. Fl. Br. Ind. II, 19; Engler Mon. Phan. V, 213.

Malacca: Griffith, No. 1100; Maingay, No. 465.

19. MANGIFERA SUPERBA, Hook. fil. Fl. Br. Ind. II, 19. A very large tree: the young branches three-quarters of an inch thick. *Leaves* large, very coriaceous, cuneate-oblanceolate, sub-acute, the margins slightly undulate, gradually narrowed from the upper third to the short flattened stout petiole; both surfaces hard and quite glabrous, not reticulate; the midrib very stout, flattened on the upper but prominent on the lower surface; main nerves 30 to 35 pairs, spreading, not very prominent: length 10 to 16 in., breadth 3 to 5; petiole very stout, from ·5 to 1 in. long. *Panicle* terminal, much longer than the leaves, tawny-pubescent, on a very stout peduncle with many woody lanceolate bracts at its base; its primary branches few, sub-erect, with short branchlets crowded near the apex, the flowers densely crowded near the apices of the branchlets; bracts numerous, large, broadly lanceolate, concave, pubescent. *Flowers* ·75 in. long, lilac, their pedicels very short. *Sepals* 5, ovate-lanceolate, pubescent, concave, ·35 in. long. *Petals* 5, twice as long as the sepals, adnate to the cylindric disc, lanceolate, acuminate, recurved, veined, with a thickened central ridge on the lower half. *Stamen* 1, bearing a perfect anther, the others with imperfect small anthers, the filaments of all subequal. *Ovary* obliquely ovoid, tapering into a slender sub-termin[al] elongate style; *ovule* horizontal, laterally attached. Engler in DC. M[on.] Phan. II, 214.

Malacca: Maingay, No 476.

This is at once distinguished in the genus by its large flowers and prominently bracteolate peduncles. It has hitherto been collected only in Malacca, and only by Maingay. The great massing of semi-ligneous bracts at the base of the peduncle is quite unique in the genus.

Besides the foregoing there are in the Calcutta Herbarium flowering specimens of a *Mangifera* collected by Mr. L. Wray at an elevation of 3,400 feet on Gunong Batu Patch in Perak, (Herb. Wray, No. 982). These have good flowers, but not one of them is in fruit. The species is 5-merous, and is evidently allied to *M. Griffithii*, Hook. fil. and to *M. longipes*, Griff. From the former of these it is distinguished by its glabrous—not puberulous—panicles, and more laxly reticulate leaves with shorter petioles. From *M. longipes* it differs in having shorter and more condensed panicles and smaller flowers. There are also fruiting specimens of a species gathered by the Calcutta Garden Collector, the late Mr. H. Kunstler, in Perak at an elevation of 500 to 800 feet (King's Collector, No. 7744); but none of them has a single flower on it. The fruit when ripe is described by Mr. Kunstler as yellowish-grey in colour, measuring from four to five inches in length, and about half as much in diameter. The leaves are oblong, tapering to each end, finely reticulate and with 13 to 15 pairs of faint ascending nerves. It is described as a tree 50 to 70 feet in height.

4. Anacardium, Rottb.

Shrubs or trees. *Leaves* alternate, petioled, simple, quite entire. *Panicles* terminal, bracteate. *Flowers* polygamous. *Calyx* deeply 5-partite; the segments narrow, erect, imbricate, deciduous. *Petals* 5, linear-lanceolate, recurved, imbricate. *Disc* filling the base of the calyx, erect. *Stamens* 8–10, all or some fertile; *filaments* connate and adnate to the disc. *Ovary* obliquely obovoid or obcordate; *style* filiform, excentric, stigma minute; *ovule* 1, semi-pendulous by a funicle from the side of the base of the ovary. *Nut* kidney-shaped, seated on a large pyriform fleshy body formed of the enlarged disc and top of the peduncle; *pericarp* cellular and full of oil. *Seed* kidney-shaped, ascending; testa membranous, adherent; *cotyledons* semi-lunar; *radicle* short, hooked.—Distrib. A small tropical American genus, of which one species is naturalised in Asia.

Anacardium occidentale, Linn. Sp. Pl. 548. A small tree. *Leaves* coriaceous, glabrous, obovate, obovate-oblong or elliptic; the apex obtuse, rounded or retuse, the edges entire; the base cuneate or sub-cuneate, rely rounded; main nerves 10 to 12 pairs, spreading, rather promi- t beneath; length 4 to 9 in., breadth 3 to 5 in.; petiole ·5 to ·75 in. cles terminal, longer than the leaves, on peduncles which lengthen

with age, puberulous toward the apex, the branches cymose; the flowers at the apices, ·5 in. long, the pedicel shorter; *bract* ovate-lanceolate, nerved, puberulous. *Sepals* lanceolate. *Petals* longer than the sepals, linear-lanceolate, deflexed from the middle. *Stamens* about 9, one longer than the others. *Fruit* 1 in. long; its peduncle large, fleshy, dark-coloured. Jacq. Ann. I, 121, t. 35; DC. Prod. II, 62; Roxb. Fl. Ind. II, 312; Wall. Cat. 990; Wight and Arn. Prodr. I, 168; Grah. Cat. Bomb. Pl. 40; Dalz. and Gibs. Bomb. Flor. Suppl. 18; Griff. Notul. IV, 408, t. 565. f. 3 *e. f.*; Hook. fil. Fl. Br. Ind. II, 20; Bedd. Fl. Sylv. t. 163; Kurz For. Flora Burma, I, 310; Engler in DC. Mon. Phan. IV, 219.—Rheede Hort. Mal. III, t. 54.

In all the Provinces, but always near villages and probably planted. A native of tropical America.

5. Gluta, Linn.

Trees with caustic juice. *Leaves* crowded at the ends of the branchlets, short-petioled, simple, oblong, coriaceous. *Panicles* axillary and terminal. *Flowers* small, hermaphrodite. *Calyx* spathaceous, bursting irregularly, caducous. *Petals* 4–6, adnate to the disc, imbricate. *Disc* elongate, rarely short. *Stamens* 4–6, inserted on the disc, filaments capillary. *Ovary* sessile on the disc or stipitate, oblique, 1-celled; *style* lateral, filiform, stigma simple; *ovule* solitary, pendulous from a basal funicle. *Drupe* sub-ligneous, stalked, dry, more or less irregularly globose, irregularly tubercled or ridged; the endocarp coriaceous, connate with the testa, juicy: *cotyledons* fleshy, large, connate: the radicle short and incurved.—Distrib. About six species all either Malayan or Burmese.

Calyx only about one-fourth of the length of the petals, glabrous; petioles short (·3 to ·6 in. long) ... ... 1. *G. Benghas.*

Calyx half as long as the petals.

Calyx glabrous; petioles slender, ·6 to 1 in. long, ovary obliquely ovoid ... ... 2. *G. elegans.*

Calyx tomentose; ovary obliquely sub-reniform-orbicular, tubercled, glabrous; petioles very short (·1 to ·35 in.) ... ... 3. *G. coarctata.*

Calyx pubescent; ovary obovoid-rotund, tomentose; petioles ·6 or ·7 in. broad, channelled ... 4. *G. Wrayi.*

1. Gluta Benghas, Linn. Mant. 293. A tree. *Leaves* oblanceolate, oblong, the apex broad and rounded, rarely with a blunt apiculu gradually narrowed in the lower half to the short narrow chann petiole; both surfaces shining and reticulate; main nerves 18

pairs, spreading, not very prominent; length 4 to 7 in., breadth 1·6 to 2·25 in.; petiole ·3 to ·6 in. *Panicles* axillary, when in flower shorter than the leaves, when in fruit often longer, puberulous, the branches divaricate and corymbose, pedicels shorter than the buds. *Calyx* glabrous, only about one-fourth as long as the petals. *Petals* elliptic-lanceolate. *Stamens* 5, about half as long as the petals, the gynophore shorter than the stamens. *Ovary* obliquely globosely sub-reniform, the style sub-lateral, 2 imperfect ovaries sometimes present. *Drupe* irregularly globose or sub-reniform, much tuberculate, furrowed on one side, about 1·5 in. in diam. Willd. Sp. Pl. I, 1120; DC. Prod. I, 501; Blume Bijdr. 1159; Mus. Bot. Lugd. Bat. I, 182, t. 39. *G. Renghas*, Engler in DC. Mon. Phan. IV, 226, t. 6. *Stagmaria verniciflua*, Jack in Malay Misc. ex Hook. Comp. Bot. Mag. I, 267.

Pahang: Ridley, No. 1228.

Distributed over the whole Malayan Archipelago and known to the Malayas as *Renghas*, which was no doubt the name that Linnæus intended to use as the specific name, although it appears in his Mantissa as *G. Benghas*. The copious resin of this tree is acrid, but it forms the basis of an excellent varnish which is exported to China and Japan.

2. GLUTA ELEGANS, Kurz For. Flora Burma, I, 310. A small tree, every part except the inflorescence glabrous: young branches slender, with cinereous bark. *Leaves* coriaceous, oblong-lanceolate or elliptic-lanceolate, shortly and obtusely acuminate, the base cuneate; upper surface shining, the lower faintly reticulate and sub-glaucous; main nerves 10 to 14 pairs, spreading, faint or slightly prominent on the lower surface; length 3 to 6 in., breadth 1 to 2 in.; petiole ·6 to 1 in., slender, thickened at the base. *Panicles* much shorter than the leaves, mostly terminal, with alternate sub-corymbose branches each with 5 to 9 pedicellate flowers, bracteole linear. *Flowers* nearly ·5 in. long. *Calyx* tubular, split on one side, 4-nerved, glabrous, scarlet, the apex with 2 teeth. *Petals* 4 or 5, twice as long as the calyx, linear-lanceolate, blunt, spreading. *Stamens* 4 or 5, as long as the petals or longer. *Gynophore* half as long as the corolla. *Ovary* obliquely ovoid. *Drupe* oblong, gibbous, glabrous, ·75 in. long when dry, the scar of the style nearer the base than the apex. Hook. fil. Fl. Br. Ind. II, 22; Engler in DC. Mon. Phan. IV, 225. *Syndesmis elegans*, Wall. in Roxb. Fl. Ind., ed. Carey, II, 315; Cat. No. 1003.

Penang: Porter, (Wall. Cat. 1003 and 9049). King: King's Collector, No. 1366. Malacca: Maingay, No. 481. Perak: King's Collector, No. 4913.

Var. *Helferi*, Hook. fil. & c. leaves linear-oblong, obtuse, nerves oblique.

Tenasserim and Andamans: Helfer, Nos. 1117 and 1118.

3. Gluta coarctata, Hook. fil. Fl. Br. Ind. II, 22. A small tree, all parts except the puberulous inflorescence glabrous. *Leaves* thinly coriaceous, often recurved and conduplicate, obovate-oblong, oblanceolate-oblong or oblong, obtuse or sub-acute, narrowed in the lower third to the short stout petiole, occasionally minutely cordate; the edges often undulate: both surfaces shining and reticulate; main nerves 13 to 20 pairs, spreading, faint on both surfaces; length 5 to 9 in., breadth 1·75 to 3 in.; petiole ·1 to ·35 in., stout. *Panicles* axillary, shorter than the leaves, pedunculate, tawny-puberulous, with a few corymbose branches, each with 3 to 5 shortly pedicelled flowers nearly ·4 in. long when fresh. *Calyx* half as long as the petals, shortly bilobed, cinereous-tomentose. *Petals* 5, broadly oblanceolate, veined, puberulous outside. *Stamens* 5, shorter than the petals, the gynophore much shorter. *Ovary* obliquely sub-reniform, orbicular, rugulose, glabrous, the style lateral. *Drupe* sub-globose, apiculate, with an irregularly tuberculate ridge round the base, the sides also irregularly tubercle-ridged; the epicarp leathery; the mesocarp white, fibrous and spongy; the endocarp coriaceous, aduate to the erect seed. *Cotyledons* unequally sub-hemispheric, fleshy, about 1·5 in. long when fresh. Engler in DC. Mon. Phan. IV, 227, (excl. syn. *G. velutina* Bl.)

Malacca: Griffith, No. 1120. Perak: Scortechini, No. 1375. Johore: King and Hullett.—Distrib. Sumatra.

The Bornean species which Blume (Mus. Bot. Lugd. Bat. I, 183) names *G. velutina* is known only by his description which consists of the following six words "*paniculae ramis patentibus calycibusque sericeo velutinis.*" It is considered by Dr. Engler to be identical with this: but Blume's description, short as it is, appears to me to negative the suggestion.

4. Gluta Wrayi, King n. sp. A tree, all parts except the inflorescence glabrous. *Leaves* thickly coriaceous, elliptic, sub-acute, the edges sub-undulate, narrowed from about the middle to the broadly channelled petiole, both surfaces faintly reticulate when dry; the main nerves 12 to 14 pairs, spreading, quite obsolete on the upper surface, faint on the lower; length 4 to 6·5 in., breadth 1·6 to 2·5 in.; petiole ·6 or ·7 in. *Panicles* in the upper leaf-axils only, much shorter than the leaves, shortly pedunculate, densely and minutely pubescent, the branches spreading; the flowers numerous, ·4 in. long, crowded towards the apices; *pedicels* shorter than the buds. *Calyx* pubescent outside, about half as long as the petals. *Petals* 5, narrowly oblong-lanceolate, rather blunt at the apex, the base clawed, puberulous outside, glabrescent inside. *Stamens* 5, longer than the petals, anthers short, filaments thickened

towards the base: *ovary* obovoid-rotund, tomentose; the *style* lateral, elongate. *Fruit* unknown.

Perak: Wray, No. 2290.

This differs from *G. coarctata*, Griff. in its longer leaf-petioles, shorter panicles, broader petals and sub-obovate-rotund, tomentose, ovary. It has been hitherto collected only once by Mr. Wray: fruit is as yet unknown.

Note.—Kurz (Pegu Report 41, and in Journ. As. Soc. Bengal for 1876, pt. 2, p. 210) refers (under the name *G. petiolata*) to a tree which he had seen common on the shores of the Andamans, but of which he had collected neither flowers nor fruit. The specimens to which he has attached this name in the Calcutta Herbarium do not, however, appear to me to be those of a plant of this genus.

6. Melanorrhœa, Wall.

Trees with much oleo-resinous juice. *Leaves* alternate, simple, quite entire, coriaceous. *Panicles* axillary or terminal. *Flowers* rather large, hermaphrodite. *Sepals* 5, united, calyptriform or collar-like, deciduous. *Petals* 5–8, linear-oblong, imbricate, much enlarged in fruit. *Disc* hemispheric or columnar. *Stamens* 5–10, or very numerous, inserted on the disc; *filaments* slender. *Ovary* stalked, lenticular, oblique, 1-celled; *style* sublateral, stigma simple; *ovule* 1, pendulous from a basal funicle. *Fruit* dry, subsessile, or on a long pedicel rising from the stellately-spreading persistent petals, globose, coriaceous. *Seed* subglobose or oblong; *testa* papery; *cotyledons* thick, plano-convex; *radicle* ascending. A Malayan genus of about 9 species.

Sect. I. *Eumelanorrhoea*: petals accrescent in the fruit.

Calyx spathaceous and falling off like a calyptra.

Stamens 5.

Bracts if any small and deciduous.

Leaves broadly elliptic, the lower surface with many very minute hairs and numerous dots ... 1. *M. Maingayi.*

Leaves obovate-elliptic, glabrous on both surfaces, not dotted ... 2. *M. Wallichii.*

Bracts large and persistent, embracing the flower buds ... ... 3. *M. Woodsiana.*

Stamens 10 ... ... 4. *M. Curtisii.*

Calyx withering and remaining as a loose 3-toothed collar round the pedicel ... 5. *M. torquata.*

Sect. II. *Apterae*: petals not accrescent.

Petals oblanceolate, leaves 6 to 15 in. long 6. *M. aptera.*

Petals elliptic, leaves 4 or 5 in. long ... 7. *M. inappendiculata.*

The characters of the genus *Melanorrhœa*, as defined by Wallich its founder, were modified, as regards the number of stamens, by Sir Joseph Hooker in the Flora of British India, in order to admit the pentamerous species *M. Maingayi* and *M. Wallichii*. I have ventured still further to modify them in two points, *viz.*, the calyptrate nature of the calyx, and the accrescence and persistence of petals as wings in the fruit. In the species which I have here named *M. torquata*, the calyx, instead of slipping off over the apex of the flower as a calyptra, drops downwards and forms a loose collar hanging round the pedicel. And, in the two species which I have named *M. aptera* and *M. inappendiculata*, the petals are deciduous and do not persist as wings to the fruit. But, even after these modifications, there remain a sufficient number of characters by which *Melanorrhœa* may be distinguished from its nearest ally *Swintonia*.

1. Melanorrhœa Maingayi, Hook. fil. Fl. Br. Ind. II, 25. A tree 80 to 100 feet high: the young branches rather slender, their bark when dry pale brown, at first puberulous afterwards glabrous. *Leaves* coriaceous, broadly elliptic, the apices rounded or obtuse, the base very slightly cuneate, the edges sub-undulate; both surfaces reticulate, shining, the upper glabrous, the lower with a few very minute hairs and many dots; main nerves 12 to 16 pairs, sub-horizontal, prominent on both surfaces but especially on the lower: length 3·5 to 6 in., breadth 2 to 3 in.; petiole 1 to 1·25 in. *Panicles* terminal and axillary, slender, two or three times as long as the leaves, tawny-pubescent especially towards the extremities, their branches few and sub-erect, the ultimate branchlets few-flowered. *Flowers* ·5 in. in diam., on slender pedicels; buds elliptic, acute, pubescent. *Petals* lanceolate, pubescent. *Stamens* 5; the filaments slender, pubescent above the middle. *Disc* elevated. *Ovary* tomentose. *Fruit* oblong, obtuse, about ·5 in. long, glabrescent; the enlarged petals at its base coriaceous, veined, linear-oblong, the gynophore very short. Engler in DC. Mon. Phan. IV, 235.

Malacca: Maingay, Nos. 482; 485; Derry. Perak: Scortechini, No. 1719: King's Collector, No. 7788. Singapore: Ridley, No. 4780.

2 Melanorrhœa Wallichii, Hook. fil. Fl. Br. Ind. I, 25. A very large tree; the young branches slender, glabrous. *Leaves* coriaceous, obovate-elliptic, the apex obtuse or rounded, the base slightly cuneate and somewhat oblique; both surfaces glabrous and shining, the lower reticulate, the upper obscurely so: main nerves 10 or 12 pairs, sub-horizontal, not very prominent; length 3·5 to 8 in., breadth 2 to 4 in.; petiole ·75 to 1·5 in., slightly winged, and somewhat dilated at the base, puberulous. *Panicles* numerous, axillary and terminal, branched from the base, about 12 in. long, the branches with slender

cinereous-tomentose branchlets and numerous softly pubescent flowers; bracts large, obovate, concave, membranous. *Flowers* ·25 in. long, on pedicels shorter than the buds. *Calyx* narrowly ovoid, very membranous. *Petals* narrowly oblong, villous on both surfaces, inserted towards the base of the short disc. *Stamens* 5. *Ovary* shortly stalked, densely pilose, attenuated into a style longer than itself. *Drupe* unknown. Engler in DC. Mon. Phan. IV, 235. *Stigmaria vernicifluа*, Jack? in Wall. Cat. 980.

I have seen only Wallich's specimen of this in the Calcutta set of his plants. The specimen is a very poor one, and the above description is taken mostly from Sir Joseph Hooker. Mr. Derry collected in Malacca, (Herb. No. 1010) a plant of which there are two fruiting specimens in the Calcutta Herbarium which, from the shape of its leaves, I would have referred to this, were it not that remains of numerous stamens persist at the base of one of the young fruits. Mr. Derry's plant must I believe belong to an as yet undescribed species.

3. Melanorrhœa Woodsiana, Scort. MSS. in Herb. Calc. A tree 60 to 100 feet high; young branches velvetty, ferrugineous. *Leaves* thickly coriaceous, elliptic-oblong, elliptic or elliptic-rotund, the apex obtuse or rounded or emarginate, the edges sub-undulate, the base rounded or sub-cuneate; upper surface glabrous, the transverse reticulations rather distinct; the lower surface densely and uniformly rusty-tomentose, or glabrescent with age: main nerves 15 to 24 pairs, sub-horizontal, very prominent on the lower surface slightly so on the upper; length 4 to 5·5 in., breadth 1·75 to 3·5 in.; petiole 1 to 1·35 in., deeply channelled, dilated at the base, tomentose or glabrescent. *Panicles* from the upper leaf-axils, longer than the leaves, on long peduncles densely and minutely rusty-tomentose, branching more or less trichotomously towards the apex; the ultimate branches compressed, cymulose. *Flowers* sub-sessile, ·25 in. long, enveloped while in bud by imbricated concave broadly-ovate tomentose bracts; buds narrowly elliptic; the spathaceous calyx membranous, veined, puberulous. *Petals* 5, oblong. *Stamens* 5, anthers versatile, filaments hairy. *Ovary* obliquely ovoid, style lateral. *Drupe* elliptic, smooth, without a pedicel; the enlarged petals narrowly elliptic, obtuse, puberulous, red in colour, 1·5 in. long and ·75 in. broad (perhaps not quite fully grown).

Perak: Scortechini, No. 2086; King's Collector, No. 7788.

This has as yet been collected only by the late Father Scortechini and Mr. Kunstler, and their specimens have no ripe fruit. It approaches *M. Maingayi* in its leaves, but has much more tomentose panicles. The [illegible]at distinctive mark, however, is that the flower buds of this are each [illegible]eloped in a large concave sheathing bract. As regards the pubes-

cence of the under surface of the leaves in this species there is some diversity, many specimens having the under surface covered with a dense and uniform layer of rusty tomentum, while in other specimens the lower surface of the leaves and the petioles are glabrescent. The species was named by Father Scortechini to commemorate his friend, the Revd. Father Tennison Woods, who died of an illness contracted during his exploration of the physiography of the central mountainous range of the Malayan Peninsula.

4. Melanorrhœa Curtisii, Oliver in Hook. Ic. Plantar, t. 1513. A tree 40 to 80 feet high: young branches very slender. *Leaves* coriaceous, oblong-lanceolate or elliptic-oblong, obtuse, or shortly and bluntly acuminate, the base cuneate, both surfaces quite glabrous and without scales or dots; main nerves 12 to 16 pairs, spreading, curving, faint; length 3 to 5 in., breadth 1·25 to 2 in.; petiole ·5 to ·75 in. *Panicles* slender, open, axillary and terminal, pedunculate, much longer than the leaves; the branches opposite or sub-opposite, distant, lax, each bearing several ultimate few-flowered branchlets near the apex, puberulous close to the flowers, otherwise quite glabrous; *bracteoles* small, ovate-lanceolate, caducous. *Flowers* ·25 in. long, on puberulous pedicels, the buds narrow. *Calyx* with dark nerves. *Petals* 5, linear, puberulous outside, contorted in æstivation. *Stamens* 10, a little shorter than the petals, glabrous; the *filaments* slender; the *anthers* small, oval. *Disc* pubescent. *Ovary* obliquely ovoid, stalked, glabrous. *Style* sub-terminal. *Drupe* depressed-globose, ·5 to ·75 in. in diam., its stalk ·35 in.; the enlarged petals leathery, linear-oblanceolate, 1·75 to 2·5 in. long. *M. Duthieana*, Scort. MSS. in Herb. Calcutta.

Penang: Curtis, No. 242; King's Collector, No. 1635. Perak: King's Collector, No. 6887. Kedah: Ridley, No. 5359.

The late Father Scortechini notes on this that the stamens are occasionally 8 instead of 10.

5. Melanorrhœa torquata, King n. sp. A tree 80 to 100 feet high: young branches stout, and with rough rather pale brown bark. *Leaves* coriaceous, obovate, with broad rounded apices, sub-undulate edges, and sharply cuneate bases; both surfaces glabrous, the upper with the reticulations almost obsolete, the midrib very broad and flat; the lower with the transverse veins rather distinct, the midrib sharply convex; main nerves 22 to 26 pairs, rather faint on the upper surface when dry, very distinct on the lower, spreading and rather straight; length 7 to 11 in., breadth 4 to 6·25 in.; petiole ·25 to ·35, stout. *Panicles* terminal, branching from the very base, densely and minutely tawny tomentose; the branches spreading, naked below but with many branch[lets] toward the apex, the ultimate branchlets cymulose. *Flowers* ·25

long, on pedicels ·2 in. long, buds ellipsoid. *Calyx* tubular or narrowly campanulate, its mouth with 3 broadly-triangular unequal teeth, puberulous externally, withering and hanging round the pedicels like a loose collar. *Petals* 5, slightly imbricate, elliptic, sub-acute, spreading or sub-reflexed, ·2 in. long, tomentose outside, pubescent inside. *Stamens* 5, nearly as long as the petals; *anthers* small, ovate; *filaments* subulate, pubescent below the middle. *Ovary* globose or obovoid, shorter than the gynophore, both tomentose; *ovule* solitary, its podosperm from the very base of the cell: *style* longer than the ovary, cylindric, pubescent except near the apex. *stigma* truncate. *Fruit* unknown.

Perak: King's Collector, No. 5552.

This differs in calyx from *Melanorrhœa* as usually understood, inasmuch as in this plant the calyx separates from the flower soon after expansion and remains as a loose 3-toothed collar hanging round the pedicel; whereas in *Melanorrhœa*, as hitherto defined, the calyx is calyptriform and is pushed off the flower by the expansion of the petals. In both cases the calyx is deciduous; in the one case it separates from the flower by the apex of the latter, in the other case by its base.

6. Melanorrhoea aptera, King n. sp. A tree 40 to 70 feet high; young branches stout, with rough cinereous bark, the cicatrices of the fallen leaves very prominent. *Leaves* very coriaceous, oblanceolate-oblong or obovate-elliptic; the apex broad and rounded, rarely with a short sub-acute point; narrowed from above the middle and decurrent on the short stout petiole; the edges quite entire, slightly revolute when dry; both surfaces glabrous, the upper pale greenish-brown when dry, the lower brown, the midrib on the upper surface broad and flattened in its lower half, on the lower surface convex; main lateral nerves 15 to 18 pairs, spreading, rather straight, somewhat prominent beneath; length 6 to 15 in., breadth 2 to 6 in.; petiole ·5 to 1 in., stout. *Panicles* shorter or longer than the leaves, axillary, crowded near the ends of the twigs; their branches short, racemose, few-flowered, glaucous. *Flower-buds* narrowly ellipsoid, glabrous, ebracteate. *Flowers* 1 in. in diam., their pedicels ·25 to ·3 in. long, sparsely adpressed-pubescent. *Calyx* glabrous, about ·5 in. long at the time of falling. *Petals* 5 or 6, much imbricate, oblanceolate, densely adpressed-sericeous outside, glabrous inside. *Stamens* numerous (about 50), on a conical torus which is produced upwards into a gynophore. *Ovary* obliquely ovoid, compressed, ridged, glabrous, 1-celled, with a single oblong ovule pendulous from basal funicle. *Style* sub-terminal, stout, bent, glabrous, longer than ovary; *stigma* short, cylindric. *Drupe* depressed-globose, glabrous, numerous thin vertical ridges, 1·5 in. in diam. *Seed* solitary,

1 in. long, the testa thin: *cotyledons* plano-convex, very thick and fleshy.

Perak: King's Collectors, No. 3485, 3727, 7656. Penang: Curtis, No. 1567.

A fine species readily distinguished by its large flowers and inappendiculate fruit.

7. MELANORRHOEA INAPPENDICULATA, King n. sp. A tree 50 to 60 feet high; young branches only as thick as a swan's quill, cinereous, rough. *Leaves* coriaceous, oblong-oblanceolate; the apex broad and rounded, sometimes retuse; the blade narrowed from above the middle to the narrowly cuneate base and prolonged along part of the petiole, the edges slightly revolute; both surfaces glabrous; main nerves 15 to 18 pairs, spreading, straight, slender; length 3·5 to 5 in., breadth 1·5 to 2 in.; petiole ·75 to 1 in., winged for half its length. *Panicles* about as long as the leaves, axillary, solitary in the axils of the leaves, few-flowered. *Flowers* ·75 in. in diam.; *petals* narrowly elliptic, blunt; *ovule* oblong, pendulous, its funicle attached to the side of the base of the wide loculus of the ovary, otherwise as in *M. aptera*. *Drupe* globular, glabrous, 1 to 1·5 in. in diam.

Perak: King's Collector, No. 5418. Penang: Curtis, No. 2475.

This is a second species of *Melanorrhanoea* with non-accrescent petals. According to Mr. Curtis the petals are white, with a pink flush at the base, and the filaments are pink, while the anthers are green. The attachment of the funicle of the ovule in this species is to the side of the base of the ovular loculus, whereas in *M. aptera* it is attached to the centre of the base.

7. SWINTONIA, Griff.

Trees, quite glabrous. *Leaves* alternate, long-petioled, simple, quite entire. *Panicles* terminal and axillary, very large and broad. *Flowers* small, hermaphrodite or unisexual. *Calyx* small, 5-lobed; lobes rounded, imbricate. *Petals* 5, adnate to the middle of the disc, linear-oblong, imbricate, much enlarged and reflexed in fruit. *Disc* short or elongate or cylindric. *Stamens* 5, inserted on the top of the disc, free. *Ovary* sessile, ovoid, 1-celled, narrowed into the slender style; *stigma* capitellate; *ovule* pendulous from a basal funicle. *Drupe* ovoid, smooth, sessile, coriaceous, subtended by the 5 reflexed enlarged petals. *Seed* erect, testa thin, *cotyledons* amygdaloid. DISTRIB. The following are the only species known.

Bracts of the panicle inconspicuous or absent.

Leaves sub-coriaceous, main nerves 14 to 18 pairs; flowers on very short pedicels ... 1. *S. Schwenk*

Leaves coriaceous, main nerves 10 to 12 pairs, inconspicuous; pedicels longer than the flower, slender ... ... 2. *S. Penangiana.*

Flower-buds embraced by large concave imbricate bracts ... ... 3. *S. spicifera.*

Imperfectly known species ... ... 4. *S. lurida.*

1. Swintonia Schwenkii, Teysm. and Binn. Cat. Hort. Bogor. (1866) p. 230. A tree; young branches slender, glaucous. *Leaves* sub-coriaceous, oblong-lanceolate or narrowly elliptic, shortly and obtusely acuminate, the edges sub-undulate, the base slightly narrowed but usually rounded; both surfaces obscurely reticulate, the lower paler when dry; main nerves 14 to 18 pairs, spreading and rather straight: length 3 to 6 in., breadth 1·25 to 1·5 in.; petiole 1·25 to 1·5 in. slender, with a slight swelling at the very base. *Panicles* crowded at the ends of the branches in the axils of the upper leaves, slender, usually longer than the leaves, pedunculate; the branches short, alternate, spreading, the ultimate branchlets cymose. *Flowers* polygamous, ·1 in. diam., on very short pedicels. *Segments* of the calyx united only at the base, orbicular, concave, glabrous. *Petals* oblong, obtuse, pubescent on both surfaces, rapidly enlarging in the ripe fruit and reflexed, 2·5 in. long, narrowly oblong, coriaceous, veined. *Drupe* oblong, smooth, ·75 in. long. Kurz in Journ. As. Soc. Beng. Vol. XXXIX, Pt. 2, (1870), 75; Engler in DC. Mon. Phan. IV, 232. *Anauxanopetalum Schwenkii*, Teysm. and Binnend. in Miquel Journ. I, 368. *Astropetalum* 2, Griffith, Notul. IV, 415.

Malacca: Griffith, No. 1156; Maingay, No. No. 486.—Distrib Sumatra.

I have followed Sir Joseph Hooker and Dr. Engler in identifying this Malacca species of *Swintonia* with *S. Schwenkii*, T. B., although the specimens in the Calcutta Herbarium hardly bear this out. In the Calcutta Herbarium there are authentic specimens of *Anauxanopetalum Schwenkii*—the name originally given to the species by Teysm. and Binn. These specimens were collected in the Beuitenzorg garden and were sent out by its authors. They are therefore practically type specimens, for as the authors explain (Miq. Journ. Bot. I, 369) the species was named in the Beuitenzorg garden from specimens taken from trees originally received from Sumatra by Major Schwenk. Dr. Anderson in 1861 also collected in the Beuitenzorg garden specimens of the same. These Beuitenzorg specimens all agree in having flowers with rather long pedicels. Now, in describing *S. Schwenkii* in the Fl. Br. India from the Malacca specimens, Sir Joseph Hooker makes it a diagnostic mark of the species, as understood by him, that the flowers

are subsessile. In their leaves the Malacca and Buitenzorg specimens closely resemble each other, but the panicles of the latter are much larger than those of the former. I think it possible therefore that, when better specimens of the Malacca plant are collected, other characters may be found which will prove that it is not really the same as *S. Schwenkii*, T. and B.

2. Swintonia Penangiana, King n. sp. A tall tree: young branches slender, glaucous. *Leaves* coriaceous, oblong-lanceolate, rarely ovate-lanceolate, tapering from the middle to the shortly bluntly acuminate apex and to the cuneate base; main nerves 10 to 12 pairs, spreading, faint on both surfaces, the reticulations obsolete: length 3 to 4·5 in., breadth 1·1 to 1·4 in.; petiole ·75 to 1·25 in., slender, but slightly thickened near the base. *Panicles* axillary and terminal, as long as or longer than the leaves, pedunculate, slender, glabrous: the branches lax, spreading, the flowers in ultimate cymules of about three. *Flowers* ·15 in. long; their pedicels slender, longer than themselves. *Calyx* narrowly campanulate, with 5 broad subtruncate sub-ciliate lobes. *Petals* 5, longer than the calyx, sub-erect, oblong, obtuse, minutely tomentose with glabrous margins. *Stamens* 5; the *anthers* elliptic, dorsifixed, the filaments slender. *Disc* thin, cylindric. *Ovary* obliquely ovoid, pubescent, tapering into the short sub-terminal style, *stigma* rather large for the genus. *Drupe* globular, glabrous, smooth, ·5 in. in diam., the reflexed accrescent petals narrowly oblong, sub-acute, about 1·35 in. long and ·3 in. wide, glabrescent.

Penang: Curtis, No. 1579.

A species allied to *S. floribunda*, Griff., but with shorter panicles, and globular not oblong, fruit. The leaves of this moreover are more coriaceous and have fewer nerves than those of *S. floribunda*.

3. Swintonia spicifera, Hook. fil. Fl. Br. Ind. II, 27. A lofty tree: young branches smooth, reddish when fresh. *Leaves* coriaceous, oblanceolate or elliptic-obovate, the apex sub-acute or obtuse, the base attenuate-cuneate; upper surface shining, not reticulate, the lower pale brown when dry and glaucous: main nerves 13 to 20 pairs, obsolete on the upper and only slightly prominent on the lower surface, spreading, slightly curved; length 3·25 to 4·5 in., breadth 1·5 to 1·75 in.; petiole ·6 to 1·25 in. *Panicles* crowded near the ends of the branches, long-pedunculate, exceeding the leaves; the branchlets articulate, corymbosely crowded and trichotomously branched, angled, puberulous. *Flowers* ·2 in. long, each on a pubescent pedicel embraced by a broadly-ovate concave puberulous bracteole. *Calyx* fleshy, tubular, with 5 deep quadrate segments, puberulous outside, glabrous inside. *Petals* 5, twice as long as the calyx, thick, obovate-oblong, obtuse, concave, shortly

clawed. *Stamens* 4 or 5, shorter than the petals, filaments slender, the anthers short oblong; *disc* thin, cylindric. *Ovary* stalked, obliquely ovoid, puberulous. *Drupe* obliquely ovoid, smooth, ·75 in. long, the accrescent petals reflexed, coriaceous, veined, 1·75 in. long, pericarp thin. Engler in DC. Mon. Phan. V, 233.

Penang: Maingay, No. 486/2; Curtis, No. 371; King's Collector, No. 1802. Perak: Scortechini, Nos. 1891, 2083; King's Collector, Nos. 3534, 3677.

Var. *Scortechinii*, King; leaves oblong-lanceolate, shortly and bluntly acuminate, the base rounded or sub-cuneate, main nerves 12 to 14 pairs.

Perak: Scortechini, No. 1891.

This species and its variety are both notable for the bracts which embrace the flower-buds.

4. SWINTONIA LURIDA, King n. sp. A small tree: all parts quite glabrous; the young branches slender, striate and dark-coloured when dry. *Leaves* thinly coriaceous, narrowly elliptic-oblong, the edges slightly thickened and undulate, the apex shortly abruptly and bluntly acuminate, the base cuneate, decurrent on the petiole; both surfaces glabrous and minutely reticulate; the upper shining, olivaceous green when dry; the lower dull, pale liver-coloured when dry; main nerves 22 to 24 pairs, rather faint, spreading to the edge without interarching, the secondary nerves almost as prominent: length 6 to 8 in., breadth 1·5 to 2·25 in.; petiole ·6 to ·75 in., thickened near the base. *Panicle* terminal, branching from the base, drooping, slender; the branches long, bearing short branchlets with the numerous flowers in small cymes. *Male flowers* a little more than ·1 in. long, pedicelled. *Calyx* cupular, fleshy, with 5 broadly triangular teeth, glabrous. *Petals* 5, twice as long as the calyx, pale, oblong-elliptic, obtuse, with a truncate base, glabrous. *Stamens* inserted outside the shallow cupular dark-coloured slightly 5-lobed fleshy disc, shorter than the petals: *anthers* short, ovate, dorsifixed; *filaments* broadly subulate, with a very fine-pointed apex. *Rudimentary ovary* narrowly elliptic, sunk in the disc, tapering slightly upwards; no distinct style, stigma small, concave. *Semecarpus? lurida*, Hook. fil. Fl. Br. Ind. II, 34; Engler in DC. Mon. Phan. IV, 496.

Malacca: Maingay, No. 495. Perak: Wray, No. 3249.

A species of which female flowers and fruit are still unknown. Maingay's specimens were originally described by Sir Joseph Hooker as a doubtful species of *Semecarpus*, under the name? *S. lurida*. They are very incomplete. Since Maingay's time good specimens of exactly the same plant, but still without female flowers or fruit, have been

collected by Mr. L. Wray in Perak. These have enabled Dr. Stapf, of the Kew Herbarium, and myself to refer the plant to the genus *Scintonia*, its nearest allies being *S. floribunda* and *S. Schwenkii*. In Wray's field note on his specimens he writes "flower pale-greenish-yellow: leaves shining, bright green above; pale and bluish beneath."

8. Parishia, Hook. fil.

Tall trees with alternate unequally-pinnate leaves; the *leaflets* coriaceous, entire. *Panicles* large, nodding. *Flowers* dioecious. *Male Flower.* *Calyx* cupular, 4-lobed; the lobes ovate, valvate. *Petals* 4, oblong, imbricate. *Disc* short, annular, obscurely 4-lobed. *Stamens* 4, inserted below the margin of the disc. *Rudimentary ovary* cylindric. *Female Flower.* *Calyx* 4-lobed, the lobes persistent and greatly enlarged in fruit. *Petals* 4. *Ovary* sessile, ovoid, 1-celled; *style* terminal, unequally 3-fid, stigmas capitate; *ovule* pendulous from near the apex of the cell. *Fruit* sub-globose, dry, pubescent, bearing the persistent base of the style at its apex, the pericarp thin. *Seed* pendulous, its testa membranous; *cotyledons* amygdaloid, radicle superior.—Distrib. 5 species, all either Burmese or Malayan.

Wings of accrescent-calyx 2·5 to 3 in. long ... 1. *P. insignis.*
Wings of accrescent-calyx 4·5 in. and upwards in length.
Leaflets glabrous beneath, the midrib and nerves very slightly puberulous ... ... 2. *P. Maingayi.*
Leaflets rusty-pubescent on the lower surface 3. *P. pubescens.*

1. Parishia insignis, Hook. fil. in Trans. Linn. Soc. XXIII, 170, t. 26. A tall tree; young branches stout, lenticellate, rusty-puberulous. *Leaves* 12 to 20 in. long, the rachis cylindric: *leaflets* 6 to 8 pairs, thinly coriaceous, obliquely ovate-oblong to oblong-lanceolate, acute or shortly acuminate: the base broad, rounded or sub-cordate, unequal; upper surface shining, glabrous or glabrescent, the lower glabrescent and reticulate, or (var. *pubescens*) shortly and softly pubescent; main nerves 8 to 12 pairs, spreading, curving: length 3 to 5 in., breadth 1·2 to 2 in.; petiolule ·1 to ·2 in. *Male panicles* as long as the leaves, much branched, many-flowered, rusty-pubescent or tomentose. *Flowers* ·25 in. in diam., on pedicels longer than themselves. *Calyx* rusty-pubescent; its lobes unequal, triangular. *Petals* oblique, broadly ovate, sub-glabrous, reflexed at the apex, longer than the calyx. *Stamens* about as long as the petals; the *anthers* short, ovate, about one-third as long as the filaments. *Disc* pubescent, 4-angled. *Female flower* not seen. *Fruit* sub-globular, ·5 in. in diam., the persistent remains of the style ·15 in. long; accrescent calyx-wings narrowly oblong, blunt, 2·5 to 3

in. long, veined, pubescent. Hook. fil. Fl. Br. Ind. II, 30; Kurz For. Flora Burma, I, 318; Engler in DC. Mon. Phan. IV, 309. *Astronium insigne*, March. Rev. Anacard., 179.

Andaman Islands. Penang: Curtis, No. 2264. Langkani: Curtis, No. 2806.—Distrib. Burma.

This species has not hitherto been supposed to go farther south than Burma. But it appears to me that Mr. Curtis's No. 2806 from Langkani (an island off the coast a little to the southward of Burma) is probably this species, and also that his No. 2264 from Penang likewise belongs to this.

Var. *tomentosa*, King: *leaflets* pubescent on the lower surface. *Panicles* and *calyx* in all its stages densely rusty-tomentose.

Andaman Islands: King's Collectors.

2. Parishia Maingayi, Hook. fil. Fl. Br. Ind. II, 30. A tree: young branches stout, glabrous, sparsely lenticellate. *Leaves* 12 to 15 in. long, the petioles slightly dilated at the base; *leaflets* very coriaceous, 9 to 10 pairs, narrowly oblong or elliptic-oblong, not oblique, the apex acute, the edges sub-undulate, the base rounded or slightly cuneate; both surfaces shining and indistinctly reticulate, the upper quite glabrous, the lower slightly puberulous on the midrib and nerves; main nerves 15 to 20 pairs, spreading, faint: length 2·5 to 3·5 in., breadth 1 to 1·25 in.; petiolules about ·2 in. *Panicles* (*fide* Sir J. Hooker) apparently shorter than the leaves, pubescent. *Petals* linear-oblong. *Disc* pilose, young fruit narrowly ovoid, tapering to a long point, densely rusty-tomentose; the enlarged calyx-wings linear-oblong, sub-acute, pale, puberulous, sub-coriaceous, striate, 4·5 in. long and about ·5 in. broad.

Malacca: Maingay, No. 488.

Except Maingay's, I have seen no specimens which I can refer to this species. I have copied from the Fl. Br. Ind. Sir J. D. Hooker's description of the panicles and flowers, neither of these being represented in the Calcutta Herbarium. There is some doubt as to whether the fruits and leaf specimens brought together by Maingay really belong to the same tree; and not only so, but it is doubtful whether the fruits of two species have not been mixed up by him. For Sir Joseph Hooker notes that, while some of the fruits are densely covered with hispid ferrugineous bristles and have accrescent calyx-wings 6 to 7 inches long with rounded apices, others are pubescent and have wings only 4·5 in. long with acute tips. The species clearly requires investigation in the field.

3. Parishia pubescens, Hook. fil. Fl. Br Ind. II, 30. A lofty tree: young branches stout, deciduously rusty-tomentose. *Leaves* 12 to 18 in long; the petiole pubescent, terete above, dilated near the

base; *leaflets* 5 to 7 pairs, subsessile, thickly coriaceous, oblong, acute or acuminate, the base rounded, upper surface glabrous except the densely pubescent midrib; the lower shortly rusty-pubescent, reticulate; main nerves 12 to 16 pairs, irregular, spreading and ascending, curved, prominent on the lower surface when dry; length 4·5 to 5·5 in., breadth about 1·5 in.; petiolules very short (only ·05 to ·1 in.) or absent. *Panicle* rather shorter than the leaves, divided to the base into numerous fascicled branches, densely and softly tomentose. *Flowers* ·5 in. in diam., pedicelled. *Ovary* conical, pilose; *styles* 3 ? *Fruit* broadly ovoid, apiculate, ·5 in. long, densely tomentose, the pericarp cartilaginous; accrescent-calyx-wings thinly coriaceous, pale, striate, adpressed-puberulous or almost glabrous, narrowly oblong, sub-acute, 4·5 to 5 in. long and about ·5 in. broad. Engler in DC. Mon. Phan. IV, 3 10.

Malacca: Maingay, No. 487.

A very imperfectly known species collected hitherto only by Maingay, and as much in want of investigation as the last.

9. Campnosperma, Thwaites.

Trees. *Leaves* alternate, very coriaceous, simple, quite entire. *Racemes* axillary, simple or sparingly branched. *Flowers* sessile, minute, hermaphrodite. *Calyx* 3–5-partite; *segments* erect, persistent, imbricate. *Petals* 3–6, suborbicular, erect, imbricate. *Disc* urceolar. *Stamens* 6–10, inserted at the base of the disc. *Ovary* free, sessile, ovoid, 1-celled; *style* very short, stigma discoid or capitate; *ovule* 1, pendulous from the top of the cell. *Drupe* ovoid, fleshy; *stone* hard, almost 2-celled by a vertical plate from the top of the horse-shoe-shaped cell. *Seed* pendulous, curved round the imperfect septum: *cotyledons* curved, rather flat; *radicle* short superior.—Distrib.

Male flowers sessile	1.	*C. Griffithii.*
Male flowers pedicelled.		
Female flowers in short racemes; the males in long panicles; fruit ·6 in. in diam. ...	2.	*C. auriculata.*
Male and female flowers in sub-equal panicles; fruit ·2 to ·25 in long	3.	*C. Wallichii.*

1. Campnosperma Griffithii, Marchand Rev. Anacard. 174. A tree 60 to 80 feet high; young branches very stout, rough and with sparse minute tomentum. *Leaves* very coriaceous, obovate-oblong or elliptic, the apex very broad rounded or emarginate, the edges slightly recurved when dry, the base much cuneate, slightly decurrent on the broad stout channelled petiole: upper surface quite glabrous, the midrib depressed; lower surface minutely stellate-pubescent, the midrib very

convex and strong; main nerves 24 to 36 pairs, spreading, only slightly curved, projecting on the lower surface, depressed on the upper; length 7 to 15 in., breadth 3·5 to 5·5 in.; petiole 1·25 to 2·5 in., tomentose, dilated at the base. *Panicles* of male flowers axillary, slender, shorter than the leaves, rusty stellate-tomentose; the branches only a few inches long, spreading, spicate, bearing the flowers in small crowded sessile glomeruli. *Flowers* about ·05 in. diam., sessile. *Calyx* thick, cupular, cut into 4 broad sub-acute concave ovate-rotund segments, rusty-tomentose outside. *Petals* 4, a little exceeding the calyx, thin, pale, glabrous, elliptic-ovate, concave. *Stamens* 4 or 8 in two rows; *filaments* thickly subulate, anthers short; *disc* crenate, fleshy. *Panicle of female* flowers shorter and less branched than that of the males. *Drupe* ovoid, slightly oblique, glabrous, ·35 in. long. *C. macrophylla*, Hook. fil Fl. Br. Ind. II, 41; Engler in DC. Mon. Phan. IV, 316; Miq. Fl. Ind. Bat. I, pt. 2, p. 637.

Malacca: Griffith, No. 1109; Maingay, No. 484/2. Singapore: T. Anderson, No. 71. Perak: Wray, No. 2575; King's Collector, No. 5327, 6528, 6541 and 7292.—Distrib. Sumatra, Borneo, Bangka.

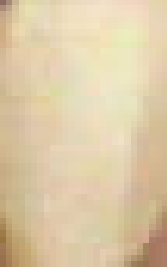
This species was first named as a *Campnosperma* by Marchand in 1869, and he based his description of it on Griffith's Malacca specimen No. 1109. The plant had previously (1850) been named *Buchanania macrophylla* by Blume in Mus. Bot. Lugd. Bat. I, 185. Had Marchand known this, he ought to have named it *Campnosperma macrophylla* instead of *C. Griffithii*. It is easily recognised by its sessile glomerulate flowers; although its fruit closely resembles that of the plant which is accepted as *C. Griffithii* both by Sir Joseph Hooker and by Dr. Engler, but which is here named *C. Wallichii*.

2. Campnosperma auriculata, Hook. fil. in Fl. Br. Ind. II, 41. A tall shrubby tree: young branches as thick as a swan's quill, glabrous, polished, lenticellate. *Leaves* thinly coriaceous, obovate-oblong or oblanceolate-oblong, the apex rounded sometimes retuse or emarginate, tapered gradually in the lower two-thirds and continued down the petiole as a wing to its slightly auricled base; both surfaces glabrous, minutely reticulate; main nerves 9 to 18 pairs, oblique, not prominent on either surface; length 4 to 9 in., breadth 1·75 to 3 in.; petiole below the auricles only ·1 or ·2 in., glabrous. *Panicles of male flowers* 10 to 14 in. long, axillary, covered with scurfy minute stellate rusty tomentum; the branches slender and with numerous many-flowered branchlets. *Flowers* pedicellate, ·15 in. in diam. when expanded. *Calyx* cupular, puberulous outside, with 4 broadly triangular segments. *Petals* 4, twice as long as calyx-teeth, elliptic, obtuse, deflexed. *Stamens* 8; four longer than others, spreading and longer than the petals, the other 4 shorter. *Disc*

large, fleshy, corrugated, ovary none. *Female flowers* in racemes shorter than the panicles of the males and stouter. *Flowers* ·15 in. in diam., on stout puberulous pedicels. *Calyx* thick, cupular, puberulous, with 4 broad triangular segments. *Petals* 4, broadly triangular, puberulous, larger than the calyx-segments. *Stamens* 8, shorter than the petals, the anthers imperfect. The *disc* a deep fleshy cup with crenate edges. *Ovary* broadly ovoid, rusty-tomentose, crowned by the large discoid glabrous obscurely-lobed reflexed stigma. *Drupe* ovoid-rotund, compressed, minutely tomentose, fleshy, ·6 in. in diam. Engler in DC. Mon. Phan. IV, 320. *Buchanania auriculata*, Blume in Mus. Bot. Lugd. Bat. I, 185. *Semecarpus? grandifolia*, Wall. Cat., No. 985 (exclude the specimens mentioned in the Appendix to the Cat.).

Penang: Wallich, No. 985. Malacca: Maingay, No. 484/4. Singapore; Kurz, Anderson, No. 69; Ridley, Nos. 444, 1880 and 4775 E.; Hullett, No. 223. Penang: Curtis, No. 1037.

This is distinguished from the next species by its smaller leaves and panicles and much larger fruit. It is the plant from Penang, issued by Wallich as No. 985 of his Catalogue, which he doubtfully referred to the genus *Semecarpus*, as *S.? grandifolia*. Along with this however Wallich issued, as noted in the Appendix to his lithographed Catalogue, p. 286) under the same number, and not (as is usual with Wallich's plants in similar cases) distinguished by any letters, the much larger (although in other respects similar) leaves of another species. The specific name *grandifolia* is not applicable to the present plant which is the true *Buchanania auriculata* of Blume (not however of Miquel), although it is applicable to the supplementary sheets of 985, one of which, as issued by Wallich is 30 inches in length. I have followed Sir Joseph Hooker and Dr. Engler in retaining Blume's specific name *auriculata* for the present plant. But, for the supplementary sheets, I do not propose to retain Wallich's name of *grandifolia* (his name having really been given to two things), but I propose for them the name *Campnosperma Wallichii*. In this I do not follow the distinguished Botanists just mentioned, for they call them *C. Griffithii*, Marchand. But Marchand's name, in my opinion, ought to be given to the plant on which he founded that species, which (as he mentions in his Monograph) was Griffith's No. 1109. And this I do in spite of the fact that Griffith's No. 1109 is exactly what Blume named *Buchanania macrophylla*. There is no doubt that, had Marchand known of Blume's name, he ought to have called his plant *Campnosperma macrophylla*. But as he did not, and as he was the first to put the plant into the genus *Campnosperma*, his name *C. Griffithii* must I think remain; and another name must be found for what Sir Joseph Hooker and Dr. Engler name *C. Griffithii*.



and that other name I propose to make *C. Wallichii*, in commemoration of its earliest collector.

3. Campnosperma Wallichii, King. A tall much-branched tree: young branches very stout, rough. *Leaves* coriaceous, the blade obovate-oblong with broad rounded and sometimes emarginate apex, tapering from about the middle downwards, forming a narrow wing to the petiole and expanding at its base into a small auricle; both surfaces glabrous and minutely reticulate; main nerves 20 to 30 pairs; length 10 to 30 in., breadth 4 to 7 in.; petiole 2 to 3 in. long, dilated, channelled, glabrous. *Panicles of male flowers* axillary, shorter than the leaves, stellately rusty-tomentose, with slender much-branched suberect many-flowered branchlets. *Male flowers* ·1 in. in diam., pedicelled; *calyx* thick, puberulous outside, its segments 4, broadly triangular, blunt; *petals* 4, larger than the calyx segments, ovate-rotund, concave, glabrous; *disc* fleshy, corrugated: *stamens* 8 in two rows, the outer 4 slightly longer than the inner 4. *Panicles of female flowers* about the same length as those of the male, but with shorter branches and fewer flowers; *flowers* larger than the males; *ovary* ovoid, puberulous; *drupe* ovoid-globular, slightly compressed, glabrous, ·2 to ·25 in. long. *C. Griffithii*, Hook. fil. in Fl Br. Ind. II, 41 (not of Marchand); Engler DC. Mon. Phan. IV. *Campnosperma auriculata*, Miq. (not of Blume) Fl. Ind. Bat. I, pt. 2, p. 637. *Semecarpus? grandifolia*, Wall. Cat. 985 *in part* (*i.e.* as to the specimens mentioned on p. 286 of the Appendix to the Catalogue.)

Penang: Porter, (Wall. Cat., 985). Malacca: Maingay, No. 464/3. Singapore: Kurz, Goodenough.—Distrib. Sumatra: Forbes, No. 3030.

This is in general appearance very like *C. auriculata*. The great difference between the two lies in the fruit which in this is only about ·2 in. long, while in *M. auriculata* it is ·6 in in diam. Other distinctions are to be found in the leaves, which in this are larger than in *C. auriculata*. The texture and venation are, however, the same in both; and both have curious small rounded auricles at the base of the petiole. The panicles of male and female flowers in this species are sub-equal, whereas in *M. auriculata* the panicles bearing male flowers are several times longer than these bearing females.

10. Microstemon, Engler.

Trees, with alternate exstipulate unequally-pinnate leaves. *Flowers* small, in axillary many-branched panicles, hermaphrodite. *Calyx* small, with 5 imbricate segments. *Petals* 5, much larger than the calyx, obovate, spreading, imbricate in æstivation. *Disc* annular, suberect, 10-toothed. *Stamens* 5, alternating with an equal number of capitellate

or spathiform staminodes: *filaments* very short, thickened towards the base; *anthers* broadly ovate, dorsifixed. *Ovary* ovoid-globose, its base immersed in the disc, unilocular, with a single pendulous ovule. *Style* terminal, very short, thick; the *stigma* broad, fleshy, with 3 broad spreading, blunt lobes. *Fruit* obliquely oblong-ovoid, attenuate towards the apex; the *pericarp* leathery, 1-celled, 1-seeded. *Seed* with membranous testa, exalbuminous, the cotyledons flat, the radicle curved.—Distrib. three species, all Malayan.

Leaflets tomentose on the lower surface ... 1. *M. velutina.*
Leaflets glabrescent and minutely scurfy (when dry) on the lower surface, the axils of the main nerves with tufts of white hair ... ... 2. *M. Curtisii.*

1. Microstemon velutina, Engler in DC. Mon. Phan. IV, 294. A tall tree: young branches, rachises and under surfaces and petioles and rachises of leaves and the inflorescence softly pubescent-tomentose, rusty-cinereous. *Leaves* 6 to 10 in. long, the petiole slender; *leaflets* 7 to 11, thinly membranous, oblong-lanceolate, entire, shortly and bluntly acuminate; the base slightly narrowed, cuneate or rounded: upper surface glabrous except the pubescent midrib; main nerves 12 to 16 pairs, spreading, rather obscure; length 2 to 4 in., breadth ·8 to 1·5 in.; petiolule ·15 in., the terminal one longer. *Panicles* pedunculate, much branched towards the apex, the branches very slender. *Flowers* numerous, less than ·1 in. in diam., sessile. *Calyx* glabrous, the lobes elliptic. *Petals* obovate, glabrescent on the outer surface minutely tomentose on the inner. *Fruit* narrowly oblong, compressed, with a rusty scurfy leathery pericarp, 1-celled, 1-seeded (young) ·75 in. long and ·35 or ·4 in. broad. *Pentaspadon? velutinus*, Hook. fil. Fl. Br. Ind. II, 28.

Malacca: Griffith, Maingay (Kew Distrib.), No. 464. Perak: Scortechini, No. 1924; King's Collector, No. 7417. Pahang: Ridley, No. 2560.

2. Microstemon Curtisii, King. A medium sized tree *(Curtis)*; young branches slender, deciduously puberulous, their bark pale and lenticellate when dry. *Leaves* 5 to 7 in. long, the petiole and rachis slender and puberulous; *leaflets* very dark when dry, about 7, membranous, narrowly oblong-lanceolate, acuminate, entire, the base rounded and slightly oblique, with scattered short hairs, the midrib and nerves pubescent, not reticulate; lower surface glabrescent, minutely scurfy when dry, the midrib and nerves puberulous; main nerves 13 to 17 pairs, ascending, curved, with conspicuous tufts of white hair at their junction with the midrib: length 1·75 to 3 in., breadth ·75 to ·9 in.; petiolules ·1 in., the terminal one ·2 in. *Panicles* near the end of the branches, axillary, slender, slightly longer than the leaves,

pedunculate, puberulous ; the branches divergent, the flowers solitary or in clusters of 2 to 4 at rather distant intervals. *Flowers* less than ·1 in. in diam., on pedicels shorter than themselves. *Calyx* cupular, with 5 spreading concave broadly-ovate acute segments, puberulous outside, glabrous inside. *Petals* 5, broadly elliptic, very obtuse, twice as long as the calyx, minutely pubescent on the inner surface, glabrescent on the outer. *Stamens* 5, shorter than the petals, the filaments not swollen at the base. *Disc* glabrous. *Ovary* conical, glabrous : *stigma* minute. *Drupe* unknown.

Kedah : Curtis, No. 2620.

A species of which I have seen only Mr. Curtis's specimen from Kedah. It is readily distinguished from the preceding two by the tufts of white hair in the axils of the main nerves on the under surface of the leaflets. The stigma is very minute and it is not easy to make out the three lobes which characterise the genus. The flowers have, however, the staminodes and disc of the genus.

11. PENTASPADON, Hook. f.

Trees. *Leaves* unequally pinnate ; *leaflets* opposite, sub-sessile, entire. *Panicles* axillary, peduncled, much-branched, branchlets very slender. *Flowers* pedicelled, minute, hermaphrodite. *Calyx-lobes* 5, imbricate. *Petals* 5, oblong-obovate, strongly imbricate. *Stamens* 5, minute, inserted at the base of the disc, alternate with 5 short subulate staminodes which are free or adnate to the side of the disc ; filaments short, broadly subulate ; *anthers* didymous. *Disc* cupular, obscurely 10-lobed. *Ovary* seated on the disc, very minute, 1-celled, contracted into a stout short style ; stigma globose or obliquely oblong, much bent to one side ; *ovule* 1, pendulous from the upper part of the cavity.

1. PENTASPADON OFFICINALIS, Holmes MSS. in Herb. Soc. Pharm. Lond. A tree 60 to 100 feet high : young branches puberulous and with prominent small brown warts. *Leaves* 4 to 7 in. long, the rachises puberulous or glabrescent : *leaflets* 7 to 9, thinly coriaceous, oblong- or elliptic-lanceolate, entire, shortly and bluntly acuminate, the base narrowed, both surfaces glabrous : the lower with tufts of short hair in some of the nerve axils, curving upwards ; main nerves 6 to 9 pairs, interarching far from the margin, rather prominent on the lower surface when dry ; length 1·75 to 2·75 in., breadth ·8 to 1·25 in. ; petiolules ·15 in., those of the upper leaflets twice as long. *Panicles* pedunculate, as long as or exceeding the leaves, much branched towards the apex ; the branchlets slender, minutely cinereous-tomentose. *Flowers* numerous, about ·05 in. in diam., their pedicels shorter than themselves. *Calyx-lobes* rounded. *Petals* obovate-rotund, glabrous. *Drupe* narrowly ellip-

tic, compressed; the pericarp fleshy, pale and covered with rusty scurf, 1-celled, 1-seeded, ·65 to ·8 in. long.

Perak: King's Collector, Nos. 3315, 3770, 4868, 6549, 6933: Scortechini, No. 2043; Wray, No. 4168.

This plant is known to the Malay population of Perak as the source of *Minyak Plang*, a dark brown viscid oil which is in great repute for the cure of certain skin diseases. An interesting note upon the plant and its oil by Mr. E. M. Holmes of the Pharmaceutical Society of London is to be found in the *Journal* and Transactions of that Society, Vol. LII, p. 389. The stigma in this species, prior to dissection, appears to be sub-globular with a central groove; and it is only after careful manipulation that it is seen to be bent on itself. Some specimens of this were by mistake issued from the Calcutta Herbarium under the name *Microstemon officinale*, Holmes.

12. Rhus, Linn.

Trees or shrubs, often with an acrid juice. *Leaves* alternate, simple or 1–3 foliolate or pinnate; *leaflets* entire or serrate. *Flowers* small, in terminal and axillary panicles, polygamous. *Calyx* small, 4–6-parted, persistent; the segments unequal or equal, imbricate. *Petals* 4–6, equal, spreading, imbricate. *Stamens* 4, 5, 6, or 10, inserted at the base of the disc, free; *filaments* subulate; *anthers* short, imperfect in the ♀ flower. *Ovary* sessile, ovoid or globose, 1-celled: *styles* 3, free or curved, short or long; *stigmas* simple or capitate; *ovule* pendulous from a basal funicle. *Drupe* small, dry, compressed; *stone* coriaceous, crustaceous or bony. *Seed* pendulous from the funicle, testa membranous, cotyledons flattish; radicle hooked, short, superior.—Distrib. about 114 species, mostly extra-tropical in both hemispheres, a few Malayan, many from tropical Africa.

Rhus Perakensis, Scortechini MSS. A glabrous shrub climbing to the extent of 15 to 40 feet. *Leaves* 8 to 12 in. long, unequally pinnate; *leaflets* in rather distant pairs, opposite, thinly coriaceous, oblong, shortly and bluntly acuminate, entire; the base slightly oblique, rounded or sub-cuneate; main nerves 16 to 20 pairs, sub-horizontal, rather prominent on the lower surface; length 2·5 to 3·5 in., breadth 1 to 1·4 in.; petiolules ·1 to ·15 in., the terminal one ·3 or ·4 in. *Panicles* axillary and terminal, longer than the leaves, pedunculate, the branches rather short, bearing the flowers on small ultimate racemes. *Flowers* numerous, less than ·1 in. in diam., on short minutely bracteolulate pedicels. *Calyx* with 5 unequal oblong blunt spreading segments. *Petals* longer than the calyx, elliptic, blunt, pinnately nerved. *Stamens* 5; *anthers* broadly ovate, dorsifixed. *Drupe* compressed, obliquely reniform, orbicular, broader than long, glabrous, ·2 in. across.

Perak: Scortechini, No. 1668; Wray, Nos. 2316, 3095; King's Collector, Nos. 3626, 4896, 5046, 6537, and 6807.

The nearest ally of this is probably *M. succedanea*, L., than which it, however, has much larger panicles and smaller more reniform drupes. It has moreover differently veined petals, and the leaflets are less narrowed to the base. It differs, however, not only from that, but from every other Indian or Malayan species in being scandent. Of the scandent habit there appears to be no doubt whatever, for the fact is noted on almost every specimen in the Calcutta Herbarium.

13. Odina, Roxb.

Trees with few stout branches. *Leaves* few at the ends of the branches, alternate, unequally-pinnate, deciduous; *leaflets* opposite, quite entire. *Racemes* simple and panicled, terminal, fascicled. *Flowers* small, monœcious or diœcious, fascicled, shortly pedicelled. *Calyx* 4–5-lobed, persistent; *lobes* rounded, imbricate. *Petals* 4–5, imbricate. *Disc* annular, 4–5-lobed. *Male flower Stamens* 8–10, inserted within the disc. *Ovary* 4–5-parted. *Female flower Ovary* sessile, oblong, 1-celled; *styles* 3–4, stout, stigmas simple or capitellate; *ovule* pendulous from near the top of the cell. *Drupe* small, compressed, oblong, sub-reniform, crowned by the distant styles; *stone* hard. *Seed* compressed; *embryo* curved, cotyledons flat fleshy, ratlicle superior.—Distrib. About 12 species, mostly African.

Odina Wodier, Roxb. Fl. Ind. II, 293. A small deciduous tree 20 to 40 feet high: young branches thick, puberulous at first, soon becoming glabrous. *Leaves* 12 to 18 in. long; *leaflets* 3 or 4 pairs, obliquely ovate, acuminate; the base rounded or sub-cuneate, unequal; the edges entire; length 3 to 6 in.; the petiolules ·15 in. long. *Male racemes* compound, the female simple, puberulous. *Flowers* crowded in cymose fascicles on the racemes or panicles, bracts ciliate. *Sepals* obtuse. *Petals* twice as long as the sepals, oblong, spreading. *Stamens* in the male equalling the petals.—*Drupe* about ·5 in. long, red. W. and A. Prodr. I, 171; Thwaites Enum. 78; Grah. Cat. Bomb. Pl. 42; Wt. Ic. t. 60; Bedd. Fl. Sylv. t. 123; Wall. Cat. 8475; Royle Ill. t. 31; Dalz. and Gibs. Bomb. Fl. 51; Brandis For. Flor. 123; Miq. Fl. Ind. Bat. Vol. I, Pt. 2, p. 622; Hook. fil. Fl. Br. Ind. II, 29; Kurz For. Flora Burm, I, 321; Engler in DC. Mon. Phan. IV, 267.

The Andaman and Nicobar Islands. Penang: (probably planted.) —Distrib. British India.

14. MELANOCHYLA, Hook. f.

Trees. *Leaves* simple, very coriaceous, exstipulate, quite entire. *Panicles* branched, axillary and terminal. *Flowers* small, unisexual. *Calyx-tube* persistent, slightly enlarged in fruit and adnate to the very base of the drupe, cupular or campanulate, lobes 5, erect. *Petals* 5, inserted on the edge of the disc; very coriaceous, persistent, erect or sub-erect, villous in front, valvate. *Disc* lining the calyx-tube. *Stamens* inserted on the edge of the disc; filaments stout, sometimes coherent at the base with the petals, villous; *anthers* oblong. *Ovary* globose, 1-celled; *style* short, stigmas 3; *ovule* 1, pendulous from near the top or from the side of the cell. *Drupe* globose, areolate at the base by the enlarged calyx, flesh full of black varnish; *stone* thick, hard. *Seed* oblong, testa thin; *cotyledons* amygdaloid, radicle superior.—DISTRIB. Malayan Peninsula and Archipelago: about 12 species.

Leaves more or less hairy on the lower surface.

Leaves elliptic-oblong.

The whole of the under-surface of the leaves rusty-tomentose, panicles condensed ... 1. *M. densiflora.*

Petioles midrib and main nerves on the under surface of the leaves rusty-tomentose, panicles lax ... ... 2. *M. tomentosa.*

Leaves oblong-oblanceolate or narrowly elliptic-oblong.

Lower surface of the leaves glaucescent, the midrib and main nerves with adpressed brown hairs, leaves 2·75 to 5 in. long ... 3. *M. Kunstleri.*

Lower surfaces of the leaves slightly pubescent, leaves 5 to 8 in. long ... ... 4. *M. Maingayi.*

Leaves glabrous on both surfaces.

Leaves much elongate, narrowly oblong, their bases cordate or auriculate, sessile or with very short petioles.

Drupes vertically ridged ... ... 5. *M. auriculata.*

Drupes very rugose, not ridged .. 6. *M. rugosa.*

Leaves oblong-lanceolate, oblong-elliptic or oblong-oblanceolate, with distinct slender petioles.

Inflorescence densely crowded and with large prominent bracts ... ... 7. *M. bracteata.*

Inflorescence more or less laxly paniculate, not bracteate.

Young branches and panicles covered with a thin felted layer of minute tomentum, flowers less than ·1 in. long ... ... 8. *M. angustifolia.*

Young branches glabrous, panicles pubescent-tomentose (not felted), flowers more than ·1 in. long ... ... 9. *M. nitida.*

1. MELANOCHYLA DENSIFLORA, King n. sp. A tree 60 to 100 feet high: young branches stout, covered with short rusty deciduous tomentum. *Leaves* very coriaceous, oblong-elliptic, sometimes slightly obovate, subacute, somewhat narrowed to the rounded slightly unequal base; upper surface glabrous, not reticulate, the midrib and nerves slightly depressed when dry; lower surface densely and minutely rusty-tomentose, the midrib very prominent as are the 20 to 25 pairs of strong subhorizontal main nerves; length 6 to 8·5 in., breadth 2·5 to 3·5 in.; petiole ·65 to 1 in., thickened and channelled near the base. *Panicle* terminal, condensed, shorter than the leaves, branched from the base, everywhere rusty-tomentose; branches numerous, the branchlets racemulose and bearing the flowers in ultimate sub-sessile crowded cymules. *MALE FLOWERS* ·2 in. long, sessile; *buds* ovoid, gibbous near the base. *Calyx* fleshy, campanulate, rusty-tomentose externally with 5 triangular sub-acute sub-erect segments. *Petals* 5, twice as long as the calyx-teeth, erect, thick, elliptic, obtuse, tomentose along the midrib externally, the edges glabrous, but with a tuft of coarse hairs along the lower part of the midrib. *Stamens* 5, shorter than the petals, anthers elliptic; filaments compressed, densely villous in front, about as long as the anthers; *disc* small, slightly convex, villous in the middle; *ovary* 0. *FEMALE FLOWERS* and *drupe* unknown.

Perak: King's Collector, Nos. 5615 and 5626.

A species allied to *M. tomentosa*, Hook. fil.; but at once distinguished from that by its denser panicles, larger and more numerous flowers. This is also much more hairy on the under surface of the leaves than *M. tomentosa*. Female flowers and fruit are still unknown.

2. MELANOCHYLA TOMENTOSA, Hook. fil. Fl. Br. Ind. II, 38. A tree: young branches rather slender, densely rufous-tomentose. *Leaves* coriaceous, elliptic-oblong, sometimes slightly obovate, shortly and sharply acuminate, the base rounded but slightly narrowed; upper surface quite glabrous except the pubescent base of the midrib; lower surface reticulate, glabrescent, pale when dry, the midrib and nerves more or less rufous-pubescent like the petiole: main nerves 20 to 30 pairs, spreading, prominent on the lower surface; length 6·5 to 14 in., breadth 2·75 to 4 in.; petiole ·35 in., stout, rufous-pubescent. *Panicles* terminal, about as long as the leaves, the main axis rufous-tomentose; the branches slender, distant, sub-erect, puberulous, spike-like, bearing the flowers in distant sub-sessile cymules. *MALE FLOWERS* about ·1 in. in diam. *Calyx* with 5 deep unequal ovate concave segments, puberulous externally.

Petals 5, thick, oblong, obtuse, longer than the calyx, pubescent outside, villous inside. *Stamens* nearly as long as the petals, the filaments stout. *Female flower* not seen. *Drupe* elliptic to sub-globose, ferruginous-pubescent, orange-yellow when ripe, 1 to 1·5 in. in length. Hook. fil. Ic. Plant. t. 1292, 1293; Engler in DC. Mon. Phan. IV, 470.

Malacca: Maingay, No. 1423.—Distrib. Java (*fide* Engler): Zollinger, No. 800.

3. Melanochyla Kunstleri, King n. sp. A tree 80 to 100 feet high? young branches as thick as a quill, lenticellate and with deciduous sparse rusty pubescence. *Leaves* very coriaceous, elliptic-oblong, sometimes oblanceolate-oblong, tapering to each end, shortly acuminate; the edges with a shining cartilaginous thickening, slightly recurved when dry; upper surface glabrous, shining, not reticulate, the midrib prominent; lower surface paler, glaucescent, the midrib and 18 to 20 pairs of prominent spreading main nerves with adpressed brown hairs; length 2·75 to 5 in., breadth 1 to 1·5 in.; petiole ·35 in., slightly scurfy. *Panicles* terminal, twice as long as the leaves, minutely rusty-tomentose, with numerous short spreading racemose branches. *Male flowers* ·15 in. long, on pedicels shorter than themselves. *Calyx* coriaceous, minutely tomentose outside, cupular, deeply divided into 5 broadly-ovate acute slightly-spreading segments. *Petals* 5, thrice as long as the calyx-segments, narrowly elliptic, blunt, pubescent on the outer surface, densely villous on the inner surface, the margins only glabrous. *Stamens* 5, much shorter than the petals; the *anther* narrowly ovate, the filament subulate, slightly villous. *Ovary* 0. *Female flowers* and *drupe* unknown.

Perak: King's Collector, No. 6810.

The nearest ally of this is *M. Maingayi*, from which, however, this may be distinguished by the smaller leaves more shining on the upper surface, and by the adpressed brown hairs on the under surface of the midrib and nerves.

4. Melanochyla Maingayi, Hook. fil. Fl. Br. Ind. II, 39. A tree: young branches slender, scurfy-puberulous. *Leaves* very coriaceous, oblong-oblanceolate or narrowly elliptic-oblong, abruptly and shortly acuminate, tapering in the lower two-thirds to the short channelled petiole; upper surface glabrous, faintly reticulate, shining, the midrib very prominent; lower surface slightly pubescent; main nerves 18 to 24 pairs, spreading, prominent on the lower surface, only slightly so on the upper: length 5 to 8 in., breadth 1·75 to 2·25 in.; petiole ·5 or ·6 in. *Panicle* terminal, longer than the leaves, rusty-tomentose; the branches spreading, rather short; the ultimate branchlets cymose, about 3-flowered. *Male flowers* about ·1 in. in diam., on short stout pedic

Calyx with 5 ovate acute segments, rusty-tomentose. *Petals* several times longer than the calyx-segments, elliptic, obtuse, externally adpressed, rusty-tomentose but with broad glabrous edges. *Female flowers* twice as large as the male; the *calyx* sub-urceolate; *ovary* globose, hairy. *Drupe* unknown. Engler in DC. Mon. Phan. IV, 471.

Malacca: Maingay, No. 490.

5. Melanochyla auriculata, Hook. fil. Fl. Br. Ind. II, 39. A tall tree; young branches very stout, glabrous. *Leaves* coriaceous, sessile or nearly so, oblong or oblanceolate-oblong, shortly and rather abruptly acuminate, the edges subundulate, tapering from the middle to the narrow auriculate base; both surfaces glabrous and shining, the upper drying of an olivaceous brown, very faintly reticulate, the lower liver-coloured and with the reticulations more distinct; main nerves about 30 pairs, thin but distinct on both surfaces, sub-horizontal; length 12 to 18 in., breadth 3·5 to 4·75 in.; petiole when present very stout, broad, less than ·5 in. long, often adnate to the branch. *Male panicles* axillary, shorter than the leaves, puberulous; the branches short, lax, cymose, 2- to 3-flowered. *Flowers* ·3 in. long, on stout pedicels about as long as themselves. *Calyx* campanulate, coriaceous, minutely tomentose outside, deeply cut into 5 broadly-ovate sub-acute segments. *Petals* 5, longer than the calyx-segments, elliptic, obtuse, externally adpressed-pubescent, but with the edges glabrous, internally minutely pubescent and with a large villous tuft in the lower half. *Stamens* 5, shorter than the petals, with small anthers and pubescent filaments. *Female flowers* not seen. *Drupe* oblong, obtuse or depressed-globose, rusty-tomentose, when ripe 1·25 to 1·5 in. long, vertically ribbed, stone very thick. Engler in DC. Mon. Phan. IV, 470.

Malacca: Maingay, No. 491; Derry, No. 1189. Singapore: Ridley, Nos. 3588, 3975.

6. Melanochyla rugosa, King n. sp. A large tree: young branches as thick as a goose-quill, tawny-pubescent with long pale flexuose hairs intermixed. *Leaves* coriaceous, narrowly oblong, sometimes almost oblanceolate, shortly and sharply caudate-acuminate, tapering very gradually to the cordate sub-auriculate base: upper surface smooth, shining, and quite glabrous; the lower dull, pale, and distinctly reticulate, glabrous except a few scattered stiff hairs near the base of the stout grooved midrib; main nerves 25 to 30 pairs, spreading, curving upwards and interarching at the apices; length 7 to 15 in., breadth 1·6 to 3·25 in.; petiole ·35 to ·5 in., very stout, dilated, pubescent like the young branches. *Male panicles* not seen. *Female panicles* terminal, about half as long as the leaves, stout, rusty-pubescent, with a few distant short branches. *Female flowers* ·3 in. in diam.,

depressed-hemispheric, sessile. *Calyx* coriaceous, tomentose outside, divided into 5 orbicular-ovate acuminate concave conniving segments. *Petals* 5, not much exceeding the calyx, coriaceous, broadly triangular, minutely pubescent, with a small villous patch at the base in front. *Stamens* rudimentary. *Ovary* broadly conical, rusty-tomentose; the style terminal, glabrescent, shorter than the ovary; *stigma* capitate, 3-lobed. *Drupe* globular-ovoid, very rugulose, rufous-tomentose, ·75 to 1 in. long and ·65 to ·9 in. in diam. (probably not quite mature).

Perak, at Tapa: Wray, No. 1301.

A species with leaves somewhat like those of *M. auriculata*, but smaller: collected only once.

7. Melanochyla bracteata, King n. sp. A tree 50 to 80 feet high: young branches slender, glabrous, with pale lenticellate bark. *Leaves* coriaceous, narrowly oblong-lanceolate, tapering to each end, the apex caudate-acuminate, the base narrowly cuneate; both surfaces glabrous: the upper shining; the lower dull, paler than the upper, glaucescent; main nerves 10 to 12 pairs, slender, faint, curving upwards: length 4 to 6 in., breadth 1 to 1·6 in.; petiole ·5 to ·75 in., thickened in the lower half. *Male flowers* ·25 in. long, crowded in small sub-sessile cymules on axillary or terminal rusty-pubescent congested racemes or few-branched panicles as long as or longer than the leaves; *bracts* at the bases both of the cymules and of the individual flowers, ovate, acuminate, concave, rusty-pubescent like the calyx and petals, and as large as the flowers. *Calyx* campanulate, with 5 ovate acute segments. *Petals* 5, longer than the segments of the calyx, lanceolate, acuminate, with a dense villous tuft on the lower half of the anterior surface. *Stamens* 5, shorter than the petals; the *anthers* linear, glabrous, the *filaments* thick, compressed and densely villous from base to apex. *Disc* lining the inflated tube of the calyx, ovary none. *Female flowers* not seen. *Drupe* ovoid or ovoid-globular, minutely tomentose, about ·75 in. in length, the pericarp with a thick black juice.

Perak: King's Collector, Nos. 5549 and 7303.

A very distinct species distinguished by the small size of its leaves and by its congested bracteate inflorescence.

8. Melanochyla angustifolia, Hook. fil. Fl. Br. Ind. II, 39. A tree: young branches slender, covered with a thin close layer of very minute tomentum. *Leaves* coriaceous, oblong or oblanceolate-oblong, shortly acuminate, the edges slightly undulate, the base cuneate, sometimes unequal, both surfaces glabrous, the lower reticulate: main nerves 12 to 16 pairs, spreading, prominent like the midrib on the lower surface, less so on the upper, length 4·5 to 10 in., breadth 1·5 to 4 in.; petiole ·75 to 1·5 in., dilated and channelled near the base

Panicles of male flowers axillary or terminal, as long as or much longer than the leaves, very slender, with many spreading branches, everywhere minutely tomentose like the young branches. *Male flowers* in lateral cymules from the branchlets, sub-sessile, less than ·1 in. long; *calyx* tubular-campanulate, the lobes erect, oblong-triangular, sub-acute, rusty-tomentose externally; *petals* oblong, sub-acute, much longer than the calyx, adpressed-pubescent outside, villous in the lower half inside; *stamens* shorter than the petals, the anthers small, elliptic; the *filaments* subulate, villous, *ovary* none. *Panicles of female flowers* shorter than the males: *female flowers* not seen. *Drupe* globose, apiculate, minutely tomentose like the panicle, ·5 to ·75 in. in diam. Engler in DC. Mon. Phan. IV, 469.

Malacca: Maingay, No. 492. Perak: King's Collector, No. 3359.

9. Melanochyla nitida, King n. sp. A tree; young branches rather slender, angled and dark-coloured when dry. *Leaves* very coriaceous, oblong-elliptic or oblanceolate-oblong, shortly bluntly and rather abruptly acuminate, narrowed from the middle or below it to the long plano-convex stout petiole; both surfaces quite glabrous; the upper shining and not reticulate; the lower paler, dull, with the wide reticulations slightly prominent; main nerves 12 to 16 pairs, slightly prominent on both surfaces when dry, spreading and curving upwards: length 4 to 11 in., breadth 2·25 to 3·25 in.; petiole 1 to 2 in., thickened in the lower half or third. *Panicles* terminal, minutely tomentose, but not felted, slightly longer than the leaves; the branches few, scattered, ascending, having few spicate short branchlets bearing the flowers in ultimate sessile cymules. *Male flowers* more than ·1 in. long, sessile, crowded; *calyx* coriaceous, campanulate, deeply cut into 5 broadly-triangular acute sub-erect concave segments, tomentose outside: *petals* 5, triangular-oblong, thick, longer than the calyx-teeth, adpressed-pubescent externally but with broad glabrous edges; internally glabrous but with a large tuft of coarse hair on the middle of the lower half: *stamens* 5, shorter than the petals, the filaments densely villous: *disc* small, villous in the middle; *ovary* none. *Female flowers* ·2 in. long, on short pedicels; *stamens* present but apparently without pollen; *ovary* filling the whole fundus of the flower, hemispheric, densely rusty-tomentose, tapering into a short stout conical hairy style; *stigma* sub-capitate. *Drupe* unknown.

Perak: Scortechini, No. 2037; Wray. Penang: Curtis, No. 1496. Perak: King's Collectors, No. 6722.

The nearest ally of this is *M. angustifolia* which has, however, its young branches and panicles covered with a thin felted layer of minute tomentum; whereas, in this plant, the young branches are glabrous

and the panicle is pubescent-tomentose not felted. The flowers of this moreover are larger than those of *M. angustifolia*, the main nerves are more oblique, and the reticulations wider and less distinct.

15. SEMECARPUS, Linn. f.

Trees. *Leaves* alternate, simple, quite entire, coriaceous. *Flowers* small, polygamous or dioecious, in terminal or axillary panicles. *Calyx* 5-6-fid, segments deciduous. *Petals* 5-6, imbricate. *Disc* broad, annular. *Stamens* 5-6, inserted at the base of the disc, imperfect in the ♀ flowers. *Ovary* 1-celled; *styles* 3; *ovule* pendulous from a basal funicle. *Drupe* fleshy, oblong or sub-globose, oblique, seated on a fleshy receptacle formed of the thickened disc and calyx base; *pericarp* loaded with acrid resin. *Seed* pendulous, testa coriaceous, inner coat somewhat fleshy; *embryo* thick, cotyledons plano-convex, radicle superior.—DISTRIB. About 40 species, tropical Asiatic and Australian.

Leaves densely rusty-pubescent on the lower surface	1. *S. velutina.*
Leaves with the lower surface densely clothed with pale very minute scales	2. *S. Curtisii.*
Leaves at first puberulous on the lower surface but ultimately glabrous	
Panicles tomentose; flowers glabrous, sessile; leaves oblanceolate-oblong, with 20 to 26 pairs of nerves	3. *S. Kurzii.*
Panicles puberulous, flowers pedicelled; leaves broadly elliptic, with 10 to 15 pairs of nerves ...	4. *S. lucens.*
Leaves quite glabrous; panicles glabrous in the lower part, pubescent towards the extremities; flowers subsessile, the calyx puberulous: leaves oblanceolate-oblong, with 18 to 24 pairs of main nerves	5. *S. Prainii.*

1. SEMECARPUS VELUTINA, King n. sp. A dioecious tree 50 to 60 feet high: young branches softly rufous-pubescent, the bark pale. *Leaves* thickly coriaceous, obovate-elliptic or oblanceolate, rarely elliptic, shortly and abruptly acuminate, the edges sub-undulate, narrowed from the middle or above it to the stout petiole; upper surface glabrous except the slightly-pubescent depressed midrib, shining and minutely reticulate; the lower surface densely and softly pubescent, the transverse veins and the reticulations distinct; main nerves 20 to 24 pairs, slightly depressed on the upper surface, very prominent on the lower, spreading and interarching near the edge; length 6 to 13 in., breadth 2·5 to 5 in.; petiole ·5 to 1·25 in. *Panicles* of flowers of both sexes

terminal, stoutly pedunculate, rusty-tomentose, those with female flowers longer than the leaves, those with males shorter; the branches of both short, ascending, those of the male more numerous. *Male flowers* ·1 in. in diam., much crowded in short sub-globular sessile cymose fascicles; *calyx* cupular, flat, with 5 spreading broad triangular acute teeth, pubescent outside; *petals* 5, longer than the sepals, broadly elliptic, acute, glabrescent. *Stamens* 5, the filaments longer than the petals; *disc* broad, convex, fleshy, hairy in the middle; *ovary* none. *Female flowers* less numerous than the males and twice as large: *calyx* rusty-tomentose and petals pubescent outside; *petals* acute. *Stamens* with very small anthers. *Ovary* obliquely hemispherical, slightly compressed, densely rusty-tomentose: *styles* 3, short, horizontally radiating, pubescent; *stigmas* truncate. *Drupe* transversely oblong, ·35 in. from base to apex and ·6 in. from side to side, compressed, sparsely tomentose, the enlarged peduncle about one-third of its length, thin, cup-shaped, sparsely pubescent.

Perak: King's Collector, Nos. 7439, 7622 and 7655.

Allied to *S. Anacardium*, Linn. fil., but well distinct from that and from any other hitherto described species.

2. Semecarpus Curtisii, King n. sp. A small tree: young branches stout, their bark pale. *Leaves* coriaceous, oblanceolate-oblong, shortly and bluntly acuminate, the edges slightly undulate, gradually narrowed from the upper third to the stout petiole, upper surface shining, greenish when dry, reticulate; the lower dull, pale from very minute scales; main nerves 18 to 20 in., spreading and interarching within the pale cartilaginous edge, very prominent and pale on the lower surface, faint on the upper; length 13 to 16 in., breadth 4 to 5 in.; petiole 1·5 to 2 in., very stout. *Panicles* much shorter than the leaves, branching from near the base; the branches ascending, angled, tawny-puberulous, the ultimate branchlets cymose. *Flowers* unisexual and the sexes on different panicles, shortly pedicelled. *Male flowers* ·15 in. in diam.; *calyx* cupular, with 5 ovate sub-acute spreading segments, minutely tomentose externally: *petals* 5, spreading, much longer than the calyx, elliptic, obtuse, minutely tomentose on the outer, glabrescent on the inner surface; *stamens* 5, longer than the petals, the anthers small, the filaments narrow, compressed; *disc* sub-convex, pubescent; *ovary* 0. *Female flowers* larger than the male; *stamens* rudimentary; *ovary* obliquely globose-ovoid, compressed, densely tomentose; *styles* 3, radiating, horizontal or depressed, glabrous, bifid at the apex. *Drupe* unknown.

Tongka: Curtis, No. 2930.

A very distinct and handsome species; readily recognised amongst

the Malayan species by its large leaves which are very pale glaucescent beneath: collected hitherto only by Mr. C. Curtis, of the Forest Department, Penang.

3. Semecarpus Kurzii, Engl. in DC. Mon. Phan. IV, 489. A small tree: young branches stout, rough and lenticellate, covered with deciduous dense minute rusty tomentum. *Leaves* coriaceous, oblanceolate-oblong, suddenly and very shortly acuminate, gradually narrowed in the lower three-fourths to the short stout dilated petiole, the edges subundulate: both surfaces minutely reticulate; the upper glabrous, shining, olivaceous when dry; the lower pale brown when dry and not shining, glaucescent, sparsely covered with short stiff deciduous hairs; main nerves 20 to 26 pairs, spreading, slightly ascending, interarching near the edge, prominent on the lower surface rather faint on the upper; length 12 to 24 in., breadth 3 to 4·25 in.; petiole stout, dilated, channelled, ·6 to 1 in. long. *Panicle* terminal, longer than the leaves, the main rachis stout; the branches slender, ascending, lax, the ultimate branchlets spicate, everywhere tomentose. *Flowers* sessile, ·1 in. in diam. *Calyx* cupular, thick, with 5 shallow spreading orbicular teeth, sub-ciliate at the edges, otherwise glabrous. *Petals* 5, much longer than the calyx, broadly elliptic, sub-acute, glabrous externally, puberulous internally. *Stamens* 5, shorter than the petals; the *filaments* flattened, puberulous. *Disc* convex, glabrous; *rudimentary ovary* pilose. *Drupe* obliquely ovoid, sub-compressed, keeled, glabrous, 1 in. long, and about as much across the swollen peduncle, deciduously pubescent, obconic, about ·5 in. long. *S. heterophyllus*, Kurz (not of Blume) in Journ. As. Soc. Beng. Vol. XLV, Pt 2, (1876) p. 126; For. Flora Burma, I, 312.

Nicobar Islands: Jelinek, No. 210; Kurz; King's Collector. Bati Malv, Dr. Prain.

Distinguished by its long lax tomentose panicle and glabrous sessile flowers. Dr. Prain's specimens from the little-known island of Bati Malv are in ripe fruit and have no flowers, but I have no hesitation in referring them to this species.

4. Semecarpus lucens, King n. sp. A tree 40 to 70 feet high; young branches rather slender, with pale glabrous bark. *Leaves* coriaceous, broadly elliptic, rarely sub-ovate-elliptic, the apex obtuse and rounded or very shortly and abruptly acuminate; the edges with a shining pale margin, sub-undulate, the base cuneate and slightly oblique; upper surface glabrous and shining, greenish when dry, reticulate; lower surface pale brown when dry, not shining, conspicuously reticulate, the nerves and reticulations broad and shining, sparsely shortly and deciduously puberulous; main nerves 10 to 15 pairs, stout, shining, broad and conspicuous on the lower surface, thin and only

slightly prominent on the upper, spreading, interarching near the edge: length 4 to 7·5 in., breadth 2 to 3·25 in.; petiole ·75 to 1·5 or even 2 in., thickened near the base. *Panicles* usually terminal, pedunculate, longer than the leaves, puberulous; the branches slender, long, lax, sub-erect; the branchlets short and bearing the flowers in rather crowded ultimate fascicles. *Flowers* ·15 in. in diam., on pedicels shorter than themselves. *Male flowers*; *calyx* cupular, flat, with 5 ovate-acute spreading teeth, glabrous; *petals* 5, ovate-lanceolate, acute, several times longer than the calyx, glabrous: *stamens* 5, shorter than the petals; the cells of the anthers divergent, the filaments flattened; *disc* fleshy, flat, with a small concave pit, puberulous *Female flowers* on smaller fewer-flowered panicles; the flowers themselves larger than the males; *calyx* as in the male; *petals* broader and more fleshy. *Stamens* 5, short and rudimentary, each rising from one of the angles of the cupular fleshy 5-angled glabrous disc. *Ovary* tomentose, conical, slightly oblique, its base surrounded by the disc. *Styles* 3, horizontal or depressed, radiating. *Drupe* (young) obliquely ovoid, compressed, the enlarged peduncle about a third of its length, rusty-puberulous.

Perak: King's Collector, Nos. 5256, 5377, 5444, 5470, 6895.

5. Semecarpus Prainii, King n. sp. A tree 40 to 50 feet high; young branches rather stout, deciduously puberulous. *Leaves* oblong-oblanceolate to obovate-oblong, shortly and abruptly acuminate, the edges slightly undulate, gradually narrowed from the upper third to the rather short petiole; both surfaces glabrous and minutely though distinctly reticulate, the upper pale-greenish when dry, the lower pale brown; main nerves 18 to 24 pairs, prominent on the lower surface, slightly so on the upper, the lower pairs sub-horizontal, the upper spreading and curving upwards; length 5 to 10 in., breadth 1·5 to 3·25 in.; petiole ·5 to ·8 in. *Panicle* terminal, pedunculate, glabrous below, pubescent towards the extremities, longer than the leaves; the branches numerous, slender, with many branchlets, the ultimate branchlets cymulose. *Flowers* rather crowded, almost sessile, globular in bud, about ·1 in. in diam. when expanded. *Calyx* cupular, puberulous, rather coriaceous, with 5 broadly-ovate obtuse ciliate spreading segments. *Petals* 5, imbricate, longer than the calyx, glabrous, broadly ovate, acute. *Stamens* 5, shorter than the petals. *Disc* fleshy, convex, dark-coloured, with a tuft of hairs in the middle; *ovary* in the male flower absent. *Drupe* obliquely obovoid, compressed, glabrous, about ·5-in. long and ·65 in. broad; the enlarged peduncle obconic, ·35 in. long, glabrous. *S. heterophyllus*, Hook. fil. (not of Blume) Hook. fil. Fl. Br. Ind. II, 35.

Barren and Little Cocos Islands; Prain. Andamans: Prain, King's Collectors. Perak: King's Collector, No. 7442 Andamans: Helfer, No. 1131.

There is a large suite of specimens of this species in the Calcutta Herbarium (twelve gatherings from the Andamans alone). I have dissected flowers of every one of these which is in flower, and I find that they all agree perfectly with each other. They also agree absolutely with Helfer's specimen, No. 1131. With the plant collected in Perak by the Bot. Garden Collector (No. 7442) they also as to flowers and leaves (fruit is absent) agree, except that the Perak plant has slightly larger flowers and that the calyx-lobes are longer and more acute. Helfer's specimen above quoted has, however, been referred by Dr. Engler, in his excellent monograph of the family of *Anacardiaceæ*, to *Semecarpus albescens*, Kurz. To that identification I must, with all respect, demur. Moreover an examination of the large suite of specimens of *S. albescens* in the Calcutta Herbarium proves that that plant is not a *Semecarpus*, but a *Holigarna*; for it has quite the fruits and spurred petioles of the latter genus. Its name ought therefore to be changed to *Holigarna Kurzii*; the specific name *albescens* being too like *albicans* which has already been applied to another species. Kurz was rather unfortunate in his treatment of this family. His *Holigarna Grahami* was not, as he supposed, the *Semecarpus Grahami* of W. and A., which is a plant confined to the West of British India and which does not extend to Burma. For the Burmese specimens included by Kurz under *H. Grahami*, Sir Joseph Hooker has substituted the name *H. albicans*, (Fl. Br. Ind. II, 38.) My own opinion, however, is that these Burmese plants are nothing more or less than *H. longifolia* of Roxburgh, of which species that author has left an admirable coloured figure in the Calcutta Herbarium.

Besides the foregoing there are, in the Calcutta Herbarium, specimens from Perak (King's Collector, No. 6623) of a species of *Semecarpus* which, except in the finer reticulation of the leaves, agree excellently with Beccari's Bornean specimens, No. 2875, and 3318, which have been named *S. glauca* by Dr. Engler. (DC. Mon. Phan. IV, 478),

16. Drimycarpus, Hook. f.

Trees. *Leaves* alternate, petioled, simple, quite entire. *Racemes* or panicles axillary. *Flowers* small, subglobose, polygamous. *Calyx* superior; *lobes* 5, rounded, imbricate. *Petals* 5, erect, sub-orbicular, imbricate. *Disc* broad, annular. *Stamens* 5, inserted at the base of the disc. *Ovary* in the male flowers 0, in the female inferior, 1-celled; *style* 1, very short; *stigma* capitate; *ovule* attached to the wall of the cell. *Drupe* transversely obliquely ovoid, fibrous, flesh resinous; stone coriaceous. *Seed* attached to the wall of the cell, testa membranous; embryo thick, cotyledons plano-convex; radicle minute, opposite the hilum; plumule hairy. A single species.

Drimycarpus racemosus, Hook. fil. in Benth. and Hook. fil. Gen. Plantar. I, 424. A large tree: young branches rather slender, somewhat glaucous, the bark afterwards pale and striate. *Leaves* coriaceous, oblanceolate or oblong-lanceolate, shortly acuminate, the edges conspicuously undulate, the base cuneate; upper surface glabrous, shining, the lower dull often glaucous or glaucescent, the reticulations distinct in both; main nerves 14 to 18 pairs, spreading, often irregular, prominent beneath: length 4 to 6 in., breadth 1·2 to 2·25 in.; petiole ·35 to ·5 in., channelled. *Flowers* in racemes or panicles, terminal or in the uppermost axils, shorter than the leaves, puberulous, slender, the panicles branched from the base; male flowers sessile, fasciculate, the females shortly pedicelled, both about ·1 in. in diam. *Anthers* shortly ovate, *filaments* thick. *Disc* crenate, fleshy. *Drupe* broader than long, red when ripe, 1 in. or more broad, and about ·75 in. long. Hook. fil. Fl. Br. Ind. I, 36; Kurz For. Flora Burma I, 314; Engler in DC. Mon. Phan. IV, 472. *Holigarna racemosa*, Roxb. Fl. Ind. II, 82; Wall. Cat. 1006.

The Andaman Islands.—Distrib. Burma, the Assam Range, and the lower slopes of the Eastern Himalaya.

17. Dracontomelum, Blume.

Trees. *Leaves* alternate, unequally-pinnate; *leaflets* opposite or alternate, quite entire. *Panicles* axillary and sub-terminal. *Flowers* hermaphrodite. *Sepals* 5, imbricate. *Petals* 5, sub-erect, sub-valvate. *Disc* large, cup-shaped, crenulate. *Stamens* 10, inserted at the base of the disc. *Ovary* sessile, 5-celled; *styles* 5, thick, erect, connate by their obtuse stigmatiferous tips; *ovules* solitary and pendulous in the cells. *Drupe* globose, fleshy, tubercled above the middle by the style-bases; *stone* hard, depressed, 2–5-celled; *cells* diverging, opening by canals through the top of the stone. *Seeds* compressed, pendulous, testa membranous; *cotyledons* plano-convex; radicle short, superior, centrifugal.—Distrib. 5 species natives of tropical Asia and the Pacific.

Dracontomelum mangiferum, Blume Mus. Bot. Lugd. Bat. I, 231, fig. 42. A tree 80 to 100 feet high; young branches stout, densely covered with minute deciduous tawny-tomentum. *Leaves* 12 to 20 in. long, their rachises minutely puberulous or glabrous, the petiole slender and but little thickened at the base; *leaflets* 5 to 8 pairs, alternate, rarely sub-opposite, thinly coriaceous, the upper ones elliptic-oblong, the lower ovate-oblong and shorter, all shortly and abruptly acuminate, unequal-sided with rounded oblique bases: both surfaces minutely reticulate when dry, the upper quite glabrous, the lower also glabrous or the midrib often puberulous and with small tufts of hair in the nerve

axils: main nerves 9 to 12 pairs, spreading, curving, rather prominent beneath; length 4 to 9 in., breadth 1·75 to 2·75 in.; petiolules ·15 to ·2 in. *Panicles* nearly as long as the leaves, from above the axils of the upper leaves or sub-terminal; the branches minutely tawny-pubescent, spreading, only about 4 to 15 in. long, the ultimate branchlets few-flowered, minutely bracteolate. *Flowers* ·3 in. long. *Sepals* united at the very base, a little shorter than the petals, elliptic, obtuse, minutely pubescent outside, pale. *Petals* oblong-lanceolate or spathulate, their apices recurved or linear, narrower than the sepals, inserted on the edge of the disc. *Stamens* about as long as the petals; the *anthers* narrowly oblong, cordate at the base, the filaments subulate. *Disc* broad, obsoletely crenulate. *Ovary* oblong-ovoid, deeply divided vertically into five 1-celled 1-ovuled lobes: *styles* long, slender, connate by their apices, stigma 5-lobed. *Drupe* depressed-globose, an inch or more in diam., mesocarp copious; the stone much depressed, very rugulose, crustaceous and with marginal pores. Hook. fil. Fl. Br. Ind. II, 43; Kurz For. Flora Burma, I, 322; Engler in DC. Mon. Phan. IV, 252.

In all the Provinces: a common tree.

Addition to Chailletiaceæ.

Since writing out this Natural Order for the last number of these papers, I have received two new species of the genus *Chailletia* of which I now give descriptions. And, in order to fit these into the key to the species given at p. 91 of the last volume of this *Journal*, I here reproduce that key, with these two new species introduced into their proper places and indicated by the letter *a* following the number of each.

Leaves oblong or elliptic-lanceolate.

Leaves very thin, quite glabrous; cymes globular, ·25 to ·4 in. in diam. ... ... 1. *C. tennifolia.*

Leaves coriaceous, glabrous except the midrib, strigose at the base; cymes 1 to 2 in. in diam.... ... ... 2. *C. Hookeri.*

Leaves membranous, with many fulvous bristles on the edges midribs and nerves ... 3. *C. Griffithii.*

Leaves-elliptic or oblong-elliptic.

Leaves coriaceous, upper surface with scattered bristles with bulbous bases, lower surface hispid especially on the midrib and nerves ... ... 3a. *C. setosa.*

Midribs of leaves strigose beneath; cymes ·5 in. in diam.: ripe drupes ·65 in. broad 4. *C. Helferiana.*

Midribs of leaves quite glabrous, cymes ·3 in. in diam.; ripe drupes 1·25 in. in diam. 5. *C. Laurocera*

Leaves everywhere quite glabrous, their under surfaces tesselate-areolar ...	5a.	*C. tesselata.*
Leaves elliptic but more or less oblanceolate or obovate, glabrous	6.	*C. andamanica.*
Leaves elliptic-obovate, retuse, minutely tomentose on the lower surface	7.	*C. deflexifolia* var. *tomentosa.*

3a. Chailletia setosa, King, n. sp. A slender creeper; young branches and under surfaces of leaves with long yellow bristly hairs. *Leaves* coriaceous, elliptic-oblong, acuminate, the base narrowed to the very short petiole; upper surface shining, with scattered bulbous-based bristles most numerous on the midrib near its base; lower surface of a yellowish-olivaceous colour, much reticulate; main nerves 9 or 10 pairs, curving upwards, very prominent and bristly on the lower surface, less so on the upper; length 6 to 8·5 in., breadth 2 to 3·25 in.; petiole ·15 in. long, densely hispid. *Cymes* axillary, very short, often in pairs, 4- to 6-flowered, almost sessile. *Flowers* ·2 in. long. *Sepals* oblong, blunt, very concave, much imbricate, densely pale-tomentose outside, glabrescent inside. *Petals* shorter than sepals, oblong-obovate, the apex with 2 rounded concave lobes, quite glabrous. *Stamens* as long as the petals, glabrous; the *anthers* adnate; the connective broad and bearing the narrow cells on its margin. *Ovary* densely lanate. *Fruit* unknown.

Perak: King's Collector, No. 10429.

A species closely allied to *C. Griffithii*, Hook. fil.; but with larger leaves of thicker texture and very much more hispid.

5a. Chailletia tesselata, King, n. sp. A slender woody climber, 10 to 15 feet long: young branches glabrous, shining, the bark black when dry. *Leaves* coriaceous, more or less broadly elliptic or elliptic-oblong with a short sub-acute often abrupt apical point; narrowed in the lower fourth to the petiole, the edge slightly recurved: both surfaces quite glabrous, the upper shining with numerous very minute black dots, the lower tesselate-reticulate: main nerves 6 or 7 pairs, spreading, much curved upwards and forming wide arches far from the edge, prominent on the lower surface; length 4·5 to 5 in., breadth 2·5 to 3 in.; petiole ·4 in. long, rough when dry and with transverse ridges, puberulous. *Cymes* axillary, in pairs, shortly pedunculate, much-branched, many-flowered, minutely yellowish-tomentose, from ·5 to 1 in. in diam. *Sepals* oblong, obtuse, tomentose on the outer surface, glabrous on the inner. *Petals* glabrous, obovate, sub-acute, deeply bifid at the apex, the lobes oblanceolate. *Stamens* longer than the petals, exserted, glabrous, the broad orbicular connective bearing the narrow anther cell on its edge; the *filaments* thick. *Ovary* ovoid, covered with white wool. *Style* longer than the ovary, *stigma* bifid. *Fruit* unknown.

Trang: Wray, No. 3185. Perak: King's Collector, No. 6726.

A species of which the nearest ally is *C. Hookeri*, King, which has however much narrower leaves not tesselate on the lower surface. This is also allied to the Bornean species *C. Beccariana*, Stapf, which has however much smaller leaves, not tesselate beneath.

Natural History Notes from H. M. Indian Marine Survey Steamer 'Investigator,' Commander C. F. Oldham, R. N., commanding.—Series II., No. 24. *Report on the Paguridæ collected during the season* 1893-94.—*By* J. R. Henderson, M.B., F.L.S., *Fellow of the University of Madras, Professor of Biology in the Madras Christian College.**

[Recd. 23rd June—Read 1st July.]

The *Paguridæ* collected by the "Investigator" during the season 1893-94, form a small but interesting collection of seventeen species, for the opportunity of examining which I am indebted to my friend Surgeon-Captain A. R. Anderson, I. M. S., the Surgeon-Naturalist of the "Investigator." The small number of species is doubtless to be explained by the fact that no special attention could be paid to shallow-water forms; had time and opportunity permitted, the number of these might have been very largely increased. Of the seventeen species taken, two have been left unnamed, as the specimens by which they are represented are either very young or are in an imperfect state of preservation. The collection also contains an undescribed *Glaucothoë* which appears to be a larval form, and I have therefore not given it a specific name. Of the fourteen named species no less than seven are described as new, and the remaining seven—six of which are from shallow water—belong to previously known species. The large proportion of new species is not remarkable when the deep-water habitat of the majority is taken into consideration. The fourteen species are included in no fewer than ten genera.

The specimens were taken at six dredging stations, at five of which the depth exceeded 100 fathoms, so that the collection may fairly be described as a deep-water one. The greatest depth at which Pagurids were taken during the trip was 719 fathoms, off the North Maldive Atoll, where two new species of the characteristic deep-water genus *Parapagurus* were obtained. The last dredging station on the list is a shallow-water one off the east coast of Ceylon, where from 28 fathoms six species were obtained, three of which are new. There are

* Communicated by the Natural History Secretary.

also included in the collection three shore species, from the Laccadives, Trincomalee Harbour, and Pulicat on the Madras coast.

Four species belong to deep-water genera, *viz.*, two (new) to *Parapagurus*, one to *Sympagurus* (which is very closely allied to if not identical with *Parapagurus*), and the fourth (new) apparently to *Pylopagurus*. The two last named genera are new to Indian seas. The genus *Pylopagurus* was recently established by MM. A. Milne-Edwards and Bouvier, to include several species taken by the "Blake" in the West Indian region, and a single species described by Studer (as an *Eupagurus*) from the South African coast. The four remaining new species belong to the following genera:—two to *Paguristes* (including one from deep-water), one to *Eupagurus*, and one to the interesting genus *Catapagurus*.

Of the previously known shallow-water species four belong to well known and for the most part widely distributed species, *viz.*, the two species of *Calcinus*, *Spiropagurus spiriger* (De Haan), and *Clibanarius padavensis*, de Man. The remaining two are now recorded for the first time since their diagnoses were published by the present writer some years ago. *Pagurus dearmatus* was originally taken at the Admiralty Islands, and *Eupagurus zebra* on the north-west coast of Australia, as well as on the Ceylon coast.

The majority of the species are represented each by a small number of specimens, but two—*Paguristes puniceus* and *Sympagurus monstrosus*—were taken in large numbers.

LIST OF DREDGING STATIONS WITH THE SPECIES TAKEN AT EACH.

Station 150, off the north Maldive Atoll. Lat. 7° 05′ 45″ N. Long. 75° 04′ 0″ E. Depth 719 fathoms. Bottom fine coral sand.

Parapagurus andersoni, n. sp.
„ *minutus*, n. sp.
Glaucothoë.

Station 151, Colombo Light House S. 64 E. 13½ miles distant. Depth 142 to 400 fathoms. Bottom brown mud.

Sympagurus monstrosus (Alcock).
Eupagurus, sp.

Station 162, off the Madras coast. Lat. 13° 51′ 12″ N. Long. 80° 28′ 12″ E. Depth 145 to 250 fathoms. Bottom brown mud.

Paguristes puniceus, n. sp.
Sympagurus monstrosus (Alcock).

Station 166, off the Madras coast. Lat. 13° 34′ 55″ N. Long. 80° 32′ 12″ E. Depth 133 fathoms. Bottom brown mud.

Paguristes puniceus, n. sp.
Pylopagurus magnimanus, n. sp.

Station 170, off the Madras coast. Lat. 13° 01′ 06″ N. Long. 80° 36′ 56″ E. Depth 107 fathoms. Bottom sand and soft brown mud with cinders (steamer route).

Pylopagurus magnimanus, n. sp.

Station 175, off the east coast of Ceylon. Lat. 8° 51′ 30″ N. Long. 81° 11′ 52″ E. Depth 28 fathoms. Bottom sand, shells, and stones.

Pagurus dearmatus, Henderson.
Eupagurus zebra, Henderson.
Spiropagurus spiriger (De Haan).
Eupagurus pergranulatus, n. sp.
Catapagurus muricatus, n. sp.
Paguristes pusillus, n. sp.

SHORE SPECIES.

Calcinus herbsti, de Man. Laccadives. Trincomalee.
„ *elegans* (Milne Edwards), Laccadives.
Clibanarius padavensis, de Man, Pulicat.
„ sp. indet. Trincomalee.

REPORT ON THE SPECIES.

Genus PAGURUS, Fabricius.

1. *Pagurus dearmatus*, Henderson.

P. dearmatus, Henderson, "Challenger" Anomura, p. 58, pl. vi. fig. 5 (1888).

Station 175, off the east coast of Ceylon, depth 28 fathoms. A male about 18 mm. long.

This species was founded on a single specimen—a female with ova, measuring 24 mm. in length—taken by the "Challenger" at the Admiralty Islands, from a depth of 16 to 25 fathoms. It is allied to *P. pedunculatus*, Herbst (with which *P. varipes*, Heller, is perhaps identical) and *P. deformis* Milne Edwards, but is distinguished from both by the uniform granulation of the outer surface of its larger hand as well as by the smaller size of the species in general.

The "Investigator" specimen agrees closely with the original description, except that the propodus of the third left leg is faintly carinated externally, a character not mentioned in the "Challenger" Report. A red band encircling each eye-stalk about its middle, is still visible.

Genus CALCINUS, Dana.

2. *Calcinus herbsti*, de Man.

Pagurus tibicen, Milne Edwards Ann. Sci. Nat. (2) t. VI. p. 278 (1836); Hist. Nat. Crust. t. II. p. 229 (1837).

Calcinus tibicen, Dana, Crust. U. S. Explor. Exped. pt. i. p. 457 (1852).

Calcinus herbsti, de Man, Arch. f. Naturg. Jahrg. 53, Bd. i. p. 437 (1887) Ortmann, Zoolog. Jahrbücher, Bd. VI. Abth. f. Syst. p. 292 (1892) *ubi synon.*

Suhelipar, Laccadives: a male about 25 mm. in total length.

Great Sober Island, Trincomalee Harbour; a female about 20 mm. long.

The chelipeds are dark brown in colour, with the exception of the fingers and outer surface of the palm in the left or larger chela, and the finger-tips of the right chela, all of which are white. The second and third pair of walking-legs are orange with white dactyli, the latter having each a small orange band near the tip; there is also a faint red longitudinal band on the outer or posterior surface of the meral and carpal joints. The eye-stalks are orange with a broad white basal band.

The species is common and widely spread over the coral region of the Indo-Pacific area, from Natal and East Africa, to the Sandwich Islands, and the islands of the Pacific generally. It is recorded from the Maldives by Ortmann.

3. *Calcinus elegans* (Milne Edwards).

Pagurus elegans, Milne Edwards, Ann. Sci. Nat. (2) t. vi. p 278 (1836); Hist. Nat. Crust. t. ii, p. 229, pl. xiii. fig. 2 (1837).

Calcinus elegans, Dana, Crust. U. S. Explor. Exped. pt. i. p. 458, pl. xxviii. fig. 10 (1852); Ortmann. Zoolog. Jahrbücher, Bd. vi. Abth. f. Syst. p. 294 (1892) *ubi synon.*

Suhelipar, Laccadives; two males.

The larger specimen which measures about 40 mm. in length, has the left or larger chela dark olive-green in colour. The second and third pairs of ambulatory legs are blue, with purple-black bands on the meral, carpal, and propodal joints, while the dactyli are similarly spotted. The eye-stalks are blue, the antennal peduncles and flagella orange.

The second specimen measuring about 33 mm. in length, has the left chela orange brown. The ambulatory legs are white with crimson bands, and similar spots on the dactyli. The eye-stalks are white with a bluish tinge, the antennæ orange. According to Dana the colouring is as follows:—"Hands bright green except white tubercles, antennæ orange, eyes blue. Second and third pairs of legs banded with velvet black and bright blue, hairs of tarsus carmine." The colour differences in the two specimens may be partly due to greater fading in the second, but not entirely so. There is evidently considerable colour variation.

This species like the last, extends from Natal and East Africa to the Pacific, but is evidently less common than *C. herbsti*.

Genus Clibanarius, Dana.

4. *Clibanarius padavensis*, de Man.

C. padavensis de Man, Mergui Crust. p. 242, pl. xvi. figs. 1-5 (1888); Henderson, Trans. Linn. Soc. 2 ser. Zool. Vol. V. pt. 10, p. 423 (1893).

Pulicat, Madras Coast; a large series.

The largest specimen is an adult male measuring 70 mm. in length. Young individuals are found in the shells of a *Cerithium*, older ones in the shells of *Ranella*, *Eburna*, etc., and on one of the shells there is an encrusting hydroid.

The second and third pairs of ambulatory legs exhibit a well-marked longitudinal blue band, best seen on the posterior surface of the propodi. This blue band is bordered both above and below, by a dark brownish or reddish band.

The species was first recorded by de Man from Mergui, and as I have elsewhere shown, is common in the brackish back-waters, along the Madras Coast, as far south as Tuticorin.

Genus Eupagurus, Brandt.

5. *Eupagurus zebra*, Henderson.

E. zebra, Henderson, Trans. Linn. Soc. 2 ser. Zool. Vol. V. pt. 10, p. 425, pl. xxxix. figs. 12–15 (1893).

Station 175, off the east coast of Ceylon, depth 28 fathoms. Two specimens in the shells of a *Murex*.

The smaller specimen is a female with ova about 15 mm. long the other a male about 20 mm. in length.

The species was founded on two specimens, one from the Ceylon coast, the other taken at a depth of 53 fathoms, off the north-west coast of Australia. The latter, which was the larger of the two, measured 21 mm. in length. It is easily distinguished by its colour markings, which take the form of dark red lines on the ambulatory legs, chelipeds, carapace, and even on the antennal peduncles and flagella. From evidence supplied by one of the original specimens, there is reason to believe that this hermit-crab like the mollusc *Avicula zebra*, Reeve, lives among hydroids, and the linear colour markings by their resemblance to the ramuli of the hydroid, serve a protective function.

6. **Eupagurus pergranulatus*, n. sp.

Station 175, off the east coast of Ceylon, depth 28 fathoms. An adult female.

The anterior portion of the carapace is membranous, with th median frontal projection slightly marked, and exceeded by the sligh

* Ill. Zool. Investigator, Crustacea, pl. xxxi. fig. 1 (*in preparation*).

better marked lateral projections. The eye-stalks are very large, and slightly curved, with large deeply pigmented corneæ; they are about one-fourth of their length longer than the antennal peduncles, and about equal in length to the antennular peduncles, when the latter are fully extended. The ophthalmic scales have narrow subacute apices, and are separated by a wide interval. The antennal acicle has a slight sigmoid curve, and extends almost to the end of the antennal peduncle; the antennal flagellum appears to be about two-thirds the length of the body.

The right or larger chelipede is massive and slightly pubescent. The merus is provided with a series of short acute spines on either side of the under surface, but is otherwise smooth. As all the joints move in a vertical plane, the under surface of the merus is excavated anteriorly to receive the carpus, and the above mentioned spines are placed on the margin of this depression. The upper surface of the carpus is armed with short scattered spinules, which are most prominent on the inner margin, while the lower surface is reduced to a narrow transverse area. The upper surface of the hand is granulated, the granules especially those on the immobile finger, being crescentic in outline, and all of them are smooth and glabrous. Each granule has an anterior depression or concavity, which gives it the characteristic crescentic form, but some few of the granules are circular with a central depression. On the inner margin of the hand, which terminates in a well-marked subacute lobe, projecting over the insertion of the mobile finger, the granules are replaced by short denticles. On the outer margin of the hand there is a very regular row of granules, which appear square-topped when viewed from the side. The mobile finger is massive, with a faint median carina on its upper surface, and crescentic granules similar to those of the hand. The apices of the fingers are calcareous.

The left or smaller chelipede has a few spinules on the lower surface of the merus, and on the upper surface of the carpus; in the latter situation they are arranged in two rows. The carpus is as long as the hand. The hand has a slight dorsal carina, and its upper surface is provided with crescentic granules; the apices of the fingers are corneous.

The ambulatory legs are faintly pubescent, with the dactyli ending in acute horny tips.

The margin of the telson is fringed with short acute spinules.

The single specimen gives the following measurements:—

Length of body about	...	...	...	...	16 mm.
„ „ carapace	...	...	...	...	8 „
„ „ right chelipede (which cannot be fully extended) about	...	...	...	...	15 „

Length of carpus of right chelipede ... ... 4·5 mm.
„ „ hand of right chelipede ... ... 7 „
„ „ eye-stalk ... ... 4 „

Although there is only a single specimen, I have ventured to describe this species on account of its well marked characters, more especially the peculiar type of granulation met with on its chelipedes, which distinguishes it from all other members of the genus with which I am acquainted.

Genus Pylopagurus, A. Milne-Edwards and Bouvier.

"Blake" Paguridæ, Mem. Mus. Comp. Zool. (Harvard Coll.) Vol. XIV. No. 3. p. 74 (1893).

I refer the species described below with some hesitation to this genus, as it does not possess the characteristic lid-like right chela, used as a kind of operculum to close the shell, which is one of the special features of *Pylopagurus*. The hand is not ovate in form, and it can be fully extended, yet at the same time it is capable of being bent at a right angle to the carpus, a character mentioned by Milne-Edwards and Bouvier. It has the general appearance of an *Eupagurus*, and I would have referred it to that genus but for the arrangement of the abdominal sexual appendages, which present the very unusual characters described for *Pylopagurus*. There is a single pair of minute appendages in the female immediately behind the last thoracic sternum, while corresponding paired appendages are entirely absent from the male.

7. **Pylopagurus magnimanus*, n. sp.

Station 166, off the Madras Coast, depth 133 fathoms. A female (damaged) in a *Rostellaria* shell.

Station 169, off the Madras Coast, depth 107 fathoms. A male in perfect condition, but without a shell.

The anterior portion of the carapace is slightly calcified, and practically eight-sided in outline; it is separated from the surrounding regions by deep grooves. The median frontal projection is well-marked, with a broad base and a sub-acute apex; the lateral frontal projections are fairly well-marked, and some distance behind each there is a pit on the dorsal surface of the carapace. The eye-stalks are moderately slender, and faintly compressed from above downwards; the cornea are rather pale in colour. The ophthalmic scales are well-developed, entire, and acute, the apical half of each scale being slightly depressed. The antennal peduncles exceed the eye-stalks by about one-half the length of their terminal joint; the acicle is strongly curved, with a fringe of hairs on its inner margin. The external prolongation of the

* Ill. Zool. Investigator, Crustacea, pl. xxxi. fig. 2 (*in preparation*).

second joint of the antennal peduncle extends slightly beyond the middle of the penultimate peduncular joint, and its apex carries a series of hairs. The antennal flagella are about one and a half times the length of the body. The antennular peduncles exceed the eye-stalks, by about three quarters of the length of their last (peduncular) joint.

The right chelipede is massive, and its form recalls that of *Eupagurus zebra*, Henderson; the joints are granulated, and the granules exhibit a tendency to become sub-spinose. The merus has a prominent serrated lobe on its inner and lower margin; on the under surface of the joint there is a low regularly granulated pyramidal elevation. The lower and inner margin of the carpus presents a similar but smaller serrated lobe, while the upper surface of this joint is armed with sub-spiniform granules. On the inner margin of the carpus these granules are replaced by short conical spines, arranged in several longitudinal rows, and along the distal margin of the joint, adjoining the carpo-propodal articulation, there are about six of these spines, somewhat larger than the others, arranged in a row, behind which a narrow smooth area is visible. The upper surface of the propodus is rather uniformly granulated, but the granules have a tendency to become spiniform along the inner margin of the joint, near its proximal end; the outer margin is thin and regularly curved or deflexed towards the apex of the immobile finger. The upper surface of the dactylus is uniformly granulated; its inner margin is thin, and there is a longitudinal concave area on the under surface.

The left chelipede when stretched, extends almost to the insertion of the dactylus in the larger chelipede. It is moderately pubescent, and a row of spinules is found on the lower margin of the merus, and another on the upper margin of the carpus. The latter joint is only slightly shorter than the combined hand and fingers.

The ambulatory legs are slightly pubescent, and almost unarmed, only one or two minute spinules being visible on the carpal joints, in the male specimen. The dactyli have yellow horny apices. The sexual appendages on the first abdominal segment of the female are minute, but the three biramous appendages on the left side are well developed.

The gill lamellæ, which are arranged in two rows, are long and narrow.

The male specimen gives the following measurements:—

Length of body	...	...	...	...	38 mm.
„ „ carapace	...	...	...	...	16·5 „
„ „ right chelipede		...	...	...	37 „
„ „ carpus of same		...	...	...	8·5 „

Length of propodus	...	...	...	15 mm.
Greatest breadth of propodus	...	...	...	11·5 „
Length of second right leg	...	...	...	47 „
„ „ propodus of same	...	...	...	9 „
„ „ dactylus „ „	...	...	...	15 „

The female is slightly smaller.

There is a note by Surgeon-Captain Anderson, as to the colour of the species during life, preserved in the bottle which contains the broken specimen. "Legs crimson dotted with yellowish white, under surface of the joints white. Carapace brownish pink. Lived in the accompanying *Rostellaria*."

The species differs from all others so far allotted to its genus, in the form of its non-operculiform hand.

Genus Spiropagurus, Stimpson.

8. *Spiropagurus spiriger* (De Haan).

Pagurus spiriger, De Haan, Crust. Japon. p. 206, tab. xlix. fig. 2 (1850).

Spiropagurus spiriger, Stimpson, Proc. Acad. Nat. Sci. Philad. p. 248 (1858); Henderson, "Challenger" Anomura, p. 72 (1888); Ortmann, Zoolog. Jahrbücher, Bd. VI. Abth. f. Syst. p. 297 (1892).

Station 175, off the east coast of Ceylon, depth 28 fathoms. Two males.

The larger specimen is about 30 mm. long and inhabited the shell of a *Harpa*. Its extended or unrolled copulatory organ measures 20 mm. in length. The species is devoid of any bright colouration and a special feature is the large size of its eyes. The dactyli and propodi of the ambulatory (or probably swimming) legs, are closely fringed with hairs. All the specimens I have met with at Madras—where the species is common—occurred in light shells, such as could be easily carried by a swimming animal. A similar selection of the shell in order probably to suit the habits of the inmate, is seen in the genus *Clibanarius*, the members of which on the Madras coast at least, almost invariably select heavy shells, and are generally found in exposed and often surfbeaten situations.

The present species has been recorded from the seas of Japan, China, Admiralty Is., Torres Strait, Malay Archipelago, and the Bay of Bengal (Madras and Gulf of Martaban). It is a shallow-water form.

Genus Catapagurus, A. Milne-Edwards.

9. **Catapagurus muricatus*, n. sp.

Station 175, off the east coast of Ceylon, depth 28 fathoms. Three males, and two females with ova.

* Ill. Zool. Investigator, Crustacea, pl. xxxi. fig. 3 (*in preparation*).

The anterior portion of the carapace is smooth, with the median or rostral projection scarcely marked. The eye-stalks extend almost to the end of the antennal peduncle, but scarcely to the middle of the terminal joint of the antennular peduncle; the cornea are somewhat dilated. The inner distal end of each ophthalmic scale is produced into a small conical projection, from the under surface of which, near its apex, a small spinule arises. The antennal acicle is slender and strongly curved, reaching to about the middle of the terminal joint of the antennal peduncle; the antennal flagellum is naked.

The right chelipede is only slightly longer and stouter than the left; both are pubescent and strongly spinose, especially on the hands and fingers, the arrangement being similar in the two chelipedes. The carpus is slightly longer than the hand (*i.e.*, the propodus *minus* the immobile finger), and it carries an inner row of curved acute spinules on its upper surface, and an outer row of smaller and blunter spinules. The upper surface of the hand is armed with three longitudinal rows of short and curved, but somewhat blunt, spines; the two marginal rows extend to the apices of the dactylus and immobile finger respectively, and are slightly more prominent than the median row, which extends along the upper surface of the immobile finger. There are in addition numerous smaller spines, scattered irregularly between those of the longitudinal rows. The opposing edges of the fingers are rather strongly toothed, and towards its apex the dactylus is corneous and slightly excavated. The fingers of the left chelipede are about equal in length to the palm, whereas those of the right chelipede are slightly shorter.

The ambulatory legs are faintly pubescent, but unarmed. Their dactyli are slightly longer than the propodi, and terminate in acute horny apices.

The male copulatory organ (protruded vas deferens) is very slender; it springs from the coxal joint of the last right leg, and in one specimen is rolled into a spiral of at least two turns. It becomes readily uncoiled when the specimen is handled.

The total length of a male is about 15 mm., while females with ova are even smaller. Detached chelipedes probably from the same specimen measure as follows:—

Length of right chelipede	...	...	...	14 mm.
„ „ left chelipede	...	...	...	13 „

One specimen has a small Bopyrid in its branchial chamber.

This species is distinguished at once from the only other known Indo-Pacific species, viz., *C. australis* Henderson, taken by the "Challenger," at Fiji, and in the Arafura Sea, and *C. ensifer*, Henderson, from the Gulf of Martaban, by the armature of its subequal chelipedes.

Moreover in the latter species the dactyli resemble sword-blades, and are perhaps used for swimming. The American species described by A. Milne-Edwards, and S. I. Smith, come from deep water, and have the sexual organ shorter, stouter, and simply bent round the abdomen, whereas in the species just described, and probably in the two other Indo-Pacific forms, the organ is much longer, more slender, and capable of being coiled after the fashion of *Spiropagurus*. These differences are not in my opinion sufficiently important to separate the eastern and western species generically.

Genus PAGURISTES, Dana.

10. **Paguristes pusillus*, n. sp.

Station 175, off the east coast of Ceylon, depth 28 fathoms. Three males, and two females with ova.

The median frontal projection is prominent, extending well between the ophthalmic scales, and is at the same time subacute and deflexed; the lateral frontal projections are also subacute. The eye-stalks are long, exceeding the antennal peduncles by about half their length, and even slightly exceeding the antennular peduncles. The ophthalmic scales have their apices in some cases minutely bidentate, or even tridentate, in other cases they are apparently entire. The antennal acicle scarcely reaches the end of the ultimate peduncular joint, and exhibits three well marked spinules on its outer margin; the external prolongation of the second joint is apparently bispinose. The antennal flagellum is extremely short, being only slightly longer than the eye-stalk; it is only sparingly ciliated.

The chelipedes are subequal, or the left is very slightly larger; they are without prominent hairs anywhere, and the upper surface of the carpus, propodus, and dactylus, is uniformly provided with subspiniform granules. These granules become distinctly spinose on the inner margin of the carpus and propodus, especially on the former joint, which is longer than the hand. A few spinules are also met with at the distal end of the merus, both on its upper and its lower margin. The fingers are in contact throughout their length, and are without prominent teeth.

The ambulatory legs are of moderate length; the first pair with their carpal and propodal joints spinulose anteriorly, the dactylus less distinctly so; the second pair are almost devoid of spinules. Both pairs are faintly pubescent. The propodi of both pairs are slightly shorter than the dactyli.

The following colour markings are still visible. The eye-stalks, antennal, and antennular peduncles, are purplish. The meral joints

* Ill. Zool. Investigator, Crustacea, pl. xxxi. fig. 4 *(in preparation)*.

of the chelipedes exhibit a single, pale blue spot on the outer surface, and two similar spots on the inner surface—all three near the distal end of the joint. The ambulatory legs are faintly banded with red.

The eggs carried by the females are of large size for such a small species, and are concealed in the ovigerous sac. They are even larger than in the next species—*Paguristes puniceus*—in which moreover, they are freely exposed on the side of the abdomen.

An adult male gives the following measurements:—

Length of body	... ...	... 16 mm.
„ „ carapace	... ...	... 7 „
„ „ eye-stalk	... ...	... 4·5 „
„ „ chelipede	... ...	... 9 „
„ „ first leg	... ...	... 15 „
„ „ second leg	... ...	... 16 „
„ „ dactylus of second leg	... ...	... 4·5 „
„ „ propodus of same	... ...	... 4 „

The species is characterised by its small size, the nature of its chelipedes, colour markings, etc. In its very short antennal flagella it agrees with *P. hians*, Henderson, from the Philippines, but the two are very different in other respects.

11. **Paguristes puniceus*, n. sp.

Station 162, off the Madras coast, depth 145 to 250 fathoms. A large series chiefly inhabiting the shells of a *Rostellaria*, many of which have an investing *Epizoanthus*. Several of the females are with ova.

Station 166, off the Madras coast, depth 133 fathoms. An adult male in the shell of a *Rostellaria*.

The median frontal projection is less prominent than usual in the genus, and varies considerably in length in different individuals; in some specimens the apex is subobtuse, and scarcely reaches the base of the ophthalmic scales, whereas in others it is acute, and extends almost to the middle of the scales. The lateral frontal projections are almost as prominent as the median one. The anterior surface of the carapace is somewhat rugose, with a few scattered hairs, and there is a marginal sulcus following the contour of the anterior margin. On the posterior membranous region of the carapace, the median or cardiac area is reduced to a linear elevation, bounded by a sulcus on either side, and the two branchial areas thus almost meet in the middle line. This cardiac elevation widens out slightly in front immediately behind the cervical groove. The eye-stalks are shorter than usual in the genus, just reaching the end of the antennal peduncle, or even in some cases slightly falling short of this, and extending to about the

* Ill. Zool. Investigator, Crustacea, pl. xxxii. fig. 1 *(in preparation)*.

middle of the last joint of the antennular peduncle. The ophthalmic scales are rather small, and separated by a considerable interval, with their apices acute and entire. The antennal acicle extends to about the middle of the terminal joint of the antennal peduncle; it is straight and acute, with a few short spines on its inner margin, and sometimes also on its outer margin, concealed by the hairs with which the acicle is clothed. The external prolongation of the second joint of the antennal peduncle is bispinose in some specimens at least; the third joint is produced inferiorly into a strong spine. The antennal flagellum is of moderate length, extending to the tips of the chelipedes, and is fringed with long hairs.

The chelipedes as well as the ambulatory legs are clothed with long silky hairs. The chelipedes are subequal in most specimens, but in some males the right is larger. The carpus, propodus, and dactylus are armed with short acute spines, some of which are horny tipped, and the majority give rise to bunches of silky hairs. On the upper surface of the carpus there is a median longitudinal smooth area, with rows of spinules on either side. The spines are arranged irregularly on the upper surface of the hand and fingers, but there are always three or four more prominent than the others on the inner margin of the hand. The apices of the fingers are horny.

The ambulatory legs are long and slender, especially the second pair; all the joints are provided with long marginal hairs. In some specimens a few spinules are met with on the anterior margin of the carpal and propodal joints, and in older specimens they appear to be represented by slight tubercular elevations. The dactyli are about one and a half times the length of the propodi.

In a note accompanying the specimen from Station 166, the colour during life, according to Surgeon-Captain Anderson, was as follows:—"Legs and anterior part of carapace light pink. Eye-stalks rather darker pink."

The following are the measurements of an adult male:—

Length of body	...	35 mm.
„ „ carapace	...	17 „
„ „ eye-stalk	...	5·5 „
„ „ chelipede	...	25 „
„ „ first leg	...	40 „
„ „ second leg	...	38 „
„ „ dactylus of second leg	...	12·5 „
„ „ propodus of same	...	7·5 „

Some of the specimens are infested by two different Bopyrid parasites—one living in the branchial cavity, the other attached to t abdomen—but occurring in different hosts.

The species is chiefly characterised by the shortness of its eye-stalks, and the great reduction of the cardiac area of the carapace. It is apparently allied to *P. setosus*, a species from New Guinea, insufficiently described by H. Milne-Edwards, but if Ortmann (Zoolog. Jahrb., Bd. vi., Abth. f. Syst., p. 281, taf. xii., fig. 9, 1892) is correct in his identification of the latter, the two are distinct. The species figured by Ortmann has slightly longer eye-stalks, a longer antennal acicle, and an entirely different configuration of the cardiac area of the carapace; in his description there is but slight reference to the other characters. According to Milne-Edwards the colour of his species was reddish yellow.

Genus Parapagurus, S. I. Smith.

12. * *Parapagurus andersoni*, n. sp.

Station 150, off the north Maldive Atoll, depth 719 fathoms. An adult male in a shell of *Bathybembix woodmasoni*, E. A. Smith, invested by an anemone.

The anterior portion of the carapace is moderately convex, both from side to side, and from before backwards; the surface is slightly uneven, with a few tufts of hair near the lateral and anterior margins. The median frontal projection is fairly prominent, while the lateral projections are scarcely indicated at all. The portion of the carapace behind the cervical grooves is membranous, and even the cardiac area is uncalcified. The eye-stalks are slightly concave on their inner surface, and a few rather long hairs are found on the upper surface of each; the corneæ are small, but deeply pigmented. The ophthalmic scales are small and laterally compressed, each terminating in four small apical denticles. The antennal peduncles are broad, and exceed the eye-stalks by about the length of the last peduncular joint; the acicle has a slight sigmoid curve, and extends to the end of the peduncle, while its inner margin is provided with a row of spinules. The external prolongation of the second joint of the antennal peduncle is acute, but very short; the terminal joint of the peduncle is broad, and flattened from above downwards. The antennal flagellum is more than twice the length of the body. The antennular peduncles exceed the eye-stalks by the whole of their terminal joint, and about two-thirds of the length of their penultimate joint.

The chelipedes are elongated and slender, with the joints faintly pubescent, and armed with subspiniform granules. The carpus is about one-fourth of its length longer than the merus; it is practically cylindrical, and the whole surface is uniformly granulated, but the granules or spinules as they might almost be termed, are most marked on the

* Ill. Zool. Investigator, Crustacea, pl. xxxii. fig. 2 *(in preparation)*.

upper surface. The propodus is slightly flattened when compared with the carpus, though both its surfaces are really somewhat convex; the granules are practically confined to its inner and outer margins, where they have assumed a distinct spinose character; they are strongly marked also on the corresponding margins of the fingers. The upper surface of the hand is pubescent, but otherwise almost smooth. The left chelipede extends to a point opposite the middle of the carpus of the larger chelipede. It is everywhere clothed with rather long hairs, and the upper margin of the carpus is carinated.

The ambulatory legs are very long and slender, even exceeding the chelipedes, and they are everywhere glabrous. The anterior margin of all the joints, but especially the meri, carries a few setose hairs, and there is a small spinule at the anterior distal end of the carpi. The dactyli are slightly bent, and flattened towards their apices; their apical portions carry long setose hairs.

The single specimen measures as follows :—

Length of carapace	...	12 mm.
„ „ right chelipede	...	52 „
„ „ left chelipede	...	27 „
„ „ merus of right chelipede	...	12 „
„ „ carpus of same	...	15 „
„ „ propodus of same	...	20 „
„ „ dactylus of same	...	8 „
„ „ second right leg	...	57 „
„ „ propodus of same	...	12 „
„ „ dactylus of same	...	20 „

The gill-filaments are somewhat flattened, and arranged, as usual in the genus, in four rows; the filaments of each outer row are about two-thirds the length of, and at the same time somewhat narrower than, those of the inner row.

The present species, which I have pleasure in associating with the name of Surgeon-Captain A. R. S. Anderson, is in some respects similar to *P. pilosimanus*,* S. I. Smith, but is more slender, and distinguished at once by the different nature of its ophthalmic scales. In the latter respect it is more like *P. affinis*, Henderson, but this latter is a much stouter species, and differs from the one just described in many respects.

* According to MM. A. Milne-Edwards and Bouvier, the *Parapagurus abyssorum* of my Report on the "Challenger" Anomura, is identical with *P. pilosimanus*. At the time the Report was written I had compared the "Challenger" specimens with those taken by the "Talisman," to which A. Milne-Edwards had given the name of *Pagurus abyssorum*, and finding them identical, described the species under the latter specific name. The *Eupagurus jacobii*, A. Milne-Edwards, is also identical with *P. pilosimanus*.

From the same locality—station 150—there are two small individuals (male and female), which I consider as undeveloped individuals of *P. andersoni*; one is in a similar shell to that which holds the adult type, with an investing anemone, while the other is in a *Natica*. In the larger specimen the carapace measures only 7 mm. in length. Both exhibit much less relative elongation of the chelipedes and ambulatory legs, rendering it probable that elongation is a special character of adult males. The joints of the right chelipede are more definitely subspinose, especially the under surface of the merus and the edges of the hand and fingers, but the subspiniform granulation can of course only be made out with a lens. The hand is broader than in the adult, and more ovate in shape. In one specimen only two denticles can be made out at the apices of the ophthalmic scales, but in the other specimen there are three denticles.

13. **Parapagurus minutus*, n. sp.

Station 150, off the north Maldive Atoll, depth 719 fathoms. Nine specimens—all living in *Dentalium* shells—including two females with ova. The shell tenanted by the largest example is covered by a colony of *Epizoanthus*, composed of four polyps.

In this minute species, which appears to be fully adult, as shown by the presence of eggs, the largest example has the carapace, chelipedes, and legs glabrous with a white porcellanous aspect. In the smaller specimens there is a slight pubescence on all the above named parts, including the eye-stalks, where the hairs may be rather long. Hairs are met with in this last situation even in the largest specimen.

The anterior portion of the carapace is glabrous and regularly convex, with the exception of a slight wrinkling antero-laterally. The median frontal projection is scarcely indicated. The eye-stalks exhibit considerable basal dilatation, and the narrowed apex carries a reduced but deeply pigmented cornea. The ophthalmic scales are minute, and terminate in a subacute point. The antennal peduncles slightly exceed the eye-stalks; the acicle is almost straight, ciliated, and faintly spinose on its inner margin; the external prolongation of the second joint exhibits considerable depth, and its apex can scarcely be termed acute. The antennular peduncles exceed the eye-stalks by more than the length of the last peduncular joint—this however is almost a generic character. The antennal flagellum is apparently not longer than the body, if as long.

The right chelipede has the joints of a white porcellanous aspect. The hand (omitting the fingers) is slightly longer than the carpus, but the proportion seems to vary slightly in different specimens.

* Ill. Zool. Investigator, Crustacea, pl. xxxii. fig. 3 *(in preparation)*.

The length of the hand is not quite twice its breadth. In the largest specimen the joints of the chelipede are almost smooth, there being only a faint denticulation, or almost granulation, visible on the margins of the hand and fingers, but in other specimens there is a regular minute serration, and in these cases the margins are thinner or less rounded. In some cases minute granules are visible on the under surface of the hand and wrist. In one or two examples the tip of the dactylus is bent under that of the immobile finger. The smaller or left chelipede extends to about the middle of the hand of the larger chelipede, and in some cases even to the articulation of the dactylus.

The ambulatory legs are unarmed, though faintly pubescent, especially the terminal portions of the dactyli. The dactyli are not quite twice the length of the propodi.

The gills are similar to those of *P. andersoni*, but the lamellæ are narrower. The eggs are moderately large, and the oviducal opening of the female is, as usual in the genus, present only on the left side.

The largest specimen is a female with ova, which measures as follows:—

Length of body*	...	...	...	...	16 mm.
„ „ carapace	...	...	...	...	5·5 „
„ „ right chelipede		...	...	...	10·5 „
„ „ first right leg	...	...	...	...	16 „

The chief feature of the species is its small size. Although the fact that some of the females carry ova is not in itself sufficient to indicate that they have attained their maximum size, yet I think it may be safely assumed that by this time they have developed all the leading specific characters. In some Pagurids, notably the common European *Eupagurus bernhardus*, (Linn.) considerable differences may be observed in the size of egg-bearing females.

Genus Sympagurus, S. I. Smith.

This genus according to A. Milne-Edwards and Bouvier, is distinguished from *Parapagurus* solely by the arrangement of the gills, which are biserial and not quadriserial, and in the opinion of these observers the two genera ought probably to be united. A connecting link occurs in the *S. nudus*, A. Milne-Edwards, taken by the "Hirondelle," in which at the base of each branchial lamella there is an external rudimentary lamella, and if the latter were somewhat larger the gill would resemble that of a *Parapagurus*. The evidence furnished by this species, tends at

* Owing to the species inhabiting a *Dentalium* shell, the body—unlike that of most Pagurids—is fully extended.

least to show that characters derived from the gills are of somewhat doubtful value in the classification of the Paguridae. On the other hand the species of *Sympagurus* do not appear as a rule to reach the great depths at which species of *Parapagurus* are found, and in some of the species, including the one about to be described, the eye-stalks, unlike those of the last named genus, exhibit a certain amount of dilatation. Moreover the gill-branches of *Parapagurus* are more or less filamentous, while those of *Sympagurus* are lamellate. For the present the two genera may therefore I think be kept separate.

14. **Sympagurus monstrosus*, (Alcock).

(?) *Parapagurus monstrosus*, Alcock, Ann. Mag. Nat. Hist. (6) xiii. 1894, p. 243.

Station 151, off the coast of Ceylon, depth 142 to 400 fathoms. Four specimens.

Station 162, off the Madras Coast, depth 145 to 250 fathoms. A large number of specimens, the majority inhabiting *Rostellaria* shells, some of which have an investing *Epizoanthus*, others an *Actinia*.

The anterior portion of the carapace is slightly convex, with a curved line on either side terminating behind the basal joint of the antennal peduncle. The three frontal projections are slight, but the median one exhibits a faint dorsal carina. The eye-stalks are stout, with the upper surface slightly pubescent, and the cornea considerably dilated. The ophthalmic scales are broad basally, but acute and spinulous at the apex. The antennal peduncle only slightly exceeds the eye-stalk; the acicle is moderately curved, with its inner margin dentate; the external prolongation of the second peduncular joint is spinulous. The antennular peduncle exceeds the eye-stalk by slightly more than the length of the terminal peduncular joint.

The chelipedes are slightly pubescent, and yet glabrous, with the terminal joints of the larger one regularly dentate. The right chelipede has the merus provided with a serrated lobe on its lower distal margin, while the upper margin is more faintly serrated, and the outer surface is obscurely tuberculate. The carpus is considerably swollen below, and all its projecting margins are dentate, the denticles being best marked on the outer margin, and on the lower and inner margin. The upper surface of the hand is regularly arched or convex from end to end, the curvature showing clearly on the thin outer margin; both inner and outer margins are regularly dentate, the thick inner margin showing a double line of denticles. The upper surface of the hand is smooth and glabrous, only a few minute granules being present, but it is at the same time more or less pubescent. The fingers are strongly

* Ill. Zool. Investigator, Crustacea, pl. xxxii. fig. 4 *(in preparation)*.

incurved, and the upper margin of the dactylus is strongly dentate. The left chelipede is slender and almost smooth, with the carpus considerably longer than the hand, and the fingers about equal in length to the palm.

The ambulatory legs are practically smooth, only a few marginal hairs being present. The anterior margin of the meri is faintly tubercular, and in some specimens there is a denticle at the anterior distal end of the carpus. The dactyli are about one and a half times the length of the propodi.

The gills are biserial, without any trace of outer lamellae; the inner lamellae are long and somewhat narrow, resembling those of *S. pilimanus*, A. Milne-Edwards, as figured by Milne-Edwards and Bouvier, in their Report on the "Blake" Paguridae.

An adult male gives the following measurements:—

Length of body	...	17 mm.
„ „ right chelipede	...	20 „
„ „ left chelipede	...	15 „
„ „ third right leg	...	27 „
„ „ eye-stalk	...	2·5 „

This species is closely allied to *Parapagurus gracilis*, Henderson (which is probably a *Sympagurus*), taken by the "Challenger" off Pernambuco, at a depth of 350 fathoms. It agrees with the latter in the character of its eye-stalks, but the dilatation of the corneae is somewhat greater in *S. monstrosus*. It differs, however, in the more regular denticulation of its hand, while this part is also considerably broader in the "Challenger" species. It also bears considerable resemblance to *S. arcuatus*, A. Milne-Edwards and Bouvier, from the West Indies, in which however, the larger hand is more distinctly granulated on the upper surface, and the carpus presents a row of denticles on its upper surface, bordering the articulation of the hand. Subsequent investigation may possibly show that all three species are identical.

Undetermined species.

15. *Clibanarius* sp.

Great Sober Island, Trincomallee Harbour. Four small specimens.

The largest example measures only 20 mm. in total length, and all are obviously very young. They probably belong to some common litoral species.

16. *Eupagurus* sp.

Station 151, off the coast of Ceylon, depth 142 to 400 fathoms

A female apparently adult, and a very young individual in shells (*Murex ?*), overgrown by an *Epizoanthus*.

The larger specimen has lost its abdomen, but the carapace measures 10 mm. in length.

Both the median and lateral frontal projections are prominent and subacute, the median being somewhat better marked than the lateral. The eye-stalks are rather short, while the narrow and acute ophthalmic scales are separated by a somewhat narrow interval. The external prolongation of the second joint of the antennal peduncle, and the antennal acicle, are both well developed; the antennal flagellum is not twice the length of the carapace, and is fringed with long hairs.

The chelipedes and ambulatory legs have a dense covering of long yellowish hairs on their upper surface. The right chelipede is stouter but only slightly longer than the left; its fingers move in a horizontal plane, and have horny tips. The carpal and propodal joints show a few acute denticles scattered among the hairs on the upper surface. The dactyli of the ambulatory legs are provided with yellow horny apices.

I hesitate to describe this species under a new name as the single adult specimen is very incomplete, and it is impossible to ascertain whether sexual appendages were present or not. If the species is an *Eupagurus*, as is seems to be, it is probably new, and is chiefly characterised by the form of its chelipedes, and the strongly marked pubescence.

17. Glaucothoe.

Station 150, off the North Maldive Atoll, depth 719 fathoms. A single example measuring about 20 mm. in length.

The right chelipede is granulated and considerably larger than the left. The abdomen is slighly folded on itself perhaps accidentally, but is not spirally twisted. The species agrees with *G. peronii*, Milne-Edwards (Ann. Sci. Nat, t. XIX. p. 334, pl. VIII. 1830), in its unequal chelipedes, whereas in *G. rostrata*, Miers, and *G. carinata*, Henderson, they are equal. It is distinguished from Milne-Edwards' species by the granulation of the larger chelipede, the presence of a rather broad median frontal projection, and by the greater length of the ambulatory (or possibly swimming) dactyli, which in Milne-Edwards' figure are represented as about equal in length to the propodi, while in our example they are fully one and a half times as long. Milne-Edwards' example was also considerably smaller.

Glaucothoe has been regarded both as an adult, and as an imma-

ture form, but the balance seems in favour of the latter view. No trace of sexual openings can be made out in the "Investigator" specimen, nor do they appear to have been described in any of the previous records. It is apparently very rare, and it is difficult even to surmise what Pagurid it can be the normal larva of, so it may possibly be an arrested larval form. If Miers' theory as to the nature of *Grimothea gregaria*, Leach, be correct, *viz.*, that this Galatheid is merely a pelagic larval form of *Munida subrugosa* (White), we would have a similar parallel, but there is no evidence to show that *Glaucothoë* leads a pelagic life.

Noviciæ Indicæ XIII. *Further Notes on Indian* Convolvulaceæ; *with descriptions of three additional species.*—*By* D. Prain.

[Recd. 24th June, Read 1st July.]

Since the presentation of the notes on *Convolvulaceæ* published as *Noviciæ Indicæ* VIII, in August 1894, three more species have been added to the Indian Flora. Descriptions of these are now given for the convenience of field-botanists and the present opportunity is taken of adding notes regarding several species already dealt with.

1. ERYCIBE Roxb.

10. Erycibe coriacea *Wall.*

While at work in the *Prodromus* Herbarium of M. Casimir de Candolle at Geneva, the writer was able to compare examples of *E. fragrans* (agreeing with *Wall. Cat.* n. 1336) with the apparently unique specimen of *E. coriacea* Wall. (*Cat.* n. 1337) which has not been lost but is safely preserved in the cover in which M. Choisy had placed it. Its flowers are exactly identical with those of *Wall. Cat.* n. 1336 nor do its leaves differ sufficiently, in the writer's opinion, to admit of the two plants being treated even as distinct varieties.

15. Erycibe festiva *Prain, Nov. Ind.* viii. 76.

In the description, for "cymes many-fld." read "cymes 7–12-fld."

17. Erycibe strigosa *Prain*; branchlets round densely covered with a black adpressed tomentum, leaves rather long-petioled thinly coriaceous glabrous above densely covered with a black adpressed tomentum beneath, elliptic; base cuneate apex rather long-acuminate, lateral nerves visible beneath not above, cymes few-fld. in long narrow axillary panicles with densely rusty tomentose rachis, peduncles and pedicels.

Malay Peninsula: Perak, at Taaipeng 500–800 feet elev., *Kunstler* n. 8461!

A creeper 40–60 feet long with stems 1–2 in. in diam. *Leaves* 3–4 in. by 1½ in., dark green above dark brownish-black beneath as are the branches; lateral nerves 5 pairs oblique, secondary veins not visible. *Panicles* 3–6 in. long, ½ in. wide, peduncles of individual cymes ¼ in. or less, pedicels short, bracteoles linear deciduous. *Sepals* rusty pubescent, orbicular. *Corolla*-lobes apparently white, interlobular portion brown tomentose externally, lobules ovate margins subentire. *Fruit* not seen.

This species is very distinct from any of the others by reason of the black tomentum on the leaves beneath.

2. RIVEA Choisy.

1. Rivea ornata *Choisy.*

var. Griffithii *Clarke.*

Further large suites of this very distinct variety (*i.e.*, of Dr. Roxburgh's original *Lettsomia ornata*) have been brought to Calcutta from the Duars by Mr. Haines. These make it more probable than ever that Roxburgh's plant is specifically distinct from *Convolvulus candicans* Roth. Mr. Haines has demonstrated that the plant is quite common in the Sub-Himalayan region far to the East of the Sivoke Sal Forest and that it extends at least as far as the Assam Frontier.

More interesting still is the fact that, since the previous paper was written, Dr. King's native collectors have sent large suites of specimens from, and report the plant to be quite common in, the Southern Shan States. From no part of its wide area, (from the Sivaliks to the Shan Hills) come any specimens showing the slightest tendency to connect Roxburgh's plant with Roth's one from Southern India.

5. IPOMŒA Linn.

21*b*. Ipomœa scindica *Stapf, Decades Kewenses* ix, n. 87 in *Kew Bulletin*, September 1894, 346; hairy, leaves triangular-hastate acute or acuminate, cymes few-fld. often reduced to 1–2 flowers, axillary short-peduncled, bracts short linear or linear-subulate, corolla small funnel-shaped, capsule globose glabrous, seeds thinly grey-velvety.

Scinde: *Cooke!*

Stems prostrate slender hispid. *Leaves* ¾–2½ in. long, glabrescent above, hirsute but at length also glabrescent beneath; petiole ¼–1 in. *Peduncles* ½ in., sepals ¼ in., in fruit ¼ in. long. *Corolla* ½ in. long. *Capsule* ¼ in. long.

Nearly related to *I. eriocarpa* but with glabrous in place of hairy capsules and hairy in place of glabrous seeds; also to *I. Stocksii* but with different hairs on seeds and with very different leaves.

6. LEPISTEMON Blume.

2. Lepistemon leiocalyx *Stapf, Decades Kewenses* xviii, n. 172 in Kew Bulletin, May 1895, 113; tawny-hirsute, leaves ovate-cordate acuminate entire or casually obscurely 3-lobed, cymes congested umbellate, sepals ovate-rotund quite glabrous, corolla urceolate.

Travancore: near Kcui, in secondary forest, *Bourdillon!*

Stem scandent tawny-hirsute. *Leaves* 2 in. long, 1½–2¼ in. wide, tawny-hirsute as are the petioles 1-1½ in. long. *Peduncles* 1–2½ in., tawny-hirsute: cymes many-fld.; pedicels ¼ in. *Calyx* ⅛ in. quite glabrous. *Corolla* ½ in., yellow, tube urceolate limb short; filaments glabrous; basal processes papillose. *Ovary* 2-locular, locules 2-ovuled; base surrounded by a deep disk.

The presence of this genus in Southern India is interesting as the locality is mid-way between its Malayan and its African habitats. The present species is somewhat intermediate in structure as well as in locality between the wide-spread African, and the almost equally wide-spread Indo-Chinese and Malayan species, though it perhaps approaches more closely to the latter. Is is however abundantly distinct by reason of its quite glabrous obtuse sepals.

9. CONVOLVULUS Linn.

7 *b*. Convolvulus tenellus *Stocks.*

Add to localities of *Novitiæ Indicæ* viii. 102:—

N.-W. Himalaya: Kashmir, Bargila, *Winterbottom!*

It is interesting to find that this was collected in Kashmir by Winterbottom during his 1847 journey; it is remarkable that no one has reported it from Kashmir since.

Description of a New species of Branchipus from Calcutta.—*By* A. Alcock, M.B., C.M.Z.S., *Superintendent of the Indian Museum.*

Plate X.

[Received 19th August, 1896.]

The species here described and figured was found in flooded rice-fields near Calcutta, by Museum Employées Moti Rám and Seorutton. Twelve males and six egg-laden females were taken.

It belongs to the section *Streptocephalus* of the genus *Branchipus*, and is most closely related to *Branchipus rubricaudatus*, Klunzinger, from the south coast country of Arabia, and, through the female, to *Branchipus torvicornis*, Waga, from the neighbourhood of Warsaw.

Branchipus (*Streptocephalus*) *bengalensis*, n. sp.

The body in life is rather over an inch long, and is of a semi-transparent hyaline colour flecked with grey, except the tail-fork which is bright red. Spirit specimens are a good deal shrunken, and are uniform white.

Behind the head are twenty segments, namely, 11 thoracic, each with a pair of swimming feet, and 9 abdominal, legless.

Each fork of the tail is over one-eighth of an inch long, and h[as] beautifully plumose edges.

The antennules are well developed, and the eyes are large globular and stalked.

The "rostrum" is a small fleshy foliaceous excrescence, situated in front of the mouth, and furnished with a short median finger-like papilla: its free edge is thus somewhat trilobed.

The antennæ *in the male* are more than half as long as the body.

Their *basal joint* has on the ventral surface, at the distal end, a curved rather rigid antenniform filament.

The doubly-curved *second joint* has (1) at its proximal end, dorsally, four curved flagella, one of which is much larger than the others and has its concave edge serrated; and (2) along its outer and upper surface a row of long acicular spinelets.

The *third segment*, which joins the second almost at a right angle, bifurcates from its base into (1) a short upstanding (dorsad) branch, and (2) an obliquely-directed (ventrad) branch. The outstanding dorsad branch itself soon bifurcates into (1) a stout downcurved hooklet; and (2) a slender slightly curved flagellum. The long ventrad branch consists of (1) a slender basal piece; and (2) two long slender flagella: the outer flagellum is elegantly curved and hook-like; the inner flagellum, which has its dorsal edge armed with a row of short spinelets, again bifurcates—the outer (longer) branch of this last bifurcation being also curved and hook-like.

The antennæ *in the female* form a pair of short broad leaf-like lobes—usually with a thickened fleshy midrib—bending over the eyes in repose, like curtains.

In the above description the antennæ of the male are supposed to be fairly well extended, not flexed in repose; and the animal is supposed to be in morphological position, not swimming on its back as in life. A male and an egg-laden female were liberated in the Museum tank in the hope of establishing a supply of this large and beautiful species.

An Instance of the Natural Repellent Effect of "Warning Colours."—By A. Alcock, M.B., C.M.Z.S., *Superintendent of the Indian Museum.*

[Received 19th August, 1896.]

The observation here recorded appears to be noteworthy as corroborative evidence in favour of the protective value of "Warning Colours."

I have in my possession a very docile young Himalayan bear, one of whose most strongly marked appetites is for grasshoppers. He seizes

greedily, and crunches with every sign of relish, the common bright-green and dull-brown grasshoppers found in Calcutta; and one of the few displays of real ill-temper of which he has been guilty was occasioned by my attempting to pick up a large grasshopper that had dropped from his mouth.

Recently I offered him a specimen of the glaring-coloured and evil-smelling *Aularches miliaris* (Linn.) which, as soon as he smelt it, he refused in a most comical way, but without any show of anger or violent distrust.

(It may be re-called to memory that, in life, *Aularches miliaris* has the abdomen broadly cross-striped in alternate black and scarlet, and the forewings black with large canary-yellow spots, and also that it secretes a most peculiarly pungent-smelling frothy fluid.)

A little after the first refusal I again forced the insect upon him, when he stood up on his hindlegs and violently struck it out of my hand, in exactly the same way as—after a single experience of their nature—he is accustomed to treat the offer of a burning cigar-end or a lighted match.

Whenever now I show him this grasshopper (*Aularches miliaris*), he first endeavours to move off; but if he is compelled to face it, he rises and strikes one's hand such a hearty cuff that the insect is knocked out of one's grasp.

The bear also has certain amount of objection to a very large spiny-legged species of *Acridium* and to a species of *Euprepocnemis* nr. *robusta* Serv. with spiny legs, if these are offered to him alive and with their legs intact. In these cases the dislike is not to the insect, but only to its hard spiny legs, and it is not accompanied by any gesture of fear or apprehension—for it is these emotions, rather, perhaps, than blind anger, that the bear's cuff seems to be meant to express.

I may mention that the bear lives, as far as is possible, in a state of nature: it is never confined, and is only chained up when nobody can be spared to watch it.

I offer this note as a simple record of fact. So far as it goes it appears to support the almost universally accepted though now by no means unquestioned beliefs (1) that when an insect has been found by experience to be unpleasant to (taste and) smell it has only to be *seen* to be avoided: and (2) that any conspicuous markings that lead to the immediate recognition of such an insect by eyesight and at a distance are likely to be of such vital benefit to the insect as to be acted on by Natural Selection.

Noviciæ Indicæ XIV. *Some additional* Solanaceæ. - *By* D. Prain.

[Recd. 24th June Read 1st July.]

The present paper contains descriptions similar to those in the *Flora of British India* of a few species that have been recorded as Indian since the account of the order contained in that work was published.

1. SOLANUM Linn.

6*b*. Solanum Kurzii *Brace MSS. in Herb. Calcutta*; leaves irregularly ovate, with subtruncate base acute apex and deeply triangularly lobed margin, densely tomentose beneath, more sparingly above, racemes lateral 8–12-fld., calyx-teeth ovate-lanceolate, corolla violet-purple. S. pubescens var.? lobata *C. B. Clarke* in *Flor. Brit. Ind.* iv. 231. S. pubescens *Kurz* ex *C. B. Clarke loc. cit., not of Willd.*

Sikkim; at 4000 feet elevation *T. Thomson! King!* Khasia: *G. Mann!*

A small tree (*Thomson*) quite unarmed; branches densely stellately woolly. *Leaves* 3–4 in. long, 2–2·5 in. across; lobes ·75–1 in. deep, ·5 in. across, subacute or acute, base unequally truncate stellately woolly, above sparsely beneath very densely; lateral nerves about 5 pairs prominent beneath; petiole 1–1·25 in., densely stellately woolly. *Racemes* densely woolly, peduncles 1 in. pedicels ·25–·5 in. *Calyx* shortly campanulate, lobes ·15–·2 in. in flower, ·25 in. in fruit. *Corolla* violet-purple (*Thomson*) ·5 in. across, closely tomentose without. *Berry* ·4 in. in diam. globose smooth.

This very distinct species appears to be rare. It was first collected by Dr. T. Thomson in 1857 and again by Dr. G. King in 1874, both times in Sikkim; Mr. Gustav Mann collected it in the Khasia Hills in 1877. No other botanist appears to have met with it before or since in either locality.

The solitary specimen seen by Mr. Clarke had no fruit; it was therefore referred tentatively in the *Flora of British India* to *S. pubescens*. Mr. Brace, when Curator of the Herbarium at the Royal Botanic Garden, having seen excellent fruiting specimens collected by Dr. King was able to decide that the plant is a distinct species; he has noted it as intermediate, in his opinion, "between *S. verbascifolium* and *S. pubescens*."

7. Solanum subtruncatum Wall.

Add to localities of F. B. I.:—

Malay Peninsula: Perak, *Kunstler* n. 4709! n. 10260! *Wray* n. 3409! 3968! *Scortechini!*

16. Solanum barbisetum *Nees*.

var. *Griffithii*, var. nov.; all parts densely shortly softly stellate woolly.

Assam: *Griffith* n. 5911/1 [K. D.]! *Jenkins!* Upper Burma: at Poneshee, *J. Anderson!*

In general appearance and in leaves this resembles *S. indicum* just as much as typical *S. barbisetum* resembles *S. ferox*; so unlike are the two plants that it is at first sight difficult to realize that they are conspecific. The calyx, corolla and fruit are, however, exactly alike in both.

17. Solanum khasianum *Clarke.*

Add to localities of F. B. I.:—

Naga Hills: Kohima, etc., common; *Watt! Clarke! Prain!* Upper Burma: Maymyo, *King's Collector!* Hotha; *J. Anderson!*

23*b*. Solanum sisymbriifolium *Lamk Illust.* 2386; glandular hairy; leaves oblong pinnatifid or 2-pinnatifid prickly, peduncles extra-axillary and terminal many-fld.; berry subglobose glabrous, when young overtopped by the inflated 5-angled often armed calyx-tube which ultimately becomes reflexed and exposes the edible fruit. *Dunal, Sol.* 232 and in *DC. Prodr.* xiii. pt. I. 326. S. inflatum *Hornem. Hort. Hafn.* i. 221. S. Balbisii *Dun. Sol.* 232; *Hook. Bot. Mag.* t. 2568, t. 2828.

Lower Bengal: occasionally, as an escape, in waste places and on river banks. Nilghiris: at Coonoor, apparently naturalized. Khasia Hills: at Shillong quite naturalized and rapidly spreading.

A villous viscous undershrub with simple gland-tipped hairs; prickles long straight slender subulate yellow or reddish-yellow. *Leaves* 6–12 in. long, 4–7 in. wide, lobes acute sinuate-dentate the terminal exceeding the others, softly subviscously hairy, lateral nerves 4–5 pairs prominent, like midrib beneath, beset with long hairs and armed on both surfaces; petiole 1·5–7 in. slightly decurrent prickly. *Calyx* 5-partite tube ovate cupular, lobes lanceolate acute sparingly armed. *Corolla* 1 in. across slightly hirsute externally, white or violet. *Berry* ·5 in. diam., red.

A rather variable species, frequently cultivated, readily escaping and, at least in the Khasia Hills, thoroughly naturalized. The form from Coonoor has violet flowers, that usually met with in Lower Bengal has white flowers. Both forms are sent from Shillong but the form that has become so completely naturalized is the white-flowered one. The berry in Indian specimens is always red. The species is a native of S. America, but it has of late years been so frequently sent to Calcutta Herbm. for identification, with the remark that it could not be found in the *Flora of British India*, that a description is now given.

25*b*. Solanum scindicum *Prain*; all parts closely white woolly, leaves ovate or elliptic irregularly sinuate or lobed without prickles, cymes lateral and terminal 6–8-fld., corolla blue, berry globose much exceeding the calyx-lobes.

Cutch: *Stoliczka!* Scinde: *Stocks! Cooke!* Rajputana: Jessole *King!*

An undershrub, stems and branches beset with short stout much compressed and much recurved prickles; *leaves* ·5–1·5 in. across irregularly obtusely sinuate or lobed, base cordate, petiole ·25–·5 in. *Peduncles* 1 in. and slender pedicels ·5 in. long always unarmed. *Calyx*-lobes ·15 in. wide, triangular, hardly enlarged in fruit. *Corolla* ·6 in. across externally densely woolly, lobes triangular almost as long as tube. *Berry* ·3 in. in diam.; seeds ·15 in. diam. smooth.

This plant has long been known in Herbaria; it has been issued as *S. gracilipes* from Herb. Calcutta and as *S. indicum* VAR. from Herb. Poona but obviously is not referable to either species.

It stands very nearly intermediate between *S. gracilipes* and *S. trilobatum*. With *S. gracilipes* it agrees in having the leaves unarmed and cordate at the base and in having unarmed peduncles and pedicels; it differs in having more deeply lobed leaves, more numerous flowers, broader and shorter calyx-lobes, shorter stouter and compressed not conical prickles. With *S. trilobatum* it agrees in having lobed leaves and in having compressed prickles; it differs in having the leaf-bases cordate; in having the leaves, peduncles and pedicels unarmed and in being densely persistently woolly in all its parts.

In tomentum and general appearance it closely resembles *S. albicaule* Kotschy with which it agrees in flower and in fruit. But the leaves of *S. albicaule* are less deeply lobed, and are rather narrower and more acute; its prickles too are conical as in *S. gracilipes* not compressed as in *S. trilobatum* and *S. scindicum*. The whole facies of *S. scindicum* is quite unlike that of *S. indicum*, the other species with which it has been compared; the prickles on the branches are much less recurved in *S. indicum*; the leaves are armed on the nerves beneath in that species, and the peduncles and calyx-lobes are beset with long straight slender prickles.

8. SCOPOLIA JACQ.

1. SCOPOLIA LURIDA *Dunal.*

Add to localities of F. B. I.:—

KAMAON: Kutti valley, *Duthie* n. 3215! n. 5834!

10. HYOSCYAMUS LINN.

2*b*. HYOSCYAMUS RETICULATUS *Linn. Sp. Pl.* ed. 2. 257; cauline leaves sessile ovate-lanceolate acute pinnatifid lobes acute, flowers subsessile, calyx sparsely pubescent teeth large triangular mucronate, corolla dirty yellow purple-veined. *Dunal DC. Prodr.* xiii. 1. 547; *Boiss. Flor. Orient.* iv. 295. H. Camerarii *Fisch. & Mey. Ind. Sem. Petrop.* iv. 38; *Dunal, DC. Prodr.* xiii. i. 547. H. pinnatifidus *Schlecht. Linnæa* (1843). 127.

BRITISH BELUCHISTAN: Quetta, *Stocks! Lace! Duthie!* KURRAM VALLEY: *Aitchison!*

Densely pubescent with short glandular tomentum and long white hairs intermixed. *Leaves* 5 in. long, 1-1·5 in. wide. Lower *pedicels* in fruit ·3 to ·5 in. *Calyx* in flower ·65 in. teeth longish triangular, in fruit 1·25 by ·5 in. subcontracted in the middle, teeth ·5 in. long rigid. Capsule ·5 in. in diam. seeds ·05 in. in diam.

Nearest to *H. niger* but easily distinguished by its much larger calyx-teeth.

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Notes on the action of Nitric Oxide on Alkalies.—*By* A. PEDLER, F.R.S., *and* JYOTIBHUSHAN BHADURI, M.A.

[Received Oct. 5th, 1896; Read 4th Nov., 1896.]

Gaylussac* found that when nitric oxide was kept for three months in contact with a concentrated solution of potash, it was resolved into one-fourth of the original volume of nitrous oxide gas, and into nitrous acid, which latter combined with the potash. Cooke,† Russell‡ and Lampraik and others have also come to the same conclusion. They have moreover found that nitrogen is in addition liberated. Sabatier and Senderens§ more recently have also studied the action of nitric oxide on metals and metallic oxides.

The action of nitric oxide on such substances as potassic or sodic hydrate might take place in three directions. It is possible, that according to the analogous case of the action of nitrogen tetroxide on potassic hydrate, which as is well known yields a mixture of an equivalent amount of nitrite and nitrate, nitric oxide under the same circumstances might yield equivalent amounts of nitrite and hyponitrite, according to the equation:—

$$2\,NO + 2\,KOH = NOOK + NOK + H_2O.$$

If this occurred the gas would be wholly dissolved by the alkali.

* Gm. **2**, 378. † *C. N.* **58**, 115. ‡ *C. J. Trans.* **32**, 35 and 37.
§ *Comptes Rendus.* **114**, 1429 and 1476; **120**, 1158.

But if the nitrite *only* were formed the equation would be,

$$4NO + 2KOH = 2NOOK + N_2O + H_2O,$$

or out of eight volumes of nitric oxide, two volumes of nitrous oxide would remain, and an absorption of three-fourths of the volume of the gas would take place.

On the other hand, a direct combination of nitric oxide and the hydrate with the formation of a single salt might occur as in the supposed case,

$$2NO + 2KOH = N_2O_3K_2 + H_2O,$$

and thus the potassium salt of a nitrogen acid corresponding to hypovanadic acid might be produced. In this case also, the whole gas would combine with the alkali and no residual gas would be left.

The work done in the researches alluded to previously having given no very positive proof as to whether either of the above reactions will occur, a series of experiments was commenced and had been brought to partial completion when salts of the missing acid, intermediate between nitrous and hyponitrous acid and corresponding to hypovanadic acid, were obtained by a totally different method by Dr. A. Angeli (*Gazetta Chimica Italiana*, July 31, 1896), a summary of whose researches is given in "Nature" for August 20, 1896.

Angeli obtained the sodium salt of the new acid $H_2N_2O_3$ by the action of hydroxylamine on ethyl nitrate in presence of sodium ethylate, according to the equation:—

$$C_2H_5ONO_2 + NH_2OH = C_2H_5OH + H_2N_2O_3.$$

As the problem was being attacked by us from a different direction, and the results we had obtained appeared to point to the second of the three possibilities occuring, namely the formation of a nitrite and free nitrogen monoxide, while the potassium salt of the new acid does not appear to be formed by the direct union of nitric oxide and potassium hydrate, it is thought of sufficient interest to put some of the experiments on record.

In order to study the action of nitric oxide on alkalies two methods have been employed. In none of these experiments has solution of alkaline hydrate been used. In order to hasten the absorption the tubes containing the solid hydrate and the nitric oxide were invariably heated to temperatures higher than 100° C, sometimes up to 400° C. The consequence was that the same absorption, which was observed by Gaylussac and others to occur during three months, took place in the course of ten to twelve hours. Some tubes, however, were also exposed to the solar rays, but under these circumstances only slight absorption appeared to take place. The maximum absorption of nitric oxide by the hydrate varied from two-thirds to three-fourths of the

original volume of the gas, and in no case was the gas absorbed as a whole, as would be required if the salt of the new acid were being formed. Indeed in all cases, nitrogen monoxide was left, and this hence showed that the potassium salt of the new acid was not formed.

The following will represent two typical experiments of the kind made:—

28th Feb. 1895. (*a*) A thick combustion tube containing about 11 grams of freshly prepared soda lime, and approximately 50·4 c.c. nitric oxide, containing about 3% of free nitrogen, was heated for 6 hours at 100–120° C, 18 hours at 200–210° C and one hour at about 320° C. When cold it was opened under mercury. The residual gas amounted to 15·2 c.c. of which about 2·1 c.c. was found to be nitrogen, and the remainder nitrogen monoxide, thus—

Original vol. of NO ... $50{\cdot}4-\frac{50{\cdot}4\times3}{100}=48{\cdot}9$ c.c.

But as 2·1 c.c. of nitrogen was found at the end of the experiment, therefore 2·1 c.c. − 1·5 c.c. or 0·6 c.c. of nitrogen must have been formed by the further decomposition of nitrogen monoxide.

$\therefore$ Vol. of N_2O+N formed from NO = 15·2 c.c. − 1·5 c.c. = 13·7 c.c.

Vol. of N_2O ... 15·2 − 2·1 = 13·1 c.c.

$\therefore$ Contraction ... $\frac{48{\cdot}9-13{\cdot}7}{48{\cdot}9}=\frac{35{\cdot}2}{48{\cdot}9}=0{\cdot}72.$

or 72 per cent. of the gas had been absorbed, while theory requires 75 per cent., the remaining 25 per cent. of the volume being nitrogen monoxide.

5th March, 1895. (*b*) Caustic potash was used and the tube was heated for 13 hours to 200° C. Out of 48·6 c.c., 28·3 c.c. of gas remained behind. On treating with a concentrated solution of ferrous sulphate only 14·6 c.c. of what appeared to be pure nitrogen monoxide and nitrogen remained.

Original vol. of nitric oxide ... $48{\cdot}6-\frac{48{\cdot}6\times3}{100}=47{\cdot}1$ c.c. pure NO.

Vol. of unacted on nitric oxide ... = 28·3 c.c. − 14·6 c.c. = 13·7 c.c.

$\therefore$ Vol. of NO taking part in the reaction ... ... 47·1 c.c. − 13·7 c.c. = 33·4 c.c.

Vol. of nitrous oxide and nitrogen from nitric oxide ... 14·6 − 1·5 = 13·1 c.c.

Contraction ... $\frac{33{\cdot}4-13{\cdot}1}{33{\cdot}4}=0{\cdot}61.$

A contraction of 61 per cent. or nearly two-thirds of the volume.

In the second method the action was observed in a silver boat in an open tube heated in a combustion furnace or tube heater.

The fused alkali, which to begin with was white, turned faintly yellow and became distinctly crystalline as absorption went on. After the absorption had been completed, in a solution of the substance formed, silver nitrate gave the characteristic precipitate of silver nitrite. A quantitative determination of the silver salt gave 70·4 instead 70·1 per cent. of silver, showing that it was silver nitrite.

Experiments have already been made with the hydrates of sodium, potassium, barium and calcium and with soda lime, and apparently the same action occurs in each. It is interesting to observe that anhydrous sodium carbonate when heated just to low redness in a current of nitric oxide also gives a small quantity of sodium nitrite. We reserve the full details of the experiments for a future communication.

Notes from the Chemical Laboratory of the Presidency College, Calcutta.

Notes on New Salts of Cobalt and Nickel.—*By* NAGENDRA CHANDRA NAG, M.A. *Communicated by* ALEX. PEDLER, F.R.S.

[Received 22nd September, 1896; Read 4th Nov., 1896.]

While examining some samples of bromine, last March, some bromine, mixed with solution of potassium bicarbonate, was added to cobalt chloride solution, with the expectation that it would give a precipitate with the cobalt, but contrary to experience a green solution was formed of a colour just like that of nickel salts. A green cobalt salt solution was naturally very striking, and an attempt was made to isolate this compound.

While the experiments were proceeding, a paper was read before the Chemical Society in London, on April 23rd, 1896, by R. G. Durrant, who had noticed the same formation of a soluble green cobalt salt. The abstract of this paper is published at page 96 of the *Proceedings, of the Chemical Society* for 1896, but though several numbers of the *Journal* have since appeared, no full description of these experiments has been published. In the abstract the green substance is conjectured to be a cobaltate or cobaltic acid H_2CoO_4, and the probable reaction from hydrogen peroxide, which was the process used, is given as:—

$$CoCO_3 + 2H_2O_2 = H_2CoO_4 + CO_2 + H_2O.$$

In the absence therefore of any fuller published information, and as the compound obtained here was produced by a slightly different process to that used by Mr. Durrant, a few particulars of the work done are placed before the Society.

To get the product free from potassium chloride, it is best to ta

cobalt carbonate precipitated with potassium bicarbonate, and then to add to it a solution of potassium bicarbonate in excess and afterwards bromine; there is a rapid effervescence of carbon dioxide, while the pink precipitate of cobalt carbonate gradually goes into a solution of green colour. That the new compound is not a compound of bromine is seen from the fact that when a concentrated solution is shaken with alcohol and ether, the new compound, with excess of potassium bicarbonate settles down immediately and adheres to the bottom of the vessel, while the colourless solution with the whole of the bromine in the state of bromide, &c., can be poured off, leaving the new compound with the excess of potassium bicarbonate free from bromine compounds. But after this extraction with alcohol, the substance is liable to decomposition even in watery solution, probably due to the presence of adhering alcohol. Use of filter papers with the substance is also not at all safe; both of which facts point to the compound being of a highly oxidising nature, and easily decomposable by organic substances. All attempts to isolate the substance have hitherto failed.

The compound seems to be an oxidation product corresponding, possibly, to the ferrates. If the aqueous solution of the new compound with the excess of potassium bicarbonate after extraction with alcohol and ether be left for some time, the solution as it becomes reduced exhibits dichroism, due probably, to the presence of a violet coloured precipitate which comes down. The green solution when treated with yellow ammonium sulphide or sulphuretted hydrogen, first gives a dark brown solution, probably going to a lower oxidation product, and then becomes further reduced and precipitated. Solution of ammonia, too, reduces the substance, discharging the green colour, and giving probably cobalt-ammonium compounds.

Attempts were made to prepare the corresponding nickel compound, but they were unsuccessful.

If instead of adding potassium bicarbonate and bromine to cobalt carbonate, sodium acetate and bromine be added, a dark brown solution is obtained. The same process for nickel gives a solution of the colour of potassium bichromate solution; but on boiling, a part of the nickel salt comes down as a violet precipitate, whereas in the case of cobalt no such precipitate comes down. These would seem to be lower oxidation products than the one mentioned above; for when to the brown cobalt solution containing excess of bromine, potassium bicarbonate solution is added, again the green solution referred to above is obtained. That nickel should give only the lower oxidation product, and that, even this should decompose on boiling is accounted for by the more basic nature of nickel.

It is suggested that the formation of these salts may, possibly, be represented by the following equations:—

(1) $CoCO_3 + 2Br_2 + 6KHCO_3 = K_3CoO_4 + 7CO_2 + 4KBr + 3H_2O$.

(2) (*a*) $6NiCO_3 + 2CH_3CO.ONa + 3Br_2 = Na_2Ni_2O_6 + 3NiBr_2 + (CH_3CO.O)_2Ni + 6CO_2$.

(*b*) $Na_2Ni_2O_6 + (CH_3CO.O)_2Ni = 3NiO_2 + 2CH_3CO\text{-}ONa$.

It has been said above, that the nickel solution decomposes on boiling, a *part only* of the nickel coming down, leaving a neutral solution of apple-green colour.

An Account of the Reptilia collected by Dr. F. P. Maynard, Captain A. H. McMahon, C.I.E., and the Members of the Afghan-Baluch Boundary Commission of 1896.—*By* A. Alcock, M.B., C.M.Z.S., *Superintendent of the Indian Museum, and* F. Finn, B.A., F.Z.S., *Deputy Superintendent of the Indian Museum.*

Plates XI–XV.

[Received 10th September, 1896; Read 2nd December, 1896.]

The Reptiles mentioned in this paper were collected by the Members of the Afghan-Baluch Boundary Commission, in the early part of the present year, in the course of the demarcation of the boundary-line between Baluchistan and Afghanistan. They include several extremely rare, and two new, species of Lizards and two new snakes—a *Lytorhynchus*, and a Viper which forms the type of a new genus.

The nature of the country in which they were collected is briefly described in the following introductory note by Dr. F. P. Maynard, I.M.S., who has also contributed field notes on the habits, colouration, etc., of the several species.

All Dr. Maynard's notes are enclosed between square brackets.

[1. *Note on the Physical Features of the country traversed by the Commission.—By* Dr. F. P. Maynard, I.M.S.]

[Spintijha, where the collecting began, is 6050 feet above sea level, and is situated among the Khwaja Amran mountains south of Chaman. There is here what is stated to be an earthquake crack running north-east to south-west. It runs at right angles to the natural drainage of the country, and is supposed to have opened and partially closed within the memory of man. Captain McMahon had previously traced it as far north as Murgha Chaman, and on this mission it was traced south nearly as far as Nushki, a total length of about 100 miles. The rocks on its western side are igneous and on its eastern sedimentary.

From Spintijha we struck the Lora River, and followed its course south to its termination in the plains of Shorawuk and Nushki. Game was abundant all along the river and most of the birds obtained were shot round about Sáhib Záda Kili, a village at the northern end of Shorawuk, which is all Afghan territory. Near this village the waters of the Lora river are diverted into irrigation channels, and used for turning wheat-grinding mills. In February, at the time of our visit, wheat and barley crops were coming on well, and the plain appeared fertile. This appearance was confirmed by the numerous large *pukka* built villages. After leaving them we practically met with no more inhabitants, a few nomad families being the only people we saw.

From Nushki onwards to Robat I, the country was of a more desert character, and water was scarce. Barren rocky mountains alternated with intervening sandy plains. We crossed the northern end of the Lora Hamun. This is a large area of flat desert '*pat*' which, having been occasionally flooded with water, has become covered with a thin saline coating, and is now one huge white level plain about 36 miles by 10 miles in area. It is without vegetation save for an occasional low bush. All the same some lizards were caught far from its edge, and we had a magnificent three miles gallop after '*gad*' (antelope) which seemed to be fairly numerous and very wary and fleet.

Robat I is situated just south of the Koh Malik-do-khand, on the bank of a small stream. This *Koh* is a remarkable granite mountain with a double peaked top which gives it its resemblance to a double crowned tooth,—the meaning of the name it bears. Although there is said to be a *ziarat* (shrine) on the summit of the blunter peak, its sides are very precipitous and appear unscaleable, and rise straight up 2500 feet from the plain below, making the hill the most striking looking object for fifty miles round. On some rocks at the foot were scratched several rough sketches of ibex. Near the northern foot were some beds of red and white marble. There was also a hot spring credited with medicinal powers. The water contained chiefly sulphate of magnesium.

From Robat I to Robat II (the word *robat* signifying *outpost* and being common all over Afghanistan), at the foot of the Koh-i-malik Siah, the country is desert pure and simple. The route skirted along the northern foot of successive barren mountain ranges and crossed alternate gravel plains (*dasht*) and sand mountains. "Sandhill" does not describe these, as they are not composed of sand entirely, but are really rocky hills that have become buried in sand. Vegetation was very scanty and water even more so. Water was only met with in about seven places in the 270 miles, and was always saline and generally scanty, being found either in springs or by digging wells.

Two salt lakes were seen. The Gaud-i-Zirreh, some 60 by 20 miles in size, is formed by overflow water from the Helmund river. The last flood was in 1884, but the lake is still very large. The water is intensely salt from evaporation. At its western end the lake receives the Shelag river, which is now dry, except near Godar-i-Shah, where a small salt lake still exists in the river bed. We dug wells near its banks and obtained very brackish drinking water. At Robat II, where Baluchistan, Afghanistan, and Persia meet, are the remains of extensive old copper smelting furnaces, and the hills round are said to be rich in metals.

The only inhabitants of the desert plains seemed to be wild asses and lizards. In the different mountain ranges, Sultán Koh, Kacha Koh, etc., were seen ibex, markhor and oorial, but a few ibex only were obtained. The Sultán Koh are rich in assafœtida, sulphur and some dyes.

We experienced great variations in the way of climate. In February, while still among the Khwaja Amran and Sarlat mountains, the cold was intense. The thermometer was 15·5° below freezing point, and frozen soda-water, bath water and bread were common occurrences. Snow and hail fell frequently. Later on, in April and May, the heat was equally intense. Shade temperatures read up to 115°, and the solar radiation thermometer often registered 205°, the highest point to which the instrument could rise. Violent dust and sand storms occurred daily and "dust devils" literally swarmed. I have counted as many as twenty-six in sight at one time. They varied in size from tiny ones 18 inches high by two or three inches in diameter up to real whirlwinds, a hundred yards across and nearly a quarter of a mile in height, advancing in a grand and destructive manner, whirling everything along with them.

Even comparatively small ones were much dreaded and left a line of fallen tents and scattered contents in their track whenever they passed through the camp. They invariably revolved the reverse way to watch hands and behaved generally as miniature cyclones. *Miráges* were common, and some of the best were seen in the early chill mornings before the sun had risen, or just as it rose. In the absolute sandy desert a red haze was noticed round the moon: not a halo, but a diffused redness, more intense near the moon, and fading away very gradually into the surrounding sky. It was particularly well marked after sandstorms. The dryness of the air in the desert was extreme, the difference between the dry and wet bulb thermometers being frequently 30° to 40°. Thanks to the unusual rain in February—there had been none for two years previously—the hot weather was much delayed, and this it was that enabled the Mission to stay as late as it did. When leaving Robat I in the middle of May, the hot west winds were just

beginning to blow. Usually they begin early in April, and the inhabitants much dread their terrific heat, which they say shrivels everything up, and compels them to remain shut up in their tamarisk houses all day. Our slight experience of them before they had reached their full strength quite bore out these statements, and made us very thankful to get out of the country and back to civilisation. The 307 miles march from Robat I back to Quetta (done in 14½ days including two days' halts) was very trying indeed.

I take this opportunity of thanking Captain McMahon, C.I.E., British Commissioner, Captain H. F. Walters, 24th Baluchistan Regiment, Mr. G. P. Tate, Survey of India, Lieutenant F. C. Webb-Ware, 7th Bombay Lancers, Mr. Nicol Cumming, Head Clerk, Mir Shamshah, Faqir Ahmed, and others with the Mission for their enthusiastic help in collecting.]

2. *List of the Species Collected.*

In this list the principal reference in every case is intended to be to Mr. Boulenger's Standard Volumes—the *British Museum Catalogue of Reptiles*, and the *Reptilia and Amphibia* of the *Fauna of British India* Series. References are also given to citations of later date than the date of publication of those volumes, and to species *figured* in Mr. W. T. Blanford's *Zoology of Eastern Persia*, although the latter, of course, are to be found in Mr. Boulenger's synonymies.

LACERTILIA.

Family Geckonidæ.

1. *Teratoscincus scincus* (Schleg.)

Teratoscincus scincus, Boulenger, Brit. Mus. Cat. Lizards, I. 12: Ann. Mag. Nat. Hist. (v) XIX. 1887, p. 384: Trans. Linn. Soc. Zool. (ii) V. 1889, p. 94, pl. viii. fig. 1: P. Z. S. 1891, p. 629.

Teratoscincus keyserlingii, Strauch, Mem. Ac. Sci. Petersb. XXXV. 1887, Art. 2, p. 68: Boettger, Zool. Jahrbuch., Syst. etc., III. 1888, p. 878.

[Two specimens. One was caught by Captain McMahon, at 2·30 A.M. on a moonlight night, in the desert between Drana Koh and Zeh, elevation 3000 feet. It ran in spurts from bush to bush and was difficult to catch. It was marked with ten broad black cross-bands on the back and upper surface of the tail, with some reddish-brown scales between: abdomen and throat white: head marked above with black and dark brown. Skin very delicate and fragile—like human skin to the touch.

The other was caught near Robat I, on the sand by a stream.

The natives regard this species as poisonous.]

2. *Ceramodactylus affinis*, Murray.

Ceramodactylus affinis, Boulenger, Brit. Mus. Cat. Lizards, I. 14.

Three specimens differing from the description (*loc. cit.*) in having five broken cross-bands across the dorsum, instead of four.

[Caught near Robat I. Colour in life the same as in spirit].

3. *Stenodactylus orientalis*, Blanford.

Stenodactylus orientalis, Boulenger, Brit. Mus. Cat. Lizards, I. 16: Fauna Brit. Ind., Rept., p. 57, fig. 21.

Colours in spirit pale sandy; a dark band along either side from the snout, through the eye, to the thigh; dark brown reticulations on the upper surface.

[Colours in life: three irregular yellow longitudinal bands, with brownish-black stripes intervening, from top of head to tail: under surface of body and limbs delicate pinkish.]

4. *Gymnodactylus*, sp.

Two small tail-less specimens, apparently near *G. Kachhensis*, Stol.

5. *Agamura cruralis*, Blanford.

Agamura cruralis, Boulenger, Brit. Mus. Cat. Lizards, I. 50: Fauna Brit. Ind., Rept., p. 71, fig. 23.

[Colours in life: five dark cross-bands with fawn-coloured bands between: similar narrower bands on legs and tail: ventral surface white, chin and throat dotted with black. One caught at Kacha (elev. 3300 ft.) was rich reddish sand-colour, with four dark cross-bands and numerous round raised yellow spots on the back; tail with light and dark bands above, yellowish white below; belly white, throat finely speckled with brown; head sandy-brown with fine yellow dots. Iris greyish brown. It was noticed in this—and subsequently in several other species—that there was no consensual reaction of the pupils to light: each pupil contracted to light and dilated in shade independently of the other. This species often bit fiercely at one's finger.]

6. *Agamura persica*, Blanford.

Agamura persica, Boulenger, Brit. Mus. Cat. Lizards, I. 51: Trans. Linn. Soc. Zool. (ii) V. 1889, p. 95, pl. ix. fig. 2: Strauch, Mem. Ac. Sci. Petersb. XXXV. 1887, Art. 2, p. 53: Werner, Verh. zool. bot. Ges. Wien, XLV. 1895, p. 14.

[Ten young specimens of all sizes caught along whole line of march. Nine brownish cross-bars on back; brownish cross-bars on legs: general colour semitransparent: velvety to the touch. Iris with

a yellow inner margin. The youngest, which was caught at night, had no definite colouration.]

Family **Agamidæ.**

7. *Agama isolepis*, Boulenger.

Agama isolepis, Boulenger, Brit. Mus. Cat. Lizards I. 342: Trans. Linn. Soc. Zool. (ii) V. 1889, p. 96, pl. x: Faun. Brit. Ind., Rept., p. 147, fig. 43.

[A very common species all over the country after leaving Lijji Talao.

In general the throat and the under surface of the body and thighs were cobalt blue, fading in the dark but deepening in bright daylight; a round bright yellow spot, the size of a hemp-seed, on each side of the neck behind the ear; iris brown. Brownish diamond-shaped spots on the back gave the animal, when at rest, some resemblance to an *Echis*. All the specimens were caught on the ground, and though they sometimes hid under bushes, none were seen on bushes. In some specimens eggs were present.]

8. *Agama nupta*, De Fil.

Agama nupta, Boulenger, Brit. Mus. Cat. Lizards, I. 365: Faun. Brit. Ind., Rept., p. 151.

Stellio nuptus, Blanford, Zool. E. Persia, II. 317, pl. xix. fig. 1.

[Four specimens, three caught on black rock at the foot of Koh Málik-do-khand, 5000 feet. Colour iron-black, in one alone the ventral surface was white. The tails broke readily.]

9. *Phrynocephalus olivieri*, Gray.

Phrynocephalus olivieri, Boulenger, Brit. Mus. Cat. Lizards, I. 371: Trans. Linn. Soc. Zool. (ii) V. 1889, p. 96, pl. viii. fig. 2: Faun. Brit. Ind., Rept., p. 153, fig. 44: F. Werner, Verh. zool. bot. Ges. Wien, XLV. 1895, p. 16.

Not uncommon.

10. *Phrynocephalus ornatus*, Boulenger.

Phrynocephalus ornatus, Boulenger, Brit. Mus. Cat. Lizards, III. 496: Trans. Linn. Soc. Zool. (ii) V. 1889, p. 97, pl. viii, figs. 3, 3*a*–*c*: Faun. Brit. Ind., Rept., p. 154.

[Thirty specimens. Common all along the line of march, from Nushki onwards.]

11. *Phrynocephalus maculatus*, Anderson.

Phrynocephalus maculatus, Boulenger, Brit. Mus. Cat. Lizards, I. 377: Trans. Linn. Soc. Zool. (ii) V. 1889, p. 97, pl. ix. fig. 3: Faun. Brit. Ind., Rept., p. 155.

Twenty-one specimens.

12. *Phrynocephalus euptilopus*, n. sp. Plate XII.

Head much depressed, snout extremely short; a row of enlarged projecting imbricate scales borders the supra-orbital region and extends anteriorly nearly to the nasals; upper head-scales small, obtusely keeled, not enlarged on occipital region; nostril turned upwards; nasals in contact or separated by one scale; about three series of scales between the orbit and the upper labials.

Dorsal scales small, homogeneous, imbricate, smooth or keeled, not enlarged on vertebral region; small projecting spinose scales on the side of the head and neck; a fold along the flanks.

Gular scales pointed, smooth or very feebly keeled; pectoral and ventral scales sharply mucronate, the former smooth or feebly keeled, the latter smooth.

Scales on limbs smooth or keeled; fringe at back of thigh not usually present. Tibia longer than skull. The adpressed hind limb reaches the eye or the snout. Toes very long, the second, third and fourth with progressively longer fringes of pointed scales on each side; on the fore-foot the fifth also with a double fringe; remaining toes with a single fringe.

Tail depressed, tapering to a point, covered with keeled scales above and at the tip; lower caudal scales for about the proximal half of the tail smooth; the length of the tail about equals that of the head and body.

Colours in spirit sandy, greenish on the head, spotted and vermiculated with blackish, more strongly on the sides and limbs. In all the six specimens collected by the Mission there are some large black roundish spots on the vertex of the head and on the anterior part of the dorsum. Of these, *five*, situated one on the nape, and two on and two just behind the shoulders, are very large, and are *constant*. End of tail black below and generally above.

A large specimen measures:—

Total length...	...	...	...	4·8	in.
Head ...	...	...	...	·35	,,
Width of head	...	...	...	·35	,,
Snout to vent	...	...	...	2·45	,,
Fore limb ...	...	...	...	1·25	,,
Hind limb ...	...	...	...	2·0	,,
Tail ...	...	...	...	2·35	,,

This species comes nearest to *P. interscapularis*, Lichtenst. (Brit. Mus. Cat. Lizards, Vol. I, p. 378) but differs chiefly (actual specimens compared) in the following points:—

1. The new species is very much larger.

2. The pectoral and ventral scales are much more sharply mucronate.
3. The digits are very much more strongly fringed.
4. The colouration is strikingly different.

[All six were caught in April, near Darband, elevation 3000 feet. Darband is a small hollow in the sandy desert, with a couple of wells—the only water for 80 miles.

The lizards were caught on reddish sand, into which, on being approached, they wriggled with such rapidity that they were with difficulty followed. Before burrowing into the sand one would sometimes sit and look at you, gently waving its tail in the air, like a cat before making a spring. The colours have much faded in spirit. In life the back was rich golden brown with the jet-black spots standing out like velvet: the throat in one was lavender, in others salmon pink: the belly was a beautiful silvery white. The upper surface of the limbs presented a lovely golden sheen; the top of the head was metallic green; the distal half of the tail was black.]

13. *Phrynocephalus luteo-guttatus*, Boulenger.

Phrynocephalus luteo-guttatus, Boulenger, Brit. Mus. Cat. Lizards, III. 497: Trans. Linn. Soc. Zool. (ii) V. 1889, p. 98, pl. viii. figs. 4, 4*a*-*c*: Faun. Brit. Ind., Rept., p. 155. F. Werner, Verh. zool. bot. Ges. Wien, XLV. 1895, p. 16.

Twenty-eight specimens.

14. *Uromastix asmussii*, (Strauch).

Uromastix asmussii, Boulenger, Brit. Mus. Cat. Lizards, I. 409.
Centrotrachelus asmussii, Blanford, Zool. E. Persia, II. 337, pl. xxi.

Two specimens were brought down alive, but they did not thrive. The largest measures just over twenty inches.

[Three others were caught but got away. When caught they were very fat, and the colour of the back was buff with some of the enlarged tubercles orange-colour. When kept in a closed box they turned to an iron-grey colour and the orange faded entirely, but if removed into sunshine the original colour returned—at first rapidly, but after some weeks captivity only after some hours' exposure to light. The head and limbs at all times were of a dull grey colour.

These lizards live in large wide-mouthed holes in stony ground, at the foot of the Kacha Koh. The burrows, which are altogether about three or four feet long, run obliquely for the first foot or eighteen inches, and then bend sharply at a right angle. The tail of this lizard is a formidable weapon: it is lashed out in defence, and it is probably used to clear the ground while burrowing.

The lizards were only to be seen either in the early morning or in the evening: in captivity they avoided, and appeared to dislike, the hot sun. The natives assert that they eat snakes, which is unlikely. Their stomachs were greatly distended with tamarisk usually. The natives also extract from them an oil which is used for rheumatism and as an aphrodisiac. It is said that the lizards sleep at the mouths of their burrows, and that shikarris catch them by creeping up and breaking in the roof of the burrow with a large stone so as to block the burrow from behind.

Family **Varanidæ.**

15. *Varanus griseus* (Daud.)

Varanus griseus, Boulenger, Brit. Mus. Cat. Lizards, II. 306: Trans. Linn. Soc. Zool. (ii) V. 1889, p. 99: Faun. Brit. Ind., Rept., p. 163. Boettger, Zool. Jahrbuch. Syst. etc. III. 1888, p. 904.

[One, caught by a sepoy on the Shorawuk plain, was placed, when brought in, near some dead snakes, which it at once attacked, biting one of them savagely. Its colour was brick-red with dark greenish-black cross-bands.

Another, 3 feet long, was caught under a bush near Robat I. It made no attempt to escape, but attacked and bit my hunting-crop, raising its head and body off the ground, puffing itself out and hissing loudly. It had greyish-green cross-bands on the back, with irregularly disposed pink scales between, and a pink tinge on the throat.]

Family **Lacertidæ.**

16. *Acanthodactylus cantoris*, Gthr.

Acanthodactylus cantoris, Boulenger, Brit. Mus. Cat. Lizards, III. 61: Trans. Linn. Soc. Zool. (ii) V. 1889, p. 99: Faun. Brit. Ind., Rept., p. 170. Blanford, Zool. E. Pers. II. p. 381, pl. xxvi. figs. 3, 3*a-b*. Werner, Verh. zool. bot. Ges. Wien, XLV. 1895, p. 16.

Nineteen specimens.

[Common west of Barabchah. In one specimen the back was brown with a metallic sheen; in another, uniform brown, finely grained.]

17. *Eremias guttulata*, (Licht.)

Eremias guttulata, Boulenger, Brit. Mus. Cat. Lizards, III. 87: Trans. Linn. Soc. Zool. (ii) V. 1889, p. 99: Faun. Brit. Ind., Rept., p. 177: P. Z. S. 1891, p. 630: T. Z. S. XIII. 1891, p. 132. Werner, Verh. zool. bot. Ges. Wien, XLIV. 1894, p. 82 and XLV. 1895, p. 16.

Nine specimens.

[Found the whole way from Nushki to the Persian border. They ran fast from bush to bush, and entered holes. The brownish colour they had when fresh has faded in spirit.]

18. *Eremias velox* (Pall.)

Eremias velox, Boulenger, Brit. Mus. Cat. Lizards III. 97: Trans. Linn. Soc. Zool. (ii) V. 1889, p. 99: Faun. Brit. Ind., Rept., p. 178. Boettger, Zool. Jahrbuch., Syst. etc., III. 1888, p. 910. Werner, Verh. zool. bot. Ges. Wien. XLV. 1895, p. 16.
Eremias persica, Blanford, Zool. E. Pers. II. p. 370, pl. xxvi. figs. 1, 1a.

Eleven specimens.

[The majority were caught at Panjpai, not far from Quetta. These ran very sluggishly, and made for bushes.]

19. *Scaptira scripta*, (Strauch.)

Scaptira scripta, Boulenger, Brit. Mus. Cat. Lizards, III. 112. Boettger, Zool. Jahrbuch., Syst., etc., III. 1888, p. 914.

Three specimens.

[One, obtained by Captain McMahon on the sand hills between Sorn and Darband, 3500 feet, had a minute black mosaic pattern over the back: the abdomen was white: the upper surface of the limbs was black with small round yellow spots.]

20. *Scaptira aporosceles*, n. sp. Plate XIII.

Snout conical, acutely pointed; loreal region nearly vertical. Nasals slightly swollen, lower not reaching the rostral, but approaching it closely; upper forming a long median suture. Frontal strongly grooved throughout, the groove continued along the vertex of the snout to the anterior end of the fronto-nasal; three large supra-oculars, forming sutures with each other, the first in contact with the first supraciliary, the second loreal, the praefrontal, and generally the frontal; the second and third completely surrounded by a series of granules, separating them from the supraciliaries, the fronto-parietals, the frontal, the first supra-ocular, and the small band-like posterior supra-ocular; one of these granules commonly develops into a small shield separating more or less completely the first supra-ocular from the frontal. Interparietal lozenge-shaped; no occipital; parietals forming a suture behind the interparietal; no enlarged scales on the outer border of the parietals; temporal scales granular, smooth; no auricular denticulation; subocular not reaching the lip, resting usually on the sixth, seventh and eighth, or fifth, sixth, and seventh, upper labials; the first two pairs of chin-shields and generally the third pair also, in contact.

Collar nearly straight, the marginal scales feebly enlarged. Dorsal scales minutely granular, smooth, equal. Ventrals equilateral or longer than broad, forming oblique longitudinal series; about 35 transverse series, the longest of which contain about 22 plates.

Prae-anal plate single or divided.

The adpressed hind-limb reaches about to the ear or the eye; foot about as long as the distance between the arm and the nostril. Digits flattened, smooth or keeled inferiorly, strongly fringed laterally; the ungual lamellae much enlarged, forming a suboval disc: a series of large sub-tibial shields. *No femoral pores.*

Caudal scales smooth or more or less feebly keeled. Tail about once-and-a-half to twice length of head and body.

One specimen has the anterior loreal on each side double, or rather two small shields are cut off laterally from the fronto-nasal. The subocular may be in contact with two labials only.

Colour in spirits blackish, spotted with whitish; tail blackish above, with ill-defined light median streak; head brownish grey, speckled with black; lower surface white.

A large specimen measures:—

Total length	...	...	...	8·0	in.
Snout to vent	...	...	...	2·75	„
Head ...	...	...	...	·8	„
Width of head	...	...	...	·5	„
Snout to fore limb	...	...	...	1·15	„
Fore limb ...	...	...	...	1·0	„
Hind limb ...	...	...	...	1·75	„
Tail ...	...	...	...	5·25	„

This species is nearest to *S. acutirostris*, Boulenger, (Brit. Mus. Cat. Lizards, Vol. III, p. 114) but differs (on comparison of actual specimens) from that species in the following characters:—In the new species—

1. The lower nasal shield approaches the rostral more closely than it does in *S. acutirostris.*
2. The vertex of snout (frontal, praefrontal, and fronto-nasal regions) is very much more deeply grooved.
3. The prae-anal plate, which in the new species may be either single or divided, is also relatively very much smaller than in *S. acutirostris.*
4. The fringing of the digits is much more distinct than in *S. acutirostris*, and the ungual lamellae form much broader disks than in that species.

5. The femoral pores, which in *S. acutirostris* are remarkably distinct, are absent in the new species.

Twenty-five specimens.

[Common west of Robat I. Colours in life: back brownish yellow, with lighter-coloured circular spots. Tails fragile. They ran very fast, made for bushes, and entered holes. In general colouration they resembled *Phrynocephalus luteoguttatus.*]

Family **Scincidæ.**

21. *Ablepharus brandtii*, Strauch.

Ablepharus brandtii, Boulenger, Brit. Mus. Cat. Lizards, III. 351: Trans. Linn. Soc. Zool. (ii) V. 1889, p. 100: Faun. Brit. Ind., Rept., p. 213. Boettger, Zool. Jahrbuch., Syst., &c., III. 1888, p. 917.

Blanford, Zool. E. Pers. II. p. 391, pl. xxvii. figs. 1, 1*a*.

A single specimen.

22. *Ophiomorus tridactylus* (Blyth).

Ophiomorus tridactylus, Boulenger, Brit. Mus. Cat. Lizards, III. 394, Bull. Soc. Zool. France, XII. 1887, p. 520: Trans. Linn. Soc. Zool. (ii) V. 1889, p. 101: Faun. Brit. Ind., Rept., p. 222, fig. 59, p. 221.

Eighteen specimens.

[Very common wherever there is sand, but they are hard to catch, as they dive below the surface at the first sign of danger, working into the sand as a snake goes into a hole. They can only be obtained by following up the faint tracks that they leave on the surface of the sand, and digging where the track comes to an end. They are said to be very numerous round Chaman. They are in great request among the natives, who fry them alive in a closed vessel and thus obtain from them a burnt oil of nauseous appearance which is believed to be of great value in impotence.]

OPHIDIA.

Family **Glauconiidæ.**

23. *Glauconia blanfordi*, Boulenger.

Glauconia blanfordi, Boulenger, Faun. Brit. Ind., Rept., p. 243, fig. 72: Brit. Mus. Cat. Snakes, I. 66.

[Two specimens found beneath a rock which was being lifted to build the last boundary pillar, on the highest peak of the Koh-i-malik Siah, 5000 feet, 16th April. They were of a pink colour in life, and wriggled very actively.]

Family Colubridæ.

24. *Lytorhynchus ridgewayi*, Boulenger.

Lytorhynchus ridgewayi, Boulenger, Ann. Mag. Nat. Hist. (v) XX. 1887, p. 413: Trans. Linn. Soc. Zool. (ii) V. 1889, p. 102, pl. xi. fig. 1: Brit. Mus. Cat. Snakes I. 415.

The sub-ocular (so-called) poison-gland is well developed, and is of different consistence, to the naked eye, from the upper-lip gland.

[One specimen caught alive at Saindak, 3000 feet, had a noteworthy resemblance to an *Echis carinata* caught at the same time and place.]

25. *Lytorhynchus maynardi*, n. sp. Plate XIV.

Snout pointed, moderately long. Rostral large; viewed from above it is anchor-shaped, the narrow beam of the anchor separating the inter-nasals in about two-thirds of their extent, and the flukes of the anchor embracing the nasals and first upper labials; viewed from below it is shaped like a pointed shovel, the posterior edge of the shovel being conspicuously notched in the middle line to receive a leaf-like process of the mental shield. Nostril a long, narrow, oblique chink. A pair of præ-frontals: frontal not quite three-fourths the length of the distance between its anterior edge and the tip of the snout, rather more than three-fourths the length of the parietals, anteriorly more than twice the greatest breadth of the supra-oculars. Two loreals, the anterior small. A ring of small scales surrounding the eye, of which two are præ-ocular, two post-ocular, and three subocular. Temporals 2+2, the posterior hardly larger than the adjacent scales. Seven upper labials, none of them entering the eye: ten lower labials, four of which are in contact with the anterior chin-shields: mental trilobed, the middle lobe fitting into the notch in the posterior edge of the rostral: two pairs of chin-shields of about equal size.

Scales smooth, in nineteen rows, not including the ventral scutes. Ventrals rather acutely angulated on either side, about 192: anal divided: sub-caudals about 55.

Colours in spirit: cream-colour with a faint pinkish flush on the dorsal surface, and with a close series of large transversely-oblong brownish-black patches or bars: along either side a series of small lighter spots alternating with the dorsal bars: frontal and parietals almost entirely blackish-brown, the colour being continued down the nape, in the middle line, as a broad stripe: a narrow dark line through the eye and temple.

The largest perfect specimen measures at least fifteen inches, of which the tail makes about 2¾ inches.

The subocular so-called poison-gland is well developed.

One of the specimens, although only about $\frac{3}{16}$ in. in diameter at the throat, has swallowed a *Scaptira* of our new species more than seven inches long and nearly half an inch in diameter.

Four specimens.

[Near Robat I, 4500 feet, in May. The colour in life was striking, the general colour of the upper surface being bright salmon with blackish-brown bands.]

26. *Zamenis diadema*, Russell.

Zamenis diadema, Boulenger, Fauna Brit. Ind., Rept., p. 328: Brit. Mus. Cat. Snakes, I. 411: Werner, Verh. zool. bot. Ges. Wien, XLV. 1895, p. 18.

The subocular "poison-gland" is very large.

[Nine specimens caught between Lijji Talao and Barabchah, 2400 to 4500 feet.]

27. *Zamenis Karelinii*, (Brandt).

Zamenis karelinii, Boulenger, Faun. Brit. Ind., Rept., p. 326: Brit. Mus. Cat. snakes, I. 401.

The subocular "poison-gland" is more than twice the length of the eye.

28. *Zamenis rhodorachis*, Jan.

Zamenis rhodorhachis, Boulenger, Brit. Mus. Cat. Snakes, I. p. 398.
Zamenis ladacensis, Boulenger, Faun. Brit. Ind., Rept., p. 326.

The subocular "poison-gland" is large.

[Fifteen specimens between Gazichah and Robat I. None had red stripes. Scales fine brown, with green edging. They were said by the natives to be poisonous, but they were not fierce.]

29. *Taphrometopum lineolatum*, Brandt.

Coluber (Taphrometopon) lineolatus, Brandt., Bull. Ac. Sci. Petersb. III. 1837, p. 243.
Taphrometopon lineolatum, Boulenger, Brit. Mus. Cat. Snakes, III. p. 151 Blanford, Zool. E. Pers. II. p. 422.

The subocular "poison-gland" is well developed. The stomach of one specimen contained a small passerine bird.

[Nine specimens between Barabchah and Robat, about 4500 feet. The colour of one specimen in life was grey-yellow with fine black dots in two rows along the back: a black line running backwards from each eye.]

Family Viperidae.

Eristicophis, n. gen.

Head very distinct from neck, covered with small feebly-imbricate scales: eye small, with vertical pupil, separated from the labials by small scales: nostril directed upwards and outwards, forming a valve-like slit at the summit of an enlarged nasal, the nasal separated from the rostral by an enlarged rostro-nasal shield. Body cylindrical, scales in 23 to 24 rows, with simple (*i.e.*, non-serrated) keels, the keels not extending to the tip of the scales: lateral scales varying in size, not or hardly smaller than the dorsals, and hardly oblique: ventrals with a well-defined keel on either side. Tail short, sub-caudals in two rows.

In Mr. Boulenger's Key (Cat. Snakes Brit. Mus. Vol. III. p. 465) this form finds a place in Section II, with *Vipera*, *Echis*, *Cerastes*, &c. It does not, however, fit into any of the three sub-sections of the *Key*; since, while it has the lateral scales not, or not noticeably, smaller than the dorsals, and the keels of the scales not serrated, and the sub-caudals in two rows, it has the ventrals angulate laterally—more sharply angulate even than *Cerastes*.

We are indebted to Mr. G. A. Boulenger, F.R.S., for the opinion that this Viper is worthy of generic rank.

We are also much indebted to Mr. Boulenger for facilities afforded to one of the authors of this paper for comparing specimens.

30. *Eristicophis Macmahonii*, n. sp. Plate XV.

Snout square, even emarginate by reason of the projection of its wing-like angles and of the slight dorsal concavity of the middle line. The rostral region is covered by 5 scales, the surfaces of none of which are visible from above: these scales are disposed as follows:—(1) a true rostral bounding the mouth, concave, horse-shoe-shaped, from two to three times as broad as high; (2) above and on either side of 1, a pair of pear-shaped scales with projecting edges and concave surface, forming the wing-like angles of the snout; (3) between 1 and 2, a pair of little scales hardly differing from those that form the general investment of the head. The tips of these last are sometimes visible from above.

Nostrils large, valvular, directed upwards and backwards, pierced in the upper and posterior angle of a large nasal.

Scales of the head hardly imbricate, strongly carinate, none of them enlarged except one above either nostril and one at either outer angle of the snout; in thirteen or fourteen very irregular rows between the eyes: four series of scales between the eye and the upper labials: at least five rows of scales between the nostril and the eye.

Fourteen or fifteen upper labials slightly increasing in size from before backwards: sixteen to eighteen lower labials, the first three or four times as large as the second, the rest slightly decreasing in size from before backwards: a pair of chin-shields, separated, especially posteriorly, by a distensible scaleless space: mental acutely triangular.

Scales of the body strongly keeled, arranged in very regular transverse rings, 23 to 24 in each ring, not including the abdominal scute. Although the scales are imbricate, yet their imbrication is rendered obscure by the presence of a good deal of naked skin both between the rings and between the individual scales of each ring.

Ventrals about 140 to about 150, conspicuously angled on either side.

Tail about half again as long as the head, with sub-caudals in two rows, on about the distal half becoming quite similar to the rather strongly imbricate scales on the other surfaces of the posterior half of the tail. The tip of the tail is formed by a single conical scute.

Colours in spirit: dull dirty sandy grey, with a row of small black and white blotches (seldom involving more than 2 or 3 scales) along each side, these being much more distinct in the young: some dark peppering above and at the sides, also most marked in the young.

The length of the largest perfect specimen is about two feet.

Six specimens.

[Amirchah, 30th March, 3300 feet, Zeh, 1st April, 2500 feet, Drana Koh, 2nd April, Robat I., May, 4300 feet. The largest, measuring 25·5 in., was heard making a very loud continuous hissing, as we left Camp Drana Koh at night; and it raised its head six or eight inches from the ground and struck at my stick when, after searching for it with a lantern, I advanced to kill it.

All were found on sand with which their colours harmonized well. In confinement they fed freely on lizards, but did not live long.

In life they were of a rich reddish sandy brown colour, and the spots along either side of the back were dark brown with a nearly-complete white marginal ring.]

31. *Echis carinata* (Schneid.)

Echis carinatus, Boulenger, Brit. Mus. Cat. Snakes, Vol. III. p. 505.

Echis carinata, Boulenger, Faun. Brit. Ind., Rept., p. 422. Matschie, Zool. Jahrbuch., Syst., etc., V. 1890-91, p. 617. Peracca, Boll. Mus. Torino, IX. 1894, No. 167, p. 17.

[Common along the line of march from Lijji Talao to the Persian Frontier.]

We should like to mention here that Dr. Turnbull and Colonels Holdich and Wahab, who were delimiting the Perso-Baluch Frontier simultaneously with the operations of the Afghan-Baluch Commission, also made a small but valuable collection of Reptiles. Among these, besides many of the species already mentioned, were two fine specimens of *Agama megalonyx* Günther, and a large specimen of *Lytorhynchus ridgewayi* Boulenger.

We may also note here that *Eublepharus macularius* Blyth, has been found in a small collection from Chitral made by Assistant-Surgeon F. J. Daly.

List of the Birds collected by the Afghan-Baluch Boundary Commission of 1896.—*By* F. Finn, B.A., F.Z.S., *Deputy Superintendent of the Indian Museum.*

[Read December 2nd, 1896.]

Dr. F. P. Maynard brought home from the Afghan-Baluch Boundary expedition a fine series of well-preserved bird-skins, but as they all belong to well-known species I shall confine myself to giving a nominal list, in which I follow the nomenclature and arrangement of the Bird volumes of the Fauna of British India series so far as these have progressed, and elsewhere as far as possible those of the British Museum Catalogue.

For a general account, with map, of the country traversed, the account of the Reptiles collected by the Commission, appearing in the present number of the Society's *Journal*, (Vol. LXV. Pt. II. No. 4. p. 550) may be consulted. Herein Dr. Maynard states that most of the birds were shot round about Sahib Zada Kili, a village at the northern end of Shorawuk, in Afghan territory.

Dr. Maynard also informs me that most of the specimens were obtained by Lieutenant F. C. Webb-Ware of the 7th Bombay Lancers.

List of the species collected.

1. *Corvus corax.*
2. *Corvus umbrinus.*
3. *Pica rustica.*
4. *Prinia lepida.*
5. *Lanius vittatus.*
6. *Lanius isabellinus.*
7. *Pratincola maura.*
8. *Saxicola albinigra.*
9. *Saxicola deserti.*
10. *Ruticilla erythronota.*
11. *Ruticilla rufiventris.*
12. *Cyanecula suecica.*

13. *Rhodospiza obsoleta.*
14. *Emberiza buchanani.*
15. *Ptyonoprogne obsoleta.*
16. *Motacilla alba.*
17. *Motacilla personata.*
18. *Motacilla feldeggii.*
19. *Motacilla citreola.*
20. *Alaemon desertorum.*
21. *Galerita cristata.*
22. *Dendrocopus sindianus.*
23. *Coracias garrula.*
24. *Upupa epops.*
25. *Caprimulgus mahrattensis.*
26. *Athene bactriana.*
27. *Neophron ginginianus.*
28. *Milvus migrans.*
29. *Circus macrurus.*
30. *Buteo ferox.*
31. *Accipiter nisus.*
32. *Tinnunculus alaudarius.*
33. *Columba intermedia.*
34. *Pteroclurus senegallus.*
35. *Pterocles arenarius.*
36. *Pterocles coronatus.*
37. *Caccabis saxatilis chukar.*
38. *Ammoperdix bonhami.*
39. *Houbara macqueenii.*
40. *Cursorius gallicus.*
41. *Sarcogrammus indicus.*
42. *Eurypterus lucurus.*
43. *Ochthodromus geoffroyi.*
44. *Ochthodromus mongolus.*
45. *Aegialitis dubia.*
46. *Himantopus himantopus.*
47. *Helodromas ochropus.*
48. *Gallinago gallinago.*
49. *Tuchybaptes minor.*
50. *Casarca rutila.*
51. *Anas boschas.*
52. *Mareca penelope.*
53. *Nettion crecca.*
54. *Spatula clypeata.*
55. *Nyroca africana.*
56. *Fuligula fuligula.*

In addition to these a pair of legs of a goose were brought, apparently of a Grey-lag. A sand piper (with yellow legs) was shot, but is not apparently in the collection.

INDEX.

Names of New Genera and Species have an asterisk (*) prefixed.

Ablepharus brandtii, 561
Acanthephyra, 93
„ *armata*, var. *fimbriata*, 93
„ *brachytelsonis*, 93
„ *cristata*, 88, 94
„ *curtirostris*, 94
ACANTHEPHYRIDÆ, 93
Acanthocarpus, 138
Acanthodactylus cantoris, 558
ACANTHOPTERYGII, 311
Accipiter nisus, 567
Acer caudatum, 115
* „ *Papilio*, 115
„ *pectinatum*, 115
Achirus cyanea, 329
„ *oculus*, 329
„ *umbratilis*, 329
Acridium, 540
ACRONURIDÆ, 315
Acropoma philippinense, 311
Actæa granulata, 172
Actæomorpha, 135, 165, 166, 170, 172
* „ *lapillulus*, 172, 173
* „ *morum*, 172, 296
Actinia, 533
Adlumia cirrhosa, 12
Aega, 88, 106
„ *ventrosa*, 106
Aegialitis dubia, 567
AEGIDÆ, 106
Agama isolepis, 555
„ *megalonyx*, 566
„ *nupta*, 555
AGAMIDÆ, 555
Agamura cruralis, 554
„ *persica*, 554
Alaemon desertorum, 567
Albunea dorsipes, 290
ALEPOCEPHALIDÆ, 334
Alepocephalus, 334
„ *bicolor*, 334
„ *blanfordi*, 334
„ *edentulus*, 334
Allophylus, 420, 422
„ *Cobbe*, 422
„ *lanatus*, 423
„ *ornitrophioides*, 423
Amblyopus arctocephalus, 320
Ammoperdix bonhami, 567
AMPELIDEÆ, 113, 384
Ampelocissus, 385
„ *Arnottiana*, 112
„ *barbata*, 388
„ *cinnamomea*, 390
„ *gracilis*, 389
„ *polystachya*, 390
„ *thyrsiflora*, 391, 392
Ampelopsis, 386
„ *Cantoniensis*, 398
„ *compositifolia*, 392
„ *Himalayana*, 112, 113, 397
„ *Neilgherrensis*, 113, 397
Amphiprionichthys apistus, 313
ANACANTHINI, 321
ANACARDIACEÆ, 117, 459, 512
ANACARDIAE, 460
Anacardium, 460, 479
„ *occidentale*, 479
Anas boschas, 567
Anauxanopetalum Schwenkii, 489
Anaxtochilus, 124
„ *Griffithii*, 125
„ *Roxburghii*, 125
* „ *sikkimensis*, 124
ANOMOLA, 99, 102
ANOMURA, 135
Antigonia, 316
„ *capros*, 316
Aphania, 420, 425
„ *Danura*, 425, 426
„ *montana*, 425, 426
„ *paucijuga*, 425
Aphoristia, 330
„ *gilesii*, 330
„ *septemstriata*, 330
„ *trifasciata*, 330
„ *wood-masoni*, 330
Aphyllorchis, 128
* „ *parviflora*, 128
Apistus leucogaster, 313
„ *trachinoides*, 313
Aporetica ternata, 423
APTERAE, 483
Aquilicia Ottilis, 415
„ *Sambucina*, 415
Araneus marinus, 217
Arcania, 135, 165, 167, 171, 201, 262
„ *erinaceus*, 264, 268
„ *gracilipes*, 262, 264, 270
„ *granulosa*, 266

Arcania lævimana, 268
„ *novemspinosa*, 264, 267, 268
„ „ var. *aspera*, 266
„ *orientalis*, 262
„ *pulcherrima*, 264, 269
„ *quinquespinosa*, 263, 266, 268
„ *septemspinosa*, 263, 264, 265, 268, 269
„ „ var. *gracilis*, 266
„ *tuberculata*, 264, 268
„ *undecimspinosa*, 264, 266, 267, 268, 269
Arctus, 98
„ *rubens*, 98
Argyropelecus, 331
„ *hemigymnus*, 331
Aristæina, 91
Aristæus, 91
„ *crassipes*, 91
„ *semidentatus*, 91
Arnoglossus, 327
„ *brevirictis*, 327
„ *macrolophus*, 327
Arytera, 421, 446
„ *littoralis*, 446
„ „ var. *major*, 446
Astacidea, 96
Astronium insigne, 493
Astropetalum, 489
Ateleopodidæ, 327
Atelcopus, 327
„ *indicus*, 327
Athene bactriana, 567
Aularches auiliaris, 540
Aulastomomorpha, 335
„ *phosphorops*, 335
Avicula zebra, 520
Axiidæ, 97
Bartsia, 59, 60
„ *Gymnandra*, 59, 64
Bathybembix woodmasoni, 529
Bathyclupea, 334
„ *hoskynii*, 334
Bathygadus, 326
„ *cavernosus*, 309
„ *cottoides*, 326
„ *furvescens*, 327
„ *longifilis*, 326
Bathymyrus, 337
„ *echinorhynchus*, 337
Bathyonus, 323
„ *glutinosus*, 323
Bathypercis, 317
„ *platyrhynchus*, 317
Bathypterois, 332
* „ *atricolor*, 306, 332
„ *guentheri*, 332
„ *insularum*, 332
Bathyseriola, 315
„ *cyanea*, 315
Bathytroctes, 334
Bathytroctes microlepis, 334
„ *squamosus*, 334
Bellidilia, 166
Bembrops, 316
„ *caudimacula*, 317
„ *platyrhynchus*, 317
Benthesicymina, 91
Bentheuphausia, 90
„ *amblyops*, 88, 90
Berchemia calophylla, 375
Berycidæ, 314
* *Blachia viridissima*, 455
* *Boopsetta*, 305, 329
* „ *umbrarum*, 305, 329
Bouea, 459, 460, 464
„ *Brandisiana*, 465
„ *burmanica*, 464, 465, 466
„ „ var. *microphylla*, 465
„ *diversifolia*, 465
„ *Gandaria*, 466
„ *macrophylla*, 464, 465
„ *microphylla*, 465
„ *myrsinoides*, 465
„ *oppositifolia*, 465, 466
Brachypleura, 327
„ *zanthosticta*, 327
Brachyura, 102
Branchipus, 538
* „ *bengalensis*, 538
„ *rubricaudatus*, 538
„ *torvicornis*, 538
* „ (*Streptocephalus*) *bengalensis*, 538
Brephostoma, 312
„ *carpenteri*, 312
Buchanania, 460, 462
„ *acuminata*, 463, 464
„ *arborescens*, 464
„ *auriculata*, 496
„ *bancana*, 464
„ *florida*, 462, 463
„ „ var. *lucida*, 464
„ „ „ *petiolaris*, 464
„ *lucida*, 464
„ *macrophylla*, 495, 496
„ *palembanica*, 464
„ *petiolaris*, 464
„ *platyneura*, 462
„ *polybotrya*, 464
„ *sessilifolia*, 462, 463
„ *splendens*, 462
„ *subobovata*, 464
Bulbophyllum, 119, 120, 121
„ *cylindricum*, 118
* „ *gracilipes*, 119
„ *leptanthum*, 118
„ *parvulum*, 118
„ *zylophyllum*, 120
Burbidgea, 297, 298
„ *nitida*, 297
Buteo ferox, 567

Caccabis saxatilis chukar, 567
Calanthe, 121
„ *Mannii*, 122
„ *Whitcana*, 121
Calappa, 135, 137, 138, 139, 140, 149, 152, 153, 174
„ *cristata*, 145
„ *depressa*, 148
„ *exanthematosa*, 141, 146
„ *fornicata*, 141, 142
„ *gallus*, 140, 146
„ *guerini*, 144, 145
„ *hepatica*, 141 142, 144
„ *lophos*, 141, 144, 145, 148
„ *philargius*, 141, 145
„ *pustulosa*, 140, 147, 296
„ *sandwichica*, 143
„ *spinosissima*, 141, 144
„ *tuberculata*, 143, 144
„ *tuberculosa*, 143
„ *wood-masoni*, 140, 148, 296
CALAPPIDÆ, 103, 134, 135, 136, 137, 138, 139, 164
CALAPPIDEA, 137
CALAPPIENS, 137
CALAPPINÆ, 135, 136, 137, 138, 139
CALAPPINEA, 134
CALAPPOIDA, 138
Calastacus, 97
„ *investigatoris*, 88, 97
„ *stilirostris*, 97
Calcinus, 517, 518
„ *elegans*, 518, 519
„ *herbsti*, 518, 519
„ *tibicen*, 519
CALLIANASSIDÆ, 97
Callidactylus, 167
Callionymus carebares, 320
Callorhynchus, 311
Calocaris, 97
„ *macandreæ*, 97
Calotes, 42, 45, 46, 47, 48
„ *versicolor*, 42
Camara, 139
Cambessedea, 465
Campnosperma, 461 494
„ *auriculata*, 494, 495, 497
„ *Griffithii*, 494, 496. 497
„ *macrophylla*, 495, 496
„ *Wallichii*, 494. 495, 496, 497
Canarium Sajiga, 453
Cancellus anatum primus, 219
„ „ *secundus*, 217
„ „ *tertius*, 202
Cancer americanus, 154
„ *anatum*, 245
„ *astutus*, 280
„ *calappa*, 142
„ *calappoides*, 142
„ *cancellus*, 239
Cancer craniolaris, 231
„ *cylindrus*, 271
„ *dorsipes*, 277, 278
„ *erinaceus*, 268
„ *frascone*, 277
„ *gallus*, 146
„ *globosus*, 243
„ *globus*, 243
„ *hepaticus*, 142
„ *heracleoticus*, 142
„ *inconspectus*, 145
„ *lophos*, 144
„ *lunaris*, 154, 155, 158, 161
„ *philargius*, 145
„ *plicatus*, 180
„ *porcellanus*, 243
„ *punctatus*, 202
„ *quadridens*, 277
„ *septemspinosus*, 265
„ *tuberculatus*, 142
„ *victor*, 154, 160
Caphyra, 274
Capnites, 21
Caprimulgus mahrattensis, 567
Caracanthus apistus, 313
CARANGIDÆ, 315
Carcinaspis, 166
Cardiospermum, 420, 421
„ *canescens*, 422
„ *Halicacabum*, 421
„ *microcarpum*, 422
CARIDEA, 92
Casarca rutila, 567
Cassine discolor, 341
Catapagurus, 517, 524
„ *australis*, 525
„ *ensifer*, 525
„ *muricatus*, 518, 524
CATAPHRACTI, 320
Catha Benthami, 353
Catopsilia, 42, 43, 44, 46, 47
Cautleya, 297, 299
Ceanothus asiaticus, 377
Celastrina, 455
Celastrinea, 341, 360
CELASTRINEÆ, 339
Celastrus, 340, 352, 354
„ *bivalvis*, 342
„ *Championi*, 353
„ *robustus*, 355
Centropristis investigatoris, 311
Centroscyllium, 308, 310
„ *ornatum*, 308, 310
Centrotrachelus asmussii, 557
Ceramodactylus affinis, 554
Cerastes, 564
Cerastias, 318
„ *bispinosus*, 318
Cerithium, 520
Chætodon triangulum, 312
Chailletia, 514

Chailletia andamanica, 515
„ *Beccariana*, 516
„ *deflexifolia*, var. *tomentosa*, 515
„ *Griffithii*, 514, 515
„ *Helferiana*, 514
„ *Hookeri*, 514, 516
„ *Laurocerasus*, 514
• „ *setosa*, 514, 515
„ *tenuifolia*, 514
• „ • *tesselata*, 515
CHAILLETIACEÆ, 514
Chalinurus hispidus, 326
Champsodon, 316
„ *vorax*, 316
Chascanopsetta, 327
„ *lugubris*, 327
Chaulicelus, 332
„ *pammelas*, 332
„ *sloanii*, 332
Chawnax, 318
„ *pictus*, 318
Chelidoperca, 311
„ *investigatoris*, 311
Chiasmodon, 317
Chiasmodus, 317
„ *niger*, 317
Chimæra, 311
„ *monstrosa*, 311
Chimæridæ, 311
Chlorophthalmus, 307, 332
„ *corniger*, 332
Chondropterygii, 310
Circus macrurus, 567
Cirrhopetalum Dyerianum, 118
Cissus, 387, 395, 408
„ *adnata*, 110, 398
„ *angulata*, 110
„ *aristata*, 398
„ *auriculata*, 403
„ *barbata*, 112
„ *cantoniensis*, 398
„ *carnosa*, 403
„ *cerasiformis*, 400
„ *cinerea*, 403
„ *cordata*, 398, 400
„ *crenata*, 403
„ *discolor*, 399
„ *diversifolia*, 398
„ *edulis*, 398
„ *elegans*, 392
„ *glaberrima*, 401
„ *hastata*, 401
„ *Himalayana*, 112, 113, 397
„ *involucrata*, 408, 409
„ *japonica*, 403
„ *lanceolaria*, 395
„ *mollissima*, 402
„ *muricata*, 395
„ *Neilgherrensis*, 113
„ *novemfolia*, 404
„ *obtusifolia*, 403
Cissus pentagona, 409
„ *pubiflora*, 393
„ *pyrrhodasys*, 398
„ *quadrangularis*, 398
„ *repanda*, 110
„ *repens*, 400
„ *spicifera*, 389
„ *thyrsiflora*, 391, 392
„ *trifoliata*, 403
„ *tuberculata*, 395, 396
„ *vitiginea*, 110
Cleisostoma, 123
• „ *armigera*, 123
Clibanarius, 518, 520, 524, 534
„ *padavensis*, 517, 518, 520
CLUPEIDÆ, 334
Cœlorhynchus flabellispinis, 324
„ *investigatoris*, 325
„ • • *parallelus*, 324
„ *quadricristatus*, 325
Coloconger, 337
„ *raniceps*, 337
Coluber lineolatus, 563
„ *(Taphrometopon) lineolatus*, 563
COLUBRIDÆ, 562
Colubrina, 371, 377
• „ *anomala*, 377
„ *asiatica*, 377
„ *capsularis*, 377
„ *javanica*, 377
Columba intermedia, 567
COMPOSITÆ, 450
Congromuræna, 337
„ *longicauda*, 337
„ *macrocercus*, 337
„ *musteliceps*, 337
„ *nasica*, 337
„ *squaliceps*, 337
Connarus Jackianus, 449
CONVOLVULACEÆ, 536
Convolvulus, 538
„ *candicans*, 537
„ *tenellus*, 538
Coptis, 61
Coracias garrula, 567
Corallorhiza, 118, 119
Corvus corax, 566
„ *umbrinus*, 566
Corycodus, 274
Corydalis, 12, 14, 19, 20, 29, 41
„ *adiantifolia*, 17, 18, 39, 40
„ *Adrieni*, 37
„ *adunca*, 17, 39
„ *albicaulis*, 39
„ *alpestris*, 14, 21
• „ *Balansæ*, 26
• „ *balsamiflora*, 41
„ *Boweri*, 15, 27
„ *cachemiriana*, 14, 18, 22
„ *cashmeriana*, 22, 23
„ „ var. *brevicornu*, 22

Corydalis cashmeriana, var. *ecristata*, 22
" " " *typica*, 22
" *casimiriana*, 15, 27, 29
" *chaerophylla*, 16, 31, 32, 33
* " *Clarkei*, 16, 34
" *claviculata*, 23
" *conspersa*, 34
" *cornuta*, 16, 31, 32
" *crassifolia*, 17, 41
* " *crispa*, 16, 18, 30, 36
" *crithmifolia*, 15, 26
" *curviflora*, 22
* " *cyrtocentra*, 14, 19, 20
" *darwasica*, 19, 20
" *Davidi*, 25
" *decumbens*, 31
" *Delavayi*, 24
" *diphylla*, 14, 19, 20, 21, 27, 28, 29 * *
* " *Drakeana*, 31
* " *dubia*, 17, 34, 36
" *Duthiei*, 16, 33
" " var. *sikkimensis*, 33
" " " *typica*, 33
" *elegans*, 16, 33, 34
" *erecta*, 31, 32
" *Falconeri*, 15, 26
" *Fedtschenkoana*, 41
" *filicina*, 15, 30
" *filiformis*, 28, 29
" *flabellata*, 17, 18, 39, 40
" *flaccida*, 14, 18, 25, 31, 36
" *Franchetiana*, 16, 34, 35, 37
" *geraniifolia*, 16, 33
" *Gortschakovii*, 17, 26, 35
" *Govaniana*, 16, 33
" *gracilis*, 29
* " *graminea*, 14, 23, 24
" *Griffithii*, 19, 20
" *Hamiltoniana*, 19
" *Hemsleyana*, 29
" *Hendersonii*, 15, 26, 27
" *Hoffmeisteri*, 38
* " *Hookeri*, 16, 34, 36
" *incisa*, 29
" *juncea*, 15, 24, 31
* " *Kingii*, 16, 30
* " *Laelia*, 14, 18, 25, 36
* " *lathyroides*, 14, 23
" *latiflora*, 17, 37
" *Ledebouriana*, 19, 20
" *leptocarpa*, 14, 25
" *linearioides*, 24
" *longipes*, 15, 19, 27, 28, 30
" *macrocentra*, 19, 20, 21
" *meifolia*, 17, 18, 34, 36, 38
" " var. *sikkimensis*, 36
" " " *typica*, 36
" " " *violacea*, 36
" *Moorcroftiana*, 17, 34, 35
" *mucronifera*, 15, 26, 27

Corydalis nana, 17, 32, 37, 38
" *ophiocarpa*, 17, 18, 25, 39
" *ozypetala*, 22, 23
" *pachycentra*, 22
" *paeoniaefolia*, 23
" *paniculigera*, 41
" *pauciflora*, 21
" " var. *latiloba*, 21
" " " *parviflora*, 21
" *persica*, 14, 19, 20 *
" *polygalina*, 14, 24
" *Prattii*, 24
" *pulchella*, 17, 37 *
" *racemosa*, 23
" *ramosa*, 16, 30, 31, 37, 38
" " var. 31
" " " *glauca*, 32
" " " *nana*, 38
" " " *typica*, 31
" " " *vaginans*, 32
" *rupestris*, 17, 19, 38
" *rutaefolia*, 19, 20, 21
" *scandens*, 12, 13
" *Schelesnowiana*, 17, 39, 40
" *Semenovii*, 36
" *Sewerzovii*, 19, 20
" *sibirica*, 28, 29, 31, 32
" " var. *intermedia*, 32
" *Stracheyi*, 17, 32, 37
" " var. *ecristata*, 38
" " " *typica*, 38
" *straminea*, 35, 36
" *streptocarpa*, 39
" *stricta*, 17, 38, 41
" *temulifolia*, 41
" *thyrsiflora*, 17, 26, 35
" *tibetica*, 16, 18, 26, 33
" *tongolensis*, 28, 29
" *trifoliolata*, 14, 22
" *triternata*, 14, 25
" *vaginans*, 32
" *verticillaris*, 20
" *vesicaria*, 41
" *violacea*, 36
Corysanthes, 118, 128
" *fornicata*, 128
* " *himalaica*, 128
CORYSTOIDÆ, 103
Cosmonotus, 289, 290, 291
" *grayi*, 292
COTTIDÆ, 319
* *Croftia*, 298
* " *spectabilis*, 298
Cryptocnemus, 166
Cryptosoma, 135, 138, 139, 151
" *granulosum*, 152
Cucullaria, 41
Cupania (indeterminata) 444
" *acuta*, 446
" *adenophylla*, 446
" *fuscescens*, 447

Cupania fuscidula, 445
„ *glabrata*, 444
„ *Griffithiana*, 444, 445
„ *Helferi*, 447
„ *Jackiana*, 449
„ *Lessertiana*, 448
„ *pallidula*, 445
„ *pleuropteris*, 444
„ „ var. *apiculata*, 444
„ „ „ *bijuga*, 444
„ *regularis*, 444
„ *sumatrana*, 448
Cursorius gallicus, 567
Cyanecula suecica, 566
Cyclodorippe, 134, 135, 274, 286
Cycloes, 151
„ *granulosa*, 152
CYCLOMETOPA, 103
Cymonomops, 135, 274, 275, 286
„ *glaucomma*, 287
Cymonomus, 274, 286
Cymopolia, 274
Cymopolus, 274
Cynoglossus, 330
„ *carpenteri*, 330
„ *melanopterus*, 330
„ *monopus*, 330
„ *præcisus*, 330
„ *versicolor*, 330
Cysticapnos africana, 41
CYTTIDÆ, 316
Dactylicapnos, 13
„ *thalictrifolia*, 12, 13
Dactylopterus chirophthalmus, 320
„ *macracanthus*, 320
Dalrymplea javanica, 453
„ *pomifera*, 453
Danais, 45, 46, 47
„ *chrysippus*, 42, 43, 44, 45
„ *genutia*, 43, 44, 45, 46
„ *limniace*, 43, 44, 45, 46, 47
DECAPODA, 90
Delias eucharis, 47
Dendrocopus sindianus, 567
Dentalium, 531, 532
Dermatorus, 323
* „ *melampeplus*, 305, 323
„ *melanocephalus*, 305, 323
„ *trichiurus*, 305, 323
Dibranchus, 318
„ *micropus*, 318
„ *nasutus*, 318
Dicentra, 11, 12, 41
„ *Macrocapnos*, 11, 12
„ *Roylei*, 11, 12
„ *scandens*, 11, 12, 13
„ *thalictrifolia*, 13
„ *torulosa*, 11, 12
Diclytra scandens, 13
Dicrolene, 309, 322
„ *intronigra*, 309, 322
Dicrolene multiflis, 322
„ *nigricaudis*, 322
* *Didiceia*, 118
„ *Cunninghami*, 119
Didymococcus Danura, 427
„ *verticillatus*, 427
Dimocarpus crinita, 436
„ *Longan*, 435
„ *pupilla*, 435
„ *undulatus*, 435
„ *verticillata*, 427
Dinematichthys, 322
„ *piger*, 322
Diplacanthopoma, 323
„ *brachysoma*, 323
„ *rivers-andersoni*, 323
Dittelasma, 420, 424
„ *Rarak*, 424
Dodonæa, 421, 450
„ *angustifolia*, 451
„ *arabica*, 451
„ *Burmanniana*, 451
„ *dioica*, 451
„ *heterophylla*, 451
„ *microcarpa*, 451
„ *pentandra*, 451
„ *spathulata*, 451
„ *viscosa*, 451
„ *Wightiana*, 451
Dorippe, 135, 274, 275, 282, 286, 287, 289
„ *astuta*, 276, 280, 281
„ *atropos*, 277
„ *dorsipes*, 276, 277, 279, 280
„ *facchino*, 276, 278, 279, 280
„ *granulata*, 277, 279
„ *nodulosa*, 277
„ *polita*, 277, 281, 286
„ *sima*, 278
„ *quadridens*, 277, 278
„ *quadridentata*, 277
DORIPPIDÆ, 102, 134, 135, 136, 273
DORIPPIDEA, 273
DORIPPIENS, 273
DORIPPINÆ, 135, 136, 273, 274
DORIPPINEA, 134
Dracontomelum, 461, 513
„ *mangiferum*, 513
Drepanospermum, 460
Drimycarpus, 459, 461, 512
„ *racemosus*, 513
Dysomma, 336
„ *bucephalus*, 336
Dysommopsis, 336
„ *muciparus*, 337
Dysoxylum binectariforum, 115
* „ *reticulatum*, 114
Ebalia, 135, 165, 166, 170, 185
„ *bituberculata*, 188
* „ *diadumena*, 187, 296
„ *erosa*, 186, 189
„ *fallax*, 187, 261

Ebalia hypsilon, 189
„ *minor*, 188
„ *pfefferi*, 187, 191
„ *quadrata*, 188
„ *rhomboidalis*, 188
* „ *sagittifera*, 186, 188
* „ *wood-masoni*, 187, 188, 296
„ *(Phlyxia) erosa*, 186
Eburna, 250
Eccremanthus eximius, 441
Echis, 555, 564
„ *carinata*, 562, 565
Elæodendron, 340, 356
„ *glaucum*, 356
* „ *sub-rotundum*, 356
Elasmonotus, 100
„ *cylindrophthalmus*, 100
Elymnias, 43
„ *cendularis*, 42
„ *undularis*, 43
Embamma cordigera, 408
„ *heterantha*, 409
Emberiza buchanani, 567
Ephyrina, 95
„ *hoskynii*, 95
EPIDENDREÆ, 118
EPIDENDREARUM, 118
Epizoanthus, 527, 533, 535
Eremias guttulata, 558
„ *persica*, 559
„ *velox*, 559
Eria, 121
* „ *clausa*, 121
„ *vittata*, 121
Erigolossum, 420, 424
„ *edule*, 425
„ *rubiginosum*, 425
**Eristicophis*, 564
* „ *Macmahonii*, 564
Erycibe, 536
„ *coriacea*, 536
„ *festiva*, 536
„ *fragrans*, 536
„ *strigosa*, 536
ERYONIDÆ, 97
ERYONTIDÆ, 98
ERYONTIDEA, 98
Erythropalum scandens, 455
Ethusa, 94, 102, 135, 274, 275, 281
„ *andamanica*, 283, 284
* „ *desciscens*, 283, 286
„ *gracilipes*, 286
„ *indica*, 102, 282, 283, 284
* „ *investigatoris*, 283, 285, 286
„ *orientalis*, 285
„ *pygmæa*, 282, 284
* „ *(Ethusina) desciscens*, 283, 286
„ „ *gracilipes*, 286
„ „ *investigatoris*, 283, 285, 286
Ethusina, 103, 274, 281
**Ethusina desciscens*, 283, 286
„ *gracilipes*, 103, 286
* „ *investigatoris*, 283, 285, 286
Eublepharus macularius, 566
Eucopia, 90
„ *australis*, 90
„ *sculpticauda*, 88, 90
EUCOPIIDÆ, 90
Eumelanorrhœa, 483
Euonymus, 339, 343, 345
„ *adenophorus*, 351
„ *capillaceus*, 342
„ *filiformis*, 343
„ *garcinifolius*, 341
„ *Javanicus*, 343, 344
„ *laeta*, 343
„ *mammillaris*, 350
„ *ovata*, 349
„ *sphaerocarpus*, 344
„ *sumatranus*, 344
„ *timorensis*, 344
* „ *Wrayi*, 343, 344
Eupagurus, 517, 520, 522, 534, 535
„ *bernhardus*, 532
„ *jacobii*, 530
* „ *pergranulatus*, 518, 520
„ *zebra*, 517, 518, 520, 523
EUPHAUSIIDÆ, 90
Euphoria chrysea, 437
„ *Danura*, 427
„ *glabra*, 434
„ *Litchi*, 435
„ *Longana*, 435
„ *Nephelium*, 436
„ *pupillum*, 435
„ *undulata*, 435
„ *verticillata*, 427
Euploea, 43, 44, 45, 46
Euprepocnemis nr. *robusta*, 540
Eurypterus lucurus, 567
EUZINGIBEREAE, 297, 299
Fuligula fuligula, 567
FUMARIACEÆ, 10
GADIDÆ, 321
Galacantha, 100
„ *bella*, 100, 101
„ *investigatoris*, 100
„ *rostrata*, 100, 101
* „ *trachynotus*, 88, 100
GALATHEIDÆ, 99
Galerita cristata, 567
Gallinago gallinago, 567
Gallus, 139
Gastonia Naluga, 415
Gavialiceps, 336
„ *microps*, 336
„ *tæniola*, 338
GECKONIDÆ, 553
Gennadas, 91
„ *parvus*, 91
Gerberia, 61

Gerberia Stelleri, 64
Gilibertia Naluga, 415
Glauconia blanfordi, 561
GLAUCONIIDÆ, 561
Glaucothoë, 516, 517, 535
„ *carinata*, 535
„ *peronii*, 535
„ *rostrata*, 535
Globba, 297, 299
Gluta, 480, 480
„ *Benghas*, 480
„ *coarctata*, 480, 482, 483
„ *elegans*, 480, 481
„ „ var. *Helferi*, 481
„ *petiolata*, 483
„ *Renghas*, 481
„ *velutina*, 482
„ *Wrayi*, 480, 482
Glyphocrangon, 92
„ *prionota*, 92
„ *unguiculata*, 92
GLYPHOCRANGONIDÆ, 92
Glyptopetalum, 339, 344, 345
„ *quadrangulare*, 345
„ *Scortechinii*, 345
Glyptophidium, 309, 324
„ *argenteum*, 324
„ *macropus*, 324
Gnathophausia, 89
„ *brevispinis*, 89
„ *Sarsii*, 89
„ *zoea*, 89
GOBIIDÆ, 320
Gobius cometes, 320
Gonostoma, 331
„ *elongatum*, 331
„ *microdon*, 331
Goodyera, 127
„ *Andersonii*, 127
„ *cordata*, 128
Gouania, 370, 371, 382, 384
„ *Andamanica*, 382
„ *Brandisii*, 383
„ *dasyantha*, 384
„ *denticulata*, 384
„ *discolor*, 383
„ *Javanica*, 382, 383
„ *leptostachya*, 382, 383, 384
„ *microcarpa*, 383, 384
„ *Nepalensis*, 383
„ *pubescens*, 384
„ *Retinaria*, 384
„ *tiliæfolia*, 384
Grimothea gregaria, 536
Guaia, 167
Guioa, 420, 443
„ *bijuga*, 444
„ *fuscidula*, 443, 445
„ „ var. *glabrescens*, 445
„ *pleuropteris*, 443, 444
„ „ var. *bijuga*, 444
Guioa pubescens, 443, 445
„ *squamosa*, 443, 444
Gymnandra, 59, 60, 61
„ *altaica*, 60, 64
„ *armena*, 66
„ *borealis*, 59, 60, 64
„ *cashmeriana*, 63
„ *dentata*, 60, 64
„ *elongata*, 60, 64
„ *globosa*, 62
„ *Gmelini*, 60
„ *gracilis*, 60, 64
„ *integrifolia*, 60, 64
„ *Korolkowi*, 65
„ *kunawarensis*, 65
„ *longiflora*, 64
„ *minor*, 60, 64
„ *ovata*, 60, 64
„ *Pallasii*, 60, 64
„ *reniformis*, 60, 64
„ *spectabilis*, 65
„ *Stelleri*, 60, 63
„ *stolonifera*, 65
Gymnapistus leucogaster, 313
Gymnodactylus, 554
„ *Kachhensis*, 554
Gymnosporia, 340, 353, 354
„ *Curtisii*, 353
Habenaria, 132, 134
„ *Bakeriana*, 132
„ *Dyeriana*, 133
„ *juncea*, 132
„ *leptocaulon*, 133
„ *nematocaulon*, 132
„ *Prainii*, 134
„ *pseudophrys*, 133
Halicmetus, 319
„ *ruber*, 319
Halieutæa, 318
„ *coccinea*, 318
„ *fumosa*, 318
„ *nigra*, 318
Haliporus, 91
„ *æqualis*, 91
Halosaurichthys, 335
HALOSAURIDÆ, 335
Halosaurus, 335
„ *affinis*, 335
„ *anguilliformis*, 336
„ *carinicauda*, 336
„ *hoskynii*, 336
„ *mediorostris*, 336
„ *parvipennis*, 336
Harpodon, 332
„ *squamosus*, 332
Harpullia, 421, 451
„ *cupanioides*, 451
„ *fraxinifolia*, 452
„ *fruticosa*, 452
„ *rupestris*, 452
„ *thanatophora*, 452

Hedera hypoglauca, 398
HEDYCHIEÆ, 299
Helodromas ochropus, 567
Hemigyrosa longifolia, 429
Hemipenæus semidentatus, 91
HEPATOIDA, 138
Hepatus, 138
Hephthocara, 324
„ *simum*, 324
Herminium, 130
„ *angustifolium*, 130, 131
* „ *angustilabre*, 131
* „ *gracile*, 131
„ *graminium*, 131
* „ *Jaffreyanum*, 130
„ *orbiculare*, 131
* „ *quinquelobum*, 130
Heterolithadia, 135, 167, 171, 261
„ *fallax*, 261 *
**Heteronucia*, 135, 166, 170, 177
* „ *vesiculosa*, 177, 296
Himantopus himantopus, 567
Hippa dorsipes, 290
Hippocratea, 340, 356, 360
* „ *Andamanica*, 357, 359
„ *Arnottiana*, 361
„ *barbata*, 360
„ *Cumingii*, 357, 358
„ *disperma*, 360
„ *enonymoides*, 360
* „ *ferruginea*, 357
„ *Grahamii*, 361
„ *grandiflora*, 358, 360
„ *indica*, 357, 359
„ *lanceolata*, 358, 361
„ *macrantha*, 357, 360
„ *Maingayi*, 357, 361
„ *Nicobarica*, 357, 359
„ *obtusifolia*, 358, 360, 361
„ *rigida*, 360
„ *tortuosa*, 360, 361
„ *volubilis*, 360
HIPPOCRATEÆ, 340
Holacanthus alternans, 312
* „ „ var. *meleagris*, 303
Holigarna, 459, 512
„ *albescens*, 512
„ *albicans*, 512
„ *Grahami*, 512
„ *Kurzii*, 512
„ *longifolia*, 512
„ *racemosa*, 513
Holocentrum, 315
„ *punctatissimum*, 315
HOLOGLOSSA, 132, 133
HOMARIDÆ, 96
HOMOLIDÆ, 102
Hoplophorus, 94
„ *gracilirostris*, 94
Hoplostethus, 314
„ *mediterraneum*, 314
Hortus Schaferianensis, 335
Houbara macqueenii, 567
HYDROZOA, 243, 245
Hyoscyamus, 543
„ *Camerarii*, 543
„ *niger*, 543
„ *pinnatifidus*, 543
„ *reticulatus*, 543
Hypecoum, 10
„ *cancasicum*, 10
„ *chinense*, 11
„ *leptocarpum*, 10, 11
„ *parviflorum*, 10
„ *pendulum*, 10
„ *procumbens*, 10
Hypericinea angustata, 464
„ *lucida*, 463
Hypopeltarion, 104
Hypsicometes, 316
Hypsophrys, 102
„ *superciliosa*, 102
Ilia, 165, 167, 187, 201, 260, 261
Iliacantha, 167
ILIINÆ, 135, 166, 167
ILIOIDA, 167
Ione, 120
* „ *intermedia*, 120
IPHICULOIDA, 167
Iphiculus, 135, 165, 167, 171, 256, 257, 259
„ *spongiosus*, 256
Iphis, 167, 262
„ *novemspinosa*, 267
„ *septemspinosa*, 265
Ipomœa, 537
„ *eriocarpa*, 537
„ *scindica*, 537
„ *Stocksii*, 537
Irina alnifolia, 443
„ *diplocardia*, 441
„ *glabra*, 441
„ *integerrima*, 457
ISOPODA, 106
Ixa, 135, 165, 167, 171, 259, 270
„ *canaliculata*, 271
„ *cylindrus*, 271, 273
„ *inermis*, 271, 272
„ *megaspis*, 272
Johnia coromandeliana, 367
Junonia, 42, 43, 44, 45
Kokoona, 339, 346
* „ *coriacea*, 346
„ *littoralis*, 346
* „ *Scortechinii*, 346, 347
Kurrimia, 340, 354
„ *calophylla*, 355
„ *Maingayi*, 355
„ *paniculata*, 354, 355
„ *pulcherrima*, 354
„ *robusta*, 355
LACERTIDÆ, 558

Lacertilia, 553
Lacops, 328
„ *guentheri*, 328
Lagotis, 57, 59, 62
„ *brachystachya*, 62, 66
„ *brevituba*, 62, 63, 65
„ *cashmeriana*, 58, 61, 63
„ *Clarkei*, 58, 61, 62
* „ *crassifolia*, 61, 63, 66
„ *decumbens*, 58, 61, 62
„ *glauca*, 58, 59, 60, 62, 63, 64
„ „ *subspecies australis*, 62, 63, 65
„ „ „ *borealis*, var. *Gmelini*, 60, 64
„ „ „ „ var. *Pallasii*, 60, 64
„ „ „ „ var. *Stelleri*, 60
„ „ var. *cashmeriana*, 63
„ „ „ *kunawarensis*, 58, 65
„ „ „ *sikkimensis*, 57, 58, 63, 65
„ „ „ *Pallasii*, 60, 64
„ „ „ *Stelleri*, 64
„ „ „ *typica*, 60, 64
„ *globosa*, 58, 61, 62
„ *Korolkowi*, 62, 65
„ *kunawarensis*, 58
„ *Pallasii*, 64
* „ *pharica*, 61, 62, 66
„ *ramalana*, 66
„ *spectabilis*, 57, 58, 62, 65
„ *Stelleri*, 58, 60, 61, 63, 64
„ *stolonifera*, 62, 65
Lamprogrammus, 309, 324
„ *fragilis*, 324
„ *niger*, 324
Lanius isabellinus, 566
„ *vittatus*, 566
Lantana, 42
Leea, 384, 385, 409, 413
„ *aculeata*, 414
„ *acuminata*, 410, 415
„ *aequata*, 410, 418
„ *amabilis*, 416
„ *angulata*, 410, 413, 414
„ *aspera*, 417, 418
„ *biserrata*, 415
„ *cinerea*, 411
„ *coccinea*, 417
„ *cordata*, 109
„ *coriacea*, 411
* „ *Curtisii*, 410, 416
„ *diffusa*, 417
„ *gigantea*, 410, 412, 415
„ *grandifolia*, 409, 411
„ *herbacea*, 418
„ *hirsuta*, 419
Leea hirta, 419
„ *horrida*, 414
„ *javanica*, 410, 418
„ *laxa*, 416
„ *latifolia*, 409, 410, 411
„ *macrophylla*, 411
„ *Malayana*, 414
„ *Ottilis*, 415
„ *parallela*, 417, 418
* „ *pauciflora*, 410, 412
„ *polyphylla*, 417
„ *robusta*, 410, 417, 418
„ *rubra*, 410, 416
„ *Sambucina*, 410, 412, 413, 414, 415, 416
„ „ var. *biserrata*, 415
„ *sanguinea*, 416, 417
„ *simplicifolia*, 410, 411, 412
„ *Staphyiea*, 412, 415
„ *sundiaca*, 418
„ *tuberculo-semen*, 413
„ *viridiflora*, 415
Lepidopetalum, 421, 448
„ *Jackianum*, 449
Lepidotrigla, 319
„ *spiloptera*, 319 [319
„ „ var. *longipinnis*,
Lepisanthes, 420, 427
* „ *andamanica*, 427, 428
„ *cuneata*, 427, 428
* „ *Kunstleri*, 427
„ *longifolia*, 427, 429
„ *montana*, 428
* „ *Scortechinii*, 427, 429
Lepistemon, 537
„ *leiocalyx*, 537
Leptoderma, 335
„ *macrops*, 335
Lettsomia ornata, 537
Leucosia, 135, 165, 167, 168, 200, 201, 209, 234, 248, 254
„ *affinis*, 224
„ *chevertii*, 225
* „ *corallicola*, 212, 224, 296
„ *craniolaris*, 213, 231, 232, 233, 234
„ „ var. *laevimana*, 231
„ *cumingii*, 214, 226, 227
„ *cylindrus*, 271
„ *elata*, 214, 228
„ *erinaceus*, 268
„ *fugax*, 203
„ *globosa*, 243
„ *haematosticta*, 214, 229, 230
„ *hasselli*, 212, 222, 224
„ *longifrons*, 212, 217, 219, 220, 221, 222, 223, 224
„ „ var. *neocledonica*, 218, 219, 220
„ „ „ *pulcherrima*, 219

Leucosia maculata, 234
„ *margaritata*, 214, 230
„ *marmorea*, 212, 221, 222
„ *moresbiensis*, 223
„ *novocaledonica* 212, 218, 220
„ *obscura*, 223
„ *obtusifrons*, 211, 216
„ „ var. *unidentata*, 215
„ *ornata*, 217
„ *pallida*, 212, 222, 224, 225
„ „ var. *obscura*, 223
„ *parvimana*, 223
„ *perlata*, 223
„ *phyllochira*, 214, 235
„ *polita*, 217
„ *pubescens*, 213, 233, 234
„ *pulcherrima*, 219
„ *rhomboidalis*, 213, 234
„ *scabriuscula*, 239
„ *septemspinosa*, 265
* „ *sima*, 214, 227, 297
„ *splendida*, 219
* „ *truncata*, 214, 234, 296
„ *unidentata*, 211, 215, 216
„ *urania*, 212, 217, 218, 220
„ *vittata*, 213, 232
„ *whitei*, 214, 225
„ *whitmeei*, 212, 224
LEUCOSIADÆ, 164
LEUCOSIDÆ, 103
LEUCOSIDICA, 135
LEUCOSIENS, 164
LEUCOSIIDÆ, 134, 135, 136, 164, 289
LEUCOSIIDEA, 135, 164
LEUCOSIINÆ, 135, 165, 166
LEUCOSIINEA, 134
Leucosilia, 167
„ *granulosa*, 193
LEUCOSIOIDA, 167
LEUCOSOIDEA, 135
Liabum, 450
LIMODOREÆ, 106, 107
Limodorum, 107
Lioscorpius, 312
„ *longiceps*, 312
Listera, 118, 126
* „ *alternifolia*, 126
* „ *brevicaulis*, 126
„ *japonica*, 127
* „ *longicaulis*, 126
Lithadia, 166, 261
Lithodes, 99
„ *agasizii*, 88, 99
Lithodidæ, 99
Lophius, 317
„ *indicus*, 317
„ *lugubris*, 318
„ *mutilus*, 317
LOPHOGASTRIDÆ, 89
Lophopetalum, 339, 340, 346, 348, 352
* „ *Curtisii*, 348, 351
Lophopetalum fimbriatum, 348, 349
„ *fuscescens*, 348, 352
„ *javanum*, 349
„ *littoralis*, 346
* „ *oblongifolium*, 348, 351, 352
* „ *oblongum*, 348, 350
„ *ovatum*, 349
* „ *pachyphyllum*, 348
„ *pallidum*, 348, 350, 351
„ *reflexum*, 347, 348, 352
* „ *Scortechinii*, 348, 350
* „ *subobovatum*, 348, 349
Lophos, 139
Lyreidus, 94, 102, 135, 289, 290, 294
„ *channeri*, 294
„ *gracilis*, 102, 294
Lytorhynchus, 550
* „ *maynardi*, 562
„ *ridgewayi*, 562, 566
Macrocapnos, 12, 13
MACRURA, 90
MACRURIDÆ, 309, 324
Macrurus, 324
„ *brevirostris*, 325
„ *cavernosus*, 309
„ *flabellispinis*, 324
„ *heterolepis*, 309, 326
„ *hextii*, 326
„ *hispidus*, 326
„ *hoskynii*, 326
„ *lævis*, 326
„ *lophotes*, 325
„ *macrolophus*, 325
„ *parallelus*, 324
„ *petersonii*, 325
„ *polylepis*, 325
„ *pumiliceps*, 325
„ *quadricristatus*, 325
„ *semiquincunciatus*, 325
„ *wood-masoni*, 326
„ (*Chalinurus*) *hispidus*, 326
„ (*Cœlorhynchus*) *flabellispinis*, 324
„ „ *investigatoris*, 325
„ „ *parallelus*, 324
„ „ *quadricristatus*, 325
„ (*Macrurus*) *brevirostris*, 325
„ „ *hextii*, 326
„ „ *hoskynii*, 326
„ „ *lophotes*, 325
„ „ *macrolophus*, 325
„ „ *petersonii*, 325
„ „ *polylepis*, 325
„ „ *pumiliceps*, 325
„ „ *semiquincunciatus*, 325
Macrurus (*Macrurus*) *wood-masoni*, 326
„ (*Malacocephalus*) *lævis*, 326
„ (*Mystaconurus*) *cavernosus*, 309

Macrurus (*Mystaconurus*) *heterolepis*, 309, 326
MAIIDÆ, 105
Malacocephalus lævis, 326
Malacosteus, 334
„ *indicus*, 334
MALACOSTRACA, 89
Malthopsis, 319
„ *lutea*, 319
Mangifera, 460, 466, 479
„ *andamanica*, 466, 470
„ *caesia*, 468, 477, 478
„ *domestica*, 473
„ *foetida*, 467, 474
„ *fragrans*, 467, 475
„ *gracilipes*, 467, 474
„ *Griffithii*, 466, 468, 479
„ *Horsfieldi*, 475
„ *indica*, 467, 470, 472
„ *kemanga*, 468, 477
„ *lagenifera*, 468, 476
„ *longipes*, 467, 471, 473, 479
„ *longipetiolata*, 467, 470
„ *macrocarpa*, 476
„ *Maingayi*, 466, 469, 470
„ *microphylla*, 466, 468
„ *oblongifolia*, 467, 473, 474
„ *odorata*, 467, 474
„ *oppositifolia*, 465
„ *Parih.* 474
„ *pentandra*, 467, 472
„ *policarpa*, 477
„ *quadrifida*, 467, 470, 471
„ *sclerophylla*, 466, 469
„ *superba*, 468, 478
MANGIFFRAE, 460
Mantisia, 297
MANTISIEAE, 299
Mareca penelope, 567
Matapa aria, 47
Matuta, 135, 138, 139, 153, 289
„ *appendiculata*, 162
„ *banksii*, 154, 155, 156, 157, 158, 163
„ *circulifera*, 162
„ *distinguenda*, 154, 159
„ *granulosa*, 154, 156, 159
„ *inermis*, 157
„ *laevidactyla*, 162
„ *lesueurii*, 155, 160
„ *lincifera*, 162
„ *lunaris*, 155, 156, 158, 161, 163
„ *maculata*, 156, 160
„ *miersii*, 155, 157, 163
„ *obtusifrons*, 154, 159
„ *peronii*, 155, 160, 163
„ *picta*, 154, 155, 156, 158
„ *planipes*, 154, 156, 158, 161, 162
„ *rubro-lineata*, 156, 162
„ *victor*, 154, 155, 156, 158, 160, 162
„ „ var. *prima*, 160
Matuta victor, var. *quarta*, 159, 162
„ „ „ *quinta*, 158, 169
„ „ „ *secunda*, 160
„ „ „ *sexta*, 158, 159
„ „ „ *tertia*, 162
„ *victrix*, 156, 160
„ „ var. *crebrepunctata*, 160
MATUTIDÆ, 137, 139
MATUTINÆ, 135, 136, 137, 138, 139
MATUTOIDA, 138
MATUTOIDEA, 137
Melamphaës, 314
„ *mizolepis*, 314
Melanochyla, 461, 502
„ *angustifolia*, 502, 506, 507, 508
„ *auriculata*, 502, 505, 506
„ *bracteata*, 502, 506
„ *densiflora*, 502, 503
„ *Kunstleri*, 502, 504
„ *Maingayi*, 502, 504
„ *nitida*, 503, 507
„ *rugosa*, 502, 505
„ *tomentosa*, 502, 503
Melanorrhœa, 459, 460, 483, 487
„ *aptera*, 483, 484, 487, 488
„ *Curtisii*, 483, 486
„ *Duthieana*, 486
„ *inappendiculata*, 483, 484, 488
„ *Maingayi*, 483, 484, 485
„ *torquata*, 483, 484, 486
„ *Wallichii*, 483, 484
„ *Woodsiana*, 482, 485
Melanostoma, 311
MELIACEÆ, 114
Meliosma, 454, 455, 459
„ *Colletiana*, 116
„ *elliptica*, 455, 456
„ *ferruginea*, 116
„ *lanceolata*, 456, 458, 459
„ „ var. *pubescens*, 458
„ *lancifolia*, 455, 456
„ *levis*, 455, 457
„ *nitida*, 455, 457
„ *pungens*, 117
„ *Ridleyi*, 456, 458
„ *simplicifolia*, 456
„ *sumatrana*, 457
„ *Wightii*, 117
Merocryptus, 165, 166
Microgus, 313,
„ *unipinna*, 313
Microstemon, 461, 497
„ *Curtisii*, 498
„ *officinale*, 500
„ *velutina*, 498
Microstylis saprophyta, 118
Microtropis, 339, 340
„ *bivalvis*, 340, 341, 343
„ *coriacea*, 369

Microtropis discolor, 340, 341
* „ *elliptica*, 340
„ *filiformis*, 340, 342
„ *longifolia*, 369
Mildea, 450
Millingtonia sumatrana, 457
Milvus migrans, 567
Minous, 313
„ *coccineus*, 314
„ *inermis*, 314
„ *trachycephalus*, 313
Mischocarpus, 421, 447
„ *fuscescens*, 447, 448
„ *sumatranus*, 447, 448
„ *sundiacus*, 447
Molinaea, 448
Monomitopus, 308, 321
„ *conjugator*, 304, 309
„ *nigripinnis*, 305, 309, 322
Motacilla alba, 567
„ *citreola*, 567
„ *feldeggii*, 567
„ *personata*, 567
Moulinsia cupanioides, 425
„ *rubiginosa*, 425
Munida, 99
„ *microps*, 99
„ *subrugosa*, 536
Munidopsis, 99, 100
„ *margarita*, 100
„ *stylirostris*, 99, 100
„ *trifida*, 99
* „ *wardeni*, 88, 99
Muræneson, 338
Muræniдæ, 336
Murex, 520, 535
Mursia, 103, 135, 138, 139, 148, 151, 152
„ *bicristimana*, 103, 150
„ *hawaiiensis*, 149
Myctophum pterotus, 333
Myra, 135, 165, 167, 168, 200, 254
„ *affinis*, 202, 205, 206
„ *australis*, 205, 206
* „ *brevimana*, 202, 206, 208
„ *carinata*, 203
„ *coalita*, 203
„ *darnleyensis*, 202, 207
„ *dubia*, 203
„ *elegans*, 202, 208
„ *eudactyla*, 255
„ *fugax*, 199, 201, 202, 204, 205, 206
„ „ var. *coalita*, 203
„ *mamillaris*, 205, 206
* „ *pentacantha*, 202, 204
„ *punctata*, 205
„ *subgranulata*, 205
Myrodes, 135, 165, 167, 171, 254, 257, 259
„ *eudactylus*, 255
„ *gigas*, 255
Myrodoida, 167
Myroida, 167
Myropsis, 167, 200
Mystaconurus cavernosus, 309
„ *heterolepis*, 309, 326
Narcetes, 335
„ *crimelas*, 335
Naseus vlamingii, 315
Natica, 531
Nematocarcinidæ, 95
Nematocarcinus, 95
„ *gracilis*, 95
Nemichthys, 336
„ *acanthonotus*, 336
Neobythites, 308, 309, 321
* „ *conjugator*, 304, 322
„ *macrops*, 321
„ *nigripinnis*, 305, 322
„ *pterotus*, 309, 321
„ *squamipinnis*, 321
„ *steatiticus*, 321
* „ *(Monomitopus) conjugator*, 304
„ „ *nigripinnis*, 305
Neophron ginginianus, 567
Neoscopelus, 333
„ *macrolepidotus*, 333
Nettieæ, 106, 107, 124
Nephelium, 420, 432
„ *Bengalense*, 435
„ *chryseum*, 433, 437
„ *costatum*, 433, 436
„ *echinatum*, 436
„ *eriopetalum*, 433, 438
„ *eximium*, 441
„ *glabrum*, 433, 440
„ *hamulatum*, 433, 437
„ *hypoleucum*, 435
„ *lappaceum*, 433, 434, 436
„ „ var. *glabrum*, 434
„ *Longana*, 433, 434
„ „ var. *hypoleuca*, 434, 435
„ *Maingayi*, 434
„ *Malaiense*, 433, 439
„ *Mora*, 435
„ *muricatum*, 432
„ *ophioides*, 433, 438
„ *pupillum*, 435
„ *rubescens*, 433, 435
„ *sufferugineum*, 433, 439
„ *verticillatum*, 427
Nephropsis, 94, 96
„ *atlantica*, 96, 97
„ *carpenteri*, 97
„ *Stewarti*, 96, 97
„ *Suhmi*, 88, 96
Nettastoma, 338
„ *taeniola*, 338
Nettion crecca, 567.
Nothocaris binoculus, 92
Nothocissus spicigera, 389

Nothocnestis sumatrana, 355
Notopoides, 289
Notopus, 135, 289, 290, 291
„ *dorsipes*, 290
Nucia, 135, 167, 169, 187, 190, 198
„ *pfefferi*, 191
„ *speciosa*, 190, 191
Nucioida, 167
Nursia, 135, 165, 166, 170, 178, 184, 260
„ *abbreviata*, 180, 183, 184, 185
* „ *blanfordi*, 179, 182, 183, 296
„ *hardwickii*, 180, 181, 182
* „ *nasuta*, 179, 183, 296
* „ *persica*, 180, 183, 185, 296
„ *plicata*, 179, 181, 182, 183
„ „ *nec auctorum*, 180
„ *rubifera*, 180, 185
Nursilia, 135, 165, 167, 171, 259, 261
„ *dentata*, 260
* „ *tonsor*, 261
Nursilioida, 167
Nursioida, 166
Nyroca africana, 567
Ochthodromus geoffroyi, 567
„ *mongolus*, 567
Odina, 461, 501
„ *Wodier*, 501
Odontochilus, 125
„ *Elwesii*, 125
* „ *tortus*, 125
Odontostomus, 307, 333
„ *atratus*, 333
Oncychomorpha, 135, 165, 167, 169, 235
„ *lamelligera*, 236
Ophidia, 561
Ophidiidæ, 304, 308, 321
Ophiomorus tridactylus, 561
Ophrydeæ, 130
Ophrys, 134
Orchidaceæ, 106, 107
Oreophoroida, 166
Oreophorus, 135, 165, 166, 170, 172, 173, 175
„ *reticulatus*, 174
* „ „ var. *alcicornis*, 175
Orithyia, 138
Orithyioida, 138
Ornitrophe Aporetica, 423
„ *asiatica*, 423
„ *Cobbe*, 422
„ *glabra*, 423
„ *Malabarica*, 423
„ *Schmidelia*, 423
„ *serrata*, 423
„ *villosa*, 423
Osachila, 138
Ostracion, 338
„ *fornasini*, 338
Otophora, 420, 429
„ *erythrocalyx*, 430
„ *paucijuga*, 426
* *Otophora sessilis*, 430
Ottilis zeylanica, 415
Oxypleurodon, 106
„ *stimpsoni*, 106
Oxyrhyncha, 105
Oxystoma, 134, 135, 274, 289
Oxystomata, 102, 135
Paederota, 59
„ *borealis*, 64
Paguridæ, 516
Paguristes, 517, 526
„ *hians*, 527
* „ *puniceus*, 517, 527
* „ *pusillus*, 518, 526
„ *setosus*, 529
Pagurus, 518
„ *abyssorum*, 530
„ *dearmatus*, 517, 518
„ *deformis*, 518
„ *elegans*, 519
„ *pedunculatus*, 518
„ *spiriger*, 524
„ *tibicen*, 518
„ *varipes*, 518
Palæmonella, 95
„ *laccadivensis*, 95
Palæmonidæ, 95
Papaver micranthum, 113
Pancovia rubiginosa, 425
Pandalidæ, 92
Pandalus, 92
* „ *alcocki*, 88, 92
* *Pantlingia*, 107
* „ *paradoxa*, 107
Papaveraceæ, 10
Papilio, 44
„ *aristolochiæ*, 43, 47
„ *demoleus*, 45, 46, 47
„ *eurypylus*, 44, 47
Paracelastrus, 342
Paracentroscyllium, 308, 310
„ *ornatum*, 308, 310
Paracyclois, 138
Paradicrolene, 309, 322
„ *multifilis*, 322
„ *nigricaudis*, 322
„ *vaillanti*, 322
Paralepis, 307
Paranephelium, 421, 449
* „ *macrophyllum*, 449, 450
* „ *nitidum*, 449, 450
Parapagurus, 516, 517, 529, 532, 533
„ *abyssorum*, 530
„ *affinis*, 530
* „ *andersoni*, 517, 529, 531, 532
„ *gracilis*, 534
* „ *minutus*, 517, 531
„ *monstrosus*, 533
„ *pilosimanus*, 530
Parapenæina, 90
Parapenæus, 90

Parapenæus fissurus, 90
Parascombrops, 311
„ *pellucidus*, 311
Parilia, 135, 165, 167, 169, 191, 197, 198
„ *alcocki*, 198
**Pariphiculus*, 135, 167, 171, 257
„ *coronatus*, 258, 259
* „ *rostratus*, 258, 259, 296
Parishia, 461, 492
„ *insignis*, 492
„ „ var. *pubescens*, 492
„ „ „ *tomentosa*, 493
„ *Maingayi*, 492, 493
„ *pubescens*, 492, 493
Paromolopsis, 102
„ *boasi*, 102
Paroncirodes, 318
„ *glomerosus*, 318
Parthenocissus cuspidifera 113
„ *semicordata*, 113, 397
Pasiphæidæ, 95
Pediculati, 317
Pediculus marinus, 290
Pegasidæ, 320
Pegasus natans, 320
Penæidæ, 90
Penæidea, 90
Penæus fissurus, 90
Pentacheles, 98
„ *gibba*, 98
„ *phosphorus*, 98
Pentaspadon, 461, 499
„ *officinalis*, 499
„ *velutinus*, 498
Percis, 316
„ *tetracanthus*, 316
Periphaneta americana, 42
Peristethus murrayi, 320
„ *rivers-andersoni*, 320
Perscphona, 167
Philyra, 135, 165, 167, 168, 201, 234, 237, 248, 254
„ *adamsii*, 238, 253
* „ *corallicola*, 238, 247, 296
„ *globosa*, 199, 238, 242, 243, 245, 246
„ *globulosa*, 238, 245, 247, 253
„ *heterograna*, 245
„ *longimana*, 242
„ *platychira*, 237, 238, 241, 242
„ *polita*, 243, 245
„ *porcellana*, 243
„ *punctata*, 242
„ *scabriuscula*, 238, 239, 240, 241
* „ *sexangula*, 238, 241, 296
„ *verrucosa*, 238, 240, 247, 248
Phlyxia, 166
„ *erosa*, 186, 189
Phoberus, 96
„ *cæcus*, var. *sublevis*, 95
Photostomias, 309
Photostomias guernei, 310
**Phrynocephalus euptilopus*, 556
„ *interscapularis*, 556
„ *luteo-guttatus*, 557, 561
„ *maculatus*, 555
„ *olivieri*, 555
„ *ornatus*, 555
Phyc, 95
„ *alcocki*, 95
Physachæus, 106
„ *ctenurus*, 106
Physiculus, 321
„ *argyropastus*, 321
„ *roseus*, 321
Physostomi, 331
Physurus, 124
„ *Blumei*, 124
* „ *herpysmoides*, 124
Pica rustica, 566
Platymera, 137, 138, 151
„ *gaudichaudii*, 151
Platytroctes, 335
„ *apus*, 335
Plectognathi, 338
Plesionika, 93
„ *bifurca*, 93
Pleuronectes, 305
Pleuronectidæ, 305, 327
Pœcilopsetta, 328
„ *maculosa*, 328
„ *prælonga*, 328
Pogonia, 129
* „ *falcata*, 129
* „ *Hookeriana*, 129
„ *macroglossa*, 130
* „ *Prainiana*, 129
„ *velutina*, 130
Polyipnus, 331
„ *spinosus*, 331
Polymixia, 315
„ *nobilis*, 315
Pomaderris capsularis, 377
Pometia, 420, 440
„ *alnifolia*, 440, 442
* „ *Curtisii*, 443
„ *eximia*, 441
* „ *gracilis*, 440, 441
„ *macrocarpa*, 440
„ *pinnata*, 440, 441, 443
* „ *Ridleyi*, 443
„ *ternata*, 423
„ *tomentosa*, 441
Ponerodon, 317
„ *vastator*, 317
Pratincola maura, 566
Priacanthus, 311
„ *fax*, 311
„ *macracanthus*, 311
Prinia lepida, 566
Prionotus alepis, 319
Promyllantor, 337

Promyllantor purpureus, 337
Prosopodasys leucogaster, 313
„ *trachinoides*, 313
Psettyllis, 328
„ *ocellata*, 328
„ *pellucida*, 328
Pseudophilyra, 135, 165, 167, 168, 234, 248
„ *blanfordi*, 249, 252, 296
„ *hoedtii*, 233, 234
„ *melita*, 249, 253
„ *pusilla*, 249, 251
„ *tridentata*, 249, 250, 252
„ *wood-masoni*, 249, 250, 251, 296
Pseudoscopelus, 317
Ptelea viscosa, 451
Pterisanthes, 384, 407, 408
„ *cissoides*, 407, 408
„ *coriacea*, 407
„ „ var. *arancosa*, 408
„ *heterantha*, 407, 408, 409
„ *involucrata*, 408
„ *pedata*, 407, 409
„ *polita*, 407
Pterocles arenarius, 567
„ *coronatus*, 567
Pteroclurus senegallus, 567
Pteroidonus, 309
Pterois, 313
„ *macrura*, 303, 313
Ptyonoprogne obsoleta, 567
Pycnocraspedum, 321
„ *squamipinne*, 321
Pylopagurus, 517, 522
„ *magnimanus*, 517, 518, 522
Pyrospermum calophyllum, 355
Raja, 310
„ *mammillidens*, 310
RAJIDÆ, 310
Randallia, 103, 135, 165, 167, 169, 191, 198
„ *coronata*, 258
„ *eburnea*, 193, 197
„ *glans*, 193, 195
„ *granulata*, 190, 194
„ *granulosa*, 194
„ *lamellidentata*, 190, 192, 195
„ *lanata*, 192, 193
„ *pustulilabris*, 192, 193, 195, 197
„ *pustulosa*, 103, 190, 192, 196
Ranella, 520
Ranilia, 289
Ranina, 135, 289
„ *dorsipes*, 290
RANINIDÆ, 102, 134, 135, 136, 288
RANINIDEA, 135, 288
RANINIENS, 135, 288
RANINOIDEA, 288
Raninoides, 135, 289, 290, 292
Raninoides personatus, 293
„ *serratifrons*, 293
Raninops, 289
Retinaria scandens, 384
RHAMNEÆ, 370
Rhamnus acuminata, 377
„ *Jujuba*, 372
„ *Enoplia*, 373
Rhesa Moja, 355
„ *paniculata*, 355
Rhodospiza obsoleta, 567
RHOIDEÆ, 460
Rhomboidichthys, 328
„ *angustifrons*, 328
„ *azureus*, 328
„ *polylepis*, 328
„ *valde-rostratus*, 328
Rhus, 461, 500
„ *Cobbe*, 422
„ *Perakensis*, 500
Rhynchanthus, 297, 298, 299
„ *longiflorus*, 297
Rivea, 537
„ *ornata*, var. *Griffithii*, 537
Rostellaria, 522, 524, 527, 533
Ruticilla erythronota, 566
„ *rufiventris*, 566
Sabia, 454, 455
„ *floribunda*, 456
„ *limonacea*, 454
„ *sumatrana*, 454
„ *viridissima*, 455
SABIACEÆ, 116, 453
Saccogaster, 323
„ *maculata*, 323
Saccolabium, 122
„ *acuminatum*, 122
„ *lancifolium*, 122
Sacculina, 164
Sælanthus quadragonous, 398
Salacia, 340, 361, 362
„ *alternifolia*, 362
„ *campanuloidea*, 361, 363
„ *flavescens*, 362, 366, 368, 369
„ „ var. *dumosa*, 369
„ *grandiflora*, 362, 363, 365
„ „ var. *longifolia*, 361, 366
„ *Griffithii*, 361, 364
„ *Kunstleri*, 362, 368
„ *laevigata*, 360
„ *latifolia*, 362, 366
„ *Lawsoni*, 362, 369
„ *Lobbii*, 362, 370
„ *longifolia*, 365, 366
„ *macrantha*, 366
„ *macrophylla*, 367
„ *Maingayi*, 361, 363
„ *ovalis*, 369
„ *Perakensis*, 361, 364
„ *platyphylla*, 366
„ *podopetala*, 367

Salacia polyantha, 362, 367
„ *prinoides*, 362, 366
„ „ var. *macrophylla*, 367
„ *rubra*, 362, 370
* „ *Scortechinii*, 361, 364
„ *terminalis*, 361
„ *viminea*, 361, 362
„ *Wightiana*, 367
* „ *Wrayi*, 362, 367
Samaris, 327
„ *cristatus*, 327
SAPINDACEA, 446
SAPINDACEÆ, 115, 419
Sapindus adenophyllus, 446
„ *bengalensis*, 435
„ *Danura*, 427
„ *fraxinifolius*, 425
„ *longifolius*, 425
„ *monogyna*, 435
„ *montanus*, 426
„ *pinnatus*, 424
„ *Rarak*, 424
„ *rubiginosa*, 425
„ *saponaria*, 424
„ *squamosus*, 444
Sarcanthus, 123
* „ *bambusarum*, 123
Sarcogrammus indicus, 567
Sauromurænesox, 338
„ *vorax*, 338
Saurus, 307
Saxicola albinigra, 566
„ *deserti*, 566
Scalpellum, 281
Scaptira acutirostris, 560, 561
* „ *aporosceles*, 559, 563
„ *scripta*, 559
Schembra Valli, 112
SCHIZOPODA, 89
Schmidelia adenophylla, 423
„ *Aporetica*, 423
„ *Cobbe*, 423
„ *dentata*, 423
„ * *distachya*, 423
„ *glabra*, 423
„ *Kobbe*, 423
„ *orientalis*, 423
„ *ornithrophioides*, 423
„ *racemosa*, 423
„ *Rheedii*, 423
„ *ternata*, 423
„ *timorensis*, 423
„ *vestita*, 423
„ *villosa*, 423
„ (*Allophyllus*) *ornithrophioides*, 423
Sciæna ophiceps, 315
Scianectes, 329
„ *lophoptera*, 329
„ *macrophthalmus*, 329
SCILÆNIDÆ, 315
SCINCIDÆ, 561
SCITAMINEAE, 297, 298
SCLERODERMI, 338
SCOPELARCHINA, 306
**Scopelarchus*, 306, 332
* „ *Guentheri*, 307, 332
Scopelengys, 333
„ *tristis*, 333
SCOPELIDÆ, 306, 332
Scopelus, 307, 333
„ *engraulis*, 333
„ *macrolepidotus*, 333
„ *pterotus*, 333
„ *pyrsobolus*, 333
„ (*Myctophum*) *pterotus*, 333
Scopolia, 543
„ *lurida*, 543
Scorpæna, 313
* „ *bucephalus*, 302, 313
* „ *crostris*, 302, 313
SCORPÆNIDÆ, 302, 312
SCROPHULARINEÆ, 61
SCYLLARIDÆ, 98
SCYLLARIDEA, 98
SCYLLIDÆ, 310
Scyllium, 310
„ *canescens*, 310
„ *hispidum*, 310
Scyphopetalum, 449
Scyramathia, 105
„ *rivers-andersoni*, 105
Scytalia bengalensis, 435
„ *Danura*, 427
„ *Longan*, 435
„ *Rambontan*, 436
„ *verticillata*, 427
Sebastes, 312
„ *bougainvillii*, 302
„ *hexanema*, 312
„ *muciparus*, 312
„ *serrulatus*, 312
SELAGINEÆ, 57
SEMECARPEÆ, 461
Semecarpus, 117, 461, 491, 508, 512
„ *albescens*, 512
„ *Anacardium*, 509
* „ *Curtisii*, 508, 509
„ *glauca*, 512
„ *Grahami*, 512
„ *grandifolia*, 496, 497
„ *heterophyllus*, 510, 511
* „ *Kurzii*, 508, 510
* „ *lucens*, 508, 510
„ *lurida*, 491
* „ *Prainii*, 508, 511
„ *subracemosa*, 117
* „ *subspathulatus*, 117
* „ *velutina*, 508
Sergestes, 92
„ *robustus*, 92
„ *rubroguttatus*, 92

SERGESTIDÆ, 92
SERRANIDÆ, 311
Sirembo nigripinnis, 322
Smythea, 371, 380
„ *calpicarpa*, 381, 382
„ *macrocarpa*, 381
* „ *reticulata*, 381
SOLANACEÆ, 541
Solanum, 541
„ • *albicaule*, 543
„ *Balbisii*, 542
„ *barbisetum*, 541
* „ „ var. *Griffithii*, 541
„ *ferox*, 542
„ *gracilipes*, 543
„ *indicum*, 542
„ „ var. 543
„ *inflatum*, 542
„ *khasianum*, 542
„ *Kurzii*, 541
„ *pubescens*, 541
„ „ var. *lobata*, 541
„ *scindicum*, 542
„ *sisymbriifolium*, 542
„ *subtruncatum*, 541
„ *tribolatum*, 543
„ *verbascifolium*, 541
Solea, 329
„ *cyanea*, 329
„ *oculus*, 329
„ *umbratilis*, 329
„ (*Achirus*) *cyanea*, 329
„ „ *oculus*, 329
„ „ *umbratilis*, 329
Solenocera, 91
„ *hextii*, 88, 91
SOLENOCERINA, 91
Spatula clypeata, 567
Spelæophorus, 166
SPINACIDÆ, 308, 310
Spiropagurus, 524, 526
„ *spiriger*, 517, 518, 524
SPONDIÆ, 461
SQUAMIPINNES, 303, 312
Stagmaria verniciflua, 481
Staphylea indica, 415
Stellio nuptus, 555
Stenodactylus orientalis, 554
STERNOPTYCHIDÆ, 331
Sternoptyx, 331
„ *diaphana*, 331
Stigmaria verniciflua, 485
Stomias, 333
„ *elongatus*, 333
„ *nebulosus*, 333
STOMIATIDÆ, 309, 333
Streptocephalus, 538
„ *bengalensis*, 538
Streptostigma viridiflorum, 452
Swintonia, 460, 488, 492
„ *floribunda*, 490, 492
* *Swintonia lurida*, 489, 491
* „ *Penangiana*, 489, 490
„ *Schwenkii*, 488, 489, 492
„ *spicifera*, 489, 490
„ „ var. *Scortechinii*, 491
Sympagurus, 517, 532, 534
„ *arcuatus*, 534
„ *monstrosus*, 517, 533, 534
„ *nudus*, 532
„ *pilimanus*, 534
Synagrops, 311
„ *philippinense*, 311
Synaptura, 329
„ *altipinnis*, 329
„ *quagga*, 329
Syndesmis elegans, 481
Tachybaptes minor, 567
Tæniolabrus, 320
„ • *cyclograptus*, 320
Taphrometopon lineolatum, 563
Taphrometopum lineolatum, 563
Tauredophidium, 323
„ *hextii*, 323
TELEOSTEI, 311
Teratoscincus keyserlingii, 553
„ *scincus*, 553
Terebinthacea, 463
Tetragonopterus triangulum, 312
Tetrastigma, 386
„ *lanceolarium*, 395
„ *pedunculare*, 393
Thaumastomias, 309, 334
„ *atrox*, 310, 334
* *Thealia*, 149
Thyrsites, 315
„ *bengalensis*, 315
„ *prometheoides*, 315
Tinnunculus alaudarius, 567
Tipularia, 118, 119
Tlos, 135, 165, 166, 170, 175, 184
* „ *patella*, 176, 296
„ *petræus*, 176, 177
Tonsella disperma, 360
„ *prinoides*, 367
Toxicodendrum Cobbe, 423
Trachichthys darwinii, 314
„ *intermedius*, 314
„ *japonicus*, 314
TRACHINIDÆ, 316
Triacanthodes, 338
„ *ethiops*, 338
TRICHIURIDÆ, 315
TRICHONOTIDÆ, 320
Trichopeltarion, 103, 104
„ *nobile*, 104
* „ *ovale*, 88, 103
Trigla hemisticta, 319
Trigonachras, 421, 445
„ *acuta*, 445
Trigonocarpus littoralis, 346
Trochisandra indica, 355

Turpinia, 421, 452
„ *latifolia*, 453
„ *martabanica*, 453
„ *microcarpa*, 453
„ *nepalensis*, 453
„ *pomifera*, 452
„ „ var. *sphaerocarpa*, 453
„ *sphaerocarpa*, 453
TYMOLINÆ, 135, 136, 273, 274, 289
Tymolus, 274
Uhlias, 166
Upupa epops, 567
Uranoscopus, 316
„ *cognatus*, 316
„ *crassiceps*, 316
Uroconger, 338
„ *vicinus*, 338
Uromastix asmussii, 557
Uroptychus, 94, 101
„ *nitidus*, 101
Usubis triphylla, 422
VANDEÆ, 122
VARANIDÆ, 558
Varanus griseus, 558
Ventilago, 371, 378, 381
„ *bracteata*, 379
„ *calyculata*, 378, 379
„ *denticulata*, 379
„ *leiocarpa*, 378, 380
„ *lucens*, 380
„ *macrantha*, 379
„ *macrocarpa*, 382
„ „ var. *pubescens*, 382
„ *Madraspatana*, 378, 380
„ *Maingayi*, 378, 379
„ *silhetiana*, 379
„ *Smithiana*, 379
„ *sulphurea*, 379
Veronica, 52, 60
Vipera, 564
VIPERIDÆ, 564
Vitis, 108, 384, 395, 400, 408
„ *adnata*, 109, 110, 387, 398, 405
„ *andamanica*, 386, 393, 396, 406
„ *angulata*, 110
„ *aquosa*, 110
„ *assamica*, 109
„ *assimilis*, 113
„ *barbata*, 110, 385, 387, 405
„ „ var. *trilobata*, 388
„ *bractcolata*, 114
„ *campylocarpa*, 113
„ *cantoniensis*, 386, 397, 407
„ *carnosa*, 403
„ *cerasiformis*, 108, 109, 387, 400, 402, 405
„ „ var. *Wallichii*, 400, 401
„ *cerifera*, 108
„ *cinnamomea*, 385, 389, 391, 405
Vitis cinnamomea, var. *compositifolia*, 392
„ *compositifolia*, 386, 391, 392, 407
„ *cordifolia*, 111
„ *coriacea*, 404
„ *costata*, 110, 112, 399
„ *crenata*, 403
„ *diffusa*, 108, 401
„ *discolor*, 112, 387, 399, 405
„ *diversifolia*, 399
„ *dubia*, 113
„ *elegans*, 386, 392, 407
„ *erioclada*, 112
„ *furcata*, 387, 399, 405
„ „ var. *pubescens*, 399
„ *gigantea*, 110
„ *glaberrima*, 108, 109, 387, 400, 401, 405
„ *glauca*, 109, 110, 400
„ *gracilis*, 385, 389, 405
„ *hastata*, 108, 401
„ *Heyneana*, 109, 111, 114
„ *Himalayana*, 112, 113, 397
„ „ var. *semicordata*, 112, 113, 397
„ *inæqualis*, 399
„ *indica*, 112
„ *japonica*, 387, 403, 406
„ *Kleiniana*, 109
„ *Kunstleri*, 386, 396, 406
„ *laeta*, 110
„ *lanata*, 111, 112, 388
„ *lanceolaria*, 113, 386, 395, 406
„ *latifolia*, 109, 112
„ *Lawsoni*, 386, 394, 406
„ *Linnaei*, 110
„ *macrostachya*, 385, 388, 405
„ *mollis*, 403
„ *mollissima*, 387, 402, 406
„ *montana*, 112
„ *Mottleyi*, 391
„ *muricata*, 395
„ *neilgherrensis*, 112
„ *nitida*, 391
„ *novemfolia*, 387, 394, 403, 406
„ *oxyphylla*, 113
„ *pallida*, 109
„ *parvifolia*, 111, 112
„ *pedata*, 403
„ *pedicellata*, 114
„ *penduncularis*, 386, 393, 394, 406
„ *pentagona*, 109
„ *polita*, 407, 408
„ *polystachya*, 386, 389, 390, 406
„ *polythyrsa*, 386, 390, 407
„ *Pterisanthes*, 408
„ *pubiflora*, 393
„ *pycnantha*, 113, 396
„ *pyrrhodasys*, 110
„ *quadrangularis*, 387, 398, 405
„ *repanda*, 110, 112

Vitis repens, 109, 110, 112, 387, 398, 400, 405
„ *riparia*, 110
„ *rufula*, 409
„ *rugosa*, 111, 112, 388
„ *rumicisperma*, 395
„ *sagittifolia*, 108, 109, 401
* „ *Scortechinii*, 386, 392, 405
* „ „ var. *pubescens*, 392
„ *semicordata*, 112, 113, 386, 396, 406
„ „ var. *Roylei*, 113, 397
„ „ „ *Scortechinii*, 113, 397
„ *serrulata*, 114
„ *specifera*, 389
„ *tenuifolia*, 403
„ *thyrsiflora*, 386, 390, 391, 407
„ *trifolia*, 387, 402, 406
„ *tuberculata*, 395, 396
„ *vitiginea*, 110
„ *Wightiana*, 110, 112
* „ *Wrayi*, 386, 394, 406
Xanthochymus ovalifolius, 369
Xenodermichthys, 335
„ *guentheri*, 335
Xenomystax, 338
„ *trucidans*, 338
Xerospermum, 420, 431
„ *laevigatum*, 431
„ *muricatum*, 431
„ *Norhonianum*, 432
* „ *Wallichii*, 431, 432
Zamenis diadema, 563
„ *Karelinii*, 563
Zamenis ladacensis, 563
„ *rhodorachis*, 563
Zanclifer, 289
Zeuxine, 125
„ *goodyeroides*, 127
* „ *pulchra*, 127
ZINGIBEREÆ, 297, 298
Zizyphus, 371
„ *affinis*, 372, 375
„ *albens*, 373
„ *calophylla*, 372, 374, 375
„ *celtidifolia*, 373
„ *elegans*, 371, 374
„ *ferruginea*, 373
„ *glabra*, 372, 375, 376, 377
„ *glabratus*, 376
„ *Horsfieldii*, 372, 373, 376
„ *Jujuba*, 371, 372
* „ *Kurzii*, 371, 373
„ *mauritiana*, 372
„ *Napeca*, 373
„ *Oenoplia*, 371, 372
„ *ornata*, 375
„ *pallens*, 373
„ *pedicellata*, 373
„ *rufula*, 373
„ *rugosa*, 376
„ *scandens*, 373
„ *Sororia*, 372
„ *subquinquenervis*, 374
„ *trinervia*, 376
„ *trinervius*, 372, 376
„ „ var. *glabratus*, 376
„ *venulosa*, 376



Drawn by A. L. Singh.

LAGOTIS PHARICA, Prain.

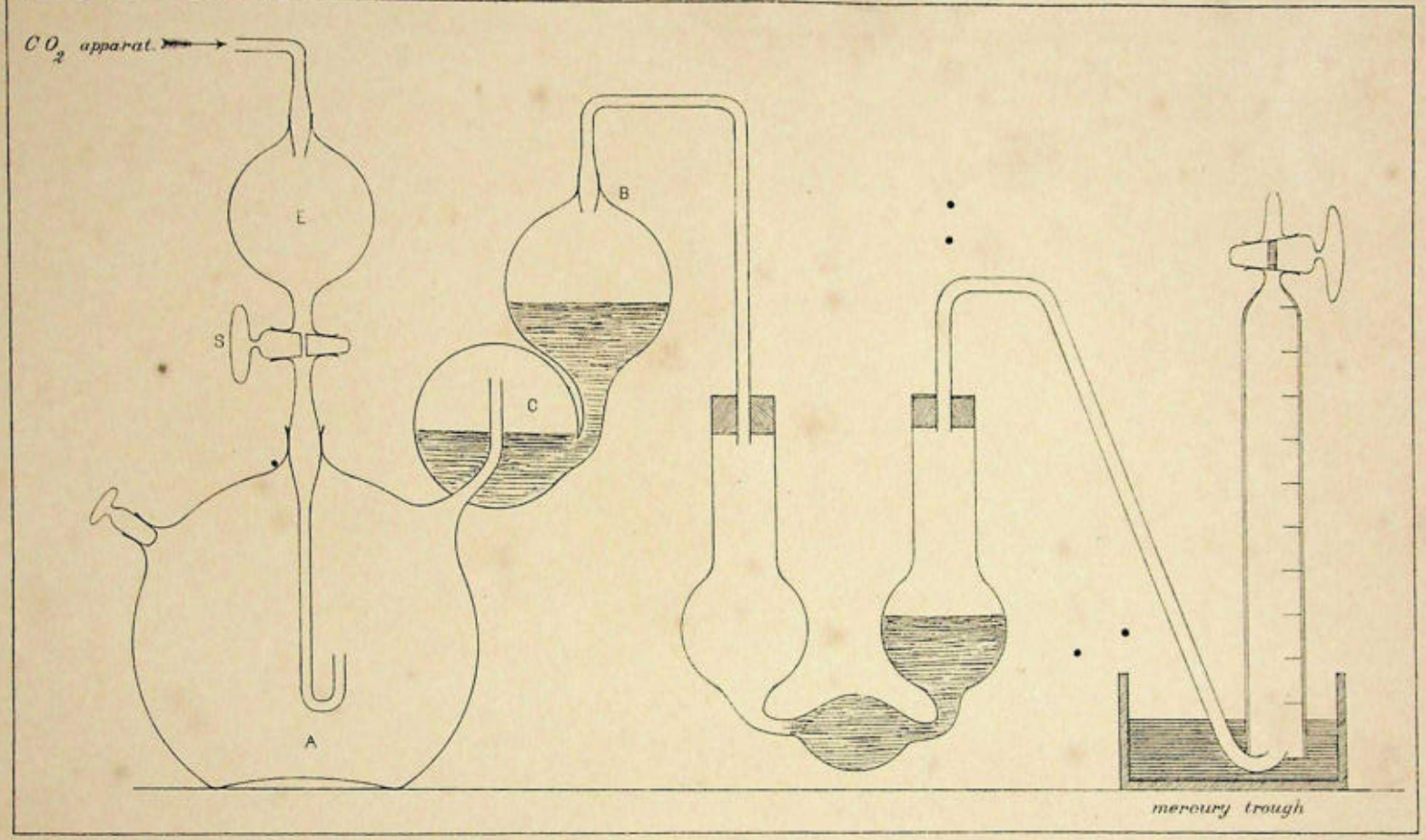
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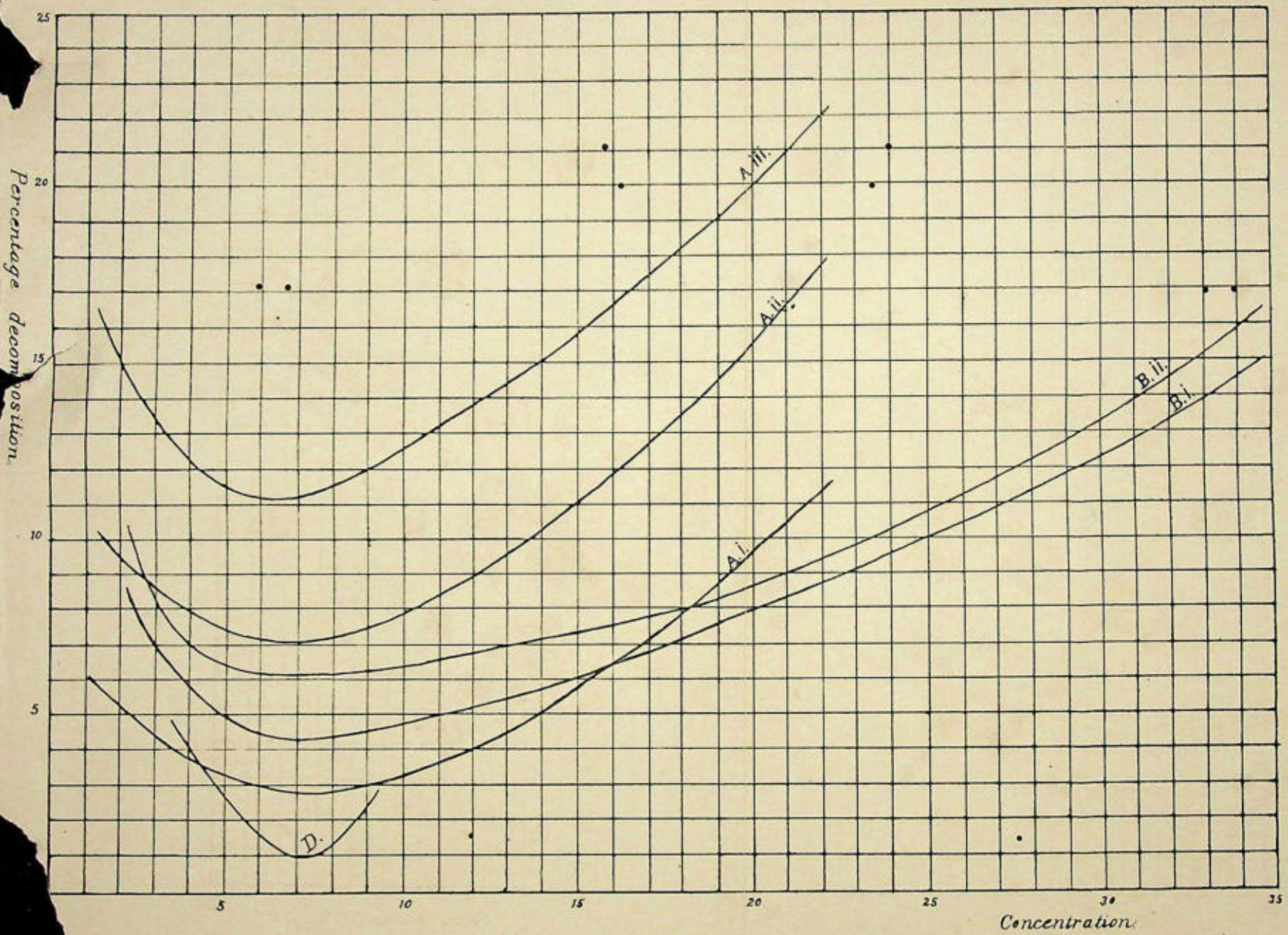


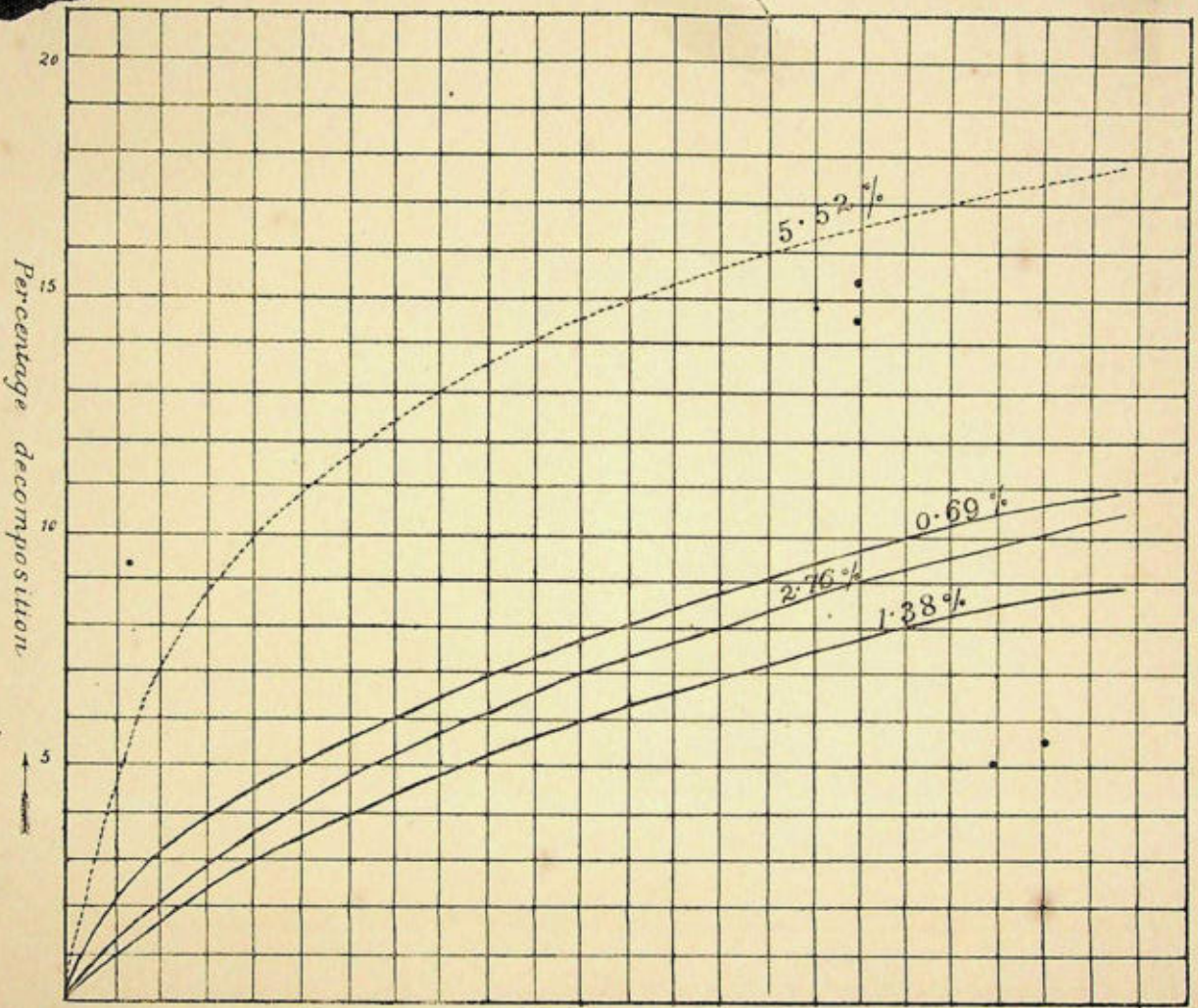
Drawn by A. L. Singh.

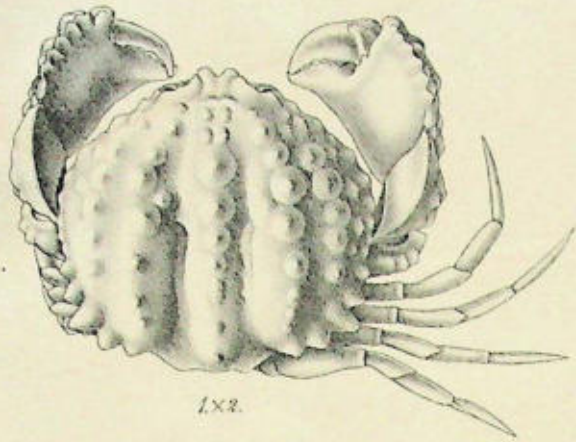
LAGOTIS CRASSIFOLIA, Prain.

Litho by K. D. Bose.

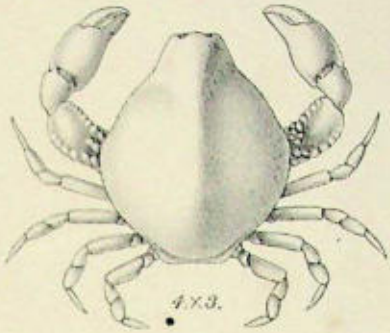

CO_2 apparat.
E
S
B
C
A
mercury trough


Percentage decomposition.
25
20
15
10
5
A. iii.
A. ii.
A. i.
B. ii.
B. i.
D.
5
10
15
20
25
30
35
Concentration.

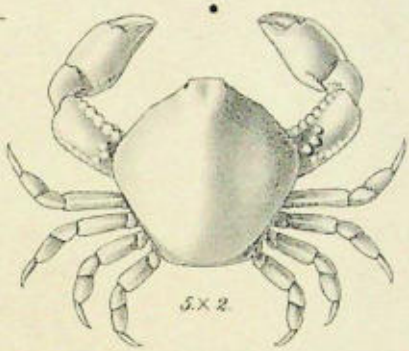

20
15
10
5
Percentage decomposition
5·52 %
0·69 %
2·76 %
1·38 %



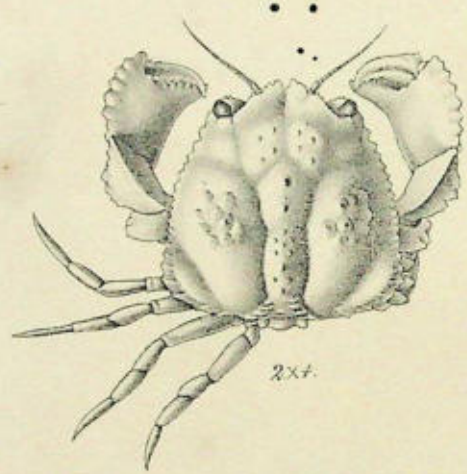
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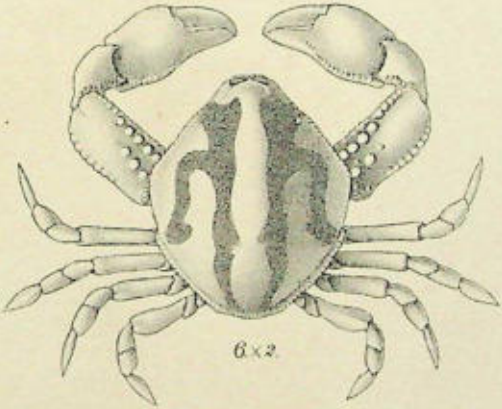
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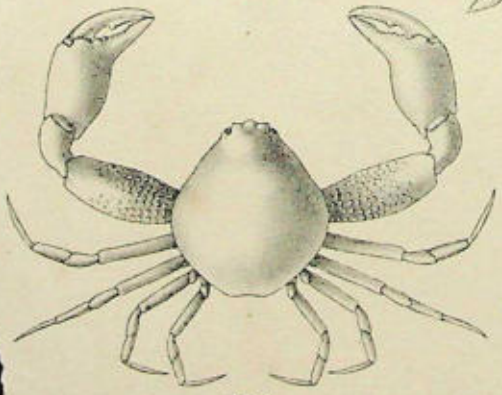
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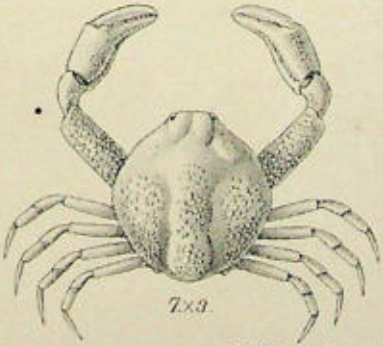
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6×2



3×3.

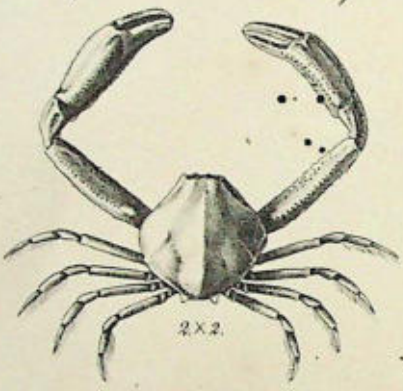


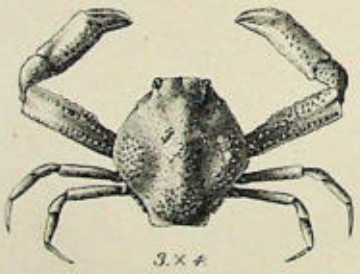
7×3.

S. C. Mondul del. et. litt.

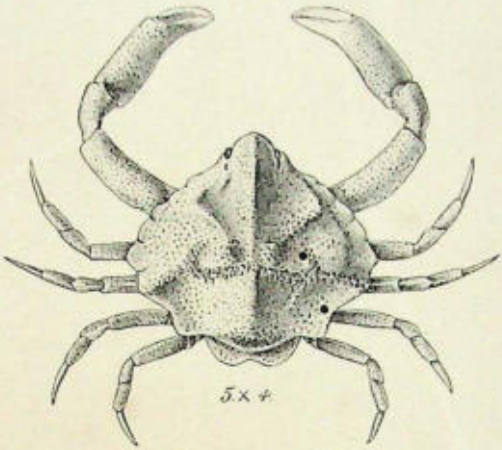
1. Calappa pustulosa, ♂. 2. Calappa wood-masoni, ♂. 3. Pseudophilyra wood-masoni, ♂.
4. Leucosia corallicola, ♂. 5. Leucosia sima, ♀. 6. Leucosia truncata, ♀.
7. Pseudophilyra blanfordi, ♂.

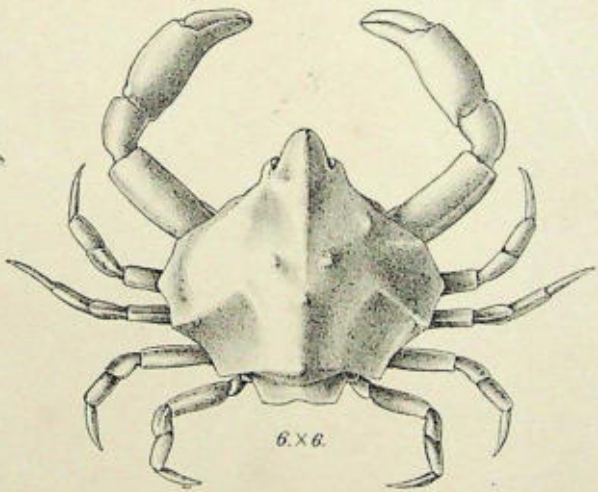


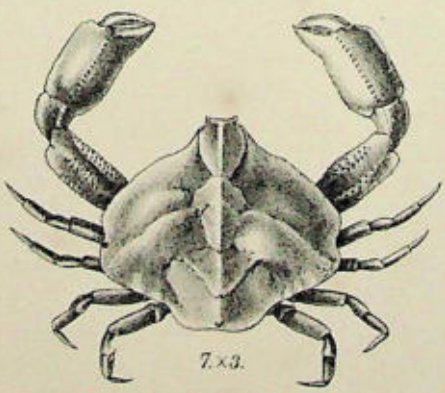






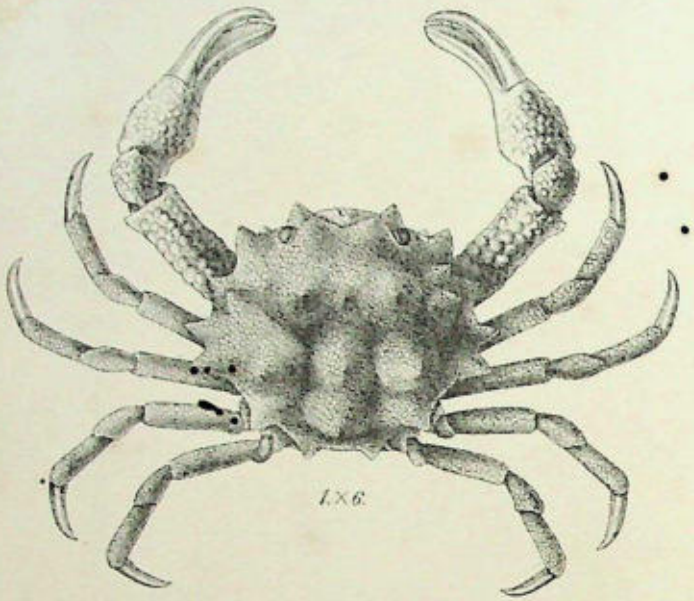


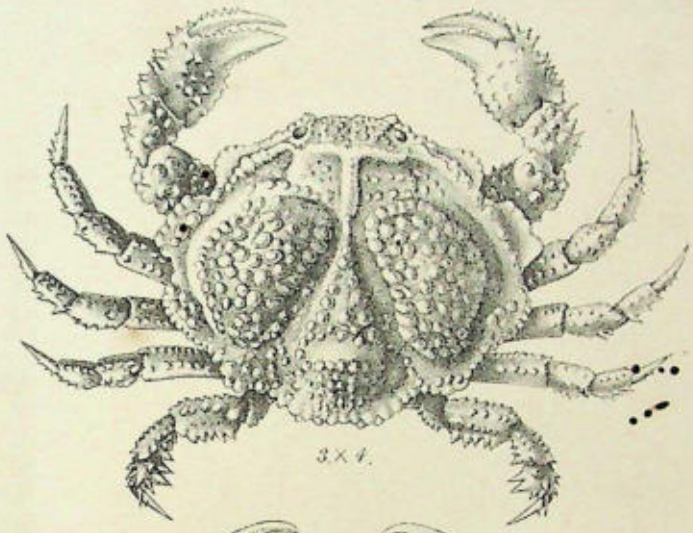


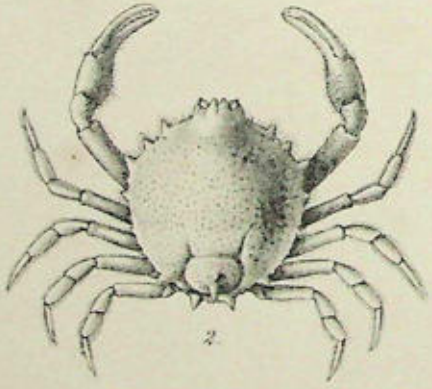


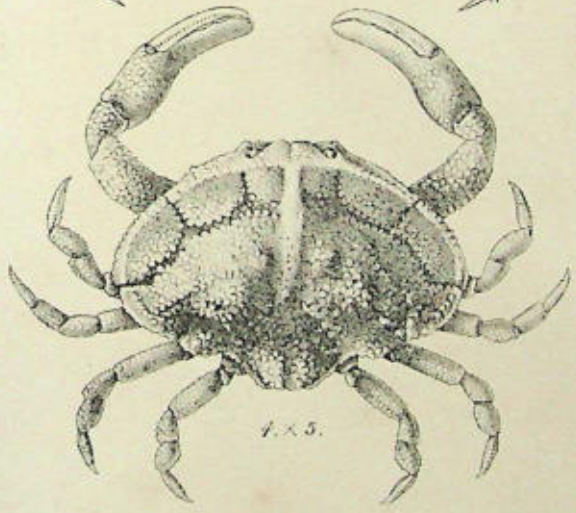
A.C. Chowdhary & S. C. Mondal del. A.C. Chowdhary lith.

1. Philyra coralliicola, ♂. 2. Philyra sexangula, ♂. 3. Ebalia wood-masoni, ♂.
4. Ebalia diadumena, ♀. 5. Nursia blanfordi, ♀.
6. Nursia nasuta, ♂. 7. Nursia persica, ♀.









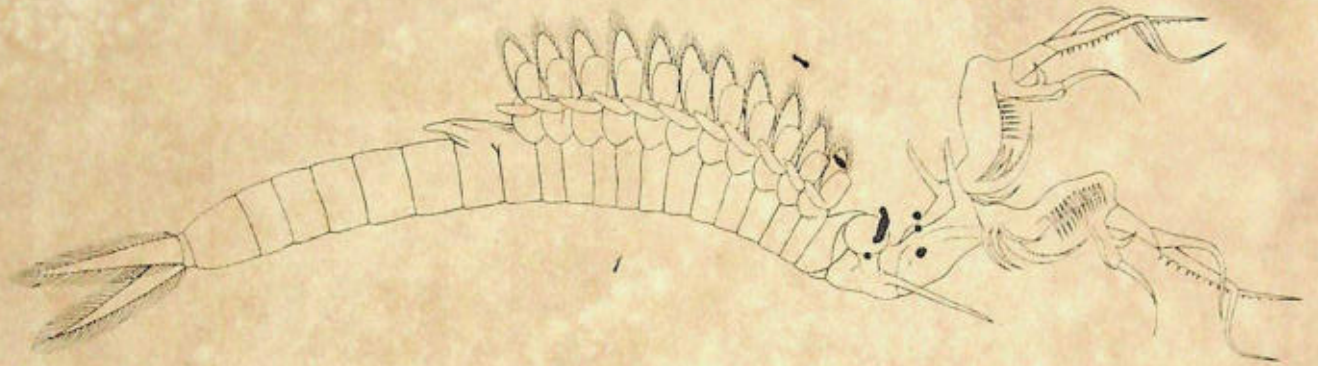
S.C. Mondul & A.C. Chowdhary del. S.C. Mondal lith.

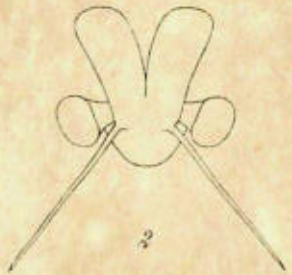
1. Heteromunia vesiculosa, ♀. 2. Pariphiculus rostratus, ♀. 3. Actaecmorphus morum, ♀.
4. Tlos patella, ♀.



Drawn by K. P. Dass. Lith by K. P. Dass.

CROFTIA SPECTABILIS, King & Pram.





S.C.Mondul del. et lith.

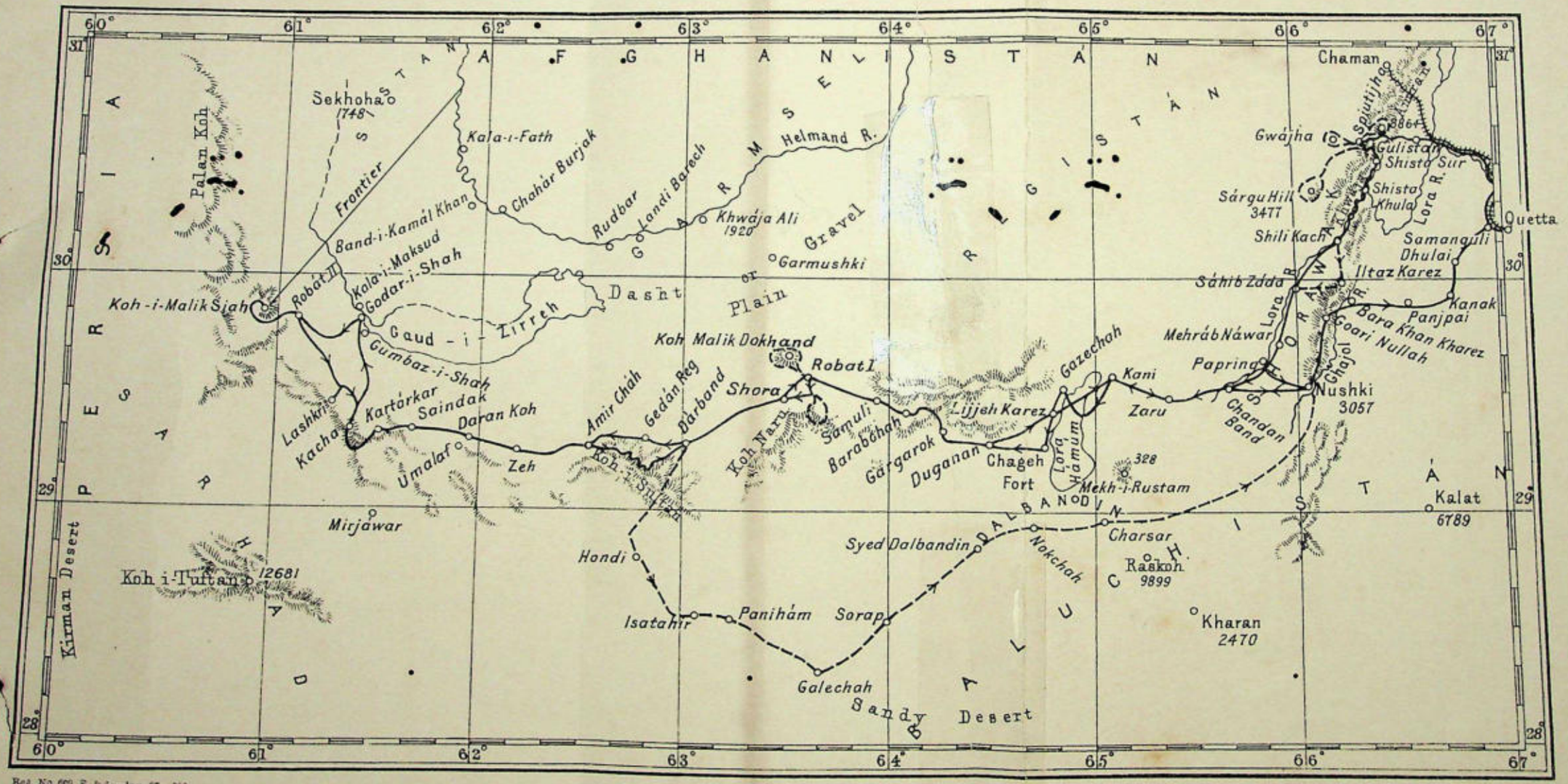
BRANCHIPUS BENGALENSIS.

1.♂ x5 2.♀ x6

Map showing roughly

THE ROUTE TRAVERSED BY THE BALUCH-AFGHAN BOUNDARY COMMISSION OF 1896.

Scale 1 Inch = 40 Miles.



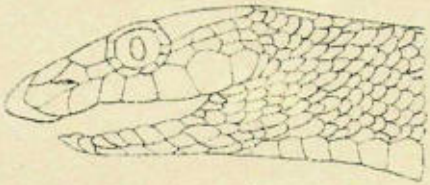
Main line of march. ————

Places visited..... — — — — —

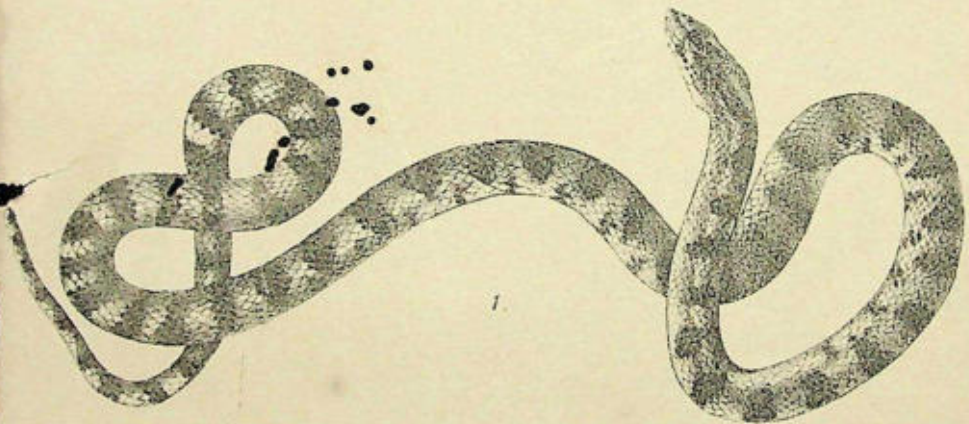
Reg. No. 609, E. & A.—Jan. 97.—260.

Reg. No. 713, As. Soc.—Jan. 97.—600.

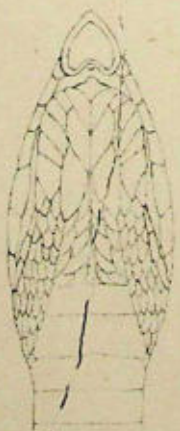
Litho. G. I. O., Calcutta.



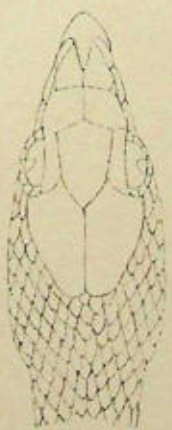
1a.



1.



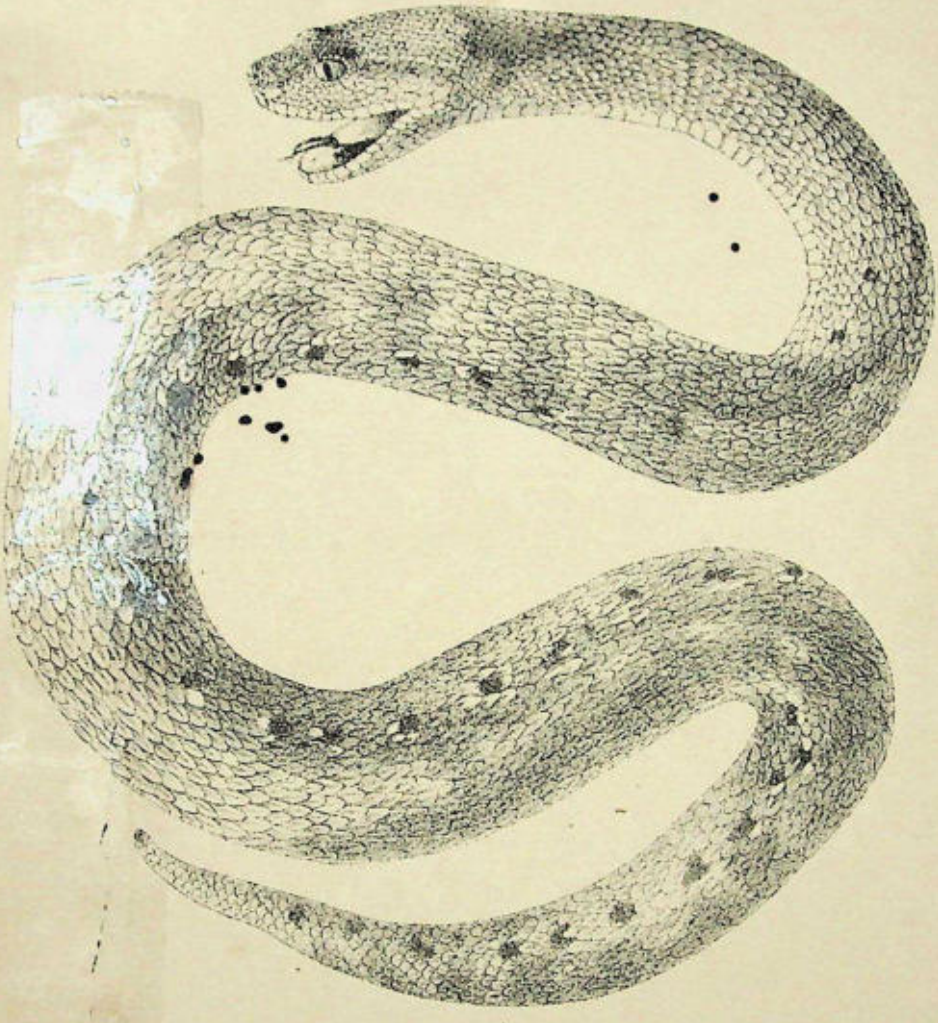
1b.



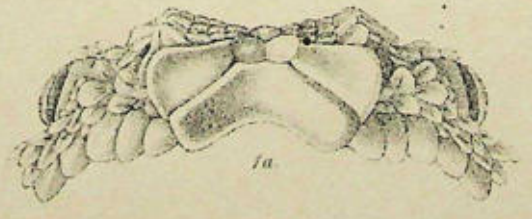
1c.

LYTORHYNCHUS MAYNARDI

A. Chowdhury del. et Lith.



1.



1a.

A. C. Chowdhury del. Lith. by S. C. Mondul.

ERISTICOPHIS MACMAHONII.



BOO
9.