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I.—*On new or little-known Butterflies from the Indo-Malayan region.*—*By* Lionel de Nice'ville, F. E. S., C. M. Z. S., &c.

(With Plates I, II, III, IV and V.)

[Received February 10th ;—Read March 7th, 1894.]

Family NYMPHALIDÆ.

Subfamily Satyrinæ.

1. Mycalesis (*Satoa*) maia, n. sp., Plate I, Figs. 1, ♂ ; 2, ♀.

Habitat : Battak Mountains, N.-E. Sumatra.

Expanse : ♂, 1·8 to 1·9 ; ♀, 2·1 inches.

Description : Male. Upperside, *both wings* black, glossed with vinous in some lights ; a narrow waved marginal line. *Forewing* with the costa, apex broadly, and outer margin decreasingly paler ; a small black white-pupilled ocellus in the anterior discoidal interspace, sometimes with a smaller ocellus attached to it posteriorly ; a large round black spot in the first median interspace, outwardly bounded by a pale line. *Hindwing* with a broad whitish patch on the costa at the base of the wing ; the outer margin narrowly pale. Underside, *both wings* fuscous ; the outer margin bears a narrow waved black line, then a waved narrow ochreous (in some specimens violet) line, then a nearly straight ochreous (or violet) line, the extreme margin narrowly black. *Forewing* with the apex washed with ochreous ; a subapical black ocellus, sometimes with a second smaller one attached to it posteriorly, and a

very large posterior ocellus, these ocelli have a white pupil, the black portion surrounded by an ochreous, a black, and lastly a violet ring; the inner margin broadly whitish. *Hindwing* with a basal nearly straight and a discal irregular violet fascia; a series of seven ocelli towards the margin similar to those on the forewing, but the outer rings of all of them joined and forming a continuous violet bordering to the whole series of ocelli, the first, fourth and sixth ocelli of medium size, the second, third and seventh small, the fifth the largest. FEMALE. UPPERSIDE, *both wings* much paler than in the male. *Forewing* with an indistinct subapical broad dull ferruginous fascia, reaching from the costa to the first median nervule; otherwise similar to the male, except that all the secondary sexual characters found in the male are wanting.

Nearest to *M. maianeas*, Hewitson, the only other species in the subgenus *Satoa*; described by Hewitson from Malacca [?] and Sarawak, of which the female has alone been figured, and from which the same sex of *M. maia* appears to differ in having a subapical ocellus on the upperside of the forewing, and the "orange band" instead of being very richly coloured and prominent is reduced to an obscure cloud on both surfaces.

This species appears to occur not uncommonly in the mountains of N.-E. Sumatra, and there are numerous specimens in Dr. Martin's collection as well as in my own. I possess specimens taken in July and December. Both Mr. Henley Grose Smith ("Head Hunters of Borneo"), and Dr. B. Hagen ("Die Pflanzen- und Thierwelt von Deli auf Der Ostküste Sumatra's") record *M. maianeas*, Hewitson, from Sumatra, but this species is probably the one meant.

Subfamily MORPHINÆ.

2. STICHOPHTHALMA SPARTA, n. sp., Plate I, Fig. 4, ♂.

HABITAT: Manipur.

EXPANSE: ♂, 5·0 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* deep rich reddish-fulvous or ferruginous. *Forewing* with the irregular discal black line of the underside shewing through by transparency; the apical area widely pale fulvous, this pale area extends from the submarginal hastate black markings to just within the discal black line, it is very wide on the costa, but dies away to nothing before reaching the first median nervule; a series of five submarginal hastate black markings, one in each interspace from the upper discoidal nervule to the submedian nervure, increasing progressively in size from the anterior to the posterior marking; a large black patch at the apex; a submarginal fulvous line, beyond which is a narrower anteciliary black line, both

reaching from the inner angle to the lower discoidal nervule; the area enclosed by the coalescing of the hastate markings forms a series of six rounded spots regularly increasing in size, the anterior spot the smallest, the posterior one the largest, these spots are of a slightly darker shade than the pale fulvous apical area, but not so dark as the dark, rich reddish-fulvous of the rest of the wing. *Hindwing* with the abdominal and outer margins rather paler than the rest of the wing; a submarginal series of seven black markings, of which the anterior one is a small lunule with its concave edge directed towards the base of the wing, the next five markings are hastate-shaped,* increasing in size from the anterior one to the posterior one in the first median interspace, the seventh posterior marking somewhat quadrate in form, and occupying the whole width of the submedian interspace; a fine black anteciliary thread. UNDERSIDE, *both wings* of a reddish-fulvous of not quite so rich a shade as on the upperside. *Forewing* with a small irregular black marking towards the base of the cell; a highly irregular and ziz-zag black line crosses the middle of the cell and extends both to the costa and to the submedian nervure, the posterior portion of the line is broken and shifted outwardly below the median nervure; the upper, middle, and anterior half of the lower disco-cellular nervule defined by a black line; an irregular discal black line from the costa to the submedian nervure, just touching the lower end of the cell; beyond the line is a series of five somewhat cordate, reddish ocelli, each ocellus centred with a whitish lunule and bounded by a fine whitish and then a fine black line, the four anterior ocelli equal-sized, the fifth posterior one in the first median interspace a little larger; beyond these ocelli is another irregular black line from the costa to the inner margin, this line is narrower and paler than the discal one; the space between these two lines is anteriorly somewhat paler than the rest of the wing; a submarginal nebulous straight blackish band; a very fine anteciliary black line. *Hindwing* with an irregular sub-basal and a discal black line, the latter posteriorly curving round and almost meeting the posterior end of the former, both terminating above the anal angle on the submedian nervure; a series of five ocelli on the disc similar to those in the forewing, the posterior one the largest and rather misshapen, the anterior one the next largest, the three in the middle nearly equal sized; the outer discal fulvous line and

* The late Professor J. O. Westwood well described these peculiar and characteristic markings of the genus *Stichophthalma* as being built up of a much curved lunule on the margin coalescing inwardly with a spear-shaped spot. To me these markings have a curious likeness to the black silhouette of the head and shoulders of a human figure, especially the third marking from the anal angle of the hindwing in the specimen here figured.

blackish submarginal band as in the forewing; a small oval deep black spot at the anal angle, with a black cloud above it reaching to the posterior ocellus; an anteciliary black thread. *Antennæ* black. *Body* throughout ferruginous.

Nearest to *S. howqua*, Westwood, var. *suffusa*, Leech,* from Western China, differing in the forewing on the upperside in the pale apical area being very much smaller, not extending into the cell as it does in *S. howqua*, var. *suffusa*; on the hindwing the hastate markings in *S. sparta* are well formed, in Mr. Leech's species they have lost all shape, having coalesced into an almost solid black band. On the underside the ground-colour in *S. howqua*, var. *suffusa* is pale greenish, in *S. sparta* it is ferruginous, but this may be only a sexual difference; but in true *S. howqua* and its named variety the outer discal line and the submarginal band on both wings are half the distance apart that they are in *S. sparta*; and they have six and sometimes seven ocelli on the forewing, while *S. sparta* has only five.

Described from a single example purchased from a telegraph signaller employed at Manipur.

Subfamily Nymphalinæ.

3. Herona pringondani, Fruhstorfer, Plate III, Figs. 5, ♂; 4, ♀.

H. pringondani, Fruhstorfer, Ent. Nach., vol. xix, p. 314 (1893).

Habitat: Java.

Expanse: ♂, 2·9; ♀, 2·9 to 3·1 inches.

Description: Male. Upperside, *both wings* dull brown, slightly tinged with ochreous. *Forewing* with an indistinct pale oblique band across the end of the discoidal cell; a broad very irregular discal white band extending across the wing, divided into oblong spots by the brown veins crossing it, the four anterior portions from the costa to the third median nervule are placed outwardly obliquely, the first portion on the costa is very small, the second is larger, the third is the largest, the fourth not quite so long as the third but broader; the four remaining portions of the band are placed parallel to the outer margin, the upper portion in the second median interspace is oval in shape, the second portion is the largest of all and has a small round black spot in its middle, the third is smaller than the second but bears a large round black spot, the posteriormost portion on the inner margin is short; two subapical crescent-shaped white spots placed obliquely, divided by the upper discoidal nervule. *Hindwing* with a broad even discal white band extending from the costa to near the abdominal margin,

* Butt. from China, Japan, and Corea, p. 114, pl. i, fig. 8, *female* (1892).

divided by a highly irregular blackish fascia which is broken at the third median nervule; an indistinct ochreous cloud across and beyond the end of the cell; some whitish spots on the margin towards the apex. UNDERSIDE, *both wings* with a highly irregular narrow discal brown line extending across the surface, commencing above the anal angle of the hindwing and ending in a rather broad dark fascia at the costa of the forewing. *Forewing* whitish, the inner margin very broadly extending half way across the discoidal cell pale ochreous; an oblique brown band across the middle of the cell, a short one at the end of the cell; the white band of the upperside indistinctly defined, but the two black spots divided by the first median nervule distinct but smaller than on the upperside. *Hindwing* whitish mottled and clouded with pale ochreous-brown; an oval conspicuous brown spot in the middle of the cell placed against the subcostal nervure. FEMALE shaped and marked precisely as in the male, and can only be distinguished therefrom by the stouter abdomen and the structure of the forelegs.

Nearest to *H. schoenbergi*, Staudinger,* from South-East Borneo, from which it appears to differ in the forewing in the discal white band being broader and continuous throughout, in *H. schoenbergi* it is broken up into a double series of spots, the outer series is white, the inner pale ochreous; in the hindwing the discal white band in *H. pringondani* is placed much farther from the outer margin than in *H. schoenbergi*, and the black fascia it bears is strongly broken and dislocated in the middle, while in *H. schoenbergi* the white discal band approaches much nearer the margin, and the black fascia across the band is continuous throughout and divides the band nearly equally; lastly, there is a small round black spot in the middle of the first median interspace in *H. schoenbergi* which is wholly wanting in *H. pringondani*.

Described from one male and two females received from Mr. H. Fruhstorfer, to whose courtesy I am indebted for a copy of his description of the species, which reached me just in time to enable me to substitute his name for the one I had proposed for this interesting *Herona*.

4. HERONA SUMATRANA, Moore, Plate III, Fig. 7, ♀.

H. sumatrana, Moore, Trans. Ent. Soc. Lond., 1881, p. 308.

HABITAT: N.-E. Sumatra.

EXPANSE: ♂, 3·0 to 3·1; ♀, 3·1 to 3·4 inches.

* *Herona schoenbergi*, Staudinger, Iris, vol. iii, p. 337, n. 3, pl. iii, fig. 3 (1890); vol. iv, p. 84 (1891). The figure is probably taken from a female specimen. This may be the species referred to by Mr. W. Doherty in Journ. A. S. B., vol. lviii, pt. 2, p. 122 (1889) thus:—"*Euthalia* (*Felderia*) *macnairi*, Distant, is mimicked by a new and remarkable species of *Herona* (?) of which both sexes were taken by me in Borneo, and are now in Mr. Neumoegen's possession."

Description: Male. Upperside, *both wings* dull brown, slightly tinged with ochreous. *Forewing* with a discal macular band consisting of seven separated portions, the four anterior ones elongated, whitish, dusted with fuscous, the three posterior ones rounded, white, tinted with violet in some lights; three subapical small violet-white spots arranged in an equilateral triangle, with the apex of the triangle towards the outer margin of the wing; a large quadrate ochreous spot in the first median interspace within the discal band, a smaller one in the submedian interspace bisected by the internervular fold, a narrow streak on the inner margin. *Hindwing* with a broad even discal white band, strongly tinted with violet in some lights, extending from the costa to near the abdominal margin, divided by a highly irregular fascia, anteriorly fuscous, posteriorly broader and paler, the fascia broken at the third median nervule; a complete marginal series of whitish spots between the veins. Underside, *both wings* marked and coloured almost exactly as in *H. pringondani*, Fruhstorfer, from Java. Female, as in the male, but the violet suffusion of the upperside rather more prominent.

Closely allied to *H. schoenbergi*, Staudinger, from South-East Borneo, and to *H. pringondani*. It differs from both in the violet reflections of the upperside; it agrees with the latter in the fuscous fascia of the hindwing on the upperside placed on the discal white band being strongly broken and dislocated in the middle, thereby differing from the former. The markings of the forewing differ a good deal in detail in *H. pringondani* and *H. sumatrana*, as will be noted by a reference to the figures and descriptions of the two species.

Described from two males and three females in Dr. Martin's and my collection, one of which was taken in the virgin forest at Selesseh in September. It may be a mimic of the common species of *Euthalia* (*Felderia*) of the group of *cocytina*, Horsfield.

5. Neptis clinioides, n. sp., Plate I, Fig. 8, ♂.

Habitat: Battak Mountains, N.-E. Sumatra.

Expanse: ♂, ♀, 2·2 inches.

Description: Male and Female. Upperside, *both wings* deep black, markings creamy-white. *Forewing* with the discoidal streak wide, joined to the triangular spot beyond, just "nicked" or indented anteriorly at the end of the cell; the discal series consists of seven spots, placed in two groups, the upper of three, the lower of four spots, the groups well separated, the uppermost spot very small, linear, the two following large, conjoined, divided only by the upper discoidal nervule, the four posterior spots large, contiguous; the submarginal macular line obsolete in the male, composed of small linear streaks in the female.

Hindwing with a broad discal band, widest on the costa, gradually and evenly tapering to the abdominal margin; the submarginal band composed of prominent narrow portions; an indistinct pale line between the discal and submarginal bands; a similar marginal line. UNDERSIDE, *both wings* reddish-brown, all the markings broader than on the upperside. *Forewing* with three marginal lines, the inner one very narrow, the middle one the broadest; on the margin are two white spots divided by the lower discoidal nervule, and two others divided by the first median nervule. *Hindwing* with a short basal streak on the costa, behind which is a longer curved one running into the discal band; between the discal and submarginal bands is a narrow straight line; two lines on the margin, the outer one the broader.

Perhaps nearest to *N. clinia*, Moore,* from Bengal (*Moore*) and Siam (*Druce*), known to me by the figure and description only, from which it appears to differ in having the discoidal streak and spot beyond in the forewing joined instead of separated, the discal spots larger, the discal band on the hindwing narrower, tapering, instead of being of equal width throughout; the submarginal band creamy-white like the other markings instead of being "brownish-white." From the figure of *N. nandina*, Moore, it differs in the discoidal streak and spot beyond of the forewing being continuous; the discal series of spots seven in number instead of six, they are also larger and conjoined instead of being well separated; the markings of the hindwing on both surfaces very similar.

Described from two examples in my collection, taken in June; there are numerous examples in Dr. Martin's collection.

6. NEPTIS NISÆA, n. sp., Plate I, Fig. 9, ♂.

HABITAT: Java.

EXPANSE: ♂, 1·3 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* deep black with pure white markings. *Forewing* with a narrow streak in the discoidal cell well separated from the triangular spot beyond; the discal series consists of six spots, placed in pairs, each pair conjoined, divided only by the crossing vein; a submarginal series of small linear spots more or less obsolete about the third median nervule. *Hindwing* with the discal band narrow on the abdominal margin gradually and regularly increasing in width to the costa; the submarginal band consists of six very narrow well separated spots; there is also an extremely faint line between the discal and submarginal bands, and a similar marginal line. UNDERSIDE, *both wings* chocolate-brown with pure white markings. *Forewing* with the inner margin broadly fuscous; the discoidal streak

* Proc. Zool. Soc. Lond., 1872, p. 563, pl. xxxii, fig. 5, *male*.

very wide; the anterior pair of spots of the discal series continued to the costa; the margin bears three interrupted series of spots. *Hindwing* with a costal band at the base of the wing; an obscure grey fascia posterior to this; the discal band very narrow on the abdominal margin, very broad on the costa; followed by a grey line; the spots of the submarginal band wider and more lunular than above; two prominent marginal lines, the outer the wider.

It is difficult to say to what group *N. nisæa* belongs. The discal band of the forewing being divided into three pairs of spots allies it to the *N. columella* group, the pure white markings and general *facies* ally it to the *N. nata* group. It is also near to *N. nandina*, Moore, originally described from Java and Darjeeling, but the middle pair of spots of the discal series on the forewing being conjoined instead of well separated will immediately differentiate between the two species. On the whole it appears to be nearest to *N. pampanga*, Felder, from N.-W. Luzon, as figured in Herr Georg Semper's "Schmett. der Philippinischen Inseln," pl. xxix, figs. 6, *male*; 7, *female*, from which it may instantly be known by the discal band of the hindwing on the underside being half the width at the point where it touches the abdominal margin that it is in that species.

Described from two examples received from Herr H. Fruhstorfer.

7. Argynnis niphe, Linnæus, Plate III, Figs. 1 and 2.

The gynandromorphous example of *A. niphe*, Linnæus, here figured was reared by Mrs. S. Robson at Bankipur, Behar, Northern India, and emerged from the pupa on the 2nd March, 1893. It is thus referred to* by that lady in describing her experiments in breeding this species:—"One *lusus naturæ*, a male, had one wing as in the ordinary male, and the other as in the ordinary female!"

This insect has the right-hand pair of wings masculine, the left-hand pair feminine. In the masculine half of the insect there is, however, in the forewing on the upperside a slight admixture of feminine coloration, the round black spot in the lower discoidal interspace in the outer discal series of spots has a streak of white on either side of it, and on the disc are many irregular blue-black streaks more or less connecting the black spots. The hindwing is quite normal. On the underside of the masculine forewing there is the commencement of a well-defined white subapical band as in a normal female example, and the discal black spots have, as on the upperside, some irregular blue-black markings attached to them. The hindwing on the underside is quite normal. The feminine pair of wings are smaller than the mascu-

* Journ. Bombay Nat. Hist. Soc., vol. viii, p. 152 (1893).

line pair, and have all the markings and coloration of an ordinary female. The masculine antenna is 14 mm. in length; the feminine is much shorter, being only 10·5 mm. in length. Externally the organs of generation are masculine, I have not dissected them to ascertain their internal structure.

Gynandromorphous butterflies are very rare. In all my experience I have met with only one other example in India, a specimen of *Cyliogenes suradeva*, Moore, collected by the late Mr. Otto Möller, and now in Mr. J. H. Leech's possession. The late Professor Westwood has figured two separate examples of *Cirrhochroa aoris*, Doubleday and Hewitson; Mr. George T. Baker has figured and described the primary sexual characters of an *Eronia* (*Nepheronia*) *hippia*, var. *gœa*, Felder, and Herr Georg Semper an example of *Papilio castor*, Westwood, these are the only other Indian gynandromorphous butterflies of which I am aware.

8. Euthalia sakii, n. sp., Plate III, Fig. 3, ♀.

Habitat: N.-E. Sumatra.

Expanse: ♀, 3·1 inches.

Description: Female. Upperside, *both wings* pale ochreous-brown. *Forewing* with a narrow fuscous line crossing the discoidal cell near the base, continued to the submedian nervure; a large ring-spot in the middle and another at the end of the discoidal cell; a series of five semi-transparent sullied-white spots between the veins beyond the end of the cell, from the subcostal nervure to the first median nervule; the anteriormost spot linear; the second also linear, but a little longer than the first; the third spot triangular, the smallest of the three, the fourth spot larger than the third, cordate; the fifth the largest of all, also cordate; beyond this series of spots is a broad irregular diffused violet-whitish-powdery fascia, narrow at the costa, wide on the inner margin, bearing a series of dark sagittate markings placed between the veins from the lower discoidal nervule to the submedian nervure; a very small fuscous ring-spot in the submedian interspace placed at the point where the first median nervule originates. *Hindwing* with a small fuscous spot in the middle of, and a much larger ring-spot closing the cell; a discal series of six spots similar to and in continuation of the series in the forewing, the three anterior ones large, cordiform, decreasing in size, placed in the costal, upper and lower subcostal interspaces, the fourth spot in the discoidal interspace almost obsolete and very small, the fifth and sixth spots in the median interspaces small; the outer margin broadly whitish washed with a metallic greenish-blue of a curious shade, and bearing a prominent

dentated dark line in its middle. UNDERSIDE, *both wings* pale ochreous, all the markings similar to those on the upperside but much more prominent. *Hindwing* with the usual markings in and around the discoidal cell, otherwise as on the upperside. *Body* above and below concolorous with the wings. *Legs* pale ochreous.

E. sakii is perhaps nearest to *E. merta*, Moore, described from China, a female of which I possess from Quang in the Malay Peninsula, but it differs in the discal series of five spots in the forewing having their outer ends more or less excavated, while in *E. merta* the exact reverse obtains, each spot being produced outwardly into a sharp point. In *E. sakii* the sagittate markings beyond the discal series of spots also in the forewing have their apices directed towards the base of the wing, in *E. merta* towards the outer margin. On the hindwing in *E. sakii* the submarginal dentated dark line is continuous, in *E. merta* it is replaced by a series of well-separated small round spots, and there are other minor differences between the two species.

Described from a single example in Dr. L. Martin's collection. I have named it after Saki, a highly intelligent Javan collector in Dr. Martin's service.

9. EUTHALIA (*Dophla*) IVA, Moore.

Adolias iva, Moore, Horsfield and Moore, Cat. Lep. Mus. E. I. C., vol. i, p. 195, n. 395 (1857); idem, id., Trans. Ent. Soc. Lond., new (second) series, vol. v, p. 78, n. 36, pl. viii, fig. 2, *male* (1859); id., Butler, Proc. Zool. Soc. Lond., 1868, p. 602, n. 14; *Euthalia iva*, de Nicéville, Butt. of India, vol. ii, p. 197, n. 491 (1886).

HABITAT: Darjeeling (*Moore*); Manipur.

EXPANSE: ♀, 4·5 inches.

DESCRIPTION: FEMALE. Differs from the male only in being somewhat larger, the forewing rather more elongated.

I have recently been so fortunate as to acquire by purchase a pair of specimens of this fine species. It was described as far back as 1857 by Mr. Moore from Darjeeling. I am a little doubtful regarding this locality, as it is strange that within recent years this large species should not have been obtained in the Sikkim district, which is for butterflies perhaps the most completely explored of any in India. However, it may have occurred there in the middle of the century, and since become exterminated, as has its near ally, *E. durga*, Moore, owing to the enormous destruction of the virgin forests that has taken place for the cultivation of tea. *E. iva* comes into the group of *E. patala*, Kollar, *E. durga*, Moore, and *E. duda*, Staudinger, in which the sexes are very much alike, in that respect differing from *E. nara*, Moore, and *E. sahadeva*, Moore, in which the sexes differ greatly, the females of these two

species being like both sexes of the former group.* My male specimen agrees very well with Mr. Moore's figure of the same sex, differing only in the lowest white streak of the discal series in the first median interspace in the forewing being slightly less elongated, and the spot in the middle of the submedian interspace of that wing being outwardly cleft only, instead of being completely separated into two spots.

10. EUTHALIA (*Dophla*) EION, n. sp., Plate III, Figs. 8, ♂; 6, ♀.

HABITAT: Java.

EXPANSE: ♂, 2·8; ♀, 3·2 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* fuscous, crossed by a common macular discal pale greenish-yellow band. *Forewing*, the band consists of seven well-separated spots, gradually increasing in size from the costal to the inner margin, the uppermost spot a little out of line with the rest, shifted inwardly towards the base of the wing, the spots all more or less rounded, the one in the submedian interspace cleft outwardly; a very small white subapical spot; a submarginal series of increasing obscure black spots placed between the veins. *Hindwing*, the discal band consists of eight conjoined spots, the three uppermost pure white, each spot has its inner edge rounded, its outer edge brought to a point in the middle; a submarginal obscure black fascia, beyond which is a decreasing series of seven small round white spots, one in each interspace. UNDERSIDE, *both wings* pale brown, glossed throughout with violet; the common discal band much as above. *Forewing* with a black ring-spot centred with crimson in the middle of the discoidal cell, a crimson line placed on the disco-cellular nervules, defined on both sides by a black line; some obscure linear black spots placed between the veins midway between the discal band and the outer margin. *Hindwing* with a very small black ring-spot in the middle of the cell, a black line on either side of the disco-cellular nervules, a submarginal series of linear black spots much as in the forewing. FEMALE. UPPERSIDE, *both wings* much paler than in the male, the disco-cellular markings shewing through. *Forewing* with the discal macular band as in the male but white, and the four anterior spots larger, all the spots outwardly sharply defined by a fine line of the ground-colour; beyond the macular band is a broad whitish fascia from near the costa to the inner margin, bearing an increasing series of six black spots, the spot in the submedian interspace double. *Hindwing* has the spots of the discal band smaller than in the male, diamond-shaped, well-separated, outwardly sharply

* *Vide* Proceedings A. S. B., 1892, p. 144.

defined as in the forewing, pure white; the broad whitish discal fascia beyond bearing a series of prominent black lunules. UNDERSIDE, *both wings* as in the male.

The male of *E. eion* may be known from the same sex of *E. teuta*, Doubleday and Hewitson, which appears to be confined to Assam and Northern Burma, by the subapical spot of the forewing on the upperside being smaller, and by the presence of the submarginal series of seven decreasing white spots on the hindwing. The female is at once distinguished by the broad whitish fascia across both wings on the upperside beyond the discal macular band, also by the spots of the latter being smaller and well separated. *E. teuta* has been recorded by Mr. Moore from Java and by Mr. Druce from Borneo. It is doubtful if it occurs in either island, the Javan species being *E. eion*, and the Bornean *E. bellata*, Druce.

Described from two males and two females in my collection, received from Mr. H. Fruhstorfer, and one male in the collection of Herr George Semper, taken in February.

11. EUTHALIA (*Dophla*) ESON, n. sp., Plate I, Figs. 3, ♂; 5, ♀.

Euthalia cenespolis, Staudinger (*nec* Hewitson), Iris, vol. ii, p. 73 (1889).

HABITAT: Palawan, Philippine Isles.

EXPANSE: ♂, 3·1; ♀, 3·7 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* pale clear brown, all the veins fuscous and prominent. *Forewing* with a small dark round spot in the middle of the discoidal cell touching the subcostal nervure; two fine black lines on either side of the disco-cellular nervules; a discal series of eight semi-transparent pale yellow spots, each spot outwardly bounded by a fuscous line, which line is inwardly lengthened out into a point, the three anterior spots lengthened, the fourth and fifth in the median interspaces pyriform, the apex of each spot directed towards the base of the wing, two small spots in the submedian interspace, a minute one in the sutural area; beyond this series of spots is a pale fascia, prominent at the inner margin, becoming lost anteriorly at a small pale yellow spot in the subcostal interspace; this pale band is outwardly defined by a highly lunulated fuscous line, anteriorly becoming obsolete. *Hindwing* bearing a discal series of eight spots, the three anterior ones white, the others pale yellow, these five latter are each outwardly defined by a fuscous line, the uppermost spot on the costa narrow, elongated, the second spot the largest, rounded, the third a little smaller, oval, the next four small, equal-sized, the eighth posterior spot the smallest; a submarginal series of seven sagittate fuscous markings, the apex of each directed inwardly, and each bearing outwardly a

pale spot placed against it between the points of the forks. UNDERSIDE, *both wings* pale ochreous-brown washed with pale violet, the discal macular band of the upperside almost obliterated. *Forewing* with the markings in the discoidal cell as on the upperside, but much more prominent; an increasing submarginal series of black spots. *Hindwing* with a pair of fuscous lines defining the disco-cellular nervules; a submarginal series of eight linear black spots between the veins, the two posterior ones in the submedian interspace geminated. FEMALE, much paler than the male throughout, but very similarly marked. *Forewing* with all the spots of the discal series very much larger and pure white, the two uppermost spots greatly lengthened. *Hindwing* with all the spots of the discal series white, of nearly the same size as in the male. UNDERSIDE, *both wings* paler even than in the male, of a more ochreous shade, the markings similar.

This is a very distinct species and quite easily separable from all those that I have placed before it in the key. The ground-colour of the male on the upperside is quite feminine, being much paler than in any other species of this sub-group of *Euthalia*. The discal series of spots on the hindwing will separate it from all the other species except *E. externa*, de Nicéville, next described, owing to each spot standing alone, and the five posterior ones being outwardly defined by a black ring; from *E. externa* it may be known by its generally paler colour, and the discal series of spots on the forewing being smaller and more regular. The female is quite unique, being the only species in the sub-group with the discal series of spots of the forewing regularly increasing in width towards the costa, the uppermost spot being extremely wide. The female of *E. eson* greatly reminds one of the same sex of *E.* (*Tanaëcia*) *pulasara*, Moore.

Described from a single pair of specimens in Herr Georg Semper's collection, to whom I am greatly indebted for the loan of his entire series of this sub-group of *Euthalia*. These specimens of *E. eson* are from those collected by Dr. Platen, who obtained ten males and eight females.

12. EUTHALIA (*Dophla*) EXTERNA, n. sp., Plate II, Fig. 1, ♂; 2, ♀.

HABITAT: Nias Island.

EXPANSE: ♂, 2·8; ♀, 3·3 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* shining fuscous, outwardly paler. *Forewing* with the usual black spot in the middle and pair of lines closing the discoidal cell; a discal irregular series of seven pale primrose-coloured spots, outwardly (owing to the ground-colour at this point being paler than the rest of the wing) defined rather broadly with fuscous, the anterior spot obsolete, a thin blurred line only, the

second and third spots also linear but of a good breadth, the fourth and fifth spots in the median interspaces somewhat irregular ovals, the fifth the largest in the series, the sixth spot constricted in the middle, almost bisected, the seventh spot small and oval; a well marked submarginal black fascia formed of regular lunules, anteriorly becoming smaller and lost altogether in the subcostal interspace, which bears between the discal series of spots and the submarginal lunular fascia a small round yellow spot. *Hindwing* with a prominent discal series of eight spots, the three anterior ones white, the five posterior ones pale primrose-coloured, these latter outwardly defined by a broad black line, the uppermost spot on the costa linear, the second the largest, the third next in size, the sixth the smallest, the fourth, fifth and seventh equal-sized; a prominent highly-lunulated submarginal black fascia placed on a pale ground, the two anteriormost portions of this band quadrate, bearing each a whitish spot on either side. UNDERSIDE, *both wings* ochreous, more or less washed with purplish; a submarginal series of small round black spots between the veins. *Forewing* with the ring-spot in the middle and double line closing the cell very prominent; the discal band white, obscure, each spot forming it outwardly defined by a thin dark line. *Hindwing* with a prominent small black ring-spot in the middle of the cell (this spot is absent in *E. eson*, de Nicéville, and *E. gupta*, de Nicéville, but is present in all the other species), two prominent black lines at the end of the cell; the spots forming the discal band much larger than on the upperside, all touching, and outwardly defined with a thin dark line. FEMALE. UPPERSIDE, *both wings* somewhat paler than in the male. *Forewing* similarly marked, but the spots of the discal band larger and pure white, as is also the subcostal spot; a prominent violet-white fascia between the discal and submarginal bands, extending from the inner margin to the lower discoidal nervule. *Hindwing* with the discal macular band of the male reduced to five spots only, all the spots very much smaller also, no spots posterior to the third median nervule. UNDERSIDE, *both wings* richer coloured than in the male, strongly tinted with ferruginous; the submarginal black spots all larger and more diffused. *Forewing* with the discal white band anteriorly much expanded. *Hindwing* with a well-formed prominent discal macular white band, extending from the costa to the abdominal margin, the spots posterior to the first median nervule run into a single spot undivided by the crossing veins.

The male of *E. externa* is nearest to the same sex of *E. eson*, de Nicéville; I have pointed out above how they differ. The female of *E. externa* is nearest to *E. goodrichi*, Distant, from Perak, from which it may be known by the spots of the discal series of the forewing on the

upperside being three times as large, greatly reducing thereby the pale area between these spots and the submarginal band; on the hindwing above there are two spots less than in *E. goodrichi*; the submarginal lunulated black band is also much broader than in that species.

Described from a single pair of specimens in the collection of Herr Georg Semper.

13. Euthalia (*Dophla*) eurus, n. sp., Plate II, Figs. 3, ♂; 4, ♀.

Habitat: N.-E. Sumatra.

Expanse: ♂, 2·7; ♀, 3·3 inches.

Description: Male. Upperside, *both wings* shining fuscous, paler externally. *Forewing* with a discal macular very pale green band consisting of seven spots, the uppermost spot of all out of line, placed nearer the base of the wing than those which follow it; the three uppermost spots small and linear, the fourth spot larger, rounded, the fifth spot larger than the fourth, also rounded, the sixth spot the largest of all, outwardly strongly cleft, the seventh spot on the inner margin small and quadrate; the usual subapical pale green dot in the subcostal interspace; an indistinct increasing submarginal macular black fascia. *Hindwing* with a conjoined macular discal very pale green band consisting of eight spots, the three uppermost spots, however, are white, the inner edge of the fascia straight and even, the outer edge saw-like, as each spot is produced into a point; a submarginal lunular black fascia, each lunule of which the fascia is composed bearing outwardly a whitish spot, the three uppermost of these increasingly prominent. Underside, *both wings* greenish-ochreous, washed with violet; the discal macular band much as on the upperside; the submarginal fascia reduced to small linear black spots between the veins. *Forewing* with a black ring-spot in the middle, and a double lunular spot closing the discoidal cell, both filled in with crimson. *Hindwing* with a black dot in the middle and a double black line closing the cell, the latter faintly tinged with crimson in the middle. Female. Upperside, *both wings* shining brownish-ochreous, the disc powdered with pale violet-white which merges again into the dark outer margin. *Forewing* with the markings on the underside in the discoidal cell shewing through; the discal series of spots increased to eight, white, each spot outwardly defined by a brown line; the three anterior spots linear, large, the fourth and fifth of equal size, the sixth and seventh in the submedian interspace well separated, the eighth on the inner margin oval; the subapical spot much larger than in the male; a submarginal series of six black spots placed between the veins. *Hindwing* with the discal macular band as in the forewing, but consisting of seven spots only, the series ending

posteriorly in the first median interspace; the uppermost spot on the costa linear, the second spot the largest of all, the rest decreasingly smaller; a prominent highly zig-zag submarginal black line. UNDERSIDE, *both wings* paler than on the upperside, the markings very similar, those in the discoidal cell as in the male.

The male of this species, as in the rest of the group, except *E. recta*, de Nicéville, is barely distinct from its allies, it is, however, nearest to *E. eion*, de Nicéville, from Java, described above. The female is nearest to *E. bellata*, Druce, from Borneo, of which latter I possess a specimen for comparison, from which it differs in the broad pale violet-powdered discal area, especially marked in the hindwing. Mr. Hewitson's figure of the female of *E. bellata*, in 'Exotic Butterflies,' vol. v, *Adolias* pl. iv, fig. 14 (1875), where it appears as *E. cenespolis*, does not quite agree with my specimen, his figure shewing a very large powdery-violet area in the forewing extending within the discal band, this area being very faint in my example, and confined to the region beyond the discal band. My female of *E. eurus* differs, however, markedly from Hewitson's figure of *E. cenespolis*, and my example also from Borneo, in having a broad discal powdery-violet area to the hindwing on the upperside.

Described from two males and a female example in Dr. Martin's, and two males in my own collection, all from N.-E. Sumatra.

The four last butterflies described above belong to a small but well-marked group of the large genus *Euthalia*, and appear to come into the subgenus *Dophla*, Moore, of which *E. evelina*, Stoll, is the type. All the species of *Dophla*, as I understand the subgenus, are remarkable in having on the underside of both wings a black ring-spot in the discoidal cell, and a pair of black lines on either side of the disco-cellular nervules centred with crimson. The ring-spot is absent however in two species, *E. eson*, de Nicéville, and *E. gupta*, de Nicéville, in the hindwing only. In the *E. evelina* group there are sometimes other crimson markings in the hindwing anterior to the discoidal cell. In all the species of *Dophla* the discoidal cell is closed in both wings by a very slender almost aborted veinlet, and the subcostal nervules of the forewing never anastomose. The outline of the wings is distinctive, the outer margin being highly emarginate in the forewing, giving that wing a more or less falcate appearance. The cilia are very short, and the butterflies give one the idea of having been neatly trimmed round the edges with a pair of scissors. To facilitate reference to the subgroup to which the four species above described belong, I give a key to the known species. The males of several of them are so closely allied that

they are almost indistinguishable, the one from the other; but the females are in all cases abundantly distinct, so I have based the key mainly on that sex.

Key to certain species of the subgenus Dophla *allied to* E. teuta, *Doubleday and Hewitson.*

A. Male and female, upperside, forewing with the discal macular band straight.

(1.) E. (*Dophla*) RECTA, Khasia Hills; Burma; Goping, Perak, Malay Peninsula (*coll. Semper*).

B. Male and female, upperside, forewing with the discal macular band curved, the anterior spot out of line, placed nearer the base of the wing than the rest.

a. Female, upperside, with the discal macular band extending from the costa of the forewing to the abdominal margin of the hindwing.

a^1. Female, upperside, both wings with a prominent white fascia exterior to the discal macular band.

(2.) E. (*Dophla*) EION, Java.

b^1. Female, upperside, both wings with no prominent white fascia exterior to the discal macular band.

a^2. Female, upperside, forewing, the two anterior spots of the discal macular band small, smaller than the third spot.

a^3. Female, upperside, both wings with the submarginal black fascia highly lunulated.

(3.) E. (*Dophla*) TEUTA, Assam; Arracan Hills; [Java, *Moore*; Borneo, *Druce*].

b^3. Female, upperside, both wings with the submarginal black fascia composed of quadrate spots, forming a broad fascia with straight edges.

(4.) E. (*Dophla*) PIRATICA, Luzon, Mindoro, Camiguin de Mindanao, Nord-Mindanao, Philippine Isles.

b^2. Female, upperside, forewing, the two anterior spots of the discal macular band very large, larger than the third spot.

(5.) E. (*Dophla*) TEUTOIDES, South Andaman Isles.

b. Female, upperside, with the discal macular band extending from the costa of the forewing to the submedian nervure of the hindwing.

(6.) E. (*Dophla*) ESON, Palawan, Philippine Isles.

c. Female, upperside, with the discal macular band extending from the costa of the forewing to the third median nervule of the hindwing.

a^1. Female, upperside, forewing with a prominent violet-white fascia between the discal and submarginal bands, extending from the inner margin to the lower discoidal nervule; the discal spots very large.

(7.) E. (*Dophla*) EXTERNA, Nias Island.

b^1. Female, upperside, forewing with no prominent violet-white fascia between the discal and submarginal bands; the discal spots small.

(8.) E. (*Dophla*) GOODRICHI, Perak.*

* Mr. Distant first described this species from Perak in the Malay Peninsula as *Euthalia goodrichi*, but subsequently sank that name in his 'Rhopalocera Malayana,' p. 436, n. 17, as a synonym of *E. bellata*, Druce, equals *Adolias cenespolis*,

d. Female, upperside, with the discal macular band extending from the costa of the forewing to the first median nervule of the hindwing.

a^1. Hindwing with a prominent powdery-violet fascia between the discal macular band and the lunulated submarginal line.

(9.) E. (*Dophla*) EURUS, N.-E. Sumatra.

b^1. Hindwing with no prominent powdery-violet fascia between the discal macular band and the lunulated submarginal line.

(10.) E. (*Dophla*) BELLATA, Borneo.

e. Female, upperside, hindwing with no discal macular band; the spots of the forewing small.

(11.) E. (*Dophla*) GUPTA, Burma, Plate II, Fig. 5, ♀.

14. CYRESTIS THERESÆ, n. sp., Plate V, Fig. 8, ♂.

HABITAT: Selesseh, N.-E. Sumatra; Borneo.

EXPANSE: ♂, 1·9 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* rich fulvous. *Forewing* with the following black markings:—A short straight line at the extreme base of the wing; a second line oblique but straight, from the costa to the submedian nervure; a third line straight from the subcostal nervure to the inner margin; a fourth line much bowed outwardly, confined to the discoidal cell; a fifth line short, straight, also confined to the cell immediately within the disco-cellular nervules, and touching the fourth; a sixth line also straight, a little beyond those veins, commencing on the subcostal nervure, and ending close to the base of the second median nervule; a seventh line angled, commencing at the costa and ending on the inner margin, the angulation being at the point where it crosses the second median nervule, the angle directed outwards; an eighth line broad, almost straight, slightly outwardly curved only, reaching from the costa to the inner margin; a ninth line narrower than the eighth, slightly sinuous, posteriorly zig-zaged, of a deep black colour, from the costa to the inner margin; a tenth line straight, extending from the costa to the first median nervule, with two prominent small round black spots in continuation in the submedian interspace; an eleventh line very narrow and straight, from the costa to the first median nervule; a twelfth line broad, paler, of similar position to the eleventh; a thirteenth line narrow, deep black, close to the outer

Hewitson, both the latter described from Borneo. As in the female of *E. goodrichi* the discal band of the hindwing on the upperside ends at the third median nervule, while in *E. bellata* it ends at the first, and in the latter all the spots of the hindwing are much larger, besides other minor differences, I think the two species may be kept distinct, and the name *E. goodrichi* revived. I possess one female of the Bornean species, and have access to three pairs of the Perak species in Semper's, Adams', and my own collection.

margin; the outer margin itself narrowly fuscous. *Hindwing* with an indistinct sub-basal black line; a second line from the costa losing itself in the abdominal region; the third and fourth lines exceedingly fine, on either side of the disco-cellular nervules; the fifth line from the costa ending in the abdominal region; the sixth line answering to the eighth line in the forewing, and like it fuscous, not deep black, extends from the costa, and runs into the ninth line in the first median interspace; the seventh line narrow, jet-black, from the costa to the first median nervule; the eighth line, composed of six detached portions, commences posterior to the first subcostal nervule and ends at the first median nervule; the ninth line extremely narrow and deep black, from the costa to the first median nervule; the tenth line broad, rather diffused, fuscous, submarginal; the eleventh line fine, deep black, following the margin; the outer margin itself narrowly fuscous: the usual large rounded clump of confused bluish and black markings at the anal angle anterior to the large anal lobe; a small round black spot encircled with whitish anterior to this clump, placed just within the second angle made by the abdominal margin; the anal lobe rich fulvous centred with a black spot. UNDERSIDE, *both wings* much paler than on the upperside; the markings very similar but usually paler. *Forewing* with a quadrate whitish patch on the inner margin between the eighth and ninth lines. *Hindwing*, anal lobe with the central black spot much larger than on the upperside.

C. theresæ is an abundantly distinct species, and comes into the group containing *C. thyonneus*, Cramer, which I possess from Celebes; *C. tabula*, de Nicéville, from Great Nicobar Island; and *C. lutea*, Zinken-Sommer, which is common in Java. In size it agrees with *C. lutea*. In the coloration of the ground of the upperside it is nearest to *C. tabula*, but is rather lighter, it is much darker than *C. lutea*, lighter than *C. thyonneus*. The tail to the hindwing is less than half as long as in either of the above-mentioned species. In markings it agrees best with *C. thyonneus*, but differs in many details, as, for instance, the seventh and ninth lines on the hindwing in that species are dark metallic steel-blue, in *C. theresæ* they are black without any metallic lustre.

Described from an unique specimen in Dr. L. Martin's collection, taken in the virgin forest of Selesseh, on the 21st May, 1893; also from another example from Borneo given to me by Dr. Martin. At his suggestion I name the species after H. R. H. the Princess Therese of Bavaria, daughter of the Prince Regent, who is a student and lover of Natural History.

Family LEMONIIDÆ.

Subfamily Nemeobiinæ.

15. Laxita laocoon, n. sp., Plate II, Fig. 6, ♀.

Habitat: Malay Peninsula.

Expanse: ♀, 1·65 and 1·80 inches.

Description: Female. Upperside, *forewing* with the apical two-thirds of the surface crimson; the costa and outer margin very narrowly, the discoidal cell not quite to its end; a small spot in the second median, and a much larger space in the first median, and almost the whole of the submedian interspace, fuscous. *Hindwing*, shining fuscous, almost bronzy in some lights; the veins slightly touched with crimson; an indistinct marginal crimson line. Underside, *both wings* marked as in *L. damajanti*, Felder.

Very near to *L. damajanti*, Felder, of which I possess six males and seven females from Perak, and five males and two females from N.-E. Sumatra; differing on the upperside in the crimson coloration being practically confined to the apical two-thirds of the forewing instead of occupying almost the entire surface of both wings.

Described from two examples from Perak, and one from Rawan in Selangor, both in the Malay Peninsula.

16. Laxita lola, n. sp., Plate II, Figs. 9, ♂; 7, ♀.

Habitat: S.-E. Borneo.

Expanse: ♂, 2·0 and 2·2; ♀, 2·1 inches.

Description: Male. Upperside, *forewing* with the costa as far as the subcostal nervure and the outer margin narrowly, fuscous; the apical two-thirds of the wing crimson; the disco-cellular nervules marked by a fuscous line; the posterior half of the discoidal cell, three streaks beyond the cell in the two discoidal and upper median interspaces, a larger space in the lower median interspace, and the entire area between the first median nervule and the inner margin, fuscous. *Hindwing* with that portion of the costal area covered by the bowed-out inner margin of the forewing pale shining fuscous, bearing the usual oval ochreous flour-like "male-mark," the rest of the wing fuscous; the outer margin bearing an indistinct crimson line. Underside, *both wings* differ from *L. damajanti*, Felder, in all the brilliant metallic blue markings being much reduced in size, the submarginal series in *L. lola*, in the *forewing*, has almost entirely disappeared, the crimson area at the apex appearing thus to be of considerably greater extent; otherwise as in that species. Female. Upperside,

forewing with the crimson area of the same extent as in the male, but of a paler shade, bearing on the disc from the third median nervule increasing to the costa a pale buff fascia. *Hindwing* paler than in the male, the veins streaked more or less with crimson. UNDERSIDE, *both wings* coloured and marked much as in the male, but the crimson ground-colour paler.

The male of *L. lola* may at once be known from the same sex of *L. damajanti* by the presence of the fuscous areas on the upperside of both wings, the latter being "rubris, supra immaculatis;" the female may be known from that sex of *L. laocoon*, mihi, by the pale buff fascia on the upperside of the forewing.

Described from two males and one female in my collection.

17. LAXITA LYCLENE, n. sp., Plate II, Fig. 10, ♂.

Abisara telesia, Distant (*nec* Hewitson), Rhop. Malay., p. 449, n. 8, pl. xl, figs. 2, *male*; 3, *female* (1886); *Taxila telesia*, Staudinger, Ex. Schmett., p. 239, pl. lxxxvii, *male* (1887).

HABITAT: Malay Peninsula; N.-E. Sumatra.

EXPANSE: ♂, 1·75 to 1·90; ♀, 1·80 to 1·90 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* fuscous. *Forewing* with the apex broadly, decreasing to the anal angle where it ends in a point, crimson, crossed by the black veins; an oval milky-white spot placed obliquely outwards across the middle of the submedian interspace, anteriorly extending slightly into the first median interspace. *Hindwing* with the costa at the base as usual broadly pale or whitish, bearing an oval flour-like ochreous "male-mark;" the apex narrowly crimson. UNDERSIDE, *forewing* differs from the same sex of true *L. telesia*, Hewitson, from Borneo, in having the chrome-yellow (Hewitson calls it "rufous") apical area much reduced or obsolete; the two submarginal chrome-yellow lunules in the median interspaces in *L. telesia* replaced by metallic blue lunules; and in having the discal series of metallic blue spots increased from two to five or six, there being three or four extra ones in the discoidal and subcostal interspaces. *Hindwing* does not differ from that of *L. telesia*. FEMALE. UPPERSIDE, *both wings* as in *L. telesia*. UNDERSIDE, *both wings* as in *L. telesia*.

The male of *L. lyclene* may at once be known by the crimson apical area on the upperside of the forewing being much larger than in *L. telesia*, and as regards the hindwing in having the apex touched with crimson. The females of the two species appear to be quite indistinguishable.

Described from one male from Rawan in Selangore, and three males and two females from Perak, both in the Malay Peninsula, and numerous specimens from N.-E. Sumatra. True *L. telesia* occurs in

Borneo, the type being from Sarawak, and in my collection are three males and a female from S.-E. Borneo. Mr. Distant records *L. telesia* from Sumatra, but this species is probably the one meant.

18. LAXITA LYNCESTIS, n. sp., Plate II, Fig. 8, ♂.

HABITAT: Malay Peninsula.

EXPANSE: ♂, 1·7 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* and *cilia* fuscous. *Forewing* with a band of crimson on the outer margin, wide on the costa, fining away to nothing at the anal angle; a broad oblique discal bluish-white band, commencing anteriorly just anterior to the lower discoidal nervule, ending just before the anal angle on the submedian nervure, notched inwardly at the origin of the second median nervule, anteriorly inwardly bounded by the disco-cellular nervules. *Hindwing* with the usual shining pale fuscous costal area bearing the "male-mark" of the genus. UNDERSIDE, *forewing* differs from *L. orphna*, Boisduval, in having numerous metallic blue markings on the disc, in the present species there are two such spots placed outwardly against the two inner black spots in the median interspaces, and three such spots placed outwardly against the three black spots beyond the outer end of the cell, with a series of five others beyond extending across the disc; in *L. orphna* all these blue spots are lacking. *Hindwing* as in *L. orphna*.*

This species is not included in Mr. Distant's "Rhopalocera Malayana." On the upperside it differs from two male specimens of *L. orphna* in my collection from S.-E. Borneo in its smaller size, brighter crimson outer border to the forewing on the upperside, and narrower discal bluish-white band, which latter in *L. orphna* is not inwardly notched below the cell.

Described from a single specimen in my collection from Perak.

There is one species of *Laxita* which I am still unable to identify. This is the butterfly figured by Hewitson in "The Genera of Diurnal Lipidoptera," vol. ii, p. 422, n. 7, pl. lxix, figs. 7, *male*; 6, *female* (1851), as "*Emesis orphna*, Boisduval," but re-named "*Taxila*" *tanita*, by Hewitson, in his "Exotic Butterflies," vol. ii, *Taxila* pl. i, text (1861). Mr. Distant in his "Rhopalocera Malayana," p. 192, n. 5, pl. xviii, fig. 14, *female* (1883), describes and figures an "*Abisara*" *tanita*. This female specimen does not at all agree with Hewitson's figure of the

* The differences pointed out above on the underside of the forewing will be at once observed by comparing the original figure of *L. orphna* in Boisduval's "Species Général," vol. i, pl. xxi, fig. 4, *female* (1836), with my figure of *L. lyncestis*.

female. It appears to me probable that Hewitson's male figure and Distant's female figure refer to one species, which might stand as *L. tanita*, the locality for which, as given in "The Genera," p. 422, n. 7, is "Borneo; India," but requires to be verified. I have seen no specimens agreeing with these two figures, Hewitson's n. 7, *male*, and Distant's *female*; the species if distinct is very near to *L. damajanti*, Felder. The species represented in Hewitson's fig. n. 6, *female*, should, it appears to me, if re-discovered, be named. It is apparently nearest to *L. telesia*, Hewitson, but has the chrome-yellow area at the apex of the forewing on the upperside much larger than in that species. Mr. Distant has further complicated matters by describing Hewitson's female figure n. 6 as a male. The bowed-out inner margin of the forewing in the males of the genus *Laxita* will at once distinguish them from the females, which have the inner margin straight. The species which Dr. Staudinger figures as "*Taxila*" *tanita*, Hewitson, in his "Exotische Schmetterlinge," p. 239, pl. lxxxvii, *male* (1887), appears not to differ from what I identify as *L. damajanti*.

Family LYCÆNIDÆ.

19. Gerydus gigantes, n. sp., Plate V, Figs. 1, ♂; 13, ♀.

Habitat: Penang; Battak Mountains, N.-E. Sumatra.

Expanse: ♂, 2·0; ♀, 1·8 to 2·1 inches.

Description: Male. Upperside, *both wings* pure chalky-white. *Forewing* with the basal third of the costa reaching to the subcostal nervure dusky; the costa beyond this, the apex and the outer margin broadly black, the inner edge of this large black area very irregular, it just enters the anterior outer angle of the discoidal cell, is pointed inwardly on the second median nervule, closely approaches the outer margin (exactly as in typical *Terias hecabe*, Linnæus) in the first median and submedian interspaces, the black area is wider again from the submedian fold to the inner margin; a small portion of the base of the third median nervule prominently swollen, this being a characteristic secondary sexual character in this genus. *Hindwing* with the costa outwardly broadly black. *Cilia* of both wings fuscous. Underside, *forewing* black, the disc crossed by a pure white oblique macular band formed of four portions; two small and obscure ring-spots in the cell, one on the costa about two-thirds from the base of the wing; the apex and outer margin decreasingly pale ferruginous, the inner edge of this area bearing anteriorly a series of four whitish ring-spots; a submarginal series of black dots between the veins; a rather large oblong dark spot placed obliquely at the anal angle. *Hindwing* pale ferrugi-

nous; bearing regularly over the surface darker red spots arranged much as in typical species of the genus *Arhopala*, Boisduval, these spots are disposed thus:—A small round one at the extreme base of the wing; followed by a series of three single spots; then another series of three, but these spots are double; then four conjoined spots at the extremity of the cell; then a discal curved band extending across the wing from the costa to the abdominal margin, broken only by the first subcostal nervule; some obscure spots on the outer margin. FEMALE. UPPERSIDE, *both wings* marked almost exactly as in the male. UNDERSIDE, *forewing* differs from the male in having the discal macular band more extensive and run together into a single undivided band, anteriorly bounded by the subcostal nervure, posteriorly by the inner margin, along which it extends to the base of the wing. *Hindwing* with the macular markings less conspicuous than in the male; the inner edge of the discal series of spots bears on the posterior half of its length a series of black spots often found in the species of this genus.

G. gigantes is not only the largest known, but is the most conspicuously-marked species in the genus, and has no near ally. Were the ground-colour of the upperside yellow, instead of pure white, it would almost exactly resemble *Terias hecabe*.

I have described the species from a male and two females in Dr. Martin's and my collection, taken in the Battak Mountains of N.-E. Sumatra, in August and November, and another pair in Mr. A. R. Adams' collection taken at Penang.

20. GERYDUS GÆTULUS, n. sp., Plate V, Fig. 12, ♀.

HABITAT: Battak Mountains, N.-E. Sumatra.

EXPANSE: ♀, 1·3 and 1·5 inches.

DESCRIPTION: FEMALE. UPPERSIDE, *forewing* pure white; the costa basally, and the base of the wing, dusky; the apex very broadly black, as is also the outer margin at the anal angle, but much more narrowly so. *Hindwing* with the disc only white, the rest of the wing dusky; the disco-cellular nervules marked by a prominent blackish line. UNDERSIDE, *forewing* with the disc white, the rest of the wing pale slate-colour; three increasing dark spots outlined outwardly with white in the discoidal cell, a dark spot posterior to the middle one of these in the submedian interspace; three ring-spots on the costa; a short subapical macular band ending posteriorly in a separated round spot in the second median interspace; an oblique prominent spot at the anal angle; a submarginal series of black dots between the veins. *Hindwing*, pale slate-colour, with the macular markings as usual in the genus.

Nearest apparently to *G. zinckenii*, Felder, from Java, of which

I have a good series, but it may at once be known from that species on the upperside by the hindwing being white on the disc with a prominent dark disco-cellular line, *G. zinckenii* being dusky throughout; on the underside the ground-colour is a pale slate-colour, in *G. zinckenii* it is pale ferruginous.

Described from two specimens, one in Dr. Martin's and one in my collection, taken in the Battak Mountains in October, 1892.

21. Gerydus gallus, n. sp., Plate V, Fig. 11, ♀.

Habitat: Battak Mountains, N.-E. Sumatra.

Expanse: ♀, 1·5 inches.

Description: Female. Upperside, *both wings* fuscous. *Forewing* with the apical area darker than the basal; crossed by an oblique discal white band with highly irregular edges, not quite reaching the costa or the outer margin above the anal angle, ending posteriorly on the submedian fold. *Cilia* fuscous. *Hindwing* immaculate. *Cilia* anteriorly white, becoming fuscous towards the anal angle. Underside, *both wings* highly variegated, being coloured black, white, pale ochreous, and ferruginous. *Forewing* with the ground-colour black; the discal white band as above but broader, its edges even, reaching the outer margin at the anal angle; a pale ochreous patch at the apex, below which the ground-colour is ferruginous; three white ring-spots on the costa; two similar ones in the discoidal cell; a prominent black spot at the anal angle; a submarginal macular black line. *Hindwing* with the anterior half pale ochreous, the posterior fuscous mottled with ochreous; the macular markings as usual, though somewhat indistinct.

This may be a highly variegated form of *G. symethus*, Cramer, a common species in N.-E. Sumatra, but it differs greatly from any specimen of that species in my large suite of examples from the Malay Peninsula, Sumatra, Borneo, and Java, from all of which *G. gallus* differs in the white band on the upperside of the forewing being half as wide, the hindwing concolorous throughout, and by the highly variegated markings of the underside.

Described from a single example in Dr. L. Martin's collection.

As the genus *Gerydus*, Boisduval, has vastly increased in numbers in recent years, it may perhaps be useful to add a list of the described species, as far as I know them. Many species described in this genus do not belong to it at all, and have been excluded. The flattened legs of all the species is an unique character by which they may be instantly known. The list is headed by the largest, most beautiful, and most aberrant species.

(1) GERYDUS GIGANTES, de Nicéville, Penang, N.-E. Sumatra (*de Nicéville*).

(2) GERYDUS SYMETHUS, Cramer, East Indies (*Cramer*), Moulmein, Penang, Malacca, Perak, Johore, Sumatra, Nias Island, Java, Borneo, Pulo Laut, Palawan, Luzon, Mindanao, Jolo Islands, S.-W. Celebes, Amboina, Sumba, Sambawa, Ceram, Goram, Flores, New Guinea.

Mr. Doherty considers that the *G. pandu*, Horsfield, described from Java, which is generally given as a synonym of this species, may be distinct. I am unable, however, to find any character by which the two species can be separated.

(3) GERYDUS PETRONIUS, Distant, N. Borneo (*Distant*).

(4) GERYDUS TEOS, Doherty, Sumba, Sambawa (*Doherty*).

(5) GERYDUS GALLUS, de Nicéville, N.-E. Sumatra (*de Nicéville*).

(6) GERYDUS BIGGSII, Distant, Malacca (*Distant*), Burma, Perak, Sumatra, Nias Island, Pulo Laut.

(7) GERYDUS GOPARA, de Nicéville, Perak (*de Nicéville*), Johore, Singapore, North Borneo.

This species is placed by Mr. H. J. Elwes and Mr. W. Doherty as a synonym of *G. biggsii*, which is probably correct.

(8) GERYDUS DRUCEI, Semper, Bohol in the Philippine Islands (*Semper*).

(9) GERYDUS ZINCKENII, Felder, Java (*Felder*).

(10) GERYDUS GÆTULUS, de Nicéville, N.-E. Sumatra (*de Nicéville*).

(11) GERYDUS CHINENSIS, Felder, Hongkong (*Felder*).

(12) GERYDUS CHINENSIS, var. CERAMENSIS, Ribbe, Celebes, Amboina, Saigun, Buru, Borneo (*Ribbe*).

(13) GERYDUS IRRORATUS, Druce, Siam (*Druce*), Luzon, Palawan.

(14) GERYDUS IRRORATUS, var. ASSAMENSIS, Doherty, Naga Hills (*Doherty*), Perak, Pulo Laut.

(15) GERYDUS PHILIPPUS, Staudinger, Palawan (*Staudinger*).

This species is placed by Herr Georg Semper as a synonym of *G. irroratus*, Druce.

(16) GERYDUS BOISDUVALI, Moore, Java (*Moore*), Sikkim, Assam, Chittagong Hill Tracts, Burma, Shan States, Singapore, Saigon, Amboina, Batjan, Buru, Ceram, Ké Islands.

(17) GERYDUS BOISDUVALI, var. ACRAGAS, Doherty, Sumba, Sambawa (*Doherty*).

(18) GERYDUS LEARCHUS, Felder, Luzon, China (*Felder*).

(19) GERYDUS STYGIANUS, Butler, Ternate (*Butler*).

(20) GERYDUS MELANION, Felder, Luzon (*Felder*), Cebú, Samar, Bohol, Camotes, Panaon, Camiguin de Mindanao, Mindanao.

(21) GERYDUS CROTON, Doherty, Burma (*Doherty*), East Pegu.

(22) GERYDUS MAXIMUS, Holland, Celebes (*Holland*).
(23) GERYDUS ANCON, Doherty, Tavoy (*Doherty*).
(24) GERYDUS HERACLEION, Doherty, Perak (*Doherty*).
(25) ? GERYDUS PLAUTUS, Fabricius, the Indies (*Fabricius*).
(26) ? GERYDUS LEOS, Guérin, Bouru (*Guérin*).

22. PARAGERYDUS PORTUNUS, n. sp., Plate V, Fig. 14, ♂.

HABITAT: Java.

EXPANSE: ♂, 1·5 and 1·6 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* dull hair-brown. *Forewing* with the usual ochreous lines on the costa and pale area on either side of the swollen third median nervule. UNDERSIDE, *both wings* pale ochreous, profusely and evenly sprinkled throughout with minute ferruginous spots. *Forewing* with the inner margin somewhat paler and free of markings, though bearing two or three striæ larger than the others towards the base of the wing.

This species appears to be nearest to *P. taras*, Doherty, which has the apex of the forewing on the underside "rufous-brown," while *P. portunus* has the whole of the underside of that colour, the ground-colour of *P. taras* is white, of *P. portunus* pale ochreous. Of *P. taras* I have captured both sexes in the Meplé Valley, middle Tenasserim, in October.

Mr. Doherty, who takes particular interest in this group of the *Lycænidæ*, has recorded his feelings of doubt as to whether the genus *Paragerydus* can be maintained as distinct from the genus *Allotinus*.* As far as the specimens of both genera contained in my collection are concerned, I am of opinion that the two genera may well be kept distinct. The length, and consequently the point of origin, of the third subcostal nervule of the forewing, certainly varies greatly, but in all my examples of *Paragerydus* the upper discoidal nervule originates from the subcostal nervure well beyond the apex of the discoidal cell; while in all my examples of *Allotinus* it originates at the apex, which feature constitutes a well-marked difference, and can be instantly detected by the application of a little benzine to the wing to make it transparent.

P. portunus is described from two specimens sent me by Mr. H. Fruhstorfer.

23. PARAGERYDUS PYXUS, n. sp., Plate V, Fig. 2, ♂.

HABITAT: Borneo.

EXPANSE: ♂, 1·4 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* rufous-brown *Forewing*

* Journ. A. S. B., vol. lviii, pt. 2, p. 437 (1889).

with the lines on the costa and "male-mark" as usual. UNDERSIDE, *both wings* pale rufous, profusely and evenly sprinkled with dots and spots of a deeper rufous colour; a marginal series of very small black spots, one in each interspace.

Closely allied to *P. portunus*, mihi, from Java, but differs on the upperside in being rufous-brown, instead of dull hair-brown, and on the underside in having the ground-colour pale rufous instead of pale ochreous, and in the presence of the marginal black dots.

Described from a single example received from the late Mr. W. Davison.

24. LOGANIA LUCA, n. sp., Plate II, Fig. 13, ♀.

HABITAT: Perak, Malay Peninsula; N.-E. Sumatra.

EXPANSE: ♀, 1·0 inch.

DESCRIPTION: FEMALE. UPPERSIDE, *forewing* with the basal half milky-white, the outer half fuscous, the costa and base dusky, the extreme costa dotted with white on the basal half. *Hindwing* fuscous, the disc obscurely purplish-white. UNDERSIDE, *both wings* with the ground-colour probably white, but the surface is so thickly irrorated with brownish-ochreous that the ground-colour appears only as minute white dots profusely and evenly scattered over the surface mixed with a few black scales. *Forewing* with an obscure darker spot towards the end of the discoidal cell, and a similar discal band. *Hindwing* with some very obscure dark spots towards the base, an oblong one at the end of the cell, and a curved discal band crossing the wing from the costa to the abdominal margin.

Probably nearest to *L. marmorata*, Moore, the two original specimens of which, in very poor condition (probably both females, one certainly is that sex, the body of the other is lost, but the shape of the wings is certainly feminine), are before me. *L. luca* differs from them in having the outer margin of both wings more even, not distinctly scallopped, and the ground-colour of the underside is far redder, with the irrorations much more dense; this latter, however, is a variable feature in *L. marmorata*, as shewn in Mr. Moore's and my figures of the species taken from different specimens. *L. luca* may be still nearer to *L. obscura*, Distant, but the short original description of the latter does not in several particulars fit my specimens; Semper's and Staudinger's figures of the species agree very well with my specimens on the upperside, but neither of them agree on the underside.

I took two fresh specimens of this species in the high forest at Namoe Oekor, in October, 1893. They were flying amongst and settling on the low bushes growing under the high trees. I also possess two other females from Perak.

As far as I am aware, the genus *Logania* contains the following species. I include in it the two species, *L. marmorata*, Moore, and *L. sriwa*, Distant, which constitute Mr. Doherty's genus *Malais*, as he himself doubted subsequently the validity of the genus.* I have arranged the species chronologically.

(1) ? LOGANIA REGINA, Druce, Borneo (*Druce*). This species may be an *Allotinus*. To judge from the figure, the type specimen must have been a male, as the body is very long. Mr. Druce does not say what sex he described.

(2) LOGANIA MALAYICA, Distant, Sungei Ujong, in the Malay Peninsula (*Distant*); S.-E. Borneo; Pulo Laut; Sibulan, S.-E. Mindanao, one of the Philippine Isles.

(3) ? LOGANIA LAHOMIUS, Khiel, Nias Island (*Khiel*). This species may also be an *Allotinus*. The specimen figured seems to be a male, as it has a very long body.

(4) LOGANIA MARMORATA, Moore, Elphinstone Island in the Mergui Archipelago (*Moore*); Monè in the Shan States; Perak; N.-E. Sumatra; Pulo Laut.

(5) LOGANIA SRIWA, Distant, Malacca (*Distant*); Perak; Pulo Laut.

(6) LOGANIA OBSCURA, Distant, Northern Borneo (*Distant*); Palawan, Cebú, and East Mindanao, in the Philippine Isles.

(7) LOGANIA DISTANTI, Semper, Cebú, S.-E. Mindanao, Philippine Isles (*Semper*).

(8) LOGANIA DISTANTI, Staudinger, Palawan (*Staudinger*). Herr Semper places this species as a synonym of *L. obscura*.

(9) LOGANIA MASSALIA, Doherty, Margherita, in Upper Assam (*Doherty*).

(10) LOGANIA LUCA, de Nicéville, N.-E. Sumatra (*de Nicéville*).

25. SIMISKINA SOLYMA, n. sp., Plate IV, Fig. 10, ♀.

HABITAT: Gapis, near Taiping, Perak, Malay Peninsula.

EXPANSE: ♀, 1·6 inches.

DESCRIPTION: FEMALE. UPPERSIDE, *both wings* fuscous. *Forewing* with a large oval discal white patch, which, in some lights, is entirely suffused with beautiful rich iridescent emerald-green, and in all lights is more or less bordered by this colour; the patch commences beyond the discoidal cell just anterior to the third median nervule, and reaches the inner margin, its posterior portion, however, is much diffused; just beyond the patch are two rounded emerald-green spots divided by the second median nervule. *Hindwing* with a rather large

* Journ. A. S. B., vol. lviii, pt. 2, pp. 415, 436 (1889); vol. lx, pt. 2, p. 29 (1891).

emerald-green spot in the second median interspace; three lunulated emerald-green lines beyond in the two median and submedian interspaces; a marginal emerald-green thread, broken where it is crossed by the veins, obsolete towards the apex of the wing; the costa of the wing broadly pale ochreous. UNDERSIDE, *both wings* with the basal third chocolate-colour, the outer two-thirds ochreous. *Forewing* with the base of the inner margin ochreous; a broad discal wedge-shaped chocolate-coloured band with its base on the costa, its apex on the submedian nervure; its outer edge closely followed by a narrow chocolate line; the outer margin broadly chocolate. *Hindwing* with a macular, short, but rather broad, chocolate line on the middle of the disc; followed by five large chocolate spots divided only by the veins, the middle one the largest, the one on either side of it smaller, the two outermost spots the smallest; these five spots are followed by a macular band extending right across the wing of somewhat diffused chocolate spots; these again are closely followed by a narrow chocolate line; the margin bears a series of lunular spots between the veins, of which the one in the second median interspace is the largest and black, the rest are black and chocolate; a fine anteciliary inner white and then an outer chocolate thread.

This species is quite unique, there is nothing remotely resembling it in the genera *Poritia* or *Simiskina*. The white patch on the upperside of the forewing at once reminds one of *Laxita telesia*, Hewitson, which has a similar patch in the male.

The type and only known specimen of this species is deposited in the collection of Mr. A. R. Adams of Penang, who caught it himself. I am much indebted to him for allowing me to describe so beautiful and interesting a species.

26. PITHECOPS MARIÆ, n. sp., Plate IV, Figs. 2, ♂; 9, ♀.

HABITAT: N.-E. Sumatra.

EXPANSE: ♂, ·8 of an inch to 1·2 inches; ♀, 1·0 inch to 1·1 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* rich deep shining blue, almost invisible in some lights. *Forewing* with the apex somewhat widely, the outer margin narrowly and decreasingly black. *Hindwing* with the costa broadly, the outer and abdominal margins less broadly, black. UNDERSIDE, *both wings* milky-white, a series of very fine black dots on the outer margin; an anteciliary black thread. *Forewing* with a very narrow blackish line defining the disco-cellular nervules; two small black dots on the middle of the costa, often absent; a submarginal decreasing ochreous fascia, which becomes dusky at the costa; within which at the anal angle are two fine ochreous lines one above the

other. *Hindwing* with a large round black spot at the apex; a submarginal ochreous line. FEMALE. UPPERSIDE, *both wings* dead plumbeous-black. *Forewing* with a short streak of blue scales in the lower discoidal interspace beyond the end of the discoidal cell. *Hindwing* unmarked. UNDERSIDE, *both wings* as in the male. *Cilia* throughout more prominently marked alternately black and white than in the male.

A comparison of the figure here given of the male (which, however, is a very poor one, drawn from a very small specimen, the first I received), with that of *Pithecops fulgens*, Doherty,* from Margherita, in Upper Assam, of which I possess three males and two females, including the type specimens, will at once disclose the fact that on the upperside the male of *P. mariæ* has the blue area of much greater extent (it is also of a deeper, more truly blue, shade), and on the underside, that it is far less heavily marked, the two costal dots of the forewing being often absent, and the apical spot of the hindwing often smaller.

The discovery of a second blue species of the genus is highly interesting. I have described it from several male examples received from Hofrath Dr. L. Martin; one taken by myself at Namoe Oekor in October, in the virgin forest, and three female examples in my own collection, and one in Dr. Martin's, after whose amiable wife I have great pleasure in naming it. Though this butterfly is so small, the male immediately attracts attention when flying by the wonderful refulgence of the coloration of the upperside of the wings.

27. CYANIRIS CRISSA, n. sp., Plate II, Fig. 12, ♂.

HABITAT: Nilgiri Hills and Ashamboo Hills, South India.

EXPANSE: ♂, 1·35 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* shining violet-blue. *Forewing* with the costa narrowly, the apex widely, the outer margin broadly and evenly, black. *Hindwing* with the costa widely, the outer margin narrowly, black; five round black spots placed against the black border, one each in the discoidal and median, two in the submedian interspace. UNDERSIDE, *both wings* dead white, all the black markings unusually large and prominent; a marginal series of prominent spots, oval in the forewing, round in the hindwing; a submarginal prominent line, broader and lunulated in the forewing, narrower and more highly lunulated in the hindwing; a very fine anteciliary black thread. *Forewing* with a broad prominent comma-shaped mark closing the discoidal cell; a discal series of seven spots, the two anterior and two posterior spots in one straight line, the three middle spots out of line,

* Journ. A. S. B., vol. lviii, pt. 2, p. 127, pl. x, fig. 6, *male* (1889).

shifted outwardly. *Hindwing* with three large rounded spots across the base of the wing; a fine line at the end of the cell, a very irregular discal series of eight spots, of which the one on the costa and the one on the abdominal margin are the most prominent. *Cilia* above dusky white, on the underside the cilia under a magnifying glass appear to be white at the base tipped with dusky.

C. crissa on the upperside agrees best with *C. placida*, de Nicéville, from Sikkim, Assam, Burma, the Malay Peninsula, and Java, but the outer black margin on the forewing is rather broader, and the submarginal black spots on the hindwing are better separated from the black margin. On the underside the two species are abundantly distinct, the markings in *C. crissa* being almost throughout deep black, while in *C. placida* they are dull fuscous, they are also far more prominent and larger in *C. crissa*. In the rains form of *C. puspa*, Horsfield, the markings on the underside are quite as prominent as in *C. crissa*, but they differ somewhat in character; in the hindwing especially the submarginal line is much nearer to the marginal spots in *C. puspa* than in *C. crissa*. *C. cyanescens*, de Nicéville, from the Nicobar Isles, is another allied species, but the markings on the underside are different, being smaller, less prominent, and more or less fuscous.

Described from a single example obtained at Kalar in the Nilgiri Hills by Lieut. E. Stokes Roberts, R. E., on the 17th August, 1892, another male taken in March, in the Ashamboo Hills of Travancore, and received from Mr. Harold S. Ferguson.

28. EVERES MOOREI, Leech, Plate II, Fig. 11, ♂.

Lycæna moorei, Leech, Trans. Ent. Soc. Lond., 1889, p. 109, n. 45, pl. vii, fig. 3; idem, id., Butt. China, Japan, and Corea, p. 310, pl. xxxi, fig. 9, *male* (1893).

HABITAT: Kiukiang, Chang-yang, Central China (*Leech*); Khasia Hills.

The Rev. Walter A. Hamilton has sent me eight specimens of this species obtained by his native collectors in the Khasia Hills. It occurs also at Kiukiang and Chang-yang in Central China. The Indian specimens are a good deal smaller than the Chinese examples (23 as against 29 mms.), but do not differ in coloration and markings. The species is a true *Everes*, as I have ascertained by bleaching the wings of a specimen, but is a little abnormal, as the hindwing has no trace of a tail. This, however, in the *Lycænidæ*, cannot be accepted as a feature of generic or even specific value, as several instances occur in which the same species is both tailed and tailless. In the genus *Everes* not only is *E. moorei* tailless, but the type species, *E. argiades*, Pallas, is sometimes without tails, Mr. W. Doherty having obtained tailless

specimens in the Naga Hills, and Lieut. E. Y. Watson similar ones in the North Chin Hills of Upper Burma (Fort White, 7,000 ft., March and April; Tiddim, 5,500 ft., April), of which he has sent me a considerable series. *E. moorei* is not mentioned in Colonel Swinhoe's "List of the Lepidoptera of the Khasia Hills."*

29. LAMPIDES LUCIDE, n. sp., Plate V, Fig. 3, ♂.

HABITAT: Battak Mountains, N.-E. Sumatra.

EXPANSE: ♂, 1·6 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* milky-white more or less glossed with pale blue; all the fuscous bands, the dark costa, and base of the wing of the underside shining through as pale blue bands. *Forewing* with the apex broadly, and the outer border rather broadly and decreasingly black. *Hindwing* with a black anteciliary thread, within which is a series of small indistinct linear black lines between the veins; *cilia* white, tipped with black; *tail* black, tipped with white. UNDERSIDE, *both wings* chalky-white. *Forewing* with the basal two-thirds of the costa and the base of the wing sprinkled thickly with plumbeous scales; a broad straight fuscous band from the dusky costa to the submedian nervure covering the disco-cellular nervules; a similar but dislocated band beyond from the costa to the third median nervule; between these two bands is a quadrate spot in the second median interspace; a third short band from the costa to the lower discoidal nervule; a fourth band, submarginal, curved, from the costa to the submedian nervure; a fifth marginal narrow band; a rather broad anteciliary black thread. *Hindwing* with the base narrowly thickly sprinkled with plumbeous scales; crossed by seven fuscous bands which are more or less straight till they approach the abdominal area when they are all recurved to the abdominal margin, except the second band from the base of the wing, which ends on the first median nervule and is not recurved; a large oval black spot near the margin in the first median interspace, bearing at the corner nearest to the base of the tail a few brilliant metallic green scales, the spot broadly crowned with rich ferruginous; a small anal black spot bearing anteriorly a few metallic green scales, crowned by a ferruginous line; an anteciliary fine black thread. *Abdomen* plumbeous above, the segments marked with a white line, the abdomen below white.

This is a very remarkable species, and unlike any other. The coloration of the underside is reversed. In the other species of the genus the ground-colour is dark and the markings are white, in *L. lucide* the ground-colour is white and the markings are black. The broad black apex and outer margin of the forewing above, and the

* Trans. Ent. Soc. Lond., 1893, p. 297.

markings of the underside of both wings being represented above by pale blue bands, are also quite unique characters. On the upperside *L. lucide* reminds one of *L. aratus*, Cramer, as figured by Heer P. C. T. Snellen in Tijdsch. voor Ent., vol. xxxiii, p. 271, pl. xi, fig. 1, *male* (1890), from Tanah-Djampea Island, near Celebes, but that species has no broad black border to the forewing.

Described from one specimen obtained by the Battaks in January, 1893, in my collection; Dr. Martin possesses a single female example, which I hope hereafter to have an opportunity to figure and describe.

30. Arhopala constanceæ, n. sp., Plate IV, Fig. 11, ♀.

Habitat: South Andaman Isles.

Expanse: ♀, 1·8 inches.

Description: Female. Upperside, *both wings* rich shining rather light blue. *Forewing* with the costa as far as the subcostal nervure, the apex very widely, and the outer margin widely, purplish-black. *Hindwing* with the costa and outer margin broadly purplish-black, the abdominal margin pale fuscous; the anal lobe small, purplish-black; tail rather short, purplish-black tipped with white; *cilia* purplish-black throughout. Underside, *both wings* purplish-reddish-brown, the markings a little darker only than the ground-colour. *Forewing* with a small round dot towards the base of the discoidal cell, a larger oval one at its middle, a large one at its end, with a spot below filling the base of the first median interspace; the discal band straight, even, formed of six nearly equal-sized spots, extending from the costa to the first median nervule; two indistinct submarginal macular bands; the inner margin broadly pale, this pale area reaching to the submedian nervure; with an indistinct spot (its outer edge sharply defined) within and posterior to the point where the first median nervule arises. *Hindwing* with the usual basal spots small, the quadrate spot closing the discoidal cell touching the large second anterior spot of the usual discal fascia; the submarginal band broad; the anal lobe bearing a small deep black spot crowned with dull dark green scales, with a few scattered similar scales in the interspace beyond.

There is no allied Indian species with which I can compare this, but it appears to be very similar on the underside to *A. ate*, Hewitson, from Amboina, differing, however, in the discal band of the hindwing touching the disco-cellular spot instead of being widely separated from it, and in having the metallic green sprinklings at the anal angle much fewer.

Described from a single example obtained at Port Blair by the late Mr. R. Wimberley, after whose widow I have much pleasure in naming it.

Genus LISTERIA, nov.

MALE. FOREWING, rather long and narrow; *costa* almost straight, *apex* to termination of third median nervule truncate, *outer margin* below truncation emarginate, *inner angle* rather acute, *inner margin* lobed before the middle; *costal nervure* ending just beyond the upper end of the discoidal cell; *subcostal* nervure with three branches, excluding the terminal portion of the nervure which is often counted as an additional subcostal nervule, terminating on the costa just before the apex of the wing; *first subcostal nervule* arising from the subcostal nervure a little beyond the middle of the cell, ending on the costa beyond the end of the cell; *second* subcostal arising nearer to the apex of the cell than to the origin of the first subcostal; *third* subcostal arising midway between the end of the cell and the apex of the wing; *upper disco-cellular* nervule wanting; *middle* disco-cellular arising at the point where the upper discoidal nervule is given off, concave; *lower* disco-cellular longer than the middle disco-cellular, in the same straight line, concave; *second median* nervule arising well before the lower end of the cell; *first* median arising twice as far from the base of the second as the second does from the end of the cell; *submedian nervure* straight; a sexual *tuft of hairs* attached to the inner margin before its middle and turned under and upwards. HINDWING, large, broad; *costa* nearly straight, *outer margin* broadly curved to the anal angle, slightly produced at the termination of the third median nervule; *anal lobe* very large; *abdominal margin* excavated anterior to the anal lobe; *costal nervure* ending at the apex of the wing, very much curved at the base, then straight to the apex; *first subcostal nervule* arising well before the apex of the cell, ending at the apex of the wing; *upper disco-cellular* nervule straight, *lower* disco-cellular also straight, in the same straight line as the upper, both slightly outwardly oblique, a little longer than the upper; *second median* nervule arising just before the lower end of the cell; *submedian nervure* straight; *internal* nervure short, recurved; a sexual *glandular* "*scale*" *patch* extending from the base of the first subcostal nervule to the termination of the discoidal cell, not extending into the cell, but with as large or rather larger an area anterior to the first subcostal nervule as there is posterior to that vein. *Antennæ* about half as long as the costa of the forewing, with a large well-formed club. *Palpi* rather long, porrect. *Eyes* hairy. *Thorax* rather robust. *Abdomen* short, extending to two-thirds the length of the abdominal margin of the hindwing only. *Cilia* of the hindwing very long and coarse. Type, *L. dudgeonii*, de Nicéville.

The secondary male sexual characters of the genus are nearest as far as Indian genera go to those of *Bindahara*, Moore, the "scale"

patch on the hindwing being placed in much the same position, though it is not quite so large and reaches quite up to the origin of the upper disco-cellular nervule, which it does not do in *Bindahara*, and it has a similar tuft of long hairs on the forewing; but it differs from the five Indian genera—*Hysudra*, *Rapala*, *Bindahara*, *Virachola*, and *Sinthusa*, all of Moore—which possess the "scale" mark and tuft of hairs, in being entirely devoid of a tail to the hindwing. The genus is so entirely aberrant that it is very difficult to know where to place it, though its affinities are perhaps more with *Thecla*, Fabricius, than with any other.

31. Listeria dudgeonii, n. sp., Plate IV, Fig. 3, ♂.

Habitat: Bhutan.

Expanse: ♂, 1·25 inches.

Description: Male. Upperside, *forewing* black; the discoidal cell, a small area at the base of the second and a larger area at the base of the first median interspace and thence broadly to the inner margin of the wing, but not nearly reaching the anal angle, bright blue. *Hindwing* with the costa broadly extending into the cell, the outer margin broadly but decreasingly to the anal angle, black; the abdominal margin broadly pale fuscous; the rest of the wing bright blue. Underside, *forewing* pale fuscous inclining to pale ochreous broadly on the inner margin; a large reddish spot at the end of the cell, a discal macular reddish band from the costa to the first median nervule; a submarginal broad black-mixed-with-red band; the sexual tuft of hairs on the inner margin turned under and upwards pale ochreous. *Hindwing* with the base rather broadly black, the rest of the wing reddish, becoming darker towards the outer margin, where it is umber-coloured; beyond the black basal area is a broad area extending across the wing consisting of a confused mass of ill-shaped ochreous spots; the outer margin bears a double lunulated fuscous line, each pair of lunules enclosing a small space of the ground-colour. *Cilia* reddish throughout, broad and coarse, and very long on the hindwing, especially where they fringe the anal lobe.

The butterfly is so entirely different from all others known to me in shape, markings and sexual characters that I can compare it with none. It remotely reminds one of *Thecla frivaldszkyi*, Lederer, and allies, in the markings of the underside; but the coloration of the upperside, the truncated apex of the forewing, and the "male-marks" are wholly dissimilar.

Described from a single example not in very perfect order, captured at 2,500 feet elevation above the sea by Mr. J. L. Lister, after whom I have much pleasure in naming the genus. As my friend Mr. G. C.

Dudgeon "discovered" the species in Mr. Lister's collection, I have named it specifically after him.

32. Camena cremera, n. sp., Plate V, Fig. 16, ♂.

Habitat: Java.

Expanse: ♂, 1·7 inches.

Description: Male. Upperside, *both wings* cerulean-blue; *cilia* black, faintly tipped with grey on the hindwing. *Forewing* with the costa at the base very narrowly black, but the black area broadening out and reaching the subcostal nervure before the apex of the cell; the apex of the wing very widely black, narrowing away to nothing at the anal angle. *Hindwing* with the costal area broadly pale ochreous, polished; the outer margin narrowly black, but widening out somewhat at the apex of the wing; anal lobe small, inconspicuous, black, with a few turquoise-blue scales posteriorly, obscurely crowned with ochreous; the abdominal margin whitish. Underside, *both wings* plumbeous; a common discal even-edged straight white band, widest at the costa of the forewing, ending on that wing at the first median nervule, in the hindwing commencing on the costa, ending on the submarginal dark line; a common submarginal narrow dark line, not quite reaching the costa of either wing, in the forewing slightly outwardly bowed, ending at the submedian nervure, in the hindwing much outwardly bowed, posteriorly zig-zag and recurved to the abdominal margin, defined on the zig-zag portion on both sides by a fine white line; a very fine anteciliary black thread, defined inwardly narrowly with whitish on the hindwing. *Forewing* with the inner margin broadly whitish; the large tuft of hairs turned under and forwards deep black, and lying across a polished area. *Hindwing* with a small round black spot in the first median interspace near the margin, anteriorly broadly crowned with a large orange spot which reaches as far as the submarginal dark line; the anal lobe bearing a prominent large round deep black spot, crowned with a thin line of turquoise-blue scales; the area between the anal lobe and the second median nervule broadly sprinkled with grey scales; *tails* black, fringed and tipped with white. *Body* above blue throughout; below whitish.

Closely allied to *C. cotys*, Hewitson, from Nepal, Sikkim, the Khasia Hills, East Pegu, and Burma, and to *C. anysis*, Hewitson, from Macassar (Celebes), and the Philippine and Jolo Isles, differing from the figure of the latter in the black area of the forewing on the upperside being less wide and reaching the inner angle in a regular curve, in *C. anysis* it appears to end abruptly at the first median nervule; in the latter species the apex of the hindwing appears to be blue, in *C. cremera*

it is somewhat broadly black; on the underside of the hindwing the black spot in the first median interspace is half as large, while the orange area anterior to this spot is many times larger than in *C. anysis.* From *C. cotys* it differs on the underside in the common white discal band being narrower, in the absence of the common "submarginal obscure rufous band," by the large size of the orange patch crowning the black spot in the first median interspace of the hindwing, and by the anal lobe being crowned with blue instead of orange.

Described from two male examples sent me by Mr. H. Fruhstorfer.

33. Aphnæus hiendlmayrii, n. sp., Plate V, Fig. 5, ♀.

Habitat: N.-E. Sumatra.

Expanse: ♀, 1·7 inches.

Description: Female. Upperside, *both wings* fuscous with strong reflections in certain lights, in one light dark purple, in another ochreous-bronzy. *Hindwing*, anal angle and lobe bearing a large patch of deep red (dragon's blood) colour, this red area outwardly marked with a black line centered with a line of pure silvery scales; *tails* also deep red, but becoming black towards the end, tipped with white. Underside, *both wings* dull brownish-ochreous, the disc somewhat mottled with deep red, profusely marked with spots of the purest metallic silvery colour. *Forewing* with the silvery spots thus:—A series of dots along the costa, the series not quite reaching the base of the wing, increasing in size as they advance towards the apex of the wing, the series not nearly reaching the apex; a large oblique streak near the middle of the discoidal cell; an upright one across its end; two spots beyond placed obliquely; an elongated curved streak below the cell divided by the second median nervule; a lengthened narrow streak lying along the first median nervule; a chain-like submarginal band—all these silvery spots narrowly outwardly defined with a black line and more broadly by deep red; a marginal deep red line; the base of the wing yellowish, the inner margin broadly whitish, becoming plumbeous at the first median nervule. *Hindwing* with sixteen silvery spots and streaks as in the forewing spread fairly evenly over the base and disc; a submarginal red band recurved to the abdominal margin, the band anteriorly slightly, posteriorly profusely, marked with silvery; a narrow deep red anteciliary line; the anal lobe deep red bearing a small black spot anteriorly crowned with yellow. *Body* above concolorous with the wings on the upperside. *Face* in front, *palpi*, body beneath, and *legs* yellow.

As far as I am aware, this species has no near ally, it does not even remotely resemble any Oriental species with which I am acquainted. In the type specimen, being a female, the upperside is not brilliantly

blue coloured as the male will probably prove to be; the rich silvery markings on a ground of an unusual shade, the markings themselves also being of a shape hitherto unknown to me, make the lower surface of this insect not only singularly beautiful but extremely different from all other Eastern species of the genus. It is possibly more nearly related to the numerous richly coloured African species allied to *Aphnœmorpha orcas*, Drury. It is not a little remarkable that while continental India is so rich in species of the genus *Aphnœus*, Sumatra should not possess more than one other species, the wide-spread *A. lohita*, Horsfield; while the Malay Peninsula and larger islands (Borneo and Java) should only possess two or three species, *A. lohita* and *A. syama*, Horsfield, and *A. vulcanus*, Fabricius.

Described from a unique example taken at Selesseh on 15th August, 1893, in Dr. L. Martin's collection. At his suggestion I have named it after Herr A. Hiendlmayr, the Custos of the Munich Museum, Bavaria.

34. Tajuria blanka, n. sp., Plate IV, Fig. 4, ♀.

Habitat: Battak Mountains, N.-E. Sumatra.

Expanse: ♀, 1·6 inches.

Description: Female. Upperside, *forewing* with the costa at the base very narrowly, the apex very widely, the outer margin decreasingly, black; the rest of the wing rather light clear blue. *Hindwing* with the costa broadly fuscous; the apex widely, the outer margin narrowly, black; the abdominal margin as far as the submedian nervure whitish; the rest of the wing blue; the anal lobe small, black, crowned with a few blue scales, the lobe anteriorly bearing against it a white fascia; the tails rather short, black, tipped with white, the longer one from the termination of the first median nervule, the shorter from the submedian nervure. *Cilia* black throughout. Underside, *forewing* immaculate, drab, the inner margin extending broadly on to the disc dull ochreous. *Hindwing* drab; with an irregular outer discal dark line outwardly defined by white from the abdominal margin to the third median nervule; a small oval black spot on the margin in the first median interspace; a slightly larger black spot on the anal lobe, anteriorly and posteriorly bearing some fine turquoise-blue scales; the space between and above these spots ochreous; an anteciliary black thread inwardly defined by a narrow white thread from the anal lobe to the third median nervule; *cilia* of the forewing and the anterior moiety of the hindwing drab, the posterior moiety whitish. *Body* above clothed with long hairs, of the shade of blue of the wings; *thorax* beneath drab, *abdomen* beneath dull ochreous.

Probably nearest to *T. mantra*, Felder, and *T. relata*, Distant, from

both of which *T. blanka* may instantly be known by the forewing on the underside having no markings whatever.

Described from a single example in Dr. Martin's collection, which was taken in October. Namoe Blanka is the name of a Battak kampong or village.

35. Charana cepheis, n. sp., Plate V, Fig. 10, ♂.

Habitat: Assam.

Expanse: ♂, 1·8 inches.

Description: Male. Upperside, *both wings* glossy purplish-black. *Forewing* with the basal two-thirds of the interno-median area ending outwardly in a point and the basal half of the sutural area rich deep blue of about the same shade as in the male of *Camena icetas*, Hewitson. *Hindwing* with the outer half from the second subcostal nervule to the submedian nervure, crossed by the black veins, rich deep blue; a diffused and indistinct submarginal black spot in the first median interspace; the outer margin narrowly black; the anal lobe orange-ochreous, bearing a few white and blue scales; the tails black, fringed and tipped with white. Underside, *both wings* with the basal two-thirds pale chrome-yellow, the outer third purplish-brown. *Forewing* with the purplish-brown area bearing two macular deeper brown bands, which are farthest apart in the middle but meet at each end, thus enclosing an oval space of the ground-colour; a submarginal whitish thread reaching from the anal angle to the middle of the wing. *Hindwing*, the outer purplish-brown area bears two macular deeper brown bands, the inner one posteriorly highly zig-zag and recurved to the abdominal margin, the outer one reaching only to the second median nervule; the first median interspace bears a round black spot with an outer rust-red ring; the anal lobe is jet-black, anteriorly bearing a few turquoise-blue scales, and bearing anteriorly to these again a rust-red line, which is continued to the abdominal margin along the edge of the incised portion of the wing anterior to the anal lobe, this red line defined on both sides with a very narrow black line. *Cilia* of the hindwing narrowly tipped with white, those of the forewing black.

This species is very near to *C. mandarinus*, Hewitson, from Sikkim, Bhutan, Assam, and Burma, from which it differs in the following particulars:—The blue coloration of the upperside is quite different, being of a much darker and richer hue, in *C. mandarinus* it is distinctly "dull cerulean blue," the blue colour also does not extend into the discoidal cell of the forewing as it does in that species; on the underside the outer area of both wings is purplish-brown instead of rufous, in the forewing the macular bands touch at both ends instead of being

parallel throughout; and in the hindwing of *C. mandarinus* beyond the inner zig-zag black line from the second median nervule to the abdominal margin there is a considerable white band, this being obsolete in *C. cepheis*, the purplish-brown area being continued uninterruptedly and of equal width throughout from the apex of the wing to the anal angle.

Described from two male specimens exactly alike captured by Lieut. C. H. Ward, on Nemotha, a peak in Cachar, 3,634 feet high, on October 15th, 1892, one of which he has generously presented to me. Lieut. Ward captured *C. mandarinus* at the same time and place.

36. NEOCHERITRA NAMOA, n. sp., Plate V, Fig. 9, ♂.

HABITAT: Battak Mountains, N-E. Sumatra.

EXPANSE: ♂, 1·6 inches.

DESCRIPTION: MALE. UPPERSIDE, *forewing* and *cilia* black; a broad oblique pale non-iridescent blue band crosses the base of the wing, this area commences narrowly on the costa, crosses the discoidal cell at about its middle, meeting the median nervure at the point where the first median nervule arises, and reaches the inner margin at about two-thirds of its length from the base. *Hindwing* with the costa at the base of the wing broadly pearly shining white, bearing in its middle a large round fuscous "scale mark," this mark being placed at the base of the first subcostal nervule by which it is equally bisected, not extending into the cell, the mark shewing clearly on the underside of the wing as a raised area: the apex of the wing reaching to the second median nervule broadly black, the rest of the wing pale non-iridescent blue shading off into pure white broadly towards the anal angle; a large round black spot placed close to the margin in the first median interspace; a similar one in the submedian interspace, but placed further from the margin; the anal lobe with a large round black spot in its middle almost hidden by overlying long white hair-like scales; an anteciliary fine black thread which extends some little distance along the middle of the two tails, the thread commences at about the first median nervule and ends at the base of the inner long tail; *cilia* anteriorly black, posteriorly pure white; outer *tail* at termination of first median nervule tipped with white, anterior to this it is black, then again white to its base, in length it is 5 mms.; inner tail at termination of submedian nervure white, in length 17 mms., or about ·65 of an inch. UNDERSIDE, *both wings* pale bluish-white. *Forewing* with the costa and apex broadly dull brownish-ochreous, shading off into the white discal area; the inner margin broadly highly polished at the base; across this polished area lies a thick tuft of long dull brownish-ochreous

hairs. *Hindwing* at the apex with a short dull ochreous-brown submarginal line ending in the second median interspace in a narrow black line; four short black lines placed in echelon across the disc, one each in the second and first median, submedian and internal interspaces; the three large round black spots on the margin towards the anal angle as on the upperside, but larger, more prominent, and of a deeper shade, the one on the anal lobe with a black line placed against it anteriorly; between the anal lobe and the line above it are a few pale greenish metallic scales, the middle black spot also bears a few similar scales scattered over it; a fine black anteciliary thread traverses the whole length of the margin and extends as above for a short distance along the bases of the tails. *Head*, *thorax*, and *abdomen* above pale blue; beneath, *palpi* and *legs* white. The *antennæ* are very interesting—the club and shaft above are black, but the shaft beneath is pure white.

Unfortunately I possess no male specimen of the type species of the genus, *Neocheritra amrita*, Felder, with which to compare the structure of *N. namoa*. As far as I can judge, however, it comes into that genus, as it possesses four subcostal nervules and a tuft of hairs attached to the inner margin of the forewing and turned under and forwards, and the cup-like depression (as seen from above) to the hindwing mentioned by Hewitson as found in the typical species. Both Hewitson and Distant figure the male of *N. amrita*, from which *N. namoa* differs on the upperside in the forewing having the blue area of less extent, in the hindwing in having the black apical area twice as large, in both the tails being very considerably shorter, and on the underside in having the apical area of the forewing dull brownish-ochreous, not deep fulvous or reddish-ochreous. I have female specimens of *N. amrita* from Perak, Singapore, and Sumatra. To this genus probably belongs the very distinct "*Sithon*" *teunga*, Grose Smith, from Borneo.* Another allied species is "*Hypolycæna*" *clœlla*, Weymer,† from the Island of Nias, of which I possess a female specimen. It has much shorter tails than *N. namoa*, and the discal series of black spots on the underside of the hindwing instead of being placed in echelon are arranged in a straight line, as they are also in *N. amrita*. The ground-colour of the two species on the underside agrees exactly, but *N. clœlla* (the species is a true *Neocheritra*) has the dull brownish-ochreous coloration more extensive on the forewing. Probably still another allied species (which I have not seen) is "*Sithon*" *paluana*, Staudinger, from Palawan in the Philippines.‡

Described from an unique specimen taken on 21st May, 1893, in the

* Ann. and Mag. of Nat. Hist., sixth series, vol. iii, p. 317 (1889).

† Stet. Ent. Zeit., vol. xlviii, p. 10, n. 8, pl. ii, fig. 5, *female* (1887).

‡ Iris, vol. ii, p. 107, pl. i, fig. 9, *female* (1889).

Battak mountains, deposited in Dr. Martin's collection. I have taken its name from Namoe Oekor and Namoe Blanka, two Battak villages.

37. SINTHUSA MALIKA, Horsfield, Plate V, Figs. 18, ♂; 6, ♀.

Thecla malika, Horsfield, Cat. Lep. E. I. Co., p. 90, n. 22 (1829); *Dipsas malika*, Horsfield and Moore, Cat. Lep. Mus. E. I. Co., vol. i, p. 37, n. 43, pl. ia, fig. 5, *male* (1857); *Myrina malika*, Hewitson, Ill. Diurn. Lep., p. 37, n. 34, pl. xv, figs. 41–43, *male* (1863); *Sithon malika*, Kheil, Rhop. Nias., p. 32, n. 112 (1884); *Sinthusa malika*, de Nicéville, Butt. of India, vol. iii, p. 487 (1890); *Sinthusa amata*, Distant, Rhop. Malay., p. 461, n. 2, pl. xliv, fig. 20, *female* (1886); id., de Nicéville, Butt. of India, vol. iii, p. 488 (1890).

HABITAT: Java (*Horsfield, Moore, Hewitson, coll. de Nicéville*); Sumatra (*Hewitson, coll. de Nicéville*); Nias (*Kheil*); Penang (*Distant, coll. de Nicéville*); Perak (*coll. de Nicéville*).

EXPANSE: ♂, 1·00 to 1·15; ♀, 1·2 inches.

DESCRIPTION: MALE. UPPERSIDE, *forewing* deep indigo-blue, viewed from the side iridescent rich ultramarine-blue; the costa and outer margin narrowly black, broadly black at the apex. *Hindwing* much lighter blue than on the forewing, not iridescent, the costa broadly black, the abdominal margin broadly fuscous. *Cilia* of the forewing black, of the hindwing pure white, except at the apex of the wing, where they are fuscous. UNDERSIDE, *both wings* white with a bluish shade, the markings brownish-ochreous. *Forewing* with the costa narrowly, the apex widely, the outer margin fining away to nothing at the inner angle, brownish-ochreous; an oblong broad spot at the end of the discoidal cell; a discal macular band consisting of six increasing spots, the band strongly broken in the middle, the three posterior portions of the band shifted towards the base of the wing; an obscure submarginal macular fascia from the submedian nervure, becoming lost anteriorly in the dark apical area. *Hindwing* with a broad oblong spot at the end of the cell; eight small discal spots arranged in pairs irregularly across the wing from the costa to above the anal angle; a round black spot in the first median interspace on the margin; a black spot in the submedian interspace sprinkled with metallic-blue scales; a double series of small lunules on the outer margin between the spot in the first median interspace and the apex of the wing, obsolete in a Javan specimen; the small anal lobe black, crowned with metallic-blue scales. *Cilia* of the forewing brownish-ochreous; of the hindwing white, with a fine black anteciliary thread. *Tail* white with a black central line. The tuft of hairs attached to the inner margin of the forewing towards the base and turned under and upwards, large and black. FEMALE. UPPERSIDE, *both wings* shining hair-brown. *Forewing* unmarked. *Hindwing* with an outer white area,

separated from the outer margin by a narrow band of the ground-colour, the white area commences narrowly at the second subcostal nervule, increases in width to the abdominal margin; a narrow black anteciliary thread from the anal angle to the third median nervule. UNDERSIDE, *both wings* with the markings similar to those in the male, but of a pure ochreous shade margined with fuscous. *Forewing* with the apex also pure ochreous. The tail twice as long and twice as broad as in the male.

My single Javan male specimen here figured has the blue coloration of the upperside of the forewing more extensive, the markings of the underside smaller,* the double marginal macular bands obsolete in the hindwing, the brownish-ochreous apical area of the forewing more restricted than in my numerous specimens from the Malay Peninsula and the Battak Mountains of Sumatra, but as all these features seem to be somewhat variable in my series of specimens, I think the *S. amata* of Distant should fall before *S. malika* of Horsfield.

The figure of the male is taken from my Javan specimen, that of the female from a Penang example. I have also figured, Plate V, Fig. 17, the unique type male specimen of *Sinthusa aspra*, Doherty (Journ. A. S. B., vol. lx, pt. 2, p. 180 (1891), from Mount Arjuno, 5,000 feet, Eastern Java, the specimen being in my collection.

Family PAPILIONIDÆ.

Subfamily PIERINÆ.

38. DELIAS DYMAS, n. sp., Plate V, Fig. 7, ♂.

HABITAT: Java.

EXPANSE: ♂, 2·6 inches.

DESCRIPTION: MALE. UPPERSIDE, *forewing* black; the disco-cellular nervules marked on each side with a white line; a submarginal series of six white streaks; a small patch of grey scales at the base of the first median interspace, a much larger one below this in the submedian interspace. *Hindwing* with the extreme base, the costa, and the outer margin black, the rest of the wing white, but the area between the abdominal margin and the second median nervule tinted with primrose-yellow. UNDERSIDE, *forewing* as on the upperside, but the grey patches on the disc smaller. *Hindwing* with the base broadly black, bearing a broad crimson patch, the disc of the wing rich chrome-yellow crossed by the narrow black veins, the outer margin black, that colour ascending the veins on either side for some little distance.

* Noted also by Hewitson.

Nearest to *D. crithoë*, Boisduval, also from Java, but differing in the submarginal series of spots on the forewing being twice as numerous, and all the disco-cellular nervules, instead of the lower one only, defined on each side with a white line; the hindwing has the white and pale yellow area much larger, thereby reducing the outer black area by one-half. Also near to *D. tobahana*, Rogenhofer, = *D. derceto*, mihi, from Sumatra, but that species lacks the two discal patches of grey scales on the forewing, has the white and yellow area on the hindwing smaller, and on the underside has the crimson band of the hindwing at least twice as broad.

Described from a single example collected by Mr. W. Doherty in Java and given to me by him as a new species. After the description above was written and the specimen figured, I received Herr Fruhstorfer's description of *D. bromo*,* also from Java, from which *D. dymas* appears to differ mainly in the entire absence of the crimson base to the hindwing on the upperside.

Subfamily Papilioninæ.

39. Papilio (*Pangerana*) hageni, Rogenhofer, Plate IV, Fig. 6, ♂.

Papilio hageni, Rogenhofer, Verh. zool.-bot. Gesellsch. Wien, vol. xxxix, p. 1 (1889); id., de Nicéville, Journ. Bomb. Nat. Hist. Soc., vol. viii, p. 55, n. 16, pl. M, fig. 2, *female* (1893).

Habitat: Sumatra.

Expanse: ♂, 5·6 inches.

Description: Male. Upperside, *both wings* rich glossy black. *Forewing* with some paler streaks in the discoidal cell and between the veins. *Hindwing* with a large white patch occupying the outer half of the wing, anteriorly bounded by the second subcostal nervule, posteriorly extending just beyond the greatly curved first median nervule, not reaching the outer margin, this latter bearing four large conjoined lunular black spots; the white area bears outwardly four large round black spots, the three anterior ones equal-sized, the posterior one smaller; the white area between these last-mentioned four spots and the four black lunular spots on the margin sprinkled with black scales; the abdominal margin is as usual twice folded over, and is lined within with a white flocculent substance, the edge of the fold within being rose-pink. Underside, *forewing* paler than on the upperside. *Hindwing* as above, except that the white area has no black sprinkling, and that there is a small white spot at the posterior end of the cell, with three similar ones in the first subcostal interspace, these latter

* *Delias bromo*, Fruhstorfer, Ent. Nach., vol. xix, p. 335 (1893).

really forming an incomplete white edging to a fifth discal black spot. *Antennæ* black. *Head* in front and *thorax* anteriorly pale buff-yellow, thorax and *abdomen* above black, thorax beneath and *legs* black, abdomen beneath rich crimson, cross-banded with black, and bearing on each side a series of small black spots; *anal valves* black.

Described from a single male taken on 5th May, 1893, and generously given to me by Hofrath Dr. L. Martin, who possesses one other male in his magnificent collection.

40. Papilio (*Menamopsis*) perses, n. sp., Plate IV, Fig. 7, ♂.

Habitat: Gayoes Mountains, N.-E. Sumatra.

Expanse: ♂, 3·7 inches.

Description: Male. Upperside, *both wings* fuscous. *Forewing* with the basal two-thirds very dark fuscous, the outer third lighter. *Hindwing* with a submarginal series of sullied-white streaks placed in pairs between the veins, reaching neither the outer margin nor the discoidal cell, most prominent at the anal angle, becoming obsolete towards the apex of the wing; a small round chrome-yellow spot outwardly surrounded by a black line at the extreme anal angle. Underside, *both wings* uniformly pale fuscous. *Forewing* immaculate. *Hindwing* with the anal spot as on the upperside; the submarginal series of white streaks longer, reaching almost to the outer margin, wider and clearer white. *Head* and *thorax* in front black, spotted with white, rest of thorax and *abdomen* black, the latter bearing three series of white spots on each side, the *anal valves* white, edged with black.

Mr. W. F. Kirby has kindly compared the drawing here reproduced with the specimen of *P. hewitsonii*, Westwood, in the British Museum, which is probably the type of that species, and was figured by Mr. Hewitson in his "Exotic Butterflies," vol. ii, *Papilio* pl. iv, fig. 9, (1859) as the female of *P. slateri*, Hewitson. Mr. Kirby informs me that the species here described in quite distinct from the Bornean *P. hewitsonii*. The latter I have not seen, but from Hewitson's figure of it, which he says is taken from a female (Wallace, however, says the specimen is a male,* as also does Westwood,† again Mr. G. C. Dudgeon has examined it and tells me that it is, with two other specimens in the British Museum, undoubtedly a male), it differs in having the outer third of the forewing lighter coloured than the rest of the wing instead of concolorous throughout; the hindwing with a prominent submarginal series of white streaks, instead of, as in *P. hewitsonii*, "two rows

* Trans. Linn. Soc. Lond., vol. xxv, p. 61, n. 86 (1864).

† Proc. Ent. Soc. Lond., third series, vol. ii, p. 10 (1864).

of indistinct white spots, in pairs, between the median nervules near the outer margin" on the upperside, those on the underside are said to form "two rows, united into distinct hastate spots pointed inwards." The chrome-yellow anal spot in *P. perses* is half the size of that in *P. hewitsonii*, and the wings of my specimen are also narrower.

Described from a single example in my collection received from Hofrath Dr. L. Martin, who has other specimens in his own collection. It is a perfect mimic—except for the chrome-yellow anal spot to the hindwing—of *Euplœa* (*Penoa*) *ménétrièsii*, Felder, which is found flying with it.

41. Papilio (*Menamopsis*) petra, n. sp., Plate IV, Fig. 5, ♂.

Habitat: Gayoes Mountains, N.-E. Sumatra.

Expanse: ♂, 4·1 inches.

Description: Male. Upperside, *forewing* fuscous, the area at the anal angle broadly paler; a curved discal series of eight inwardly-pointed white streaks placed one each between the veins; the series anteriorly well removed from the outer margin of the wing, approaching the anal angle posteriorly; the spots forming the series largest anteriorly, rapidly decreasing in size posteriorly; each spot bisected longitudinally by the internervular fold. *Hindwing* fuscous at the base only, the rest of the wing much paler; a submarginal series of sullied-white streaks placed in pairs between the veins, well removed from the outer margin except the two anteriormost ones, which approach it closely; a small round chrome-yellow spot placed on the anal angle, anteriorly crowned with a black lunule. Underside, *both wings* concolorous, shining pale fuscous. *Forewing* with the discal series of white streaks smaller and becoming obsolete. *Hindwing* with the submarginal series of white streaks more prominent, each streak whiter, larger, and almost reaching the outer margin. *Head* and *body* as usual.

Closely allied to *P. hewitsonii*, Westwood, from Borneo, and *P. perses*, de Nicéville, from the Gayoes Mountains of N.-E. Sumatra. From both it differs in its larger size, and in the presence of the conspicuous discal series of white streaks on the upperside of the forewing. It differs from *P. hewitsonii* in having the submarginal series of white streaks on the hindwing, these being obsolete or absent in that species; the anal spot is also very much smaller in *P. petra*.

Described from an unique example in the collection of Hofrath Dr. L. Martin, brought down from the mountains by his Gayoes collectors in January, 1893.

Family HESPERIIDÆ.

Genus CHARMION, nov.

MALE. FOREWING, triangular, entire; *costa* gently arched; *apex* rather acute; *outer margin* very straight in general direction, slightly convex; *inner* margin straight, in length equal to the outer margin; *costal nervure* ending opposite the apex of the discoidal cell; *first subcostal nervule* arising nearly twice as far from the second subcostal as that vein does from the third; *fourth* and *fifth* subcostals arising close together; *upper disco-cellular* nervule stout, long, strongly outwardly oblique; *middle* and *lower* disco-cellulars thin, gently curved, concave, placed inwardly obliquely, the lower slightly longer than the middle, consequently the *lower discoidal* nervule lies nearer to the upper discoidal than to the third median nervule; *discoidal cell* reaching to a little less than two-thirds the length of the wing* from the base; *second median nervule* arising far from the lower end of the cell; *first* median arises near the base of the wing, with its base further from the base of the second median than that vein arises from the third; *submedian nervure* slightly sinuous. HINDWING, entire; *costa* much arched at base, then nearly straight; *apex* rather acute; *outer margin* regularly curved to the abdominal margin, slightly produced at the termination of the second median nervule, between the second median nervule and the anal angle slightly concave; *costal nervure* nearly straight, ending at the apex of the wing; *first subcostal nervule* arising far before the apex of the cell; *disco-cellular* nervules slightly outwardly oblique; *upper* disco-cellular sinuous; *lower* disco-cellular concave, slightly longer than the upper; *discoidal* nervule well developed; *second median* nervule arising well before the lower end of the cell; *first* median arising twice as far from the second, as the second arises from the third; *submedian* and *internal nervures* straight. ANTENNÆ with a well-developed club, the thin apical portion of which is directed at right-angles to the shaft. PALPI erect; pressed close to the face, densely pilose, third joint hidden beneath the hairs. ABDOMEN reaching to the level of the outer margin of the wing. LEGS. *Foreleg* with an epiphysis on the tibia. *Hindleg* with a long tuft of hairs attached to the tibia at its base, and two pairs of spines towards its apex. FEMALE. Differs from the male in the wings being slightly rounder and fuller, and lacking the tuft of hairs on the hindleg. Type, *C. ficulnea*, Hewitson.

* Lieut. E. Y. Watson, in Proc. Zool. Soc. Lond., 1893, pp. 15 and 16, divides his subfamily *Hesperiinæ* into Sections A and B by the discoidal cell of the forewing being more or less than two-thirds the length of the costa. This is a measurement which I find very difficult to verify.

Charmion differs from *Hantana*, Moore, in the discoidal cell of the forewing being a little less than two-thirds the length of the wing, in *Hantana* the cell is obviously more than two-thirds the length. It differs from both *Hantana*, Moore, and *Celænorrhinus*, Hübner, in having the middle and lower disco-cellular nervules of the forewing considerably more upright, and the second median nervule arising far from instead of close to the lower end of the cell. The imago rests on the underside of leaves with wide-spread wings.

(1) CHARMION FICULNEA, Hewitson.

Hesperia ficulnea, Hewitson, Descr. *Hesperidæ*, p. 37, n. 33 (1868); —— *ficulnea*, Watson, Proc. Zool. Soc. Lond., 1893, p. 113; *Plesioneura signata*, Druce, Proc. Zool. Soc. Lond., 1873, p. 360, n. 3, pl. xxxiii, fig. 8; *Notocrypta signata*, de Nicéville, Journ. Bomb. Nat. Hist. Soc., vol. iv, p. 191, n. 14 (1889); idem, id., l. c., vol. vi, p. 380, n. 26 (1891).

HABITAT: Borneo (*Hewitson* and *Druce*); Victoria Point, Lower Tenasserim; Perak, Malay Peninsula; Siam; N.-E. and S.-W. Sumatra; S.-E. Borneo (*de Nicéville*).

(2) CHARMION TOLA, Hewitson.

Plesioneura tola, Hewitson, Ann. and Mag. of Nat. Hist., fifth series, vol. i, p. 340 (1878); *Notocrypta tola*, de Nicéville, Journ. Bomb. Nat. Hist. Soc., vol. iv, p. 191, n. 15 (1889); *Plastingia? plesioneuræ*, Staudinger, Ex. Schmett., p. 299, pl. c, *female* (1888).

HABITAT: Tondano (*Hewitson*); Minahassa, Celebes (*Staudinger*).

I have not seen the "*Plesioneura*" *tola* of Hewitson. From the description it appears to differ from *C. ficulnea*, Hewitson, in the forewing in the discal band extending posterior to the first median nervule, in *C. ficulnea* it ends on that vein. I have put *P. tola* in the genus on Lieut. E. Y. Watson's authority. Neither have I seen Dr. Staudinger's "*Plastingia?*" *plesioneuræ*, but as the figure agrees exactly with Hewitson's description, I have no hesitation in placing it here.

Genus SEPA, nov.

MALE. FOREWING, *costa* almost straight; *apex* acute; *outer margin* almost straight, very oblique; *inner margin* straight, exactly as long as the outer margin; *costal nervure* ending a little before the apex of the discoidal cell; *subcostal nervules* arising at gradually decreasing distances apart; *discoidal cell* long, extending beyond the middle of the wing; *upper disco-cellular nervule* short, straight, outwardly oblique; *middle* and *lower disco-cellulars* of nearly equal length, straight, strongly inwardly oblique, the middle a little longer than the lower; *second median* nervule arising a little before the lower end of the cell; *first median* arising nearer the base of the wing than the lower end of the cell; *submedian nervure* straight; a sexual brand, or "male-mark,"

extends obliquely across the submedian and first median interspaces and ends anteriorly on the second median nervule a little in front of its origin. HINDWING, *costa* greatly arched at the base, thence straight to the apex; *apex* rather acute; *outer margin* evenly and regularly convex to the anal angle; *anal angle* very acute; *abdominal margin* straight; the wing extends a little beyond the apex of the abdomen; the cilia towards the anal angle very long; *costal nervure* ending at the apex of the wing; *first subcostal nervule* arising long before the apex of the cell; *disco-cellular* nervules almost in one straight line, outwardly oblique, the upper a little longer than the lower; *discoidal* nervule obsolete, but its position is indicated, were it to be present, by a fold in the wing membrane, and by this fold the relative length of the disco-cellular nervules is given; *second median* nervule arising just before the lower end of the cell; *first* median arising about four times as far from the second as the second does from the third; *submedian* and *internal nervures* straight. LEGS. *Hindleg* with two pairs of spines on the tibia.

Sepa is nearest allied to *Matapa*, Moore, from the type species of which it may be at once known by the discoidal cells of both wings being more truncate at the end owing to the disco-cellular nervules being less strongly oblique; the shape of the wings differs also, the inner margin of the forewing in *Matapa* is longer than in *Sepa*, consequently the outer margin in the former is less oblique than in the latter; the hindwing differs in that, in *Matapa*, the anal angle appears to be somewhat produced owing to the wing about the termination of the first median nervule being somewhat emarginate, in *Sepa* the wing is evenly curved throughout. Type, *Sepa cronus*, de Nicéville.

42. SEPA CRONUS, n. sp., Plate V, Fig. 4, ♂.

HABITAT: Battak Mountains, N.-E. Sumatra.

EXPANSE: ♂, 1·7 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* rich dark shining brown. *Forewing* with three pale ochreous dots, two subapical, the anterior one most minute, the third in the second median interspace about twice the size of the lower subapical spot; a narrow obscure discal black stigma or "male-mark" crossing obliquely the submedian and first median interspaces, that portion of the stigma in the latter interspace having a prominent pale ochreous semi-transparent line placed outwardly against it. *Hindwing* immaculate. UNDERSIDE, *both wings* exactly as above except that the ground-colour is dull, not shining. *Cilia* concolorous with the wings throughout, those of the hindwing at the anal angle unusually long, though not quite as long as in *Lophoides iapis*, de Nicéville, from Burma, the Malay Peninsula, Sumatra, Java,

and Pulo Laut. *Antennæ* black, the club beneath, except the extreme tip, ochreous. *Eyes* with a band of dull ochreous setæ encircling them. *Body* concolorous with the wings throughout.

Described from a single example from the Battak Mountains taken in September, and deposited in Dr. Martin's fine collection.

Genus Ochus, nov.

Male. Forewing, entire; *costa* strongly and evenly arched throughout its length; *apex* somewhat rounded; *outer margin* strongly convex; *inner* margin considerably longer than the outer margin, nearly straight, slightly concave in the middle; *costal nervure* ending opposite the apex of the discoidal cell; *subcostal nervules* very long owing to the highly arched costa, arising progressively from the base of the wing at decreasing distances apart; *discoidal cell* broad, short, extending to a little beyond the middle of the wing; *upper disco-cellular nervule* long, straight, slightly outwardly oblique; *middle* and *lower* disco-cellulars of equal length, a little longer than the upper, directed inwardly slightly obliquely, the middle concave, the lower straight; *lower discoidal* nervule lying midway between the upper discoidal and third median nervules; *second median* nervule arising well before the lower end of the cell; *first median* arising nearer the lower end of the cell than the base of the wing; *submedian nervure* nearly straight. Hindwing, entire, oval; *costa* arched; *outer margin* evenly rounded to the anal angle; *abdominal margin* short, nearly straight; *costal nervure* short; *first subcostal nervule* arising a short distance before the apex of the cell; *discoidal cell* short, less than half the length of the wing; *disco-cellular* nervules concave, placed slightly outwardly obliquely; *discoidal* nervule absent; *second median* nervule arising very close to the lower end of the cell; *first median* arising nearer the lower end of the cell than the base of the wing; *submedian* and *internal nervures* straight, the latter rather short. Antennæ short, less than half the length of the costa of the forewing; club rather slender, long, straight, ending regularly and evenly in a point. Palpi rather thinly and laxly clothed with hairs, porrected forwards in front of the face; third joint rather long, hairy. Thorax weak, small. Abdomen very slender, long, extending beyond the anal angle of the hindwing. Male with no secondary sexual characters. Female differs from the male only in its broader and more rounded wings. Legs. *Foreleg* with an epiphysis on the tibia. *Hindleg* with two pairs of spines on the tibia. Type, *O. subvittatus*, Moore.

Ochus apparently finds its place amongst the final genera of Lieut. E. Y. Watson's subfamily *Pamphilinæ*, Section A (Proc. Zool. Soc. Lond., 1893, p. 72), which contains the genera *Argopteron*, Watson,

Heteropterus, Dumeril, *Pamphila*, Fabricius, and *Cyclopides*, Hübner. *Ochus* is apparently nearest to *Pamphila*, of which the type is *P. palæmon*, Pallas, and from which it is abundantly distinct; the costa of the forewing is greatly arched instead of straight, the apex is rounded instead of being acute, the outer margin is more rounded, the discoidal cell is much shorter and broader; the hindwing is more oval, the discoidal cell is again much shorter, the discoidal nervule is obsolete, in *P. palæmon* it is present; besides many other minor differences. The imago rests with wings closed over its back. Of all the Indian species of *Hesperiidæ*, *O. subvittatus* probably has the feeblest flight, appearing on the wing to be a dark-coloured, low-flying lycænid, similar to a female of the wet season form of *Zizera maha*, Kollar, or some other dark-coloured "blue." Lieut. Watson suggests in Proc. Zool. Soc. Lond., 1893, p. 97, that "*Cyclopides*" *subvittatus* belongs to the North American genus *Ancyloxypha*, Felder, or to one closely allied to it; but this is not the fact, *Ochus* is widely distinct from that genus, and comes into the first section of the subfamily instead of the second containing the genus in question.

(1). Ochus subvittatus, Moore.

Cyclopides subvittatus, Moore, Proc. Zool. Soc. Lond., 1878, p. 692; id., Wood-Mason and de Nicéville, Journ. A. S. B., vol. lv, pt. 2, p. 392, n. 249, pl. xvii, figs. 6, 6*a*, *male*, × 2 (1886); id., Elwes, Trans. Ent. Soc. Lond., 1888, p. 453, n. 487; *Cyclopides subradiatus*, Moore, Proc. Zool. Soc. Lond., 1878, p. 693.

Habitat: Darjeeling; Salween district, Moulmain, Burma (*subvittatus*); Khasia Hills (*subradiatus, Moore*); Kumaon (*Doherty*); Sikkim, Bhutan, Assam, Burma (*coll. de Nicéville*).

It is, I think, quite impossible to separate *O. subradiatus* from *O. subvittatus*. Mr. Moore places the former in the middle of the region inhabited by *O. subvittatus*. I have caught it as far south as the Dawnat range and Meplé in Middle Tenasserim, in the month of October.

43. Erynnis dimila, Moore, Plate I, Fig. 7, ♂.

Pamphila dimila, Moore, Proc. Zool. Soc. Lond., 1874, p. 576; id., de Nicéville, Journ. Bomb. Nat. Hist. Soc., vol. vii, p. 355, n. 23, pl. J, fig. 9, *female* (1892); *Erynnis comma*, var. *dimila*, Leech, Butt. from China, Japan, and Corea, p. 595, pl. xli, fig. 12, *male* (1893).

Habitat: Runang Pass, south-east side, about 13,000 feet elevation, Busahir (*Moore*); Khibber Nala, about 16,000 feet elevation, Spiti (*Sage*); Ganges Valley, near Nilung Pass, 16,000 feet, August, 1893 (*Mackinnon*); Ta-chien-lu, Western China (*Leech*).

As I have already figured the female of this rare species, I now take the opportunity to figure the male. Mr. P. W. Mackinnon through his native collectors obtained three male specimens, of which he has

generously presented me with two. The species appears to me to come into the genus *Erynnis* of Schrank, of which the type is *E. comma*, Linnæus, the British "Small Skipper." The shape and markings of the two species is very similar, but the male of *E. dimila* has the ochreous ground-colour of the upperside much more extensive than in *E. comma*, especially so on the hindwing; the spots on the underside of both wings are also more prominent, larger, and whiter than in *E. comma*. The club of the antenna is somewhat differently shaped, the terminal portion or apex in *E. dimila* being considerably longer than in *E. comma*.

Since the above was in type, I have received Part V of Mr. Leech's "Butterflies from China, Japan, and Corea," in which a single male of *E. dimila* is recorded from Western China and duly figured. If this specimen is really typical (the plate in which it is figured has not as yet been published), it greatly extends the range of the species. Mr. Leech considers *E. dimila* to be a "var." only of *E. comma*, Linnæus, and records the parent species from Europe, Amurland, Corea, Japan, N.-W. Himalayas, N. and W. China.

44. Padraona pavor, n. sp., Plate IV, Fig. 8, ♂.

Habitat: Battak Mountains, N.-E. Sumatra.

Expanse: ♂, 1·2 to 1·3 inches.

Description: Male. Upperside, *both wings* shining black tinged with bronzy. *Cilia* golden-orange, broadest towards the anal angle of the hindwing, gradually becoming dusky as the apex of the forewing is reached in some specimens. *Forewing* with an orange streak on the basal two-thirds of the costa, widening out at the end of the discoidal cell, crossed by the black costal and subcostal veins; an orange streak on the basal two-thirds of the inner margin; a discal straight series of seven orange spots, extending from the costa to the submedian nervure, the series broken between the third and fourth spots from the costa; the three uppermost spots linear, small, increasing; the fourth in the second median interspace quadrangular; the fifth in the first median interspace also quadrangular, but twice as large as the one anterior to it; two spots in the submedian interspace, the anterior one very small. *Hindwing* with some orange streaks from the base reaching to the middle of the wing formed of long setæ; a transverse band of five orange spots across the middle of the disc. Underside, *both wings* rich dark brownish-orange. *Forewing* with the posterior half black; a prominent oblique orange-yellow streak at the end of the cell; the discal series of spots as above, except that the four posterior ones are larger than on the upperside, the two posteriormost conjoined. *Hindwing* with a curved discal series of five spots, the four anterior ones are

of a slightly lighter shade than the ground-colour, outwardly defined by a very narrow black line, the fifth posterior spot the largest and of a bright yellow colour, with another somewhat diffused spot beyond reaching the outer margin; a black anteciliary thread from the apex of the wing to the first median nervule.

This appears to be a very distinct species, differing from all others of the genus known to me (*Padraona dara*, Kollar, = *P. mæsa*, Moore; *P. mæsoides*, Butler; *P. pseudomæsa*, Moore; *P. gola*, Moore; *P. goloides*, Moore; *P. augiades*, Felder; *P. olivescens*, Herrich-Schäffer; *P. palmarum*, Moore; *P. procles*, de Nicéville) in lacking in the forewing on the upperside the two spots divided by the lower discoidal nervule invariably present in all those species. It agrees with *P. procles* and *P. olivescens* in having no spots in the hindwing anterior to the discal band towards the costa and base of the wing. It possesses, moreover, a male-mark, which is, I believe, unique in the genus, consisting of a shining pale silky streak to be seen in some lights only on the upperside of the forewing placed within the discal band of spots in the lower median and submedian interspaces. I may add that the entire coloration of the species is very dark and rich.

Described from numerous specimens in Dr. L. Martin's collection and my own, some of which were taken in June.

45. Halpe hieron, n. sp., Plate IV, Fig. 1, ♂.

Habitat: N.-E. Sumatra.

Expanse: ♂, 1·15 to 1·25 inches.

Description: Male. Upperside, *both wings* shining hair-brown. *Forewing* with, in some specimens, two exceedingly obscure pale spots in the median interspaces, placed obliquely as usual in the genus, the lower one nearer the base of the wing than the upper; in some specimens these spots are entirely absent; no "male-mark." *Hindwing* immaculate. Underside, *forewing* with the inner margin broadly pale fuscous, the rest of the wing dull ochreous-grey; the two median spots sometimes present on the upperside always present, conspicuous, whitish; a very obscure submarginal series of pale spots in a curved series from the costa to about the first median nervule; a very fine anteciliary dark thread. *Hindwing* pale fuscous, heavily irrorated throughout with dull ochreous-grey scales. *Cilia* of the forewing sometimes faintly checkered, more often concolorous with the wing, on the hindwing always concolorous. *Antennæ* black, the base of the club beneath pale ochreous. *Palpi, thorax,* and *abdomen* above hair-brown; palpi, thorax, and abdomen beneath dull ochreous-grey.

This dull-coloured, obscurely-marked species is evidently allied

to *Halpe homolea*, Hewitson (*H. sikkima*, Moore), from which it may instantly be known by the upperside being practically spotless, and the underside but very faintly instead of prominently marked. It has also no discal stigma on the upperside of the forewing in the male.

Described from numerous specimens in Dr. Martin's and my collections taken at Bekantschan in August and September, and in the Battak Mountains, in August, both in N.-E. Sumatra.

46. KERANA FULGUR, n. sp., Plate I, Fig. 6, ♀.

HABITAT: Selesseh, N.-E. Sumatra.

EXPANSE: ♂, ♀, 1·7 inches.

DESCRIPTION: FEMALE. UPPERSIDE, *both wings* dark shining purplish-fuscous. *Cilia* concolorous. *Forewing* with a broad discal orange fascia, anteriorly not quite reaching the costa, posteriorly ending on the submedian nervure. *Hindwing* immaculate. UNDERSIDE, *both wings* with the ground-colour duller than on the upperside. *Forewing* with the apex faintly dusted with ochreous scales; the discal orange band more extensive than on the upperside, reaching the inner margin, where it is much paler, the edges of the band more irregular. *Hindwing* unmarked, except by the following steel-blue spots, which can be seen in all lights, but are more prominent in some lights than in others:—An elongated one closing the discoidal cell, one in the first median interspace about its middle, and three in the submedian interspace at about equal distances apart. *Antennæ* black above, the club beneath ochreous. *Palpi* black above, beneath chrome-yellow. *Eyes* encircled by a band of chrome-yellow. *Head*, *thorax*, and *abdomen* above fuscous; abdomen beneath with six ochreous lines.

Nearest to *K. gemmifer*, Butler,* (which also occurs in N.-E. Sumatra, as well as in Perak and Malacca, I have taken it on the Penang Hill at 2,200 feet elevation above the sea, in November), from the same sex of which it differs in being larger, the ground-colour of the upperside darker, the gem-like spots of the underside quite different, and the abdomen beneath striped with ochreous instead of being concolorous. The "gems" of *K. gemmifer* have never been described in detail. Mr. Butler refers to them thus:—"End of cell and apical area of primaries and disk of secondaries [on the underside] spotted, in certain lights, with shining amethyst-coloured spots" in both sexes. They are thus disposed:—*Forewing* with an elongated one placed on the fold in the middle of the discoidal cell just anterior to the inner edge of the discal orange fascia; three subapical ones placed one above the other,

* *Astictopterus gemmifer*, Butler, Trans. Linn. Soc. Lond., Zoology, second series, vol. i, p. 555, n. 3 (1877).

divided by the veins; *hindwing* with from four to six placed one each between the veins in a curve beyond the end of the cell. It is doubtful if Mr. Distant recognised the species, as he makes no mention* of the "gems," and his figure of the species does not shew them, nor does it agree with my specimens of *K. gemmifer*, the orange band on the underside of the forewing in true *K. gemmifer* being almost of equal width throughout, while in Mr. Distant's figure the costal portion is much narrowed and constricted. Lieut. Watson, indeed, says† that Mr. Distant's *K. gemmifer* equals *Koruthaialos xanites*, Butler, which is probable enough, that species being infinitely more common than *K. gemmifer*, the latter occurring very sparingly.

A single example of *K. fulgur*, now in Dr. Martin's collection, was taken by myself in the splendid virgin forest at Selesseh, in the Langkat district of N.-E. Sumatra, on 31st October, 1893. Since this specimen was drawn and the plates illustrating this paper made up, Dr. Martin sent me in a letter a male of *K. fulgur*. I hope to figure and describe it fully hereafter. It greatly differs from the female on the upperside in the orange fascia of the forewing being much paler, more chrome-yellow in shade, larger, and posteriorly continued almost to the base of the wing; and the base of the hindwing and base of the abdomen are clothed with long chrome-yellow setæ.

47. Plastingia vermiculata, Hewitson, Plate V, Fig. 15, ♂.

Hesperia vermiculata, Hewitson, Ann. and Mag. of Nat. Hist., fifth series, vol. i, p. 316 (1878).

Habitat: N.-E. Sumatra.

Expanse: ♂, 1·7 inches.

Description: Male. Upperside, *both wings* black. *Forewing* with the following opaque chrome-yellow markings:—A narrow subcostal streak extending from the base of the wing to about its middle, a similar but shorter and broader streak in the submedian interspace; with the following semi-transparent yellow spots:—Two very narrow and small ones placed obliquely towards the end of the discoidal cell, the upper the larger, furthest from the base of the wing, the lower minute; a dot in the lower discoidal interspace; a spot four times as large in the second median interspace; a very large spot in the first median interspace. *Cilia* black. *Hindwing* with a basal streak of long chrome-yellow hairs which runs into a broad transverse fascia of the same colour placed in the middle of the wing; the anal area very broadly chrome-yellow, which area rapidly fines away to nothing at about

* *Kerana gemmifer*, Distant, Rhop. Malay., p. 403, n. 2, pl. xxxiv, fig. 29 (1886).

† Proc. Zool. Soc. Lond., 1893, p. 77.

the termination of the third median nervule; a streak of chrome-yellow placed in the submedian interspace springs from the base of the wing and runs into the yellow anal area; the abdominal margin and *cilia* chrome-yellow. UNDERSIDE, *forewing* fuscous; the costa, discoidal cell, apex and outer margin decreasingly to the anal angle streaked with chrome-yellow; the five semi-transparent spots as above; a broad, short, chrome-yellow streak towards the base of the wing in the submedian interspace; a pale blue slightly iridescent streak just beyond the end of the cell in the upper discoidal interspace. *Hindwing* chrome-yellow, with the following black markings:—The costa at the base of the wing, two subcostal streaks from the base to the apex of the wing, the posterior of these interrupted towards its end; a streak in the subcostal interspace also outwardly interrupted; a streak in the cell; a very broad one twice interrupted in the submedian interspace; a rather obscure streak in the internal interspace, extending from the base to a little beyond the middle of the wing; three small spots on the disc between the veins: also with the following pale blue slightly iridescent elongated spots:—Two in the discoidal cell, and a series of eight others extending right round its outer end. *Antennæ* black, club prominently chrome-yellow above, the apex black. *Palpi* black above, yellow beneath. *Thorax* above black clothed with long yellow hairs. *Abdomen* black, ringed with yellow. *Legs* yellow.

The nearest ally to *P. vermiculata* appears to be the "*Hesperia*" *flavescens* of Felder (Reise Novara, Lep., vol. iii, p. 517, n. 905, pl. lxxii, figs. 7, *male*; 8, 9, *female*, 1867), from Celebes, from the female sex of which the present species differs in several particulars on the upperside, and conspicuously on the underside, in the presence of the pale blue slightly iridescent spots, these being apparently entirely absent in *P. flavescens*.

This very lovely species is described from an unique example in Dr. Martin's collection taken at Bekantschan, at the foot of the Battak Mountains, in N.-E. Sumatra, in July, 1893. Mr. Hewitson originally obtained it from Sumatra also.

EXPLANATION OF THE PLATES.

PLATE I.

Fig. 1. *Mycalesis* (*Satoa*) *maia*, n. sp., ♂, p. 1.
" 2. " " " " ♀, p. 1.
" 3. *Euthalia* (*Dophla*) *eson*, n. sp., ♂, p. 12.
" 4. *Stichophthalma sparta*, n. sp., ♂, p. 2.
" 5. *Euthalia* (*Dophla*) *eson*, n. sp., ♀, p. 12.
" 6. *Kerana fulgur*, n. sp., ♀, p. 55.
7. *Erynnis dimila*, Moore, ♂, p. 52.

Fig. 8. *Neptis clinioides*, n. sp., ♂, p. 6.
„ 9. „ *nisœa*, n. sp., ♂, p. 7.

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Fig. 1. *Euthalia (Dophla) externa*, n. sp., ♂, p. 13.
„ 2. „ „ „ „ ♀, p. 13.
„ 3. „ „ *eurus*, n. sp., ♂, p. 15.
„ 4. „ „ „ „ ♀, p. 15.
5. „ „ *gupta*, de Nicéville, ♀, p. 18.
„ 6. *Laxita laocoon*, n. sp., ♀, p. 20.
„ 7. „ *lola*, n. sp., ♀, p. 20.
„ 8. „ *lyncestis*, n. sp., ♂, p. 22.
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„ 11. *Everes moorei*, Leech, ♂, p. 32.
„ 12. *Cyaniris crissa*, n. sp., ♂, p. 31.
„ 13. *Logania luca*, n. sp., ♀, p. 28.

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Fig. 1. *Argynnis niphe*, Linnæus, ♂ and ♀, p. 8.
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„ 3. *Euthalia sakii*, n. sp., ♀, p. 9.
„ 4. *Herona pringondani*, Fruhstorfer, ♀, p. 4.
„ 5. „ „ „ ♂, p. 4.
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PLATE IV.

Fig. 1. *Halpe hieron*, n. sp., ♂, p. 54.
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„ 3. *Listeria dudgeonii*, n. sp., ♂, p. 36.
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„ 5. *Papilio (Menamopsis) petra*, n. sp., ♂, p. 47.
„ 6. „ *(Pangerana) hageni*, Rogenhofer, ♂, p. 45.
„ 7. „ *(Menamopsis) perses*, n. sp., ♂, p. 46.
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„ 9. *Pithecops mariæ*, n. sp., ♀, p. 30.
„ 10. *Simiskina solyma*, n. sp., ♀, p. 29.
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Fig. 1. *Gerydus gigantes*, n. sp., ♂, p. 23.
„ 2. *Paragerydus pyxus*, n. sp., ♂, p. 27.
„ 3. *Lampides lucide*, n. sp., ♂, p. 33.
„ 4. *Sepa cronus*, n. sp., ♂, p. 50.
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Fig. 8. *Cyrestis theresæ*, n. sp., ♂, p. 18.
„ 9. *Neocheritra namoa*, n. sp., ♂, p. 41.
„ 10. *Charana cepheis*, n. sp., ♂, p. 40.
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On the Chemical Examination of certain Indian Food Stuffs. Part I, Fats and Oils.—*By* P. C. Ray, D. Sc. *Communicated by* Alex. Pedler, F.R.S.

[Read February 7th.]

Of late years a belief has been gaining ground in Calcutta, Bombay and in many other important towns in India, not apparently without reason, that wholesale adulteration is practised in many of the common articles of diet, notably in ghee, butter, milk, mustard oil, &c. The present investigation was undertaken with a view to throw some light on these points, and it embodies the results of work carried on at intervals during the last four years.

PRELIMINARY.

As butter enters largely into the dietary of the people of Europe and America, abundant work has been done by Chemists on its analysis. It is, however, well-known that the composition of milk and of the butter made from it is, within certain limits, dependent on the breed, climate, method of feeding the cows, period of lactation, and so on. The standard for genuine butter as generally accepted in England, especially at Somerset House, cannot therefore be always accepted as a safe guide in this country.

The analysis of the fixed oil of mustard and the various other oils with which it is generally sophisticated also presents considerable difficulties. Not much work has been done in this field. The history of the substances which have been subjected to analysis is seldom given, and the experimental methods are not generally described in sufficient detail to enable the results to be compared. While the information available is meagre on the one hand, the results published from time to time are in themselves in some cases contradictory. It was thus found to be

necessary to work out in the first instance a series of *constants* for such Indian food-stuffs as mustard oil, butter, ghee, &c., which might be of some help in deciding cases of falsification.

Particular care was taken in procuring genuine samples of the substances. The oils were, in many cases, expressed under direct supervision from seeds carefully selected, so that the purity of the products was unquestionable. A sample of pure mustard oil was also obtained through the courtesy of the Superintendent, Alipur Jail, and another of cocoanut oil from the officer in charge of the "Copra" works, Viper Island, Port Blair, with a certificate from him, guaranteeing its purity, and stating it to be a standard sample.

The preliminary examination of the fats and oils is much helped by the determination of certain physical *constants*, *e. g.*, melting point, specific gravity, index of refraction, &c. The work in the present communication is confined solely to the chemical methods. The application of the physical tests, is reserved for a future occasion.

The fats and oils are simply combinations of certain acids, the so-called fatty acids, *e. g.*, butyric, stearic, oleic, palmitic, &c., with glycerin; hence they have been named the *glycerides*. By estimating the amount of both or either of these constituents of fatty substances, valuable information is obtained as to their nature. Now, if a fat be treated with an alkali, the fatty acids contained in it combine with the alkali, resulting in the formation of organic salts, commonly called a *soap*, and the separation of glycerin. It so happens, however, that the molecular weights of some of these fatty acids vary within wide limits. Thus, butyric acid, occurring in butter-fat has a molecular weight equivalent to 88, while erucic acid, a component of mustard oil, has a molecular weight of 338. A molecule of caustic potash weighing 56, will exactly neutralise 88 parts by weight of butyric acid or 338 parts by weight of erucic acid. Hence a given weight of butter-fat will require a far larger proportion of caustic potash to convert it into soap—to *saponify* it, as it is technically called—than the same weight of mustard oil. Koettstorfer has made use of this principle. It has in fact been found by actual experiments that while 100 grammes of butter-fat require very nearly 22 grammes of caustic potash for saponification, the same weight of mustard oil requires only 17 grammes of the alkali. The amount of glycerin in a fat or oil also will vary in a corresponding manner.

Again butyric, caproic and other volatile acids present in cocoa-nut oil, butter-fat, &c., may be easily separated from the non-volatile acids by distillation, and their amount ascertained by their potash neutralising power. Upon this principle is based the well-known Reichert's

test. The amount of iodine absorbed by different fats and oils also lies within wide ranges. The iodine absorption test has been employed with remarkable success by Baron Hübl in deciding cases of adulteration.

The following processes have been made use of :—

1. Direct titration of the fats and oils by alcoholic potash—Koettstorfer's test.
2. Estimation of the amount of glycerin.
3. Iodine absorption test of Hübl.
4. Estimation of the volatile fatty acids—Reichert's test.

The detailed results obtained by each of these methods as applied in the present inquiry will now be described.

KOETTSTORFER'S METHOD.

Most of the oils, when recently expressed, contain suspended impurities derived from the seeds, &c., in a very fine state of division. These settle down in course of time. The oils thus clarified by subsidence were filtered through bibulous paper to remove any traces of adherent moisture which might be present. The application of even a gentle heat cannot be resorted to for this purpose. Mustard oil, which is classed among the non-drying oils, was found to gain in weight continually when placed inside the chamber of a water-oven and weighed at intervals of 15 to 20 minutes.

Preparation of Alcoholic Potash.—The alcoholic solution of potash, approximately of semi-normal strength was prepared by dissolving sticks of potash in pure alcohol. The solution, filtered off the insoluble residue, is generally found to have a reddish-yellow color. It has therefore to be decolorised by shaking with pure animal charcoal.

Oil of Mustard.

Sinapis nigra, S. alba (Nat. order—Cruciferæ.)

Different samples of mustard seeds were found to yield a fixed oil varying from 32°/₀ to 36°/₀ of the air-dried seeds.

1. 2·534 gm. oil were weighed into a bottle of about 12 oz. capacity, and 20 c. c. of alcoholic potash solution were added. The mouth of the bottle was closed with an India-rubber cork, fastened by means of wire. The bottle was kept immersed in boiling water for 45 minutes. A blank experiment under exactly similar conditions was made side by side to determine the strength of the potash. The indicator used was phenolphthalein—

$$20 \text{ c. c. KOH} = 20{\cdot}7 \text{ c. c. } \frac{N}{2} \text{ HCl.}$$

4·95 c. c. $\frac{N}{2}$ HCl were required to neutralise the excess of alkali.

(20·7 – 4·95) c. c. or 15·75 c. c. $\frac{N}{2}$ HCl represent the amount of alkali required for the saponification of the oil.

$$1 \text{ c. c. } \frac{N}{2} \text{ HCl} = 0{\cdot}02805 \text{ gm. KOH}$$

Amount of potash consumed by 1,000 gm. oil (=*saponification. equivalent*), is therefore equal to $\frac{15{\cdot}75 \times 0{\cdot}02805 \times 1000}{2{\cdot}534}$ gm. = 174·5 gm.

2. 1·713 gm. oil were heated in a flask over a water-bath for ten minutes with 20 c. c. KOH solution, the mouth of the flask being covered by a watch-glass—

20 c c. KOH = 20·7 c. c. $\frac{N}{2}$ HCl (Blank experiment)

10·1 c. c. $\frac{N}{2}$ HCl were required by the excess of potash.

$$\text{Saponification equivalent} = \frac{10{\cdot}6 \times 0{\cdot}02805 \times 1000}{1{\cdot}713} = 173{\cdot}5$$

3. Mustard oil expressed from a different sample of seeds.

3·084 gm. oil were treated with 20 c. c. KOH solution in a bottle, which was immersed in boiling water for about 40 minutes; the mouth of the bottle being closed by an India-rubber cork tied down by means of wire—

20 c. c. KOH = 20·8 c. c. $\frac{N}{2}$ HCl (Blank titration)

1·5 c. c. $\frac{N}{2}$ HCl were required for the excess of potash.

or 19·3 c. c. $\frac{N}{2}$ HCl represented the amount of alkali used up.

$$\text{Saponification equivalent} = \frac{19{\cdot}3 \times 0{\cdot}02805 \times 1000}{3{\cdot}084} = 175{\cdot}5$$

4. 2·222 gm. oil were treated with 20 c. c. KOH solution and heated in a flask over a water-bath for 12 minutes; the mouth of the flask being covered with a watch-glass—

Excess of alkali required 7 c. c. $\frac{N}{2}$ HCl

20 c. c. KOH „ 20·8 „ „ (Blank titration).

$$\text{Saponification equivalent} = \frac{13{\cdot}8 \times 0{\cdot}02805 \times 100}{2{\cdot}222} = 174{\cdot}2$$

5. 1.8012 gm. oil were saponified under the same conditions as described above, with 40 c. c. KOH solution—

$$40 \text{ c. c. KOH} = 32{\cdot}0 \text{ c. c. } \frac{N}{2} \text{ HCl}$$

$$\text{Excess of alkali} = 21{\cdot}0 \text{ ,, ,,}$$

$$\text{Saponification equivalent} = \frac{0{\cdot}02805 \times 11 \times 10^3}{1{\cdot}8012} = 171{\cdot}3$$

6. Pure mustard oil from Alipur Jail.

3·493 gm. oil were mixed with 20 c. c. potash solution and the mixture kept immersed in boiling water for over half-an-hour. The mouth of the bottle being closed by a cork fastened by a wire—

$$20 \text{ c. c. KOH} = 30{\cdot}7 \text{ c. c. } \frac{N}{2} \text{ HCl}$$

$$\text{Excess of alkali} = 9{\cdot}2 \text{ ,, ,,}$$

$$\text{Saponification equivalent} = \frac{21{\cdot}5 \times 0{\cdot}02805 \times 10^3}{3{\cdot}493} = 172{\cdot}7$$

7. Duplicate analysis of the above. 2·195 gm. oil heated to boiling on a water-bath with 20 c. c. KOH solution for 15 minutes, the mouth of the flask being covered with a watch-glass.

$$20 \text{ c. c. KOH} = 30{\cdot}7 \text{ c. c. } \frac{N}{2} \text{ HCl (Blank experiment)}$$

$$\text{Excess of alkali} = 17{\cdot}2 \text{ ,, ,,}$$

$$\text{Saponification equivalent} = \frac{13{\cdot}5 \times 0{\cdot}02805 \times 10^3}{2{\cdot}195} = 172{\cdot}5$$

It would thus appear that mustard oil is very easily saponified by alcoholic potash, and that a large excess of the latter is not necessary.

The oil was in some cases found to have a pale yellow color, in others the tint was somewhat deeper. The soap solutions were tinged accordingly. The want of exact uniformity in the tint sometimes interfered with the exact determination of the conclusion of the reaction during the titrations. It may also be stated that the soap solutions were generally diluted with about 25 c. c. of hot water, from which all traces of carbonic acid gas had been driven off by boiling.

In the above experiments it will be seen that the saponification equivalent of the samples of mustard oil has varied between 175·5 and 171·3, the average of the seven determinations being 173·5.

Hence it would be safe probably to adopt the saponification equivalent of mustard oil as lying between 171—175.

Saponification Equivalent for Niger-Seed Oil.

Guizotia abyssinica (Nat. ord.—Compositæ).

As this oil is one of the commonest adulterants of mustard oil, a genuine sample of it was procured for experiments.

1. 1.4605 gm. oil were weighed out into a flask, 20 c. c. of alcoholic potash were then added, the mixture covered with a watch-glass and treated to gentle boiling, with occasional agitation for 15 minutes.

20 c. c. KOH $= 15.95$ c. c. $\frac{N}{2}$ HCl (Blank experiment)

Excess of alkali $= 6{\cdot}1$ „ „

$$\text{Saponification equivalent} = \frac{9{\cdot}85 \times 0{\cdot}02805 \times 10^3}{1{\cdot}4605} = 189{\cdot}2$$

2. 1·906 gm. oil were saponified as above with 40 c. c. alcoholic potash.

40 c. c. KOH $= 31.9$ c. c. $\frac{N}{2}$ HCl

Excess of alkali $= 18{\cdot}8$ „ „

$$\text{Saponification equivalent} = \frac{13{\cdot}1 \times 0{\cdot}02805 \times 10^3}{1{\cdot}906} = 192{\cdot}8$$

3. 2·184 gm. oil were treated as above with 40 c. c. alcoholic potash solution.

40 c. c. KOH $= 31{\cdot}8$ c. c. $\frac{N}{2}$ HCl (Blank experiment)

Excess of alkali $= 17{\cdot}0$ „ „

$$\text{Saponification equivalent} = \frac{14{\cdot}8 \times 0{\cdot}02805 \times 10^3}{2{\cdot}184} = 190{\cdot}0$$

The determinations described above were made in November 1891, when the oil was fresh. It was preserved in a stoppered bottle and a year after (November 1892) the saponification equivalent was found to be 191·6.

The saponification number for niger-seed oil may be taken as 190.

Saponification equivalent for Cocoanut Oil.

The sample was obtained from Viper Island, Port Blair, and was guaranteed to be a "standard sample."

1. 1·275 gm. oil were treated with 20 c. c. alcoholic solution and heated to boiling on the water-bath as in the previous cases.

20 c. c. KOH $= 30{\cdot}45$ c. c. $\frac{N}{2}$ HCl (Blank experiment)

Excess of alkali $= 18{\cdot}75$ „ „

$$\text{Saponification equivalent} = \frac{11{\cdot}7 \times 0{\cdot}02805 \times 10^3}{1{\cdot}275} = 257{\cdot}4$$

2. 1·24 gm. oil were treated with 20 c. c. alcoholic potash as above

20 c. c. KOH $= 30{\cdot}4$ c. c. $\frac{N}{2}$ HCl (Blank experiment)

Excess of alkali $= 19{\cdot}0$ „ „

$$\text{Saponification equivalent} = \frac{11{\cdot}4 \times 0{\cdot}02805 + 10^3}{1{\cdot}24} = 257{\cdot}8$$

3. 1·038 gm. oil with 20 c. c. alcoholic potash solution.

20 c. c. KOH $= 20{\cdot}4$ c. c. $\frac{N}{2}$ HCl

Excess of alkali $= 10{\cdot}8$ „ „

$$\text{Saponification equivalent} = \frac{9{\cdot}6 \times 0{\cdot}2805 \times 10^3}{1{\cdot}038} = 259{\cdot}4$$

The saponification equivalent for cocoanut oil is thus found to lie between 257—260.

SAPONIFICATION EQUIVALENT OF PURE FRESH GHEE (CLARIFIED BUTTER).

1. 13·525 gm. ghee were heated in a water-oven and then kept inside a desiccator for a week. The ghee was then found to weigh 13·5 gm. It would thus appear that ghee is not hygroscopic; nor does it contain any moisture.

1. 1·8196 gm. ghee were treated with 20 c. c. alcoholic potash solution. Details as in the previous cases.

20 c. c. KOH $= 31{\cdot}0$ c. c. $\frac{N}{2}$ HCl (Blank titration)

Excess of alkali $= 16{\cdot}55$ „ „

$$\text{Saponification equivalent} = \frac{14{\cdot}45 \times 0{\cdot}02805 \times 10^3}{1{\cdot}8196} = 222{\cdot}7$$

2. 2·0776 gm. ghee saponified with 20 c. c. alcoholic potash solution.

20 c. c. KOH $= 30{\cdot}8$ c. c. $\frac{N}{2}$ HCl (Blank titration)

Excess of alkali $= 14{\cdot}5$ „ „

$$\text{Saponification equivalent} = \frac{16{\cdot}3 \times 0{\cdot}02805 \times 10^3}{2{\cdot}0776} = 220{\cdot}07$$

3. The same ghee re-melted and filtered. There was no residue on the filter.

1·294 gm. saponified with 20 c. c. alcoholic potash.

20 c. c. KOH $= 30.9$ c. c. $= \frac{N}{2}$ HCl (Blank titration)

Excess of alkali $= 21{\cdot}45$ „ „

$$\text{Saponification equivalent} = \frac{9{\cdot}45 \times 0{\cdot}02805 \times 10^3}{1{\cdot}204} = 220{\cdot}1$$

ANOTHER SAMPLE OF GHEE.

1. 1·547 gm. were treated with 20 c. c. alcoholic potash, the mouth of the flask was closed with a cork to which was attached a long glass tube, which acted as a reflex condenser.

20 c. c. KOH = 16·5 c. c. $\frac{N}{2}$ HCl (Blank tit.)

Excess of alkali = 4·5 ,,

$$\text{Saponification equivalent} = \frac{12 \times 0{\cdot}02805 \times 10^3}{1{\cdot}547} = 217{\cdot}6$$

2. 1·1512 gm. ghee treated with 30 c. c. potash.

30 c. c. KOH = 25 c. c. $\frac{N}{2}$ HCl (Blank tit.)

Excess of alkali = 16·0 ,, ,,

$$\text{Saponification equivalent} = \frac{9 \times 0{\cdot}02805 \times 10^3}{1{\cdot}1512} = 219{\cdot}2$$

SAPONIFICATION EQUIVALENT FOR MOWA "BUTTER."

Oil of *Bassia latifolia*—(Nat. order—Sapotaceæ.)

This substance by its physical characters, *e. g.*, color, consistency, melting point, &c., much resembles ghee, and is therefore frequently used for its falsification.

1. 1·396 gm. oil were placed in a stout 12oz. bottle, together with 40 c. c. alcoholic potash solution. The mouth of the bottle was closed with a India-rubber cork, fastened by means of wire. It was then kept immersed in boiling water, with occasional shaking.

40 c. c. alcoholic potash were also heated under exactly the same conditions—

40 c. c. KOH = 31·6 c. c. $\frac{N}{2}$ HCl (Blank exp.)

Excess of alkali = 21·6 ,, ,,

$$\text{Saponification equivalent} = \frac{10 \times 0{\cdot}02805 \times 10^3}{1{\cdot}396} = 200{\cdot}9$$

2. 2·086 gm. oil heated under pressure just as above—

20 c. c. KOH = 29·3 c. c. $\frac{N}{2}$ HCl (Blank.)

Excess of alkali = 14·6 ,, ,,

$$\text{Saponification equivalent} = \frac{14{\cdot}7 \times 0{\cdot}02805 \times 10^3}{2{\cdot}086} = 197{\cdot}6$$

The soap solutions were perfectly clear and colourless.

To ensure complete saponification it is preferable to treat Mowa oil under pressure as above. If the oil be simply heated on a water-

bath, with a watch-glass at the mouth of the flask, the soap solution is sometimes found to have a turbid appearance, and the Saponification equivalent comes out rather low.

Saponification number for Mutton-fat.

The fat was melted over a water-bath and filtered to get rid of the shreds of membrane, &c.

1. 1·3906 gm. of fat were treated with 20 c. c. alcoholic potash and heated over a water-bath for 15 minutes.

20 c. c. KOH $= 16{\cdot}2$ c. c. $\frac{N}{2}$ HCl (Blank.)

Excess of ,, $= 6{\cdot}0$,, ,,

$$\text{Saponification equivalent} = \frac{0{\cdot}02805 \times 10{\cdot}2 \times 10^3}{1{\cdot}3906} = 205{\cdot}7$$

2. 0·9318 gm. of the same sample treated with 20 c. c. alcoholic potash, &c.

20 c. c. KOH $= 16{\cdot}15$ c. c. $\frac{N}{2}$ HCl (Blank.)

Excess of ,, $= 9{\cdot}3$,, ,,

$$\text{Saponification equivalent} = \frac{0{\cdot}02805 \times 6{\cdot}85 \times 10^3}{0{\cdot}9318} = 206{\cdot}2$$

Another sample of Mutton-fat.

0·8354 gm. was treated with 20 c. c. KOH.

20 c. c. KOH $= 16{\cdot}15$ c. c. $\frac{N}{2}$ HCl (Blank.)

Excess of ,, $= 10{\cdot}2$,, ,,

$$\text{Saponification equivalent} = \frac{5{\cdot}95 \times 0{\cdot}02805 \times 10^3}{0{\cdot}8354} = 199{\cdot}8$$

Duplicate analysis of the same sample gave the number as 199·2.

Saponification equivalent of oil of Sesame.*

Sesamum indicum (Nat. Order: Pedaliaceæ.)

1. 1·6835 gm. oil were heated over a water-bath with 20 c. c. alcoholic potash solution for 15 minutes.

2. 1·3145 gm. oil were heated as above with 30 c. c. alcoholic potash solution.

20 c. c. KOH $= 16{\cdot}2$ c. c. $\frac{N}{2}$ HCl (Blank.)

∴ 30 c. c. ,, $= 24{\cdot}3$,, ,,

* The oil was extracted by means of carbon bisulphide.

4·8 c. c. $\frac{N}{2}$ HCl were required by (1) for the excess of alkali.

15·4 „ „ „ „ (2) „ „ „

Saponification equivalent of (1) $= \frac{11{\cdot}4 \times 0{\cdot}02805 \times 10^3}{1{\cdot}6835} = 190{\cdot}0$

Do. do. (1) $= \frac{8{\cdot}9 \times 0{\cdot}02805 \times 10^3}{1{\cdot}3145} = 189{\cdot}9$

SAPONIFICATION EQUIVALENT OF LARD.*

1. 1·4245 gm. lard were heated over a water-bath with 20 c. c. alcoholic potash solution.

2. 1·432 gm. lard heated as above with 30 c. c. alcoholic potash solution—

20 c. c. KOH = 15·8 c. c. $\frac{N}{2}$ HCl

∴ 30 „ = 23·7 „ „

(1) Consumed 5·9 c. c. $\frac{N}{2}$ HCl for the excess of alkali.

(2) „ 13·7 „ „ „ „

Saponification equivalent for (1) $= \frac{9{\cdot}9 \times 0{\cdot}02805 \times 10^3}{1{\cdot}4245} = 194{\cdot}9$

„ „ „ (2) $= \frac{10 \times 0{\cdot}02805 \times 10^3}{1{\cdot}432} = 195{\cdot}9$

Mean of two = 195·4.

ESTIMATION OF GLYCERIN ACCORDING TO FOX AND WANKLYN'S METHOD, AS IMPROVED BY BENEDIKT AND ZSIGMONDY.

In view of the contradictory statements which have appeared from time to time as regards the applicability of this process, a few preliminary experiments were undertaken with the object of testing its trustworthiness :—

(*a*) A solution of pure oxalic acid was divided into two equal portions. The oxalic acid was thrown down by means of calcium acetate in presence of acetic acid. The oxalate precipitate was in one case dissolved in hot hydrochloric acid, the solution diluted with water and further acidified with sulphuric acid, warmed to about 60°, and titrated against accurately standardised permanganate solution. In another case the oxalate precipitate was converted by ignition into lime.

* The lard was a standard sample and was not taken off any particular part of the pig's carcass.

$\left(1 \text{ c. c. } \frac{N}{10} \text{ KMn } O_4 = 0{\cdot}0028 \text{ gm. CaO}\right)$. The two results were found to be thoroughly concordant.

(*b*) Oxidation of glycerin to oxalic acid :—

1. 5·62 gm. of glycerin were weighed into a flask and diluted to 500 c. c. with water. 25 c. c. of the solution were oxidised to oxalic acid.*

$$25 \text{ c. c. sol.} = \frac{5{\cdot}62}{20} \text{ gm. glycerin} = 0{\cdot}281 \text{ gm. glycerin}$$ on the supposition that the sample contained cent. per cent. of glycerin.

The potassium oxalate solution was made up to 500 c. c. of which 100 c. c. gave 0·028 gm. CaO (by ignition)

or 500 c. c. $K\bar{O}$ Sol. $= 0{\cdot}028 \times 5$ gm. CaO $= 0{\cdot}02 \times 5$ Ca

But 0·002 gm. Ca $= 0{\cdot}0046$ gm. glycerin.

$\therefore$ 0·02 gm. Ca $= 0{\cdot}046$ gm. glycerin.

or $(0{\cdot}02 \times 5)$ gm. Ca $= 0{\cdot}046 \times 5$ gm. glycerin $= 0{\cdot}23$ gm. glycerin.

The Sample thus contained $100 \times \frac{0{\cdot}23}{0{\cdot}281}$ or 81·8 °/₀ of glycerin.

2. 5·895 gm. glycerin (the same sample) were dissolved in water and diluted to 500 c. c., of which 25 c. c. were oxidised to oxalic acid.

$$25 \text{ c. c. sol.} = \frac{5{\cdot}895}{20} \text{ gm.} = 0{\cdot}2947 \text{ gm. glycerin.}$$

The oxalate solution was made up to 500 c. c., of which 100 c. c. yielded 0·0285 gm. CaO = 0·02035 gm. Ca.

But 1 c. c. $\frac{N}{10}$ $KMnO_4 = 0{\cdot}002$ Ca from CaC_2O_4

$= 0{\cdot}0046$ gm. glycerin.

$\therefore$ 0·02035 gm. Ca $= 0{\cdot}046805$ gm. glyc.

or 500 c. c. oxalate sol. $= (0{\cdot}046805 \times 5)$ gm. glyc.

$\therefore$ $= 0{\cdot}234$ gm. glyc.

The sample thus contained $100 \times \frac{0{\cdot}234}{0{\cdot}2947}$ or 79·75 °/₀ glycerin.

The mean of the above two determinations may be taken as 80 °/₀ approximately.

Saponification of Mustard Oil.

(Estimation of glycerin.)

1. 8·65 gm. oil were saponified according to Allen's method.† The soap solution was treated with dilute sulphuric acid, the beaker in

* An abstract of Benedikt and Zsigmondy's method will be found in *Jour. Soc. Chem. Ind.* IV, 610.

† The use of alcoholic potash is highly objectionable; "pure methyl alcohol" is difficult to procure. "Hence," as Allen remarks, "I have latterly aimed at

which it was contained was immersed in ice-cold water to completely solidify the separated fatty acids. The glycerin solution was then filtered off and made up to 250 c. c. of which 20 c. c. were each time oxidised to oxalic acid. The oxalic acid was thrown down by calcium acetate. The precipitate of $Ca\bar{O}$ was dissolved in HCl, further acidified with H_2SO_4, and titrated with N/10 $KMnO_4$. The strength of the permanganate solution was ascertained each time by titration against re-crystallised oxalic acid and sometimes against ferrous ammonic sulphate.

7·5 c. c. N/10 $KMnO_4$ were used up by the oxalic acid solution.

1 c. c. N/10 $KMnO_4$ = 0·0063 gm. $\bar{O}$ = 0·0046 gm. glycerin; hence amount of glycerin in 20 c. c. sol.

$$= 0{\cdot}0046 \times 7{\cdot}5 \text{ gm.}$$

∴ Total glycerin in 250 c. c.

$$= (0{\cdot}0046 \times 7{\cdot}5) \times \frac{250}{20} \text{ gm.}$$

$$= 0{\cdot}431 \text{ gm.}$$

Per cent. of glycerin in the oil = 4·98.

But the N/10 $KMnO_4$ = 0·0061 gm. $\bar{O}$ instead of 0·0063 gm. $\bar{O}$.

Per cent. of glycerin in the oil = 4·82.

2. 8·48 gm. oil were saponified just as above. The glycerin solution made up to 250 c. c., of which 50 c. c. were oxidised to oxalic acid.

The oxalate solution was divided into two equal portions, one-half (*a*) (= 25 c. c. glyc. sol.) was acidified with H_2SO_4, heated to boiling and titrated, the other half (*b*) was treated with Ca $\bar{A}c$, and the precipitated $Ca\bar{O}$ dissolved in dilute H_2SO_4 and then titrated with $\frac{N}{10}$ $KMnO_4$.

(*a*) Required 17·0 c. c. $\frac{N}{10}$ $KMnO_4$

(*b*) ,, 15·0 ,, ,,

1 c. c. $\frac{N}{10}$ $KMnO_4$ = 0·0046 gm. glyc.

15 c. c. $\frac{N}{10}$,, = 0·0046 × 15 gm. glyc. = 0·069 gm. glyc.

∴ 250 c. c. glyc. solution contains 0·69 gm. glycerin.

Per cent. of glycerin in the oil = 8·14.

Experience has shewn that the oxalate solution if titrated direct, after addition of H_2SO_4, gives the result too high. Precipitation of the

effecting saponification by aqueous alkali, and thus completely avoiding the source of error in question." *Jour. Soc. Chem. Ind.* V. 70; also Sutton's Volumetric Analysis, 6th ed. p. 345.

oxalate as $Ca\bar{O}$ cannot be dispensed with. These experiences are in conformity with those of Allen and Belcher. Two more saponifications carried on as above yielded the percentage of glycerin as 5·3 and 6·0 respectively.

An Improved Method of Saponification.

It is thus evident that the saponification was by no means complete, as the percentage of glycerin ranged between 8·14 and 4·8. Allen's method had thus to be abandoned. It was, in fact, noticed that the oily layer invariably floated over the solution of caustic potash and that shaking simply brought about a momentary incorporation of the oil and alkali. The two layers separated as soon as the bottle was placed in the boiling water. This difficulty was obviated by the introduction into the bottle of asbestos wool, thoroughly ignited previously to get rid of accidental organic impurities. This absorbing medium brought the oil and the alkali into intimate contact with each other and thus complete saponification was ensured. The heating was done just as in the previous cases, *i. e.*, by immersion in boiling water.

1. 1·573 gm. oil were treated as above, the fatty acids liberated by means of dilute H_2SO_4 and filtered off. The mass of asbestos, which had become slimy by the absorption of the fatty acids was then thrown on the filter-paper and repeatedly exhausted with hot water. Scarcely a trace of the fatty acids was found to pass through the filter-paper.* The filtration was carried on with the aid of a Bunsen's pump.

The glycerin solution was made up to 250 c. c., of which 100 c. c. were oxidised to oxalic acid. The latter thrown down as $Ca\bar{O}$. The $Ca\bar{O}$ dissolved in dilute H_2SO_4 and the solution made up to 250 c. c., of which

100 c.c. reqd. 4·7 c. c. $\frac{N}{10}$ $KMnO_4$

or 250 „ „ 11·75 „ „ (=100 c. c. glycerin sol.)

∴ 250 c. c. glycerin solution = 29·37 c. c. $\frac{N}{10}$ $KMnO_4$

and 1 c. c. $\frac{N}{10}$ $KMnO_4$ = 0·0046 gm. glyc.

∴ 29·37 „ „ = 0·135102 gm. glyc.

or 1·573 gm. oil yielded 0·135102 gm. glyc.

whence glycerin $^0/_0$ = 8·6

2. 2·167 gram. oil were saponified as above.

The glycerin solution made up to 250 c. c. of which 100 c. c.

* The filtered solution of glycerin was sometimes perfectly clear, sometimes slightly opalescent.

oxidised to $\bar{O}$, precipitated as $Ca\bar{O}$, &c., and titrated $= 16{\cdot}0$ c. $\frac{N}{10} KMnO_4$

whence percentage of glycerin $= 8{\cdot}45$

3. 1·99 gm. oil saponified as above. Details exactly the same as in the preceding.

250 c. c. glycerin solution $= 35$ c. c. $\frac{N}{10}$ $KMnO_4$

glycerin $^0/_0 = 8{\cdot}1$

4. 1·3165 gm. oil saponified according to the improved method. Details the same as in the previous cases—

250 c. c. glycerin sol. $= 25{\cdot}0$ c. c. $\frac{N}{10}$ $KMnO_4$

$= 0{\cdot}115$ gm. glycerin

glycerin $^0/_0$ $= 8{\cdot}7$.

The permanganate solution on direct titration against ferrous ammonium sulphate gave

1 c. c. $= 5{\cdot}6\ (1 - 0{\cdot}02)$ mgs. Fe.

Whence glycerin per cent. (corrected) $= 8{\cdot}7\ (1 - 0{\cdot}02)$

$= 8{\cdot}53$

5. 2·0365 gm. oil saponified: details the same—

250 c. c. glyc. sol. $= 37{\cdot}5$ $\frac{N}{10}$ $KMnO_4$

Glycerin per cent. $= 8{\cdot}33$ (corrected).

6. 1·264 gm. oil saponified as above

250 c. c. glycerin solution $= 23{\cdot}75$ c. c. $\frac{N}{10}$ $KMnO_4$

Whence glycerin per cent. $= 8{\cdot}64$.

It would thus be safe to take the percentage of glycerin in mustard oil as 8·5. The oil used was not in every case identical, but from different samples, in fact, the same as used in the determination of the saponification equivalent.

DETERMINATION OF GLYCERIN IN MUTTON-FAT BY THE ASBESTOS METHOD.

1. 1·0425 gm. fat were saponified under pressure as in the case of mustard oil.

The glycerin solution was made up to 500 c. c. of which 100 c. c. were oxidised to $\bar{O}$. The $Ca\bar{O}$ was dissolved in dilute H_2SO_4 and made up to 250 c. c.; 50 c. c. of the latter were equivalent to 1 c. c. $\frac{N}{10}$ $KMnO_4$

or 250 $Ca\bar{O}$ sol. $=$ 100 c. c. glyc. sol. $=$ 5 c. c. $\frac{N}{10}$ $KMnO_4$

or 250 c. c. glycerin solution $= 25$ c. c. $\frac{N}{10}$ $KMnO_4$

and 1 c. c. $\frac{N}{10}$ $KMnO_4$ $= 0{\cdot}0046$ gm. glycerin

Total amount of glycerin $= 0{\cdot}0046 \times 25$ gm. $= 0{\cdot}115$ gm.
whence percentage $= 11{\cdot}03$.

But, 1 c.c. $\frac{N}{10}$ $KMnO_4$ when titrated against pure oxalic acid was found to be equal to, 1 c. c. $\frac{N}{10}$ $KMnO_4$ $(1 - 0{\cdot}02)$

$\therefore$ per cent. of glycerin (corrected) $= 11{\cdot}03\ (1 - 0{\cdot}02)$
$= 10{\cdot}81$.

2. 1·8877 gm. fat were saponified as above; the heating was continued for 6 days on an average of $3\frac{1}{2}$ hours each day.

The filtrate* (= glycerin solution) was made up to 500 c. c. of which 50 c. c. were oxidised to $K\bar{O}$, &c.

The $Ca\bar{O}$ sol. was made up to 250 c. c. of which 100 c. c. required

1·7 c. c. $\frac{N}{10}$ $KMnO_4$

$\therefore$ 250 c. c. $Ca\bar{O}$ sol. $= \left(1{\cdot}7 \times \frac{5}{2}\right)$ c. c. $\frac{N}{10}$ $KMnO_4$

or 50 c. c. glyc. sol. $= 4{\cdot}25$ c. c. $\frac{N}{10}$ $KMnO_4$

or 500 „ „ „ $= 42{\cdot}5$ „ „ „

whence percentage of glycerin $= 10{\cdot}36$

per cent. corrected $= 10{\cdot}36\ (1 - 0{\cdot}02) = 10{\cdot}16$

Theoretical percentage of glycerin in mutton-fat, calculated as tri-stearin $= 10{\cdot}33$.

Determination of Glycerin in Niger-Seed Oil.

1. 3·165 gm. oil were treated with potash solution and asbestos, &c., as in the case of mustard oil.

The glycerin solution was made up to 250 c. c. of which 50 c. c. were oxidised to $\bar{O}$, and the $Ca\bar{O}$ sol. also made up to 250 c. c—

50 c. c. $Ca\bar{O}$ sol. $= 3$ c. c. $\frac{N}{10}$ $KMnO_4$

* The filtrate in the above cases was very faintly milky. It was therefore surrounded by ice-cold water to solidify, if possible, minute traces of fatty acids which might have remained in suspension. The opalescence, however, could not be got rid of. On standing for 3 to 4 days the solution kept in a stoppered flask became clear, but was at the same time the *nidus* of a kind of fungoid growth, resembling flakes of cotton-wool.

$\therefore$ 250 c. c. $Ca\bar{O}$ sol. $= 15$ c. c. $\frac{N}{10} KMnO_4$

or 50 glycerin solution $= 15$,, ,, ,,

or 250 ,, ,, $= 75$,, ,, ,,

But 1 c. c. $\frac{N}{10}$ $KMnO_4$ $= 0{\cdot}0046$ gm. glycerin.

$$\text{Percentage of glycerin} = \frac{75 \times 0{\cdot}0046 \times 10^2}{3{\cdot}165} = 10{\cdot}9.$$

2. 1·704 gm. oil were treated exactly as above, the glycerin solution made up to 500 c. c. of which 100 c. c. were oxidised to oxalic acid. The $Ca\bar{O}$ dissolved in dilute H_2SO_4 was made up to 250 c. c.

50 c. c. $Ca\bar{O}$ sol. $= 1{\cdot}6$ c. c. $\frac{N}{10}$ $KMnO_4$

$\therefore$ 250 c. c. ,, ,, $= 8{\cdot}0$,, ,, ,,

or 100 c. c. glycerin sol. $= 8{\cdot}0$,, ,, ,,

$\therefore$ 500 ,, ,, ,, $= 40{\cdot}0$,, ,, ,,

$$\text{Percentage of glycerin} = \frac{40 \times 0{\cdot}0046 \times 10^2}{1{\cdot}704} = 10{\cdot}8.$$

The percentage of glycerin in niger-seed oil is thus practically the same as in mutton-fat.

Estimation of Glycerin in Butter-fat.

The oxidation of glycerin by the alkaline permanganate is not applicable in the case of butter-fat, as the soluble fatty acids, *e. g.*, butyric, caproic, &c., it contains yield notable quantities of oxalic acid under the same treatment. The same remarks apply to the case of cocoanut oil (See *Chem. News*, Vol. LXIII, p. 251).

NOTE ON THE FOX AND WANKLYN METHOD OF ESTIMATING GLYCERIN.

This method, although it yields accurate results, can scarcely be made use of by the ordinary commercial analysist on account of its tedious and troublesome nature. Moreover, the manganese precipitate, sometimes bulky, cannot be properly washed without the aid of a Bunsen's filter-pump. The details recorded above will show that each determination of glycerin involves steady work of several hours. If ordinary alcohol be used as a solvent for the fats and oils, saponification is easily effected, but there is considerable risk of the loss of glycerin during the evaporation of alcohol.

On the loss of Glycerin by Volatilisation.

2·165 gm. glycerin were diluted with water to 250 c. c.; 50 c. c. were each time mixed with 25 c. c. pure alcohol, the latter evaporated off on a water-bath in—

(1) A platinum basin of 3 in. diameter.
(2) A porcelain basin of 5 in. diameter.
(3) Do. do. of about 3 in. diameter.

In (1) and (2) the percentage of glycerin was found to be 74·0; in (3) the percentage was 77·8. The percentage as found before (see p. 69) should have been 80.

It is thus evident that during the evaporation of alcohol considerable quantities of glycerin are carried off.

IODINE ABSORPTION FOR FATS AND OILS.†

Cocoanut Oil.

The sample was the same as used for the determination of the saponification equivalent.

1. 1·3585 gm. oil were digested for 24 hours with 10 c. c. chloroform and 20 c. c. iodine solution. In this as well as in the subsequent analyses a blank experiment was each time made side by side, and under exactly similar conditions, to determine the strength of the iodine solution. The time allowed for digestion was from 18 to 24 hours.

20 c. c. iod. sol. + 10 c. c. $CHCl_3$ = 35·0 c. c. $Na_2S_2O_3$ (Blank exp.)
Excess of iodine = 27·5 ,, ,,
Diff. = 7·5 ,, ,,

7·5 c. c. $Na_2S_2O_3$ represent the amount of iodine absorbed by the oil.
But 1 c. c. $Na_2S_2O_3$ = 0·01265 gm. iodine.
Hence amount of iodine consumed by 100 gm. oil, "iodine degree,"

$$= \frac{0{\cdot}01265 \times 7{\cdot}5 \times 100}{1{\cdot}3585} = 6{\cdot}99.$$

But the actual strength of the thiosulphate solution, as checked by titration against pure iodine, was found to be equal to 0·01265 (1 − 0·03) gm. per 1 c. c.

Corrected iodine number = 6·99 (1 − 0·03) = 6·78.

2. 1·459 gm. oil were digested as before.

26·5 cc $Na_2S_2O_3$ sol. were taken up by the excess of iodine, and
20 c. c. iod. sol. = 35·0 c. c. $Na_2S_2O_3$.

$$\text{Iodine degree} = \frac{0{\cdot}01265 \times 8{\cdot}5 \times 100}{1{\cdot}459} = 7{\cdot}37$$

Corrected number = 7·37 (1 − 0·03) = 7·15

† For details of Hübl's method, see *Journ. Soc., Chem. Ind.* iii, 642 also Allen's *Org. Analysis.*

3. 1·016 gm. oil were digested for 24 hours with 20 c. c. 1 and 10 c. c. $CHCl_3$

20 c. c. 1 + 10 c. c. $CHCl_3$ = 16·0 c. c. $Na_2S_2O_3$ (Blank exp.)
Excess of iodine = 10·4 „ „
Dif. 5·6 „ „

$$\text{Iodine degree} = \frac{0{\cdot}01265 \times 5{\cdot}6 \times 100}{1{\cdot}016} = 6{\cdot}97$$

Corrected number = 6·97 (1 − 0·03) = 6·76.

4. 1·984 gm. oil were digested with 30 c. c. iod. sol. and 10 c. c. $CHCl_3$. Excess of iodine = 13 c. c. $Na_2S_2O_3$.

30 c. c. iod. sol. + 10 c. c. $CHCl_3$ = 24 c. c. $Na_2S_2O_3$ (Blank exp.)

$$\text{Iodine degree} = \frac{0{\cdot}01265 \times 11 = 100}{1{\cdot}984} = 7{\cdot}01$$

Corrected number = 7·01 (1 − 0·03) = 6·81.

Ghee (Clarified Butter.)

1. 0·955 gm. ghee was digested for 24 hours with 10 c. c. $CHCl_3$ and 20 c. c. iod. sol.

10 c. c. $CHCl_3$ + 20 c. c. iod. sol. = 32·8 c. c. $Na_2S_2O_3$
Excess of iodine = 6·3 „ „
Dif. = 26·5

$$\text{Iodine degree} = \frac{0{\cdot}01265 \times 100 \times 26{\cdot}5}{0{\cdot}955} = 35{\cdot}1$$

2. 0·216 gm. ghee was digested as above

27·0 c. c. $Na_2S_2O_3$ was taken up by the excess of iodine.

$$\text{Iodine degree} = \frac{0{\cdot}1265 \times 5{\cdot}8 \times 100}{0{\cdot}216} = 33{\cdot}9$$

Mean of the two determinations = 34·5
Corrected number = 34·5 (1 − 0·03) = 33·5

The saponification equivalent of this sample of ghee was found to be 221 (See p. 65).

Another Sample of Ghee.

1. 0·355 gm. was digested with 20 c. c. iod. sol. and 10 c. c. $CHCl_3$. 10·3 c. c. $Na_2S_2O_3$ were required for the excess of iodine.

20 c. c. iod. sol. + 10 c. c. $CHCl_3$ = 22·6 c. c. $Na_2S_2O_3$

$$\text{Iodine degree} = \frac{12{\cdot}3 \times 0{\cdot}01265 \times 100}{0\ 355} = 43{\cdot}8$$

2. 0·303 gm. substance was treated with 20 c. c. iod. sol. and 10 c. c. $CHCl_3$; 12·1 c c $Na_2S_2O_3$ sol. were taken up by the excess of iodine.

$$\text{Iodine degree} = \frac{10{\cdot}5 \times 0{\cdot}01265 \times 100}{0{\cdot}303} = 43{\cdot}8$$

Mean of the above two determinations = 43·8

But 1 c. c. $N_2S_2O_3$ was equal to (1 − 0·1) gm. iodine.

Corrected number = 39·4

The saponification equivalent for this sample of ghee was 218 (p. 66).

Iodine Degree for Mustard Oil.

(1) 0·140 gm. oil was digested for about 24 hours with 20 c. c. iod sol. and 10 c. c. chloroform.

(2) 0·202 gm. oil was digested for the same length of time with 30 c. c. iod. sol. and 10 c. c. $CHCl_3$

20 c. c. iod. sol. + 10 c. c. $CHCl_3$ = 27·5 c c. $Na_2S_2O_3$ (Blank exp.)
30 „ „ „ = 41·25 c. c. „

(1) required 16·6 c. c. $Na_2S_2O_3$ for the excess of iodine.
(2) „ 25·4 „ „ „ „ „ „

Amount of iodine consumed by (1) is equivalent to 10·9 c. c. $Na_2S_2O_3$
„ „ „ (2) „ „ „ 15·85 c. c. „

$$\text{Iodine degree for (1)} = \frac{0{\cdot}01265 \times 10{\cdot}9 \times 100}{{\cdot}14} = 98{\cdot}5$$

$$\text{„ „ „ (2)} = \frac{0{\cdot}01265 \times 15{\cdot}85 \times 100}{0{\cdot}202} = 98{\cdot}5$$

But 1 c. c. $Na_2S_2O_3$ = 1 c. c. $I \times \frac{10}{10{\cdot}2}$ (as found by actual titration with pure iodine).

Iodine degree (corrected) = 96·9 or 97·0

Iodine Degree for Niger-seed Oil.

(1) 0·137 gm. oil was digested with 30 c.c. iod. sol. and 10 c.c. chloroform.
(2) 0·171 „ „ „ 40 „ „ „ „
(3) 0·098 „ „ „ 30 „ „ „ „

30 c. c. I + 10 c. c. $CHCl_3$ = 45·2 c. c. $Na_2S_2O_3$ (Blank exp.)

Whence also

40 „ „ „ = 60·26 „ „

(1) Required 32·0 c. c. $Na_2S_2O_3$ for the excess of iodine.
(2) „ 43·4 „ „ „ „ „
(3) „ 35·6 „ „ „ „ „

$$\text{Iodine degree for (1)} = \frac{0{\cdot}01265 \times 13{\cdot}2 \times 100}{0{\cdot}137} = 121{\cdot}8$$

$$\text{„ „ (2)} = \frac{0{\cdot}01265 \times 16{\cdot}86 \times 100}{{\cdot}171} = 124{\cdot}7$$

$$\text{„ „ (3)} = \frac{0{\cdot}01265 \times 9{\cdot}6 \times 100}{0{\cdot}098} = 123{\cdot}9$$

The *mean* of the three numbers is 123·5

But 1 c. c. $Na_2S_2O_3$ = 1 c. c. $\frac{N}{10}I \times \frac{10}{10{\cdot}3}$

Hence the iodine degree (corrected) = 120

IODINE DEGREE FOR EARTH-NUT OIL.*

(1) 0·181 gm. oil was digested with 20 c. c. iod. sol. and 10 c. c. $CHCl_3$.

20 c. c. I + 10 c. c. $CHCl_3$ = 20·8 c. c. $Na_2S_2O_3$ (Blank titration)

4·7 c. c. $Na_2S_2O_3$ were required for the excess of iodine.

Iodine degree $= \frac{16{\cdot}1 \times 0{\cdot}01265 \times 100}{0{\cdot}181} = 112{\cdot}5$

But 1 c. c. $Na_2S_2O_3$ = 1 c. c. $\frac{N}{10}I \times \frac{10}{11{\cdot}5}$

Corrected number $= 112{\cdot}0 \times \frac{10}{11{\cdot}5} = 97{\cdot}5$

(2) 0·1645 gm. oil was treated with 30 c. c. iod. sol. and 10 c. c. chloroform.
(3) 0·1535 „ „ „ 30 „ „ „ „
(2) Required 15·0 c. c. $Na_2S_2O_3$ for the excess of iodine.
(3) „ 16·0 „ „ „ „ „

The iodine degree for (1) = 103·8
„ „ „ (2) = 103·0
Mean of two determinations = 103·4

But 1 c.c. $Na_2S_2O_3$ = 1 c. c. $\frac{N}{10}I \times \frac{10}{10{\cdot}5}$

Hence corrected number $= 103{\cdot}4 \times \frac{10}{10{\cdot}5} = 98{\cdot}5$

MOWA FAT.

(1) 0·1815 gm. oil was treated with 10 c.c. $CHCl_3$ and 20 c.c. iod. sol.
(2) 0·186 „ „ „ and 30 c.c. „ „

11·5 c. c. $Na_2S_2O_3$ were reqd. for the excess of iod. by (1)
21·5 „ „ „ „ „ „ (2)
20·0 c. c. iod. sol. + 10 c. c. $CHCl_3$ = 20·6 c. c. $Na_2S_2O_3$
30·0 „ „ „ „ = 30·9 „ „

From which we get the iodine degree for
(1) as 63·42, and that for (2) as 63·88
Mean of two = 63·7

But 1 c. c. $Na_2S_2O_3$ = 1 c. c. $\frac{N}{10}I \times \frac{10}{10{\cdot}3}$

Corrected number $= 63{\cdot}7 \times \frac{10}{10{\cdot}3} = 61{\cdot}8$

* The saponification equivalent of this sample was found to be 195·0.

Iodine Degree for Sesame' Oil.*

(November 29, 1893.)

(1) 0·2806 gm. oil was digested with 20c. c. iod. sol. and 10c. c. $CHCl_3$.

5·9c. c. $Na_2S_2O_3$ were required for the excess of iodine.

20c. c. I $= 29{\cdot}8$c. c. $Na_2S_2O_3$ (Blank exp.)

Iodine degree $= \dfrac{23{\cdot}9 \times 0{\cdot}01265 \times 100}{0{\cdot}2806} = 107{\cdot}7$

But 1c. c. $Na_2S_2O_3$ had the actual strength 1c. c. $\times (1 - 0{\cdot}02) \frac{N}{10}$ I

Corrected number $= 107{\cdot}7\ (1 - 0{\cdot}02) = 105{\cdot}5$

(December 5, 1893.)

(2) 0·1721 gm. oil was digested with 20c. c. I sol. and 10c. c. $CHCl_3$
(3) 0·2065 ,, ,, ,, ,, ,, ,,
(4) 0·227 ,, ,, ,, ,, ,, ,,

20c. c. I sol. + 10c. c. $CHCl_3$ $= 25{\cdot}5$c. c. $\frac{N}{10}$ $Na_2S_2O_3$ (Blank titration)

No. (2) required 10·9c. c. $Na_2S_2O_3$ for the excess of iodine.
No. (3) ,, 8·2 ,, ,, ,, ,, ,,
No. (4) ,, 6·4 ,, ,, ,, ,, ,,

From which we get the iodine degree for

$$\left.\begin{array}{ll} (2) & = 10{\cdot}73 \\ (3) & = 106{\cdot}0 \\ (4) & = 106{\cdot}4 \end{array}\right\} \text{mean} = 106{\cdot}6$$

But 1c. c. $Na_2S_2O_3$ $= 1$c.c. I $(1 - 0{\cdot}02)$

Corrected number $= 106{\cdot}6\ (1 - 0{\cdot}02) = 104{\cdot}5$.

Iodine Degree for Lard.

(1) 0·2215 gm. lard was digested with 20c. c. I and 10c. c. $CHCl_3$
(2) 0·1995 ,, ,, ,, ,,

15·1c. c. $Na_2S_2O_3$ were required by (1) for the excess of iodine
16·1 ,, ,, ,, ,, (2) ,, ,, ,,
20c. c. I + 10c. c. $CHCl_3$ $= 24{\cdot}1$ c. c. $Na_2S_2O_3$ (Blank exp.)

Iodine degree for (1) $= \dfrac{9 \times 0{\cdot}01265 \times 10^2}{0{\cdot}2215} = 51{\cdot}4$

,, ,, (2) $= \dfrac{8 \times 0{\cdot}01265 \times 10^2}{0{\cdot}1995} = 50{\cdot}7$

Mean of the two determinations $= 51{\cdot}0$

But 1c. c. $Na_2S_2O_3$ $= 1$c. c. $\frac{N}{10}$ I $\times (1 - 0{\cdot}02)$

Whence corrected number $= 50{\cdot}0$

* The oil was extracted from the seeds by means of carbon bisulphide, and it was the same as used for determining the saponification equivalent.

NOTE ON HÜBL'S IODINE ABSORPTION METHOD.

There is some difference of opinion as regards the excess of iodine, which should be present after its absorption. Thompson and Ballantyne, who have carefully revised the *constants* required in the analysis of some fats and oils, are of opinion that "at least double the amount of iodine absorbed should be present." Care was taken to fulfil this condition in most of the analyses as recorded above. On reference to sesamé and earth-nut oils, it would appear, however, that it is not always necessary that the iodine should be in large excess. Thus in one case the excess of iodine corresponds to only 5·9 c. c. N/10 $Na_2S_2O_3$ solution, and in another to only 4·7 c. c. $Na_2S_2O_3$, solution without the results being discordant.

For convenience of reference the results obtained above are presented below in a tabulated form:—

Table of constants in the analysis of fats and oils.

Nature of Fat or Oil.	Saponification equivalent.	Glycerin per cent.	Iodine absorption.
Mustard oil	172–176	8·5	97·0
Niger-seed oil	190·0	10·8	120
Cocoanut oil	258·0	...	6·9
Ghee	218–222	...	33·5–39·4
Mowa fat	199·3	...	61·8
Mutton tallow	199·5–206	10·5	.....
Sesamé	189·9	...	104·5
Lard	195·4	...	50·0
Earth-nut oil	196·0	...	98·0

SUMMARY AND CONCLUSION.

It would thus appear that as the saponification equivalents of niger-seed oil, mowa fat, mutton tallow, sesamé oil, lard and earth-nut oil are very close to one another, their admixtures in considerable proportions cannot be detected by Koettstorfer's test. Even the saponification equivalent of ghee is not far removed from that of lard or tallow. The saponification equivalents of mustard oil and cocoanut oil are, however, highly characteristic. The iodine degrees, on the other hand, afford us valuable hints as to the nature of adulteration, the most remarkable feature being the exceedingly low numbers for cocoanut oil and ghee. The results of the application of Reichert's test will be communicated later on.

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Noviciæ Indicæ VII. *Description of a new species of* Meconopsis *from Sikkim.—By* D. Prain.

[Received March 31st—Read April 4th.]

Among the novelties obtained by the collectors working under Dr. King's supervision in the Eastern Himalaya since the publication of the first volume of Sir J. D. Hooker's *Flora of British India*, one of the most interesting and elegant is a small species of *Meconopsis* collected in two localities near the Nepal frontier in 1888. Seeds of this plant were sent by Dr. King to Europe in that year, but unfortunately none of the numerous foreign correspondents of the Royal Botanic Garden appear to have succeeded in raising plants, and though the species has been carefully looked for since, it has not again been met with. When it is at length obtained it is likely to prove a very acceptable addition to European and North American horticulture. It has been the writer's intention for some years to publish the results of a critical study of the Indian *Papaveraceæ*, but the pressure of more urgent duties has hitherto prevented the completion of his notes. As, however, members of the Society and others, in annually increasing numbers, make tours in Sikkim, it seems better no longer to defer the publication of a description of this species so as to make its recognition possible to those who—and all who can use the work should—take with them on their journey a copy of the *Flora of British India*. To the brief diagnosis, in which its place among the species described in that work is shewn, a full botanical account is appended.

MECONOPSIS Viguier.

(*Flor. Brit. Ind.* i. 118.)

* Scapes radical, one-flowered.

† *Leaves pinnatisect.*

1. * Meconopsis bella *Prain;* quite glabrous.

Alpine Himalaya: Western Sikkim and Eastern Nepal; alt. 12–14,000 feet; *Dr. King's collectors!*

Root stout, fusiform; neck clothed with sheaths. *Leaves* many, 2–4 in. long, petioled, 2–3-jugately imparipinnatisect. *Scapes* slender, numerous, glabrous. *Flowers* 2–3 in. diam., pale blue. *Petals* 4–5. *Ovary* globose, style short, stigmas 5. *Capsule* obovoid, $\frac{1}{2}$–$\frac{3}{4}$ in.; seeds with lax reticulated testa.

† † *Leaves subentire or entire.*

1. M. simplicifolia *H. f. & T.;* softly hairy.
2. M. horridula *H. f. & T.;* prickly.

* * Stems leafy. Flowers racemed or panicled.

3. M. aculeata *Royle*, etc., as in "*F. B. I.*"

Meconopsis bella *perennis;* glaberrima; *rhizomate* minimo digito crasso collo extruso et vaginis foliorum anni antecedentis vestito; *foliis* omnibus radicalibus longe petiolatis, glabris; petioli margine ad basin versus in vaginam membranaceam dilatato; lamina circumscriptione ovato-lanceolata, 2–3-jugim inparipinnatisecta, segmentis 3-partitis, lobulis ovato-obtusis; *scapis* numerosis gracilioribus, simplicibus, 1-floris; *floribus* majusculis coeruleis, sepalis 2, petalis 4–5, staminibus ∞ (circa 80); ovario ovato, placentis 4–5, stylo distincto, stigmate radiatim 4–5-lobo; *capsula* substipitata, obovoidea; seminibus numerosis testa laxa reticulatis et pseudostrophiolatis, embryone basilari parvo.

In Himalaya orientali: Sikkim, in tractu Jongri apud Pe-kiong-la, circa 12,000 p. s. m., et in Nyegu ad fines Napaliæ orientales, 14,000 p. s. m., *Kingii mercenar.!* In mense Julio floret.

Rhizomate 12 cm. longo, hoc 1·5 cm. crasso, parte subaërio plus quam 2 cm.; foliorum, iis *Corydalis leptocarpæ* similium, petiolo 6–10 cm. longo, lamina 2·5 cm. longa hoc 1–1·5 cm. lata, lobulis 5 mm. longis his 3 mm. latis; scapis 6–10 cm. longis; sepalis 12 mm. longis, his 8 mm. latis, ovatis; petalis 30 mm. longis, his 20 mm. latis, ovato-rotundatis; staminibus filamentis filiformibus 6 mm. longis glabris, antheribus (e sp. sicco aureis) 2·5 mm. longis, vix 1 mm. latis, oblongis; ovario 5 mm. longo, stylo 3 mm. longo; capsula matura 15 mm. longa obpyriformi in stipite 4 mm. longo attenuata; seminibus 1·25 mm. longis, 3. mm. latis.

Nulli speciei *Meconopsidis* adhuc descriptæ arcte affinis.

Noviciæ Indicæ VIII. *Some additional species of* Convolvulaceæ.—By D. Prain.

[Received Mar. 31st;—Read April 4th.]

It is now nearly eleven years since the account of the Indian species of this order by Mr. C. B. Clarke, was published (*Flora of British India*, iv., pp. 179–228: *June* 1893). In this interval, some forms new to the area dealt with in the *Flora*, including a few that appear to be new to science, have been reported from various localities, chiefly, however, from British Indo-China, and from Malaya.

Having been directed by Dr. King to re-arrange the Indian material of the order preserved in the Calcutta Herbarium, in such a manner as to incorporate the new material as nearly as possible on the lines of Mr. Clarke's account, the writer, while doing so, has drawn up, as he did in the case of the *Labiatæ*, descriptions of all the species, whether new to science or not, that are new to the Indian area, with a view to their presentation to the Society, in the hope that they may prove useful to members who require to use the *Flora of British India* in the field. As on former occasions, the descriptions have been made as nearly as possible in the style of those of the *Flora*.

Of the majority of the forms which have been previously described, but which are now for the first time reported as Indian, and of all the forms that are now being described, as the writer believes, for the first time, examples have been sent by Dr. King, Superintendent of the Royal Botanic Garden, to Mr. Dyer, Director of the Royal Gardens, Kew, for favour of comparison with the Indian material in the great national Herbarium there. In this way it has been made certain that none of the species now described as new exist under older names in the two Herbaria of Kew and Calcutta, which are the most richly endowed with Indian specimens.

The writer would wish to convey his thanks to Mr. Dyer, the Director, and to Dr. Stapf, the Assistant for India at Kew, who made the necessary comparisons, for their kindness in affording him the assurance required to render the validity of these species probable.

1. ERYCIBE Roxb.

1*b*. Erycibe peguensis *Prain*. Erycibe paniculata *Roxb.* var. peguensis: *Clarke*, *Flor. Brit. Ind.*, iv, 180. E. glaucescens *Kurz*, *For. Flor. Brit. Burma*, ii, 214 *in part, not of Wall.*

Besides the points alluded to by Mr. Clarke, this plant is distinguished from *E. paniculata* Roxb., by the much larger fruit and by the margin of the corolla, which is white, not yellow, being undulate only, not finely crenulate.

CHITTAGONG: common. ARRACAN; *Prain!* PEGU: *Kurz!* TENASSERIM, common. ANDAMANS; Coco Islands. *Prain!* South Andaman; common. NICOBARS; *Kurz!*

This plant appears to take the place of *E. paniculata* throughout South-western Indo-China. This constitutes, by his specimens, the major part of *E. glaucescens* of Mr. Kurz, in the *Forest Flora of British Burma.*

2. ERYCIBE EXPANSA *Wall*, Erycibe coriacea *Kurz, For. Flor. Brit. Burma*, ii, 213 *in part not of Wall.*

Add to localities of *F. B. I.*:—MALAY PENINSULA; Kedah, *Curtis*, n. 2128!

Flowers pinkish-white (*Curtis*). There is no example of *Wall. Cat.* n. 1337 (*Erycibe coriacea* Wall.) at Calcutta; Mr. Kurz has identified with that species both *Wall. Cat.* n. 1331 (the type of *E. expansa*) and Helfer 5879 (*E. ferruginosa* Griff. K. D.), hence the discrepancy between his description of *E. coriacea*, and those of Choisy, and of the *F. B. I.*

3. ERYCIBE SUBSPICATA *Wall.* Erycibe paniculata VAR. subspicata, *Choisy, Ann. Sc. Nat.* 2, i, 222 and *DC. Prodr.* ix, 464. Erycibe paniculata *Kurz, For. Flor. Brit. Burma*, ii, 214, *hardly of Roxb.*

Add to localities of *F. B. I.*:—

BOOTAN; alt. 2000 ft., *King's collector!* UPPER ASSAM; Akha Hills, *King's collector!* Golaghat district, *Jenkins! Mann!* TENASSERIM: *Brandis! Parish* (Dr. Stapf *in litt.*).

This is certainly, as Choisy and Kurz indicate, and as Mr. Clarke admits, very near *E. paniculata* Roxb. The writer, however, agrees with Mr. Clarke in considering it quite distinct.* The flowers and fruits in this species are larger than in *E. paniculata*, the flowers being larger than even in *E. peguensis.* The lobules are more deeply erose than in *E. paniculata*; much more so than in *E. peguensis.*

4*b*. ERYCIBE ANGULATA *Prain*; branchlets angular pubescent, leaves obovate, base cuneate or rounded, apex shortly acuminate or rounded sometimes deeply emarginate, coriaceous, glabrous, lateral nerves visible above, distinctly raised beneath, cymes in axillary and terminal racemes. Erycibe paniculata *Miq., Flor. Ind. Bat. Suppl.* 248; *not of Roxb.*

MALAY PENINSULA; Perak, Larut, *Kunstler* n. 7379! Dijong, *Scortechini* n. 1816! DISTRIB. Sumatra (*Teysmann* Hort. Bog. n. 3682!) Java (*Kurz!*)

A robust scandent shrub (*Scortechini*) or strong creeper ("over 100 feet," *Kunstler*) with stem 4–6 in. diam., branches terete glabrous, ultimate branchlets angular rusty-

* Equally distinct appears to be a species collected in New Guinea by Hellwig (n. 87 ex *Mus. Bot. Berol.*) and by Forbes (n. 439). This has flowers much as in *E. paniculata*, but the racemes are shorter, the fruits smaller, and the leaves ovate-acute with rounded bases and petioles $\frac{1}{3}$–$\frac{1}{2}$ in. long, *much* smaller ($1\frac{1}{2}$–$2\frac{1}{2}$ in. by $\frac{3}{4}$–1 in.) and more thickly coriaceous. To this species the writer would give the name *Erycibe Hellwigii.* This has been issued as *E. paniculata* from Berlin.

pubescent. *Leaves* petioled 4–8 in. by 2–4 in., lateral veins 5–8 pairs, raised beneath as in *E. glomerata* though not so prominently (and not as in that species impressed above) secondary veins indistinct; petioles ½ in., rusty puberulous. *Cymes* with angular rachis clothed with dark-red tomentum, axillary 1–6 in. by 1–1½ in., terminal 7–10 in. long, with at times floral leaves intermixed. *Pedicels* ¼–⅓ in. *Sepals* orbicular, outer stellately rusty tomentose, inner ciliate. *Corolla* white, lobes spreading ½ in., interlobular portion hirsute externally, lobules glabrous, ovate-oblong, margins slightly undulate. *Berry* not seen.

This very distinct species is the *Erycibe paniculata* of Miquel's Supplement from Sumatra, as the example of Teysmann's gathering from Danoh Tjaloh, Moerie, preserved in the Calcutta Herbarium, shows. It also occurs in Java.

6. Erycibe malaccensis *Clarke.*

Add to localities of *F. B. I.* :—

Malay Peninsula: Perak, *Scortechini* 2196! *Kunstler* 3180! 3575! Penang, *Maingay* 1154!

Berry purple when mature. Corolla tube very much shorter than in *E. paniculata.*

7. Erycibe Princei *Wall.*

Add to localities of *F. B. I.* :—

Singapore, *Kurz! Hullett!* Add to distribution; Sumatra (*Forbes* n. 1826!).

The plant that is known in the Buitenzorg garden as *Erycibe tomentosa* Bl. is this species. The *Hort. Bogor.* identification is most probably accurate, in which case Blume's name (*Bijdr.* 1048) will replace Wallich's more recent one.

8. Erycibe Griffithii *Clarke.*

Add to localities of *F. B. I.* :—

Penang: *Gaudichaud* 120; *Curtis* 181! *Kunstler*, 1458!

Corolla waxy cream-yellow, lobes very narrow, spreading ½in., interlobular portion densely red-pubescent externally, lobules small, glabrous, narrowly oblong, obliquely cut, acute, divergent.

11. Erycibe glomerata Wall.

A small tree, 10–20 feet high, with strong straggling shoots; flowers creamy yellow, "with strong odour of unripe turnips" (*Proudlock.*) *Corolla* lobes broad, spreading ¾in.; interlobular portion rusty-pubescent externally, lobules ovate, margins erose throughout.

The corolla is much like that of *E. coriacea* var. *fragrans*, but the lobules are broader and are erose instead of merely undulate.

It is still doubtful if this be the same as Blume's *E. glomerata.* Miquel says it is not; but there is no example of Miquel's plant (*Zollinger* n. 706) at Calcutta, nor is there any Java specimen here that will suit Miquel's description, or that will match with Wallich's plant. Blume's description is quite inadequate.

12. Erycibe aenea *Prain*; branchlets round, densely rusty-tomentose, leaves quite glabrous, narrowly oblong or elliptic to an obtuse apex, base cuneate, very coriaceous, nerves impressed on both surfaces, cymes ¼–1¼in., minutely closely rusty-tomentose.

MALAY PENINSULA: Perak, at 2,000—2,500 ft. elev., *Kunstler* n. 7337 !

A very large climber, "100–150 ft. long, 2–3 in. diam." (*Kunstler*). *Leaves* $2\frac{1}{2}$–5 in. by 1–2 in., shining, often blistered beneath; lateral nerves 5–6 pairs with a distinct marginal nerve, secondary veins also distinctly impressed especially beneath, petiole $\frac{1}{5}$ in., or less. *Cymes* axillary 3–20-fld. peduncles and bracteolate pedicels ($\frac{1}{8}$ in long) rusty close-pubescent. *Sepals* orbicular, closely brown-tomentose. *Corolla* lobes spreading $\frac{1}{2}$ in., pale yellow; interlobular portion pale-brown tomentose externally, lobules ovate-oblong, margins undulate. *Berry* not seen.

Allied to *Erycibe coriacea*, but with smaller and more coriaceous leaves, and with flowers more like those of *E. glomerata*. The leaves when dry are of a coppery red colour.

3. ERYCIBE PRAECIPUA *Prain;* branchlets round, quite glabrous; leaves very coriaceous, nerves obscure on both surfaces, long petioled, narrowly elliptic, attenuated to both ends, apex obtuse; cymes axillary, small lax few-fld.

PENANG: Government Hill, *Curtis* n. 911 ! 1273 !

A large climbing shrub, branches round. *Leaves* $1\frac{1}{2}$–3 in. by $\frac{3}{4}$–$1\frac{1}{2}$ in., all nerves quite obscure; petiole $\frac{1}{3}$ in., glabrous. *Cymes* $\frac{1}{2}$ in. 5–8-fld., minutely adpressed pilose, pedicels bracteolate, $\frac{1}{8}$ in. *Sepals* orbicular, outer minutely, inner densely, closely rusty pubescent. *Corolla* lobes very narrow, spreading $\frac{1}{2}$ in.; interlobular portion rufous pubescent internally and externally; lobules small, glabrous, narrowly oblong, subacute divergent. *Berry* coriaceous rough, ovoid, $\frac{3}{4}$ in. long $\frac{5}{8}$ in. across, pointed.

This species is not easily differentiated from *Erycibe Maingayi*—of which there is no specimen at Calcutta—by the somewhat incomplete diagnosis of the *F. B. I.* All the characters given for *E. Maingayi* apply to *E. praecipua*, except the explicit one of 'hairy innovations' and the implication that its secondary nerves are distinct. *E. Maingayi* is, however, said to appear to be allied to *E. Princei*—an alliance by no means marked in *E. praecipua*. This, coupled with the fact that *E. praecipua* has been distributed by Mr. Curtis as *E. coriacea*, and that Dr. Stapf informs him that the plant has been associated (though not identified) with *E. coriacea* at Kew, assures the writer that it is distinct from *E. Maingayi*.

E. coriacea is a species founded on *Wall. Cat.* n. 1337, from Chittagong, a plant that has apparently been lost. It was seen and described by Choisy (*Ann. Sc. Nat.* 2, i, 224), but it is not present now in the Wallichian type Herbarium, or in the Herbaria at Kew and at Calcutta. But Choisy considered *E. fragrans*, Wall. (*Cat.* n. 1336) con-specific with *E. coriacea;* whence we may infer that the flowers of *E. fragrans* are similar to, if not identical with, those of *E. coriacea*.

In *E. praecipua* the corolla lobes are long and narrow, with small divergent auriculate lobules, as in *E. Griffithii*, and to a less degree in *E. Stapfiana*, while the interlobular portion of the corolla lobes are densely pubescent within as well as without. In *E. fragrans* the lobes are short and wide with large ovate over-lapping lobules, the interlobular part of the lobes being glabrous within as in every other species of *Erycibe* in the Calcutta Herbarium except *E. praecipua*.

Had this character been present in the lost *E. coriacea*, Choisy would never have united with it Wallich's *E. fragrans;* unless the same character is present in the corolla of *E. Maingayi* (which has not as yet been described), this alone should be sufficient to distinguish *E. praecipua* from all the hitherto described species of *Erycibe*.

14. Erycibe Stapfiana *Prain;* branchlets round glabrous, leaves large usually elliptic or oblong, narrowed to a cuneate or narrowly truncate base, apex shortly blunt acuminate, sometimes narrowly lanceolate, coriaceous, glabrous paler beneath, lateral nerves raised beneath, cymes in axillary clusters,

Malay Peninsula: Perak; at considerable elevations, 300–3000 feet, *Kunstler*, 4015 ! 4115 ! 7784 ! *Scortechini*, 1793 ! Tenasserim *Parish !*

A shrubby or slender climber, much branched. *Leaves* 4–7 by 2–3 in. oblong or elliptic in all the Perak specimens, narrow lanceolate $4\frac{1}{2}$ by $1\frac{1}{4}$ in. in Tenasserim ones, lateral nerves 4–6 pairs, obliquely ascending (the lowest pairs extending more than $\frac{1}{2}$-way along the margin) visible above and raised beneath, secondary veins reticulately raised beneath inconspicuous above, petiole $\frac{1}{4}$ in. glabrous. *Cymes* $\frac{1}{2}$–2 in. long, in fascicles of 4–9, from an axillary woody protuberance, 5–20-fld., peduncles densely dark-brown tomentose as are the bracteolate pedicels $\frac{1}{12}$–$\frac{1}{8}$ in. *Sepals* orbicular densely brown-tomentose. *Corolla* lobes narrow, spreading $\frac{1}{2}$ in., waxy white within; interlobular portion very dark-brown tomentose externally, lobules narrow divergent, slightly crenulate along the obliquely truncate apex. *Berry* ovoid, $\frac{2}{3}$ in. long, $\frac{1}{2}$. in. diam., densely clothed with a fine dark-brown velvety tomentum.

A remarkable species, well characterised by its leaves, which bear a striking superficial resemblance to those of *Casearia macrocarpa*, and by its velvety epicarp.

15. Erycibe festiva *Prain;* branchlets angular, sparingly pubescent, leaves rather long petioled large thinly coriaceous glabrous, elliptic or oblong, base cuneate, apex long acuminate, lateral nerves distinct on both surfaces, especially beneath, cymes very short, few-fld.

Malay Peninsula: Singapore, *Hullett* n. 624 ! Perak, *Kunstler* n. 6445 !

A small tree (*Hullett*) or creeper, 60–70 feet long (*Kunstler*) branches grooved or angular. *Leaves* 3–6 in. by $1\frac{1}{2}$–$2\frac{1}{2}$ in. dark green, lateral nerves 7–9 pairs, secondary veins invisible, petioles $\frac{1}{2}$–$\frac{3}{4}$ in. *Cymes* axillary many-fld., peduncles $\frac{1}{3}$–$\frac{1}{2}$ in., rusty pubescent; pedicels bracteolate rusty pubescent $\frac{1}{8}$ in. *Sepals* rusty pubescent orbicular. *Corolla* lobes broad, spreading $\frac{3}{4}$ in., pale greenish white; interlobular portion brown tomentose externally, lobules ovate, margins deeply erose throughout. *Berry* not seen.

Resembles most closely *E. albida*, but differs very markedly in tomentum, in size of flowers and in shape of corolla lobules. A very distinct species.

16. Erycibe albida *Prain;* branchlets round sparingly pubescent leaves very large elliptic or narrow oblong shortly attenuated at both ends, coriaceous glabrous pale beneath, lateral nerves visible but not raised on both surfaces, cymes very short, few-fld., flowers large.

Malay Peninsula: Perak, *Kunstler* n. 7373 ! *Scortechini*. Pungah, *Curtis* n. 2947 !

A shrub (*Scortechini, Curtis*) or small tree (*Kunstler*) 10–20 feet high, erect, much spreading. *Leaves* 7–12 in. by 3–5 in., dark green above waxy pale greenish yellow beneath (*Kunstler*); lateral nerves 8–9 pairs, secondary veins invisible, petiole $\frac{1}{4}$–$\frac{1}{3}$ in. *Cymes* axillary 5–8-fld., peduncles $\frac{1}{10}$ in., flowers nearly sessile with 3

slightly rusty pubescent bracteoles at the base of the calyx. *Sepals* subglabrous pale waxy green (*Kunstler*) orbicular, margins ciliate. *Corolla* lobes narrow, spreading 1¼ in. white; interlobular portion rufous externally, lobules oblong obtuse slightly crenulate at the apex. *Berry* not seen.

The very large leaves pale beneath, the large flowers with nearly glabrous calyx and the erect habit render this species very distinct from any of the others here described.

2. RIVEA Choisy.

1. Rivea ornata *Choisy, Convolv. Or.* 27, t. 3 and *DC. Prodr.* ix, 326; *Sweet, Hort. Brit.*, ed. iii, 481; *Wight in Calc. Journ. Nat. Hist.* viii, 179, t. 5, f. 1; *Ill.* t. 168 *bis*, f, 1, and *Ic. Pl.* t. 1356; *Dalz. & Gibs., Bomb. Fl.* 168.

var. typica *Clarke, Flor. Ind.* iv, 183 (*excl. syn. Roxb., Wall., Ham. Sweet* and *Brand.*). Convolvulus candicans *Roth., Nov. Sp.* 106; *Roem. & Schult., Syst.* iv, 273 and 790 (*not of Soland.* [*Ipomœa fastigiata*], *nor of Rottl., Willd., Wall. and Roem. & Schult., l. c.* 302 [*Rivea hypocrateriformis*]). Lettsomia ornata, *Wall. in Roxb. Flor. Ind.*, ed. *Carey & Wall.* ii, 86 *in foot-note* (*not of Roxb.*). A shrub with climbing stems and orbicular-cordate leaves, densely silky tomentose beneath, acute sepals and mostly 3-fld. peduncles.

Deccan Peninsula: common in dry jungles, &c. Ceylon; in the hotter parts of the island.

There is nothing to add to Mr. Clarke's excellent description of this plant, which, as he remarks, appears strictly confined to South India and Ceylon.

Var. Griffithii *Clarke, Flor. Brit. Ind.* iv, 183. An erect stout shrub with branches at length twining, leaves reniform, rarely orbicular-cordate sparsely grey-hirsute beneath, sepals obtuse, peduncles mostly 7-fld. Lettsomia ornata *Roxb. Hort. Beng.* 13; *Flor. Ind.*, ed. *Carey & Wall.* ii, 86 (*text*) and *Flor. Ind.* i, 496. Argyreia ornata *Sweet, Hort. Brit.* ed. ii, 373; *Brandis, For. Flor.* 343.

Sub-Himalayan region, from the Sivaliks to the Sikkim Terai: common. Sivaliks: *Falconer! Gamble!* Dehra Dun: *Vicary!* Nepal Terai *Wallich* 1369/1! Sikkim Terai at Jhenaikuri, at Tukria Jhar, and in the Sivoke Sal Forest, *Gamble.*

A complete account of the synonymy is given here as it is almost certain that these two plants, first clearly differentiated by Mr. Clarke, are really specifically distinct. The specimens in Griffith's Herbarium are from the Roxburghian plants of the Calcutta Botanic Garden. Roxburgh originally got the seeds from General Hardwicke who collected largely in the Western Himalayas and along their base, but did not, so far as can be ascertained, collect in Southern India. In any case the plant figured by Roxburgh in his *Ic. Ined.*, and described by him, is *not* the South Indian but the Sub-Himalayan plant. It is to the latter that Roxburgh's trivial name of 'ornata' ought therefore rightly to belong; but as its application to Roth's *Convolulus candicans* has now become stereotyped, it will be necessary to

allow the name *Rivea ornata* Choisy, to continue to designate the plant from Southern India, and be preferable to name the North-Indian one *Rivea Roxburghii*. *Convolulus Tarita* Ham. (*Wall. Cat.* n. 2253) is not at Calcutta; the plant was collected at Monghir: if it really be this species, it is probably not from a wild plant; the only *Rivea* reported, since Dr. Buchanan-Hamilton's time, from the Monghir Hills is *R. hypocrateriformis*, which is common throughout Behar.

3. ARGYREIA Lour.

3 *b*. Argyreia venusta *Choisy*, *Convolv. Or.* 36, and *DC. Prodr.* ix., 330; leaves ovate cordate, obtuse or acute, glabrous above grey tomentose beneath; corymbs peduncled dense; bracts narrow oblong-obtuse with a few ovate-acute larger intermixed, and usually one or two foliaceous large ones at base of corymb; corolla sparingly hairy without; berry brownish, fruiting sepals lanceolate-reflexed. Argyreia argentea var. venusta *Clarke*, *Flor. Brit. Ind.* iv., 185. Argyreia zeylanica var. hirsuta *Kurz*, *For. Flor. Brit. Burma*, ii., 215. Convolvulus festivus *Wall. Cat.* n. 1414 (*not* Argyreia festiva *Wall*, *Pl. As. Par*).

Bengal: Faridpur, *Clarke*. Burma: Pegu, *McLelland*, *R. Scott!* Ava, *Wallich!* Mandalay, etc., *King's Collectors!* common.

A large climber. *Leaves* usually 3–4 in. diam. (lower leaves sometimes as much as 7 in., diam.) quite glabrous above at all stages; petiole $2\frac{1}{2}$–4 in. long. *Peduncles* 2–4 in.; *corymbs* rather large; bracts usually $\frac{3}{4}$ in. by $\frac{1}{3}$ in. *Corolla* $1\frac{1}{2}$ in. to $1\frac{3}{4}$ in. long, tubular funnel-shaped, $1\frac{1}{4}$ in. wide at mouth; white or pale purple. *Berry* $\frac{1}{3}$ in. diam., globose, very hard and tough; sepals ultimately exceeding $\frac{1}{2}$ in., in fruit coriaceous deflexed.

A very distinct species, easily differentiated from *A. argentea*, with which Choisy and Clarke have associated it, by its leaves glabrous above, its totally different tomentum on the leaves beneath; its longer, narrower, more reflexed sepals, and its smaller hard fruit.

5. Argyreia Hookeri *Clarke*. Add to synonyms of *F. B. I.*:—Argyreia zeylanica var. populifolia *Kurz*, *For. Flor. Brit. Burma* ii., 215. Lettsomia ? Kurzii *Clarke*, *Flor. Brit. Ind.* iv., 196.

Add to localities:—

Nepal: *Scully!* Assam: Goalpara, *King's Collectors!* Burma: Chin Hills, *Prazer!* Pegu, *Kurz!* Andamans: Coco group, common, *Prain!* South Andaman, common, *E. H. Man! King's Collectors!*

6. Argyreia splendens *Sweet*.

Add to localities of *F. B. I.*:—

Naga Hills: *Clarke*, *Collett!*

7. Argyreia Championi *Benth.*, *Fl. Hong-kong*, 236 (1861). A. obtecta, *Clarke*, *Flor. Brit. Ind.* iv. 186 (1883). Convolvulus obtectus *Wall. Cat*, 1416. Rivea ? obtecta *Choisy*, *Convolv. Or.* 28 and *DC. Prodr.* ix., 326. Lettsomia Championi *Bth. & Hook. f.*, *Gen. Pl.* ii., 869.

VAR. typica. Add to localities of *F. B. I.*:—

BURMA: Karen Hills, *Mason!* Shan Hills *Collett!* Pegu Yomah, *Kurz!* ANDAMANS: Coco group, *Prain!* MALAY PENINSULA: Perak, *Scortechini!* DISTRIB.: China.

VAR. obtusifolia. Add to localities:—

ANDAMANS: Port Blair, very common; *E. H. Man! King's Collectors!*

This species, nearest to *A. splendens*, is well distinguished by the marks indicated by Mr. Clarke.

The two varieties are perhaps hardly separable, the original specimens of *A. Championi*, from Hongkong, which is not separable from Wallich's *Convolvulus obtectus*, being intermediate as to form of leaves between the two. The leaves in the first variety (which includes here all forms with acute leaf-apices) vary in size from 3 by 1½ in. (in Wallich's), or 3 by 2 in. (in Bentham's) original specimens, to 8 by 3½ in. in some of Kurz's (from the lower part of the plant) in Pegu specimens, and in shape from elliptic-oblong (which is usual) to sublanceolate in some from Tenasserim (*Gallatly*, 557) and Kedah (*Curtis*, 2582). In Gallatly's specimens, however, leaves of the usual type occur on the same branch with the narrow ones referred to. The base, moreover, which is usually cuneate is sometimes rounded, especially in the Pegu, the Karen, and some of the Tenasserim specimens; but the same branches bear leaves of the ordinary type. Similarly, in the Andamans, branches of VAR. *obtusifolia* (which here includes the forms with apices of leaves obtuse) bear at the same time some leaves with acute tips.

Both varieties vary in degree of tomentum, especially on the upper surface: those from Pegu, the Karen Hills, the Coco-group, and some, but not all, from Tenasserim and the Andamans being glabrous above; the others (including both Wallich's & Bentham's types) are sparsely hirsute. The tomentum beneath is usually brown, but is grey in the Hong-Kong plant, and in that from the Pegu Yomah. This closely resembles in flowering calyx and in foliage *Argyreia? mollis* Choisy, from Java, and from Sumatra (Teysmann, n. 4332, Hort. Bogor.) which has, however, a very different calyx (sepals sub-connivent) in fruit.

22. ARGYREIA DALTONI *Clarke.*

Add to localities of *F. B. I.*:—

MADRAS PRESY: Ganjam, at Kukubalu, alt. 500 ft., and in Rampa State, alt. 2000 ft., *Gamble*, n. 13766, 15995!

3*b*. BLINKWORTHIA CHOISY.

Erect or scandent or trailing shrubs with slender branches. *Leaves* oblong or elliptic sparsely strigose beneath. *Flowers* axillary solitary involucrate, pedicels short, usually four-bracteate, bracts small coriaceous. *Sepals* sub-orbicular sub-equal coriaceous, slightly accrescent. *Corolla* campanulate waxy-white, limb very slightly lobed. *Stamens* included; anthers oblong. *Ovary* 2-celled, surrounded by a prominent tubular disc; locules 2-ovuled; style filiform, stigmas 2, sessile globose. *Fruit* indehiscent, baccate, 4–1 seeded.—Species 2, Indo-Chinese.

1. BLINKWORTHIA LYCIOIDES *Choisy, Convolv. Or.* 48, t. 5 and *DC.*

Prodr. ix., 354; erect, branches numerous slender, short, rigid; flowers longer than the leaves, bracts narrowly oblong, pedicels very short. *Coll. & Hemsl., Journ. Linn. Soc.* xxviii., 94, t. 15. Convolvulus lycioides, *Wall. Cat.* 1390.

BURMA: Kyauk-Taloong, *Wallich!* Pegu Yomah, *Kurz!* Meiktila, *Collett!* Tagoung, Up-slay, *J. Anderson!* Pienmona, *King's Collectors!*

An erect bush, 6–10 feet; ultimate branches straight, virgate, 2–10 in.; *leaves* numerous $\frac{1}{2}$–$\frac{3}{4}$ in. by $\frac{1}{4}$–$\frac{1}{3}$ in. glabrous above sparingly hirsute beneath, as are the branches, peduncles and outside of the bracts; *peduncles* $\frac{1}{4}$ in., bracts $\frac{1}{8}$ in. long; pedicels 0–$\frac{1}{8}$ in. *Sepals* $\frac{1}{5}$ in. (fruiting $\frac{1}{4}$ in.) diam., glabrous, as are the pedicels. *Corolla* $\frac{3}{4}$ in., white. *Berry* $\frac{1}{4}$ in. diam.

2. BLINKWORTHIA CONVOLVULOIDES *Prain*; climbing or trailing, branches few slender long flexous; flowers shorter than the leaves, bracts ovate-oblong, pedicels distinct.

BURMA: Kendat *Prazer!* Myingyan *Prazer!*

A climber, over 40 feet long (Kendat specn.) or a prostrate creeper (Myingyan specn.), ultimate branchlets 10–18 in.; *leaves* sparse $1\frac{1}{2}$–2 in., by $\frac{1}{2}$–$\frac{3}{4}$ in., glabrous above sparingly hirsute beneath, as are the branches, peduncles, and bracts externally; *peduncles* $\frac{1}{4}$–$\frac{1}{3}$ in. *Sepals* $\frac{1}{4}$ in. diam. (in fruit $\frac{1}{3}$ in.) glabrous, as are the pedicels. *Corolla* $\frac{3}{4}$ in. campanulate, white. *Berry* $\frac{1}{3}$ in. diam.

This has distinctly larger leaves, bracts, sepals and fruit than *B. lycioides*, though the writer would not on these grounds alone claim for it the rank of a species. The habit, however, is too digeverent to admit of its treatment as a mere variety. This is not a case of what is under ordinary circumstances an erect shrub becoming a climber under suitable conditions; the field-notes made by the Calcutta Garden collector show that even when deprived of support this remains a weak, slender, prostrate species.

4. LETTSOMIA ROXB.

The difference between *Argyreia* and *Lettsomia* consists in the ovary being completely 4-celled in the former, only 2-celled in the latter; not infrequently, however, a partial dissepiment is found at the base of the cell in *Lettsomia*; the fruits are in both genera indehiscent.

In *Ipomoea* (§§ *Batatas* and *Quamoclit*) the ovary is, as in *Argyreia*, completely 4-celled; in *Ipomoea* (§§ *Calonyction*, *Aniseia*, and *Euipomoea*) the ovary, as in *Lettsomia*, is 2-celled, while in many of the species of *Euipomoea* the same partial dissepiment is found at the base of the cell. If, therefore, *Ipomoea* is to retain within it those plants of both classes where the fruit is dehiscent it seems essential that the plants of both classes where the fruit is not dehiscent should be included in one widened genus *Argyreia*. Choisy in his monograph of *Convolvulaceae* (*DC. Prodr.* ix,), includes Roxburgh's *Lettsomia* in *Argyreia*; but breaks up *Ipomœa* into as many genera as there are now recognised sections. Bentham and Hooker, (*Genera Plantarum*, ii.) on the other hand, recognise, and it seems very justly so, a widened *Ipomoea* which includes all of these, but separate *Lettsomia* from *Argyreia*. The opinion that *Lettsomia* and *Argyreia* deserve to be re-united has been formally expressed by Collett and Hemsley (*Journ. Linn. Soc.* xxviii, 95). With that opinion

the writer quite agrees. Whether it be accepted generally or not, it is certain that any system of arrangement of the *Convolvulaceæ* which recognises *Lettsomia* as a genus apart from *Argyreia*, must of logical necessity rehabilitate the various sections of *Ipomoea* as separate genera.

26. Sub-genus 1. Eulettsomia laxiflora *Prain;* leaves cordate mucronulate sparsely adpressed-hirsute, ultimately glabrescent above, rather thinly grey-tomentose beneath; peduncles long round white, tomentose; corymbs many-fld. lax axillary or arranged in large terminal panicles; bracts small lanceolate obtuse deciduous, outer sepals ovate, inner lanceolate rather narrower, all externally densely patently grey-hirsute. Argyreia laxiflora *Prain Mss.*

Upper Burma: Ava, *Wallich* (*Cat.* n. 1362 *in part*)! Ngyah Kyun, *J. Anderson!* Chin Hills, *King's Collectors!* Shan Hills, frequent, *King's Collectors!*

Scandent, branches closely white-tomentose; leaves $1\frac{1}{2}$–$2\frac{1}{2}$ in. long, 1–$1\frac{1}{2}$ in across; petioles $\frac{1}{2}$–$1\frac{1}{2}$ in., peduncles 2–4 in.; corymbs 4–12-fld. pedicels $\frac{1}{4}$–$\frac{1}{2}$ in; bracts $\frac{1}{6}$ in. *Sepals* $\frac{1}{3}$ in. long, outer $\frac{1}{4}$, inner $\frac{1}{6}$ in. wide. *Corolla* $\frac{2}{3}$ in., narrowly tubular below campanulate above, purple, hirsute externally. *Stamens* exserted. *Capsule* $\frac{1}{3}$ in. red, as are the fruiting sepals within.

This species is a member of the group to which *Lettsomia aggregata* (*Argyreia aggregata*, Choisy), *L. mysorensis*, and *L. bella* belong. The corolla is exactly like that of *L. aggregata*, the calyx is almost like that of *L. bella*. From the former it differs in having small bracts, from the latter in having long peduncles: from both it is distinguished by its lax cymes. From *L. mysorensis* it is distinguished by its inner sepals being as long as the outer.

3. Lettsomia bella *Clarke.*

Add to synonyms of *F. B. I.*:—

Argyreia tomentosa *Choisy* var. cordata *Choisy, DC. Prodr.* ix., 333 Convulvulus multibracteatus *Wall.* var. *β* cordata *Wall. Cat.* n. 1408/*β*. Convolvulus vestitus *Wall. Cat.* n. 1411.

Add to localities of *F. B. I.*:—

Nepal: *Wallich!* Ganjam: Baibali, *Gamble!*

4. Lettsomia bracteosa *Clarke.*

Add to description of *F. B. I.*:—

Corolla $1\frac{1}{2}$ in. long, campanulate; stamens included.

Add to synonyms:—

Argyreia tomentosa *Choisy, DC. Prodr.* ix., 333, (except as to the description of the corolla which refers to *Lettsomia aggregata* var. *osyrensis*). Convolvulus multibracteatus *Wall. Cat.* n. 1408/1 *in part.*

Of two gatherings issued under this name by Wallich, one is this species, the other is *Lettsomia aggregata* var. *osyrensis.*

7. Lettsomia hirsutissima *Clarke.*

VAR. typica; leaves rather widely ovate-cordate, bracts oblong. Add to localities of *F. B. I.*:—

UPPER BURMA: Myingin, *Prazer!*

VAR. Collettii *Prain;* leaves narrower, bracts lanceolate. L. strigosa *Coll. & Hemsl., Journ. Linn. Soc.* xxviii., 95, *not of Roxb.*

UPPER BURMA: Shan Hills at Fort Stedman, *Collett* n. 5! *King's Collectors!* Maymyo, *King's Collectors!*

This differs from the type in the leaves, which more resemble those of *L. setosa;* and in the bracts, which are quite unlike those of true *L. hirsutissima.* The inflorescence, calyx and corolla are quite like those of the true plant, but the corolla is reported in the Maymyo gathering to be white; that of true *L. hirsutissima* is said by Prazer to be purple. It is not impossible that this may ultimately prove to be specifically distinct.

What appears to be a third variety of this species is reported (but in fruit only) by our native collectors from the Ruby Mines District. The bracts in this plant are as in VAR. *typica*, but the tomentum is as in *L. setosa.*

8. LETTSOMIA STRIGOSA *Roxb., Flor. Ind.*, ed. *Carey & Wall.* ii., 80 (1824), *not of Hort. Beng.* 13; *Clarke, Flor. Brit. Ind.* iv., 193 (*excluding the Java plant and the synonym* L. capitata *Miq.*) Argyreia capitata *Arn.*, ex *Choisy, Convolv. Or.* 41 [1834], and *DC. Prodr.* ix., 332 (*in part*); *Kurz, For. Flor. Brit. Burma*, ii., 216 (*in part*). Ipomoea capitata *Roem. & Schult. Syst.* iv., 238 [1819], *not of Choisy.* Convolvulus capitatus *Vahl, Symb.* iii., 28 [1794]. C. capitiformis *Poiret* in *Lamk. Encyc. Meth., Suppl.* iii., 469. C. strigosus *Wall. Cat.* 1365/1, 1365/D, 1365/E partly.

Add to localities of *F. B. I.*:—

CHITTAGONG: Kodala Hill, etc., common, *King's Collectors!* BURMA: Arracan, at Sandoway *Marcgrave!* Pegu, *Kurz!* Shan Hills, common, *King's Collectors!* ANDAMANS: Coco Islands, *Prain!* DISTRIB. Yunnan (*J. Anderson!*)

Though less common in Indo-China than the plant described by Mr. Clarke as *L. peguensis*, this is widely spread throughout Upper Burma; it does not appear to extend to Tenasserim where its place is taken by *L. peguensis.* This forms part of Kurz's *Argyreia capitata*—which is thus co-extensive with Choisy's, but it is not Miquel's *Lettsomia capitata* which is founded on a Java plant collected by Horsfield that, so far as the Calcutta specimen goes, is undoubtedly *L. peguensis* Clarke.

There is no doubt, from the description given by its author, that this is *Convolvulus capitatus* Vahl. Dr. Wallich, himself one of the editors of the first edition of Roxburgh's *Flora Indica*, admits that this, though the *Lettsomia strigosa* of that work, is *not* the *Lettsomia strigosa* of the *Hortus Bengalensis*, which was issued (*Cat.* n. 1404/1) as *Convolvulus barbiger* Wall.; unfortunately Wallich associated with this a different plant (or rather a mixture of two) from Burma (*Cat.* n. 1404/2). One of these Choisy has made the type of his *Argyreia barbigera* (*Lettsomia barbigera* Clarke) the other has dropped out of notice as completely as has the plant that Wallich really intended by *Convolvulus barbiger.*

9. LETTSOMIA PEGUENSIS *Clarke, Flor. Brit. Ind.*, iv., 193 [1883]. L. strigosa *Roxb. Hort. Beng.*, 13 [1814] ex *Wall. in Cat. Lith. sub.* n. 1404. L. capitata *Miq., Flor. Ind. Bat.*, ii., 591 [1856]. Argyreia capitata *Choisy, DC. Prodr.* ix. 332 [1845] (*in part and excluding* VAR. *β.* conferta); *Kurz, For. Flor. Brit. Burma* ii., 216 (*chiefly*). Convolvulus strigosus *Wall., Cat.* 1365/2, 1365/C, 1365/E partly. Convolvulus barbiger *Wall., Cat.* 1404/1, 1404/2 *in part only.* Argyreia barbigera *Choisy, Convolv. Or.* 42 and *DC. Prodr.* ix., 332; *Brand. For. Flor.* 343.

Add to localities of *F. B. I.*:—

MALAY PENINSULA: Perak, common, *Scortechini* n. 1628! Kunstler n. 2622! 8627! DISTRIB. Java.

Much confusion has been caused owing to Dr. Wallich having in the first place mixed in his distribution of *Lettsomia strigosa* (*Cat.* n. 1365) that species and *L. peguensis;* and again in his differentiation of *L. peguensis* (*Cat.* n. 1404) having included with it another species whose presence has helped to obscure the identity of this.

When the somewhat tangled synonymy is unravelled, we find that what constitutes the *Lettsomia strigosa* of the *F. B. I.* is really without a name, while the plant that Mr. Clarke has there for the first time satisfactorily differentiated is already provided with two names in the genus *Lettsomia.*

The name *Lettsomia strigosa* was in reality first applied to what is in the *F. B. I.* named *L. peguensis*, a plant which, at the time the name was applied to it by Roxburgh, was being cultivated in the Calcutta Garden from seed received from "the Straits." But to re-transfer the name to that species now (though doubtless the act will commend itself to pedantic purists in nomenclature) and to coin a new name for *L. strigosa* as limited in the *F. B. I*, would—in view of the fact that Roxburgh under the name has written a careful description which can only apply to the "*F. B. I.*" *L. strigosa*—be, in the writer's opinion, not only unnecessary but reprehensible. The name *L. strigosa* is better kept for the original *Convolvulus capitatus* of Vahl, even though we know that its first application was to *L. peguensis.* The name *L. capitata* at all events is not available since that name was employed by Miquel to designate precisely the plant that is *not* Vahl's *Convolvulus capitatus.* At the same time it does not seem necessary to replace the name *L. peguensis* by Miquel's one of *L. capitata*, though it is older by nearly 30 years than Mr. Clarke's one and though we know that it applies precisely to *L. peguensis.* For it has to be recollected that *L. capitata* Miq. is *not* the same as *Convolvulus capitatus* Vahl, and therefore is not equivalent to *Argyreia capitata* Arn.—the name that will have to be applied to *Lettsomia strigosa* of the *F. B. I.* when *Lettsomia* is once more merged in *Argyreia;* and that though it is *included* in *Argyreia capitata* as that species has been understood by Choisy and by Kurz, it is not *equivalent to* the species of these two authors.

When *Lettsomia* is again merged in *Argyreia* the *Lettsomia peguensis* of the *F. B. I.* (L. strigosa, *Roxb., Hort. Beng.* not *Flor. Ind.*) must—as will be shown in the writer's note on the next species—be known as *Argyreia barbigera* Choisy.

The further question whether these two plants are really specifically (they certainly are at least varietally) distinct is one that cannot be raised here; it can only be properly discussed by a monographer of the combined genera, though it is the writer's opinion that they should be reunited.

10. LETTSOMIA BARBIGERA *Clarke, Flor. Brit. Ind.* iv., 194, *excluding all the synonyms.*

The writer has failed to discover what this species, which is not represented in the Calcutta Herbarium, really is. The localities given are "ASSAM; *Jenkins*," and "BRITISH BURMA: Prome, *Wallich*." To these Mr. Clarke has since added MANIPUR (*Journ. Linn. Soc.* xxv., 49). The last-mentioned gathering is not represented here; all of Capt. Jenkins' "Assam" specimens at Calcutta are referable to other species; the plant collected by Wallich at Prome and issued as part of *Cat.* n. 1404 belongs to a species which, Dr. Stapf informs the writer, is not Mr. Clarke's *Lettsomia barbigera* as represented in the Herbarium at Kew.

Wallich's *Convolvulus barbiger* (*Cat.* n. 1404) consists of two parts; *viz.*, 1404/1, a plant cultivated in the Botanic Garden at Calcutta and stated expressly by Wallich to be *Lettsomia strigosa* Roxb. of the *Hortus Bengalensis* as opposed to the plant so named in the *Flora Indica;* and 1404/2, made up of two gatherings from Burma, the first from the Irrawaday Delta, the second from Prome. Of the three gatherings which therefore go to make up *Convolvulus barbiger* Wall. the *F. B. I.* formally excludes two and retains only the one from Prome: *Cat.* n. 1404 is therefore only quoted *in part.* The part which is quoted is *not* the first sheet, which (in the event of any confusion having occurred) must be taken as the type, and indeed only forms a portion of the remainder. As it is specifically distinct from the type of *C. barbiger* that name must therefore be excluded entirely from the synonymy.

It is not *Pharbitis barbigera* Don (*Gen. Syst* iv., 262) at all. That plant is a native of North America and is a true *Ipomoea.*

Not being *Convolvulus barbiger* of Wallich, it cannot be *Argyreia barbigera* of Choisy, for though that author somewhat unaccountably ignores altogether *Wall. Cat.* 1404/1, which is the true type of Wallich's plant, he has written a description that applies only to the gathering of 1404/2 from the Irrawaday Delta which is the same as 1404/1 and which is, therefore, as explained in the note under the preceding species, precisely = *Lettsomia peguensis* Clarke.

Choisy was not unaware of the fact that the remaining gathering of 1404/2 differed from the one to which his description alone applies. He speaks of it as a variety (though he does not distinguish it by name) with "leaves hardly cordate, peduncles short and few-fld., and leaves, at least when adult, less tomentose."

The citation of *Pharbitis barbigera* Don as a synonym originated with Choisy; who errs also in speaking of the species as coming from "Prome ad aestuar. Irrawady" whereas Wallich explicitly says in his *Catalogue* "Aestuar. Irrawadi; et Prome;" Choisy's citation of locality therefore reads as if he supposed that Prome was situated in the delta of the Irrawady. At all events it does not make the fact clear that Wallich has two gatherings under 1404/2, still less that these gatherings represented two different species.

Since Wallich's time the Prome plant referred to above has been collected on the Pegu Yomah by Kurz, and more recently still in Upper Burma and the Shan Hills by native collectors sent from the Calcutta garden. One of these latter specimens which Dr. Stapf has kindly compared with the Kew material of *Lettsomia barbigera* Clarke, he has been able to assure us differs from that species. Since, therefore, one part of Wallich's *Cat.* n. 1404 agrees with Mr. Clarke's plant, it is evident that Dr. Wallich must have issued three things under that number, *viz.* 1. *Lettsomia peguensis* = 1404/1 and 1404/2, (*in part*), 2. *Lettsomia barbigera* = some part of 1404/2, from Burma, and by Mr. Clarke's citation, some

part of the Prome gathering thereof; and 3. *Lettsomia confusa* = 1404/2 from Prome as represented at Calcutta—part of the species now to be described.

10 *b*. LETTSOMIA CONFUSA *Prain;* leaves ovate acute, base subcordate or truncate, sparingly hirsute to nearly glabrous on both surfaces, peduncles short, 1–3-fld., bracts $\frac{1}{4}$–$\frac{1}{3}$ in. oblong obtuse adpressedly strigose deciduous, sepals ovate-obtuse or sub-acute, longer than the bracts, densely adpressedly strigose. Argyreia confusa *Prain Mss.*

VAR. typica; peduncles glabrous usually capitately 3-fld., nearly as long as the glabrous petioles.

BURMA: Shan Hills, *King's Collectors!* Makhoye Hill, *King's Collectors!*

VAR. brevipes *Prain;* peduncles puberulous usually 1-fld., much shorter than the pubescent petioles.

BURMA: Prome Hills, *Wallich* (*Cat.* n. 1404/2 in part in Herb. Calcutta)! Pegu Yomah, in Eng forests, *Kurz* n. 1087!

A slender climber with glabrous branches. *Leaves* long petioled 1–3 in. by $\frac{1}{2}$–$2\frac{1}{2}$ in., acute or acuminate, petioles slender, in VAR. *typica* 2–$2\frac{1}{2}$ in. long, in VAR. *brevipes* 1–2 (sometimes even 4) in. long. *Peduncles* very slender, in VAR. typica 2 in. in VAR. *brevipes* 0–$\frac{1}{2}$ in.; bracts herbaceous $\frac{1}{5}$ in. across: pedicels 0–$\frac{1}{8}$ in. *Sepals* $\frac{1}{2}$ in., coriaceous, enlarging in fruit, accrescent. *Corolla* $1\frac{1}{2}$ in. externally setose, white (*King's Collector*) or purple (*Kurz*). *Stamens* included. *Fruit* globose, pink, $\frac{1}{3}$ in. diam. 4-seeded, pericarp thin, papery.

A very distinct species with the facies of *Lettsomia setosa* VAR. *minor*, but with a very different fruit which indicates a closer natural relationship to *L. strigosa* than to *L. setosa*. That portion of *Convolvulus multibracteatus* Wall. (*Cat.* 1404) which is not *Lettsomia aggregata*, seems nearly related to VAR. *brevipes:* it has a very similar corolla and fruit but the leaves are obtuse with rounded bases, and the bracts are very different, as is the shape of, and the tomentum on, the sepals. If *Lettsomia bracteosa* is the same in reality as *Convolvulus multibracteatus* (*Argyreia tomentosa* Choisy), that species must be removed from the group of species with exserted stamens, and placed next to this plant.

12 *b*. LETTSOMIA LONGIFOLIA *Coll. & Hemsl., Journ. Linn. Soc.*, xxviii, 95; leaves narrowly oblong-lanceolate acuminate, base rounded or slightly cuneate, glabrous except the midrib above, sparsely strigose throughout beneath; heads few-fld., axillary shortly peduncled, bracts large oblong-lanceolate, persistent.

BURMA: Shan Hills, at 3000 feet, *Collett!* Maymo, *King's Collectors!* Makhoye, *King's Collectors!*

A large climber. *Leaves* 5–8 in. by $\frac{3}{4}$ in., petiole $\frac{1}{2}$–$\frac{3}{4}$ in. *Peduncles* $\frac{3}{4}$–1 in., hirsute; bracts obtuse or subacute, reddish-purple, strigose beneath 1–$1\frac{1}{4}$ in. long. *Sepals* equal oblong-orbicular, $\frac{1}{3}$–$\frac{1}{2}$ in., coriaceous, dark red within, glabrous. *Corolla* $1\frac{1}{4}$ in. glabrous externally, dark purple. *Fruit* depressed, subglobose, dark red, usually 2-seeded, $\frac{1}{3}$ in. long, $\frac{1}{2}$ in. diam.

A very distinct species; most nearly allied to *Lettsomia atropurpurea*.

13. LETTSOMIA SIKKIMENSIS *Clarke, Flor. Brit. Ind.* iv., 194. Argyreia elliptica *Choisy, DC. Prodr.* ix., 330 (*in part, and as to the Burmese locality*). A zeylanica *Kurz.* (*not of Gaertn.*) VAR. peduncularis *Kurz, For. Flor. Brit. Burma*, ii., 215. Convolvulus peduncularis *Wall. Cat.*, 1417.

EASTERN HIMALAYA: Sikkim, *Clarke!* Akha Hills, *King's Collectors!* ASSAM: Naga Hills, *Masters!* Khasia, *Hooker!* Cachar, *Keenan.* BURMA: Taong Doung, *Wallich!* Ruby Mines, *King's Collectors!*

The chief distinction between *Lettsomia sikkimensis* and *Lettsomia elliptica* (*Argyreia elliptica* Choisy) is the size of the flowers and fruit. Recent specimens of *L. elliptica* show corollas nearly as long as in the Himalo-Burmese plant; the calyx and fruit however are always larger in the latter than in the Peninsular species. Possibly Choisy is right in uniting the two, but they should at least be distinguished varietally: in any case the species ought to be placed near each other.

14. LETTSOMIA RUBENS *Clarke*, has been re-transferred to *Ipomoea*.

14 *b*. LETTSOMIA PALLIDA *Prain;* leaves ovate-oblong acute, or orbicular-ovate mucronulate, glabrous except for a few hairs on the midrib above, sparsely ashy-pubescent beneath as are the petioles, peduncles and branches; peduncles short, corymbs small few-fld., bracts minute caducous linear-oblong, sepals $\frac{1}{4}$ in. outer orbicular inner broader than long, glabrous. Argyreia pallida *Choisy, Convolv, Or.* 34 and *DC. Prodr.* ix., 330; *Coll. & Hemsl., Journ. Linn. Soc.*, xxviii, 94. Convolvulus pallidus *Wall., Cat.* 1418.

BURMAH: Between Yandabu and Paghanmyo, on the road to the Petroleum Wells, *Wallich!* Mandalay, *J. Anderson!* Pwau-olwe, *Collett!* Trongla, *King's Collectors!* Shan Hills, at Meiktila, *Collett! King's Collectors!*

A large handsome climber. *Leaves* 2–3$\frac{1}{2}$ in. by 1$\frac{1}{2}$–2$\frac{1}{2}$ in., base usually slightly cordate but often truncate, sometimes shortly cuneate; petioles $\frac{1}{8}$–1$\frac{1}{4}$ in. *Peduncles* $\frac{1}{4}$–1 in., usually about $\frac{1}{2}$ in., slender. *Corymbs* 3–12-fld.; bracts $\frac{1}{8}$ in. pubescent externally, early caducous, pedicels $\frac{1}{4}$ in. or less, pubescent. *Sepals* glabrous except along the margins even in bud; slightly accrescent, coriaceous. *Corolla* $\frac{7}{8}$ in. long, $\frac{3}{4}$ in. wide at mouth, campanulate, glabrous externally, white. *Stamens* included, inserted near the base of corolla tube; filaments glabrous, anthers oblong, not twisted. *Disc* prominent; *ovary* 2-celled; stigmas 2, subsessile globose. *Fruit* a hard brown indehiscent 2-seeded berry, depressed globose, $\frac{1}{4}$ in. long, $\frac{1}{8}$ in. across; seeds 1 in each loculus, black, smooth.

This species, not taken up in the *F. B. I.*, is dealt with, in passing, in Sir Henry Collett's list of Shan Hill plants. More recent and very complete suites of specimens received from Dr. King's native collectors from various parts of Upper-Burma render it possible to give a full description of the species and to show that while it really has an indehiscent fruit the ovary is only 2-celled. As already said, the writer believes that *Lettsomia* must be again united to *Argyreia* when Choisy's name will once more be applicable. In the meantime, and so long as generic rank is accorded to *Lettsomia* in India, it is necessary to indicate the fact that this is not a

genuine 4-celled *Argyreia*. The flowers a good deal resemble those of *Ipomoea staphylina*, which has, however, longer, many-fld. corymbs, a dehiscent capsule and hairy seeds.

15 *b*. LETTSOMIA MASTERSII *Prain;* leaves large ovate-cordate acute or acuminate, sparsely hirsute above densely or sparsely softly grey tomentose beneath, heads of many-fld. dense dichotomous cymes shortly peduncled axillary, bracts long ligulate or lanceolate persistent. Argyreia Mastersii *Prain Mss.*

ASSAM: Naga Hills, *Masters! Collett!* Garo Hills, *King's Collectors!* BURMA: Chin Hills, *King's Collectors!*

An extensive climber, stems, petioles and peduncles densely rusty-tomentose. *Leaves* 4–10 in. by $2\frac{1}{2}$–7 in., towards ends of branches with base sometimes truncate not cordate; petiole $\frac{3}{4}$–1 in. *Peduncle* $\frac{1}{2}$–$\frac{3}{4}$ in., bracts very many outer ligulate $1\frac{1}{4}$–$1\frac{1}{2}$ in. long, $\frac{1}{8}$–$\frac{1}{6}$ in. wide throughout, sometimes one or two foliaceous near base of cyme, sparsely hirsute above densely tomentose beneath, and with longer spreading hairs along margins; inner lanceolate covered externally with spreading hairs. *Sepals* ovate acuminate, $\frac{1}{2}$ in. (in fruit $\frac{3}{4}$ in.) long, $\frac{1}{4}$ in. across, glabrous within, clothed with long spreading hairs externally, firmly coriaceous. *Corolla* (expanded not seen) in bud externally hirsute. *Berry* ovoid, $\frac{1}{3}$ in. long $\frac{1}{4}$ in. diam., dark-purple completely hidden within the conniving sepals.

A very distinct species, nearest to *L. barbata*, but with larger bracts, more open heads and a very different calyx. The flower is reported (by a native collector, of the Chin Hill specimens) to be yellow.

SUB-GENUS 2. MOORCROFTIA.

16 *b*. LETTSOMIA SCORTECHINII *Prain;* leaves petioled ovate-acute glabrous above, very sparsely hirsute with rusty hairs beneath, peduncles long, bracts deciduous, corymbs few-fld., sepals orbicular minutely adpressed grey-tomentose externally. Argyreia Scortechinii *Prain Mss.*

MALAY PENINSULA: Perak, *Scortechini!*

A strong climber; branches and peduncles rusty brown. *Leaves* 2–3 in. by 1–2 in., very thick, base rounded; petiole $\frac{1}{2}$–$\frac{3}{4}$ in. minutely rusty pubescent. *Peduncles* 2–5 in., corymbs 3–5-fld.; bracts caducous before the flowers expand. *Sepals* $\frac{1}{4}$ in., in fruit $\frac{1}{3}$ in., the inner pair larger than the three outer. *Corolla* $\frac{5}{8}$ in. densely fulvous strigose outside. *Fruit* sub-spherical, $\frac{1}{2}$ in. diam., tip slightly umbonate, smooth, nearly dry, lower $\frac{3}{4}$ths closely embraced by the calyx.

Closely related to *L. rubicunda*, but with fewer-fld. cymes, rather smaller corolla and fruit, somewhat different calyx, and very different leaves and tomentum.

16 *c*. LETTSOMIA RIDLEYI *Prain;* leaves large elliptic acuminate quite glabrous above tomentose especially on the nerves beneath, peduncles usually short, cymes sub-capitate surrounded by large ovate acute foliaceous persistent bracts, sepals sub-equal ovate lanceolate ashy-pubescent externally. Argyreia Ridleyi *Prain Mss.*

VAR. typica; leaves rather larger, $5\frac{1}{2}$ by $3\frac{1}{2}$ in., outline regularly

elliptic, sparsely hirsute except on the nerves beneath, as are the petioles, pedicels and bracts externally.

MALAY PENINSULA: Johore, at Kota Tinggi, *Ridley*, n. 4214! Chan Chin, *Lake & Kelsall!*

VAR. velutina *Prain;* leaves somewhat smaller, 4 in. by $2\frac{1}{2}$ in., slightly narrowed from above the rounded base, densely hirsute especially on the nerves beneath, as are the petioles pedicels and bracts externally.

MALAY PENINSULA: Singapore, at Bukit Mandan, *Ridley*, n. 1635!

Scandent, branches sparsely ashy-hirsute. *Leaves* petioled, petioles 1–3 in. *Peduncles* 2–6 in., heads $1\frac{1}{2}$ in. diam., 8–10-fld., bracts sessile, quite glabrous above. *Sepals* $\frac{1}{3}$ in. corolla $1\frac{1}{4}$ in. tubular funnel-shaped, hirsute externally. *Berry* $\frac{1}{2}$ in. by $\frac{1}{3}$ in., ovoid, two-thirds embraced by calyx.

Easily distinguished by its large bracts from all hitherto reported *Moorcroftias* except from *L. Maingayi*, where however the heads are sessile, or nearly so, the flowers are larger, and the bract and sepals much larger, longer and more lanceolate A very distinct species.

17. LETTSOMIA MAINGAYI *Clarke*; *Ridley*, *Trans. Linn. Soc.* n.s., iii. 323.

Add to description of *F. B. I.*:—

Bracts dark purple above; corolla $2\frac{1}{4}$ in. long, tubular, slightly enlarging upwards, purple, the folds whitish, hairy outside glabrous within; filaments inserted near base of tube, glandular-hairy at the thickened base.

Add to localities of *F. B. I.*:—Perak, *Scortechini!* Pahang, *Ridley*.

19. LETTSOMIA ADPRESSA "*Miq.*"

Add to localities of *F. B. I.*:—

PERAK: Larut, etc., very common, *Scortechini* n. 1280! *Kunstler* n. 2457! 5400! *Wray* n. 1914! 3298! 3961!

Recent Penang gatherings are *Curtis* n. 318! *Kunstler* n. 1324! n. 5271!

Corolla dull pale claret (*Wray*) or pale pink and white (*Kunstler*) or white with claret stripes (*Wray*). *Fruit* at first green with a reddish tint, becomes bright pink and at length red-brown when ripe.

20. LETTSOMIA PENANGIANA "*Miq.*"

VAR. typica, leaves thinly coriaceous, secondary nerves obscure.

Add to localities of *F. B. I.*:—

PERAK: Larut, etc., very common, *Scortechini* n. 1147! *Kunstler* n. 2048! n. 2574! n. 5339! *Curtis* n. 2034! *Wray* n. 2095! 2334! 2601! 2733! (A recent Penang gathering is *Curtis* n. 1586!)

The *corolla* is as figured by Choisy; as a rule the terminal flower of the cyme is distinctly larger than the others; in color bright claret (*Wray*) or purple (*Kunstler*); the fruit a beautiful rose-pink (*Wray*) bluish red (*Kunstler*) or purplish (*Curtis*). The leaves beneath are very characteristically glandular-punctulate.

VAR. reticulata *Prain*; leaves thicker, secondary nerves beneath very distinct.

PERAK: Larut, *Kunstler* n. 8544!

The peduncles and pedicels of this plant are rather shorter than in *L. penangiana*. The sepals though as long are rather narrower, and the corolla—described by Kunstler as "waxy white, pale blue inside"—is but two-thirds the length and only half the width of that of *L. penangiana*. But the leaves have exactly the sparse adpressed tomentum of the type and have the same characteristic glandular punctulation, while the fruit—described by *Kunstler* as "rich pink"—is indistinguishable from that of *L. penangiana*; so that this form, though very distinct, does not appear to deserve more than varietal rank.

21. LETTSOMIA? KURZII *Clarke*.

This plant is shown by Kurz's specimens to be *Argyreia Hookeri* Clarke. Mr. Clarke had not an opportunity of examining the material from which Mr. Kurz described his *Argyreia xeylanica* (*For. Flor. Brit. Burma* ii., 215). That description is not very clear and the three varieties recognised by Mr. Kurz refer, as the sheets named by him in the Calcutta Herbarium show, to as many very distinct species; VAR. *populifolia* is *Argyreia Hookeri* Clarke, and is not = *Argyreia populifolia* Gaertn.; VAR. *hirsuta* is *Argyreia venusta* Choisy, and is not = *A. populifolia* VAR. *hirsuta* Thwaites; VAR. *peduncularis* is *Convolvulus peduncularis* Wall., which is the same thing as *Lettsomia sikkimensis* Clarke.

22. LETTSOMIA CURTISII *Prain*; leaves large elliptic shortly acuminate glabrous except for a few hairs on the midrib above, sparingly hispid beneath, peduncles long, cymes compound subumbellate, bracts deciduous, sepals coriaceous the three outer sparingly hirsute rounded, the two inner deeply emarginate glabrous. Argyreia Curtisii *Prain Mss.*

MALAY PENINSULA: Selangor at Kwala Lampar, *Curtis* n. 2158!

Scandent; branches brown glabrous. *Leaves* long-petioled 4–5 in. by $2\frac{1}{2}$–3 in., petioles 2–3 in. glabrous. *Peduncles* 4–10 in. brown glabrous, bracts deciduous, cymes rather open, $2\frac{1}{2}$–3 in. diam., 12–16-fld. *Sepals* $\frac{1}{4}$ in. *Berry* ovoid, fleshy, $\frac{3}{4}$ in. by $\frac{1}{2}$ in., the lower third only embraced by the calyx. *Corolla* not seen.

A very distinct species, easily recognisable by its emarginate inner sepals.

23. LETTSOMIA KUNSTLERI *Prain*; leaves petioled large elliptic acuminate, quite glabrous above sparsely strigose-hirsute beneath; nerves more densely hirsute as are the petioles, peduncles and young branches: bracts small linear-lanceolate hirsute deciduous, peduncles long, cymes loose 12–20-fld., flowers small, sepals orbicular subequal, 3 outer pubescent the others glabrous externally. Argyreia Kunstleri *Prain Mss.*

MALAY PENINSULA: Perak; Goping, *Kunstler* n. 732! Chanderiang, *Kunstler* n. 5672! Kota, *Wray* n. 2856! DISTRIB. Sumatra.

A slender climber "50–80 feet long" (*Kunstler*). *Leaves* $3\frac{1}{2}$-$4\frac{1}{2}$ in. by 2–$2\frac{1}{2}$ in., glossy above (*Kunstler*), petioles 1–$1\frac{1}{2}$ in. *Peduncles* 5–8 in, pedicels $\frac{1}{4}$–$\frac{1}{3}$ in., cymes 2–3 in. across, bracts $\frac{1}{3}$ in., *sepals* $\frac{1}{6}$ in. the outer, (originally hirsute) three ultimately glabrescent. *Corolla* $\frac{1}{2}$ in. or less, white outside, bright pink or red within, externally hirsute. *Berry* $\frac{1}{2}$ in. by $\frac{1}{3}$ in., the lower fourth embraced by the calyx.

A very distinct *Moorcroftia* perhaps nearest to *I. rubicunda*, but well distinguished by its small flowers from all the other species of the section. With this the writer identifies *Forbes* n. 2530, from Sumatra (in fruit only), which has, however, rather longer petioles and less sharply acuminate leaves than the Perak plant, while the midrib near the base of the leaf is sparsely hirsute above. Perhaps Forbes's plant should be considered varietally distinct; it does not, however, appear to the writer to deserve specific rank.

5. IPOMOEA Linn.

Sub-genus I. Calonyction. Key to the Indian Species.

* Sepals lanceolate (glabrous); seeds glabrous; (leaves glabrous above and below; capsule ½ in. diam.) :—
  § Corolla white, tube linear, glabrous within; *stamens exserted; sepals cuspidate.* ... *I. bona-nox* var. *grandiflora.*
  §§ Corolla *purplish*, tube infundibuliform, hairy within; stamens included; *sepals lanceolate not cuspidate* ... *I. muricata.*

** Sepals ovate; seeds hairy; (stamens included) :—
  ¶ Sepals glabrous; leaves glabrous above and below; (hairs on seeds short; capsule 1 in. diam.) :—
    § Corolla-tube linear ... ... *I. glaberrima.*
    §§ Corolla-tube *wide-infundibuliform* ... *I. longiflora.*
  ¶¶ Sepals hirsute; leaves beneath and petioles hirsute; corolla-tube linear :—
    § *Branches pilose*, leaves deep-cordate. Corolla long; hairs on seeds short; capsule ½ in. diam. ... ... *I. yomæ.*
    §§ Branches glabrous, leaves shallow-cordate. Corolla rather short; *hairs on seeds very long*; capsule 1 in. diam. ... ... *I. jucunda.*

1. Ipomoea bona-nox Linn.—The Moon-flower.

var. *grandiflora* C. B. Clarke.

Add to distribution of *F. B. I.* :—

Australia: Baron Von Mueller has sent (under the name *I. longiflora*) to Herb. Calcutta excellent specimens of *I. bona-nox* with the cuspidate sepals and exserted stamens characteristic of the species.

As in true *I. bona-nox*, which hardly differs varietally from this, the stamens are always far exserted. This is well shown in *Rheede, Hort. Malabar*, xi., t. 50 which therefore belongs here and not to the coast moon-flower, where the stamens do not reach beyond the junction of the mid and upper thirds of the tube. Consequently *Ipomoea grandiflora* Lamk, which is based on Rheede's figure, also comes here as to the citation: the diagnosis however applies to *I. yomæ* alone of Indian *Calonyctia.*

2. Ipomoea muricata *Jacq.*—The Purplish Moon-flower.

Add to localities of *F. B. I.* :—

CENTRAL INDIA, near Goonah, *King !* "Montes Silhet," (KHASIA or JAINTEA) *Wallich, mixed with* Convolvulus asper (*I. yomae*) *under* Cat. n. 1388 ! UPPER BURMA: Shan Hills, *King's Collectors !*

Add to distribution of *F. B. I.* :—

Persia (*fide* Roxburgh) ; S. China.

3. IPOMOEA GLABERRIMA *Boj.* ex. *Bouton* in *Hook. Journ. Bot.* i., 357 [1834] ; *Baker., Flor. Maurit.* 211. I. grandiflora *C. B. Clarke* in *Flor. Brit. Ind.* iv., 198, *not of Lamk. either as to description or as to synonyms cited, and excluding the synonyms* I. longiflora, I. macrantha, I. tuba ; Convolvulus tuba ; Calonyction grandiflorum *and* C. longiflorum, *which are all* = I. longiflora *R. Br.* (*I. trichosperma* Bl.) : *also the synonym* I. jucunda *which is a distinct species : also the synonyms* Convolvulus grandiflorus *Linn. f.* ; Casper ; Calonyction asperum, *which are* = I. Yomæ : *also the synonym* C. pseudo-muricatum, *which is not, by its description, distinguishable from* I. muricata.—The COAST MOON-FLOWER.

Substitute for localities of *F. B. I.* :—

SEA-SHORES OF INDIA : Travancore, at Quilon *Rottler !* Laccadives, Betrapar *Hume ! Alcock !* Ceylon, at Dichwale, close to the sea, *Thwaites C. P.* n. 3536 ! Coromandel coast, *Wight !* Sunderbuns, *Kurz ! Heinig !* Arracan coast, at Copal, *Kurz !* in Diamond Island, *Prain !* Andaman Group : Great Coco, *Prain !* Little Coco, *Prain !* Narcondam, *Prain !* South Andaman, at Perseverance Bay, *Kurz !* Rungachang, *Prain !* Navy Bay, Port Mouat, and many other points on the coast, *King's Collectors !* Nicobars : *E. H. Man !*

The plant common in the Deccan is *I. longiflora* ; that from Dolosbage district, Ceylon is *I. jucunda.*

This species is easily recognised by its close general resemblance to the true moon-flower, and as easily differentiated by its habitat, by its included stamens, by its blunt sepals, and by its hairy seeds. From *I. longiflora* (*I. trichosperma*) it is as easily differentiated by its leaves never being lobed or hastate ; though sometimes those of *I. longiflora* are entire and therefore not distinguishable from those of *I. glaberrima*, the corolla-tube of *I. longiflora* is rather widely funnel-shaped below the limb, while that of *I. glaberrima* is straight as in the true moon-flower. Kurz (*For. Flor. Brit. Burma* ii., 218) in his *Ipomoea campanulata*, which is mainly *Argyreia tiliaefolia*, has also included this plant.

4. IPOMŒA LONGIFLORA *R. Br., Prodr. Flor. Nov. Holl.* 484 [1810] (*not* I. longiflora *Humb. & Bonpl.* ex. *Willd.* in *Enum. Hort. Berol*, i., 207 [1809] *which is* I. bona-nox *Linn.*) ; *Benth., Flor. Austral.* iv., 418. I. latiflora *Roem. & Schult., Syst.* iv., 240 [1819]. I. macrantha *Roem. & Schult. Syst.* iv., 251 [1819]. I. tricosperma *Bl. Bijdr.* 710 [1825] ; *C. B. Clarke* in *Flor. Brit. Ind.* iv., 198 (*excluding the synonym* I. Yomae *which is a distinct species*). Convolvulus latiflorus *Desr.* in *Lamk. Encyc. Meth.*

iii., 561 : C. grandiflorus *Jacq.*, *Hort. Vindol.* iii. t. 69 (*not of Linn. fil. even in part*) : C. longiflorus *Spreng.*, *Syst* i., 595. Calonyction speciosum *Choisy*, *Conv. Or.* 59 VAR. α. vulgare, *DC. Prodr.* ix., 345 *in part, and* VAR. ς. laeve, *Prodr. l. c.*, *altogether ; Miq.*, *Flor. Ind. Bat.* ii., 596 (*where the same confusion exists*) : C. trichospermum *Choisy*, *Conv. Or.* 60, and *DC. Prodr.* ix., 346 ; *Miq.*, *Flor. Ind. Bat.* ii., 598. C. diversifolium *Hassk. Flora* (1842) *Beibl.* p. 189 ; *Pl. Jav. Rar.* 523—The WIDE-TUBED MOON-FLOWER.

Add to localities of *F. B. I.* :—

WESTERN INDIA : Kanara, *Talbot !* CHITTAGONG ; Fenoa Hill, *King's Collectors !* ANDAMANS : Hills near Port Mouat, *King's Collectors !* Add to distribution :—Australia, West Indies.

The usually lobed leaves (they are not however always lobed in Old World specimens, and do not seem to be so in American ones) and the funnel-shaped corolla-tube distinguish this species very well. The reversal of the leaf-character in this, as compared with *I. bona-nox*, is worth mentioning : in that species it is in America that the leaves may be either lobed or entire, but are usually lobed ; wild specimens of the Asiatic form of the "true Moon-flower" seem never to have lobed leaves.

4 *b*. IPOMOEA YOMAE *Kurz*, *For. Flor. Brit. Burma*, ii. 218 [1877] ; leaves deep-cordate, sinus usually obtuse, long acuminate, membranous, generally glabrous except the nerves above, always sparsely or closely adpressed-pilose beneath as are the petioles and the younger branches ; pedicels short axillary 1 (rarely 2 or 3)-fld., sepals ovate subacute subequal externally adpressed pilose, in fruit glabrescent ; corolla hypocrateriform, tube long straight glabrous externally ; stamens included ; capsule ovoid ; seeds dark brown velvety throughout with shaggy margins. I. trichosperma *C. B. Clarke in F. B. I.*, iv., 198 *in part, not of Blume.* Convolvulus grandiflorus *Linn. f.*, *Suppl.* 136 *as to description, and excluding the syn. Rheede. Hort. Malab.* t. 50. C. asper *Wall. Cat.* n. 1388. Calonyction speciosum *Choisy* VAR. γ pubescens, *Choisy, DC. Prodr.* ix., 345 *as to the description.* C. asper *Choisy. DC. Prodr.* ix., 345, *in part.* C. mollissimum *Zoll.*, *Syst. Verzeichn.* 131 ; *Miq.*, *Flor. Ind. Bat.* ii. 597.

SILHET : *Wallich !* PEGU Yomah, *Kurz !* TENASSERIM : Mawayda, *Gallatly !* DISTRIB. Java.

A large climber, branchlets muricate ; leaves 4–8 in. by 3–7 in., petioles 1–3 in. ; pedicels ½–1 in., thickened in fruit under the capsule, on axillary peduncles with pulvinar swellings on branch at their base, ¼–1 in. long if 1-fld. 1–2½ in. long when 2 or 3-fld., sepals ½ in long. somewhat enlarged in fruit ; corolla white, tube 5–6 in. long ; capsule ovoid ¾ in. long ½ in. in diam.

4 *c*. IPOMOEA JUCUNDA *Thw.*, *Enum.* 211 [1860] ; leaves rounded cordate, rather long acuminate entire glabrous above tomentose beneath

as are the petioles; pedicels axillary, 1–3-fld., puberulous as long as the petioles; sepals ovate-oblong mucronulate externally hirsute; corolla hypocrateriform, tube straight puberulous externally; stamens included; capsule large depressed-ovoid; seeds densely clothed throughout with very long greyish-brown silky hairs. I. longiflora *Benth.*, *Flor. Austr.* iv., 419 *in note.* I. grandiflora *C. B. Clarke*, *Flor. Brit. Ind.*, iv., 198 *in part, not of Lamk.*

CEYLON: Dolosbage district, rare, *Thwaites* n. 3448!

A large lofty night-flowering climber; leaves 3½ in. by 3 in., petioles and pedicels 2 in.; pedicels usually 1-fld.; sepals 1 in. long, sub-reflexed in fruit; corolla white, tube 2 in. long, limb 4 in. across; capsule ¾ in. long about 1 in. in diam.

SUB-GENUS III. PHARBITIS.

8 *b*. IPOMOEA CONGESTA *R. Br.*, *Prodr. Fl. Nov. Holl.* 485 [1810]; leaves broadly or deeply cordate acute entire or slightly 3-lobed, softly sparingly hirsute above, more densely below; flowers large in congested cymes on long peduncles with sometimes a foliar bract close to the flowers; sepals long lanceolate acuminate; corolla suddenly campanulate from a short narrow cylindric base. I. congesta *Benth. Fl. Austral.* iv., 417. Convolvulus congestus *Spreng. Syst.* i., 601. Pharbitis insularis *Choisy*, *Conv. Or.* 57; *DC. Prodr.* ix., 341. Ipomœa insularis *Steud.*

CHITTAGONG: Kodala Hill, *King's Collector!* MALAY PENINSULA: Singapur, *Hullett!* DISTRIB. N. Australia, Polynesia.

A tall hirsute climber; leaves 3–6 in. by 2–5 in., petioles 2–3 in., peduncles 3–7 in., softly hairy as are the petioles and stem, foliar bracts when present 1½ in. by ⅓–½ in., with cuneate more rarely sub-cordate base; cymes 3–7 fld.; sepals ¾ in. long; corolla blue-purple or mixed red and blue, nearly 3 in. long.

Mr. Hullett has noted on his specimen (n. 646) "Jany. 1885: blue convolvulus, wild? Have never seen it in seed." Perhaps therefore it is only an escape. It is not however at all frequent in cultivation in India and its occurrence in the Chittagong Hill Tracts in at least a thoroughly naturalised state leads the writer to provide a description.

10. IPOMOEA DISSECTA *Willd.*

Add to localities of *F. B. I.*:—

UPPER BURMA: Shan Hills, 4,000 ft., *Collett! King's Collectors!*

SUB-GENUS IV. ANISEIA.

13. IPOMŒA BARLERIOIDES *Benth.*

Add to localities of *F. B. I.*:—

UPPER BURMA: Shan Hills: Meiktila, *Collett!* Koni, *Prazer!*

13 *b*. IPOMŒA NANA *Coll. & Hemsl.*, *Journ. Linn. Soc.* xxviii., 97; leaves simple shortly petioled or sub-sessile, thickly herbaceous, obovate-lanceolate or narrow-oblong obtuse or acute, base cuneate, margin

entire on both surfaces sparsely hirsute with long strigose hairs; flowers axillary solitary, peduncles short, sepals narrow lanceolate acuminate unequal externally pilose; corolla narrowly infundibuliform sparsely hairy externally; stamens included, filaments hirsute.

BURMA; Shan Hills, 4,000 ft., common, *Collett!*

An erect or ascending herb, 6–12 in. high, root fusiform; leaves $1\frac{1}{2}$–$2\frac{1}{2}$ in. *Sepals* $\frac{1}{2}$ in. long. *Corolla* $2\frac{1}{2}$–3 in. long, $1\frac{1}{4}$ in. across mouth.

The sepals in fruit are reflexed, but the fruits themselves have fallen, and it is not known whether they have been capsules or berries. The flowers are very like those of *Ipomœa barlerioides,* but the plant has the facies of a *Lettsomia* rather than of an *Ipomœa.*

13 *c.* IPOMŒA POPAHENSIS *Coll. & Hemsl., Journ. Linn. Soc.* xxviii., 97; leaves simple shortly petioled narrowly oblong lanceolate or sometimes linear apiculate, entire, on both surfaces sparsely hirsute with short strigose hairs; flowers axillary on short peduncles with usually 1, rarely 2–3 flowers; sepals ovate-lanceolate acuminate or linear lanceolate, pilose externally as are the lanceolate bracts at the base of the very short pedicels; corolla narrowly infundibuliform sparsely hairy externally; stamens included filaments papillose.

UPPER BURMA: on Popah Daoung, *Collett!* Shan Hills, near Boi Tat, 3,000 ft., and at Meiktila, *Collett!*

A very slender twiner, leaves $1\frac{1}{2}$–4 in. long, sepals $\frac{1}{2}$–$\frac{3}{4}$ in. long, $\frac{1}{8}$–$\frac{1}{4}$ in. wide, purplish; corolla purple 2 in. long, 1 in. wide at mouth.

This species also has flowers very like those of *Ipomœa barlerioides.* None of the specimens have ripe fruits; the largest unripe ones present are $\frac{1}{4}$ in. in diameter sub-globose smooth with a thin pericarp, which however shows no trace of ultimate dehiscence. The plant suggests by its general facies that it may be a *Lettsomia,* in which case it would come nearest *L. barbata* Clarke and *L. Mastersii* Prain.

SUB-GENUS VI. EUIPOMOEA.

20. IPOMOEA PES-TIGRIDIS *Linn.*

Add to localities of *F. B. I.*:—

UPPER BURMA: Sagaing, Pyinmana, Fort Stedman, *King's Collectors!*

21. IPOMOEA ERIOCARPA *Br.*

Add to localities of *F. B. I.*:—

TENASSERIM: Moulmein, *Falconer!* BURMA: Rangoon, *Cleghorn!* Shan Hills, 3,000 ft. *Collett!*

22. IPOMOEA STOCKSII *Clarke.*

Add to localities of *F. B. I.*:

CENTL. INDIA: Goonah, *King!*

27. IPOMOEA POLYANTHA *Miq.*

The synonym *Convolvulus polyanthus* Wall. Cat. n. 1378 should be

omitted. Wall. Cat. n. 1378 is *Ipomoea staphylina* Roem. & Schult. VAR. *malayana* Prain (Lettsomia sumatrana *Miq.*)

VAR. *affinis* is now reported from Chittagong, Khasia Hills, Shan Hills, and Tenasserium in addition to the localities mentioned in *F. B. I.*; it is further distributed to Yunnan.

28. IPOMOEA RENIFORMIS, *Choisy.*

Add to localities of *F. B. I.*:—

UPPER BURMA: 'near Amerapoora in fields,' *Wallich!*

30. IPOMOEA OBSCURA, *Ker.*

VAR. *typica*; add to localities of *F. B. I.*:—

Throughout Tenasserim; in Burma from Rangoon to Bhamo and the Shan states: Andamans, frequent.

VAR. *gemella*; add to localities:—

CENTL. INDIA: Goonah, *King!* S. INDIA: Dindygul, *King!*

This form hardly deserves varietal rank.

33. IPOMOEA PORANOIDES *Clarke.*

Add to localities of *F. B. I.*:—

N.-W. HIMALAYA: Garhwal Babur, *King!* NAGA HILLS: Kohima, *C. B. Clarke, Prain!*

34. IPOMOEA CYNANCHIFOLIA *Clarke.*

Add to distribution of *F. B. I.*:—South-West China.

Dr. J. Anderson collected this species at Poneshee in Yunnan.

36. IPOMOEA DENTICULATA *Choisy.*

Substitute for localities of *F. B. I.*:—

SEA-SHORES OF INDIA, INDO-CHINA AND MALAYA: Westn. India; Kanara, *Talbot!* Laccadives; Minikoi, *Alcock!* Ceylon, at Galle, *Thwaites!* Arracan; at Akyab, frequent along the sea-shore, *Kurz!* Kobah, *Kurz!* Diamond Island, *Prain!* Andaman Group: Narcondam, Great Coco, Little Coco, *Prain!* S. Andaman, *King's Collectors!* Rutland Island, Little Andaman, *Prain!* Nicobars; Kamorta, *Kurz!* Great Nicobar, *Kurz!* Malay Peninsula; Perak, *Scortechini!* Penang, *Curtis!* Pahang, *Ridley!*

42. IPOMOEA STAPHYLINA *Roem. & Schult.*

VAR. typica: corolla wide-campanulate from a very short narrow cylindric base, usually $\frac{1}{2}$–$\frac{3}{4}$, very rarely 1 in. long. and $\frac{1}{2}$–$\frac{3}{4}$, sometimes 1 in. diam. at limb.

To this belong all the synonyms of *F. B. I.*, except *Convolvulus polyanthus* Wall., and all the localities except the Penang one.

VAR. malayana *Prain;* corolla uniformly narrowly infundibuliform from base to limb, 1 to $1\frac{1}{4}$ in. long and hardly $\frac{1}{3}$ in. diam. at mouth. Convolvulus polyanthus *Wall. Cat.* n. 1378 (*not* Ipomoea polyantha *Miq.*) Lettsomia sumatrana *Miq., Flor. Ind. Bat., Suppl.* 560 (1860.)

MALAY PENINSULA; Perak; *Kunstler!* Penang, *Wallich!* DISTRIB. Sumatra.

Wall. Cat. n. 1378 is exactly the same as authentic specimens of *Lettsomia sumatrana* collected by Teysmann in Sumatra. Though the two varieties differ so markedly in the shape of the corolla, the leaves, calyces, ovaries and capsules are identical. The corolla in the Malay variety is much as in the Indian, red purple at the base, white streaked with pink near the mouth.

42 *b.* IPOMOEA NYMPHAEFOLIA *Bl., Bijdr.* 719 [1825] not of *Grisebach* [1866]; leaves orbicular-ovate, shortly acuminate entire glabrous on both surfaces or sparingly hairy on the nerves beneath, peltate with a rounded or slightly retuse base, the floral leaves more deeply cut and at times cordate with a narrow sinus; flowers large in loose cymes on a common peduncle sometimes shorter than the petioles sometimes longer than the leaves; sepals broad obtuse coriaceous nearly equal; corolla wide campanulate glabrous externally; capsule large. Ipomœa peltata *Choisy, Conv. Or.* 70 (1833); *DC. Prodr.* ix., 359; *Miq. Flor. Ind. Bat.* ii., 605; *Benth., Flor. Austral.* iv., 418; *Baker, Flor. Maurit.* 208. I. Rumphii *Miq., Flor. Ind. Bat.* ii., 605. Convolvulus peltatus *Linn., Sp. Pl.* 1194. Spiranthera peltata *Boj., Hort. Maurit.* 226.—*Rheede Herb. Amboin.* v., 428, t. 157 (both figures).

PERAK: Pangkor, *Scortechini* n. 1074! DISTRIB. Mascarene Islands to Malaya, N. Australia and Polynesia.

A tall woody climber; leaves 6–10 in. by 5–8 in.; Cymes 4–15-fld.; sepals glabrous ¾ in. in flower, nearly 1 in. in fruit; corolla 2–2½ in., yellowish-white with red spots in the Mascarene Islands, yellow or white or purplish in Malaya, white in N. Australia and Polynesia: anthers hirsute; capsule 1 in. in diam.; seeds pilose. *Ipomoea Grisebachii* (I. nymphæfolia *Griseb., Cat. Pl. Cub.* [1866], is not this plant. The flowers in Rumphius' figures are much too small; otherwise the description and figures leave no doubt as to this being the plant intended.

43. IPOMOEA CAMPANULATA *Linn.*

VAR. typica. Add to synonyms of *F. B. I.*:—Argyreia tiliaefolia *Kurz, For. Flor. Brit. Burma* ii., 215., *not of Wight.* and delete syn. I campanulata *Kurz*, l. c. 218.

Kurz's *Argyreia tiliaefolia*, as his elaborate description and *all* his specimens in Herb. Calcutta show, is *Ipomœa campanulata* Linn. which extends from South-West Yunnan (*Anderson!*) and the Shan States (*Manders! King's Collectors!*) to Tenasserim. *Argyreia tiliaefolia*, a purely sea-shore species, is on the other hand the plant described by Kurz, *l. c.*, and named by him in Herb. Calcutta, *Ipomoea campanulata*, though he has included in this species his specimens of *Ipomoea* (Calonyction) *glaberrima* as well.

VAR. illustris. Add to localities of *F. B. I.*:—

CEYLON: *Thwaites!* SUNDERBUNS: *Heinig!* ARRACAN: mouth of Kolodyne river, *Kurz!* Coco group, *Prain!* South Andaman, *King! Prain! King's Collectors!* NICOBARS: *King' sCollectors!* MALAY PENINSULA: Penang, *Curtis!*

This very distinct sea-shore form seems, as Mr. Clarke suggests, to deserve specific rank. Though collected by Kurz, it is not included by him either in his *Ipomoea campanulata* or his *Argyreia tiliaefolia*; a note in Herb. Calcutta shows that he shared Mr. Clarke's opinion that it is perhaps deserving of specific rank.

44. IPOMOEA LACTEA *Wall.* ex *Voigt.* in *Hort. Suburb. Calcutta* 361 [1845]. Convolvulus lacteus *Wall.* ex *Grah. Cat. Bomb. Pl.* 133. Ipomoea Gomezii *C. B. Clarke* in *Flor. Brit. Ind.* iv., 211 [1883] in part, and as to the Tavoy plant only.

ASSAM: foot of Naga Hills, *Masters!* TENASSERIM: Tavoy, *Gomez.*

There is not now at Calcutta a specimen collected by Gomez in Tavoy, but there is a specimen collected in the Calcutta Garden, noted as being raised from seed received from Burma from Gomez, and named in Dr. Wallich's own handwriting *Convolvulus lacteus.*

The calyx and corolla in this species closely resemble those of *Ipomoea nymphaefolia* but are twice as large; in fruit the calyx and capsule are nearly thrice as large. As in *I. nymphaefolia* the seeds are hairy, the corolla externally is glabrous. *I. lactea* in fruit still more closely resembles a macrocarpous form of *I. petaloidea* from the Andamans and the Malayan Archipelago. This plant, which the writer had supposed to be the Andaman one included by Mr. Clarke under *Ipomoea Gomezii* has a corolla smaller than that of *I. lactea*, and is shaggy externally even when full grown, whereas the corolla of *I. lactea* is glabrous externally even in bud. Dr. Stapf, however, informs the writer that while the Andaman plant referred to is certainly not *I. lactea* it does not appear to be *I. petaloidea* either. "It is, however," Dr. Stapf says, "a *very* poor one. There is one flower mounted with it, though not exactly attached;" he also says that, though the calyx agrees with that of the variety of *I. petaloidea* referred to, 'the shrivelled corolla seems to have had a narrow tube about two inches long and is glabrous outside.' This description would suit a badly prepared specimen of *Ipomœa glaberrima*, and it is not impossible that, so far at least as the flower is concerned, the Andamans *I. Gomezii* will have to be referred to that species.

45. IPOMOEA CYMOSA *Roem. & Schult.*

VAR. typica. Add to localities of *F. B. I.*:—Equally abundant in Indo-China from Upper Assam and Bhamo to the Andamans and Nicobars, and the Malay Peninsula.

To this belong all the synonyms of the *F. B. I.* except *Convolvulus umbellatus* Wall. (*Cat.* n. 2329), which is from a plant grown in the Calcutta Botanic Garden. It forms the type of Choisy's *Ipomœa cymosa* VAR. *culta*, and is perhaps a synonym of *Ipomœa umbellata* Meyer.

VAR. culta; *Choisy, DC. Prodr.* ix., 371; leaves cordate with an obtuse sinus and rounded auricles, softly velvety tomentose on both surfaces, flowers large uniformly dark-yellow. Convolvulus umbellatus *Wall. Cat.* n. 2239.

LOWER BENGAL: naturalised in various places near the Royal Botanic Garden, *Kurz!* MALAY PENINSULA: Perak; at Sungah Ryah, *Kunstler!*

The cymes in this plant are almost umbellate and the leaves, which are 4 by 3½ in., are much wider than in VAR. *typica*, where also the corolla is pure white or white tinged with yellow. The calyx and seeds are exactly as in *I. cymosa*, but the corolla is considerably larger, and in size and colour agrees with that of *Ipomoea umbellata*. Mey. (*Prim. Flor. Esseq.* 99), an American plant with very similar leaves equally deeply cordate, but with an acute sinus and glabrous above very sparingly hirsute below. This latter difference is no greater than exists between different forms of *I. cymosa* proper, and it is probable that *I. cymosa*, VAR. *culta*, and *I. umbellata* are but forms of one plant which is only a variety, as Bentham (*Flor. Austral.* iv., 423) suggests, of *I. cymosa*.

It has always been supposed that Wallich's *Convolvulus umbellatus*, cult. in Hort. Calcutta, was derived from American seed; it now seems as probable that Wallich's plant was of Malayan origin.

Dr. Stapf who has kindly examined this plant, doubts very much that it is entitled to varietal rank. He also adds "it is extremely like *I. umbellata* Meyer, from America, and I cannot find characters to separate them."

45 *b*. IPOMOEA RUBENS *Choisy*, *Convolv. Or.* 81 and *DC. Prodr.* ix., 371. Convolvulus rubens *Wall. Cat.* 1421. C. glandulosus *Ham. in Wall. Cat.* 2252. Lettsomia rubens *Clarke*, *Flor. Brit. Ind.* iv., 195.

NORTH BENGAL: Rangpur, at Pirganj, *Hamilton*; Purnea, near Caragola, *Kurz!* ASSAM: *Jenkins! Gibson!* Goalpara, *Hamilton! Simons!* Gauhati, *Jenkins!* Silhet, *DeSilva!* Cachar, *Keenan*.

This is, as Choisy says, an *Ipomoea* not a *Lettsomia*. M. Choisy does not appear to have seen fruit; Mr. Clarke says, *loc. cit.*, that he had not seen any. The plant, Mr. Clarke adds, has been supposed a *Rivea*; its facies suggests an *Ipomoea* in the vicinity of *I. cymosa* VAR. *culta*, from which however, it differs in having fewer flowers in the umbelliform cymes, a tomentose calyx, a corolla which is whitish-purple instead of dark yellow, and strigose on the plaits externally instead of quite glabrous, as well as in having glabrous in place of hirsute seeds.

There is no example of Hamilton's *Convolvulus glandulosus* at Calcutta, at Kew, or in the type set of Wallich's Herbarium at the Linnean Society; what however is evidently, from Choisy's description, the same thing, is represented at Calcutta by specimens collected in Assam (exact locality not stated) by Gibson, and at Gauhati by Jenkins. These specimens have rather larger leaves than any of the others densely velvety tomentose on both surfaces, and closely resembling those of *Argyreia Roxburghii*. There is however not the slightest difference as to calyx or corolla between these specimens and those which form the type of *Ipomœa rubens*, so that the separation of a variety *lanata*, proposed by M. Choisy, appears to be hardly necessary. The Goalpara specimens in Wallich's Herbarium (*Convolvulus bifidus*, Ham. Wall. Cat. n. 1421/B and n. 1421/C) are identical with those of DeSilva from Silhet (Wall. Cat. n. 1421/1) on which the species was founded. Kurz's Purnea specimens have leaves less densely hirsute above.

The species is evidently very closely related to the next one of which there is not a specimen at Calcutta. Being unable to separate it by Mr. Clarke's description and figure, the writer asked that the two might be compared at Kew where the type of *Ipomœa Wattii* is preserved. Dr. Stapf, who has kindly made the comparison at Kew writes:—"*Lettsomia rubens* Clarke, and *Ipomœa Wattii* are very like; but note

the sepals, which are narrower and acute in the latter." This appears to be the only tangible distinction, and is perhaps hardly sufficient to separate the two plants; till however, full material of *Ipomœa Wattii* is available it would be improper to propose the formal reduction of Mr. Clarke's species, a description of which, taken from the author's original diagnosis and figure, is given here.

45 *c*. IPOMOEA WATTII *Clarke*, *Journ. Linn. Soc.* xxv., 49, t. 22; leaves ovate-cordate acute, sparingly hairy above and on the nerves beneath, peduncles long, 3–5-fld., sepals widely oblong acute, hairy.

NAGA HILLS: Kohima, alt. 5,000 feet, *Clarke*.

Scandent. *Leaves* 3½–2½ in., somewhat deeply cordate; petiole 2–3 in. *Peduncles* 3–5 in., pedicels 1 in. *Sepals* ⅓–½ in. *Corolla* 1¼ in. long, and as much across, white with a purple tinge. *Capsule* glabrous ¼–⅓ in. diam., seeds glabrous.

The chief difference, apparently the only one, between this and *Ipomœa rubens* lies, as already said, in the sepals, which are here widely oblong acute, while in *I. rubens* they are widely oblong obtuse and rather shorter.

From the figure quoted, the artist has altogether omitted the tomentum of leaves and calyx, while the sepals are shown as lanceolate instead of widely oblong.

46. IPOMOEA PETALOIDEA *Choisy*.

VAR. typica; add to localities of *F. B. I.*:—

BEHAR: *Kurz! Wood! Revd. Campbell!* CENTL. INDIA: Godaveri district, *Beddome! Gamble!* Sagor, *Vicary!*

VAR. pauciflora *Clarke*, *Flor. Brit. Ind.* iv., 212. I. petaloidea, VAR. ? foliis fere linearibus *Coll. & Hemsl.*, *Journ. Linn. Soc.*, xxviii., 97. I. petaloidea VAR. linearifolia *Kurz. Mss. in Herb. Calc.* Add to localities:—

BURMA: Pegu, at Palawa Zeik, Tonkyeghat, *Kurz!* Shan Hills, at Pwehla, 4000 feet, *Collett!* Southern Shan States, *Manders!*

This very distinct-looking variety has also been collected by Dr. King near Mussorie, in the district where it was first obtained by Dr. Thomson.

VAR. andamanica *Prain*; sepals larger, enlarging in fruit, capsule much larger. Convolvulus platypeltis *Span. Linnea* xv., 338.

ANDAMANS: *Kurz! King's Collectors!* Common. DISTRIB: Timor.

The fruit of this closely resembles *Ipomœa lactea* Wall., but the corolla is much smaller and is shaggy externally. Spanoghe's Timor plant, referred by Miquel to *I. petaloidea*, is evidently this form.

46 *b*. IPOMOEA KINGII *Prain*: leaves narrow ovate cordate acute with shallow or deep rounded sinus and rounded auricles, glabrous above or with the midrib sometimes puberulous, sparingly hirsute on the nerves beneath, petioles long puberulous; peduncles glabrous longer than the petioles, bearing sometimes 1–3, more often a lax branching cyme of 5–12 flowers, with long smooth pedicels thickened, even in flower, under the calyx; flowers large, sepals broad ovate obtuse glabrous coriaceous, with membranous margins nearly equal; corolla wide campanulate glabrous exernally; capsule large, seeds uniformly covered

with long brownish-grey hairs. Ipomoea cymosa VAR. macra *C. B. Clarke, Flor. Brit. Ind.* iv., 212; *Journ. Linn. Soc.*, xxv., 49.

SIKKIM: Rishap, etc., 2500–5000 feet, very common, *King! Gammie! Clarke! Gamble!* BOOTAN! *Parkes! Cummins!* ASSAM: Khasia Hills, *Griffith, Hooker!* Gauhati, *Simons!* Dibrugur, *Masters!* Naga Hills, *Clarke, Prain!* BURMA: Karen Hills, 3000 ft., *Kurz!* Shan Hills, 3000 ft., *Collett!*

A large climber: leaves 3½–6 in. by 2–4 in., petioles 1–3 in.; peduncles 2–6 in. with small deciduous linear bracts at origin of pedicels, which are from 1–2 in. long. *Sepals* ¾ in., reflexed but not enlarging in fruit. *Corolla* white, 2½ in. long, mouth 2 in. across. *Capsule* ¾ in diam.

This is a very distinct species, much nearer to *I. petaloidea* (with which it agrees in having thickened pedicels and of which it has exactly the calyx) than to *I. cymosa.* It is however easily distinguished from *I. petaloidea* by its leaves, which are quite like those of *I. cymosa,* and by its glabrous corolla.

49. IPOMOEA CARNORA *Br.*

Add to localities of *F. B. I* :—

PAHANG: *Ridley!*

56 *b.* IPOMOEA GRACILLIMA *Prain;* glabrous, leaves pedately lobed, lobes narrow, spathulate sub-sinuate, peduncles 1–7 fld., filiform elongated, sepals ovate obtuse, corolla small purple, seeds velvety with a few long hairs at tip. I palmata VAR? gracillima, *Coll. & Hemsl., Journ. Linn. Soc.*, xxviii., 97.

UPPER BURMA: Meiktila, *Collett!*

A slender climber; leaves 1–2 in. diam. petioles 1 in.; peduncles much larger than leaves (2–4 in.); sepals ⅙ in., corolla ½–¾ in; capsule ⅓ in.

Very closely resembles *I. palmata* in appearance but is easily distinguished by its much longer peduncles, its flowers less than half the size, and its very different seeds.

6. LEPISTEMON BL.

1. LEPISTEMON FLAVESCENS *Bl. Bijdr.* 722. Lepistemon Wallichii *Choisy Convolv. Or.* 61; *Flor. Brit. Ind.* iv. 216.

Add to localities of *F. B. I.* :—

MALAY PENINSULA: Perak, at Larut, *Scortechini* n. 1544! DISTRIB. Java, Borneo; Philippines.

Lepistemon Wallichii (Convolvulus cephalanthus *Wall. Cat.* n. 1402; Ipomoea Wallichii *Steud.*) scarcely differs from *Lepistemon flavescens* (Ipomoea flavescens *Steud.*) as has been already pointed out by Choisy (*DC. Prodr.* ix, 348.) Choisy, however, has not seen his way to formally uniting the two plants even when monographing the natural order; on this account, and also because the geographical areas of the two forms did not then seem to overlap, Mr. Clarke has kept up the distinctive name and position of the Indian one; he has however, pointed out how closely they are related, and how nearly both are allied to still another form from

Borneo and the Philippines. The form collected by Father Scortechini in Larut differs somewhat from both the Indian and the Java plant; it has the widely urceolate corolla of *L. flavescens*, and therefore is not true *L. Wallichii*; at the same time it has sepals that are longer and more lanceolate than even in *L. Wallichii*, and therefore is not true *L. flavescens*.

Dr. Stapf writes:— "I do not think that *L. flavescens*, *L. Wallichii*, and the Borneo-Philippine plant are specifically distinct. They seem to be *very slight* variations of *one* species." This opinion, coupled with the communication from an intermediate locality of a form that combines the characters of Steudel's two "species," leads the writer to propose the identification of the Indian plant with that distributed throughout the Malayan region.

9. CONVOLVULUS Linn.

* *Erect or diffuse, not twining (except sometimes* C. glomeratus); *stigmas filiform, nearly as long as, or longer than the style.*

† *Spiny or spinescent shrubs or under-shrubs.*

1. * Convolvulus leiocalycinus *Boiss. Flor. Orient.* iv., 86; a rigid shrub with elongated again dividing branches, young parts adpressed-silky, elsewhere glabrous, the ends of branches and peduncles developing into short sharp spines, leaves small shortly petioled, shortly silky hairy, spathulate oblong subacute with rounded or sub-hastate bases, flowers solitary axillary, pedicels shorter than the leaves, sepals glabrous coriaceous ovate-obtuse mucronulate, corolla white glabrous 5–6 times longer than the calyx, ovary hirsute, stigmas filiform, as long as the style. C. lasiophlaeus *Jaub. & Spach, Ill.*, t. 368. C. lycioides *Boiss. Diagn.*, Ser. i., 7, p. 29.

Panjab Frontier: *Duke!* British Beluchistan: *Lace!* Distrib. Afghanistan (*Bellew*); Beluchistan, Persia.

Height 3–4 feet; leaves ½ in. or less; calyx $\frac{1}{6}$ in.; corolla 1-1¼ in. long, capsule ovoid.

The occurrence of this species just within the British Indian frontier renders it necessary to supply a description of the plant. It is readily distinguished from the next species by its hastate or cordate-based leaves.

1. * * Convolvulus spinosus *Burm. Flor. Ind.* 47, t. 19, f. 4; a low much-branched shrub with elongated again much divided branches, all parts covered with a short adpressed ash-grey silky pubescence, the ends of branches developing into sharp slender spines; leaves small elliptic subacute, bases narrowed, the uppermost linear and scale-like; flowers on axillary, 1–3-fld. pedicels as long as the leaves, sepals hirsute coriaceous ovate-obtuse, corolla hirsute 3–4 times longer than the calyx, ovary hirsute; stigmas filiform as long as the style. C. spinosus *Boiss., Flor Or.* iv., 87, *not of Desr. nor of Eichwald* C. genistoides *Jaub. & Spach. Ill.* t. 370.

NORTH-WEST FRONTIER: Nal, *Duke*. DISTRIB. Afghanistan (*Griffith*) Beluchistan (*Stocks*); Persia.

Height 1–3 ft.; leaves $\frac{1}{4}$–$\frac{1}{3}$ in.; calyx $\frac{1}{5}$ in.; corolla $\frac{3}{4}$–1 in.

A description of this species is necessary for the same reason that calls for one of *C. leiocalycinus*. From that species the longer pedicels, the hirsute calyx and corolla, and the different leaves, easily distinguish it.

1. CONVOLVULUS SCINDICUS *Stocks*.

† † *Herbaceous not spinescent.*

4 *b*. CONVOLVULUS LINEATUS *Linn*: *Boiss. Flor. Or.* iv., 97; adpressed sericeous, leaves oblong; the lower narrowed into a long petiole, the upper most often narrowly linear, cymes few-fld. at the ends of the branches; flowers solitary shortly pedicelled; sepals oblong lanceolate membranous at the base, tips herbaceous spreading, corolla 3 times as long as the calyx, ovary hirsute. Convolvulus spicæfolius *Desr. in Lamk. Encycl. Meth.* iii., 549. C. Besseri *Spreng. Syst.* i, 610.

BRITISH BELUCHISTAN: Quetta, *Stocks!* PUNJAB FRONTIER: frequent, *Sanders! Duke! etc.* DISTRIB: Europe, N. Africa, Western Asia, Siberia.

Root-stock woody, stems 4–8 in., herbaceous numerous, ascending or procumbent, lower leaves 2–3 in. by $\frac{1}{4}$–$\frac{1}{2}$ in., petioles 1 in. or longer, stem leaves $\frac{3}{4}$–1 in.; sepals $\frac{3}{8}$ in., adpressed sericeous; corolla rose, 1 in., externally adpressed, sericeous on the plaits.

Described for the reasons given under *C. leiocalycinus* and *C. spinosus*.

6. CONVOLVULUS GLOMERATUS *Choisy*.

Add to localities of *F. B. I.*:—

RAJPUTANA: Jodhpur, *King!*

7 *b*. CONVOLVULUS TENELLUS *Stocks*, *Hook. Kew Journ.* iv., 172; pale-green, sparingly adpressed hirsute, leaves sessile linear, peduncles 1–3-fld., sepals ovate mucronulate or suddenly acuminate, quite glabrous, corolla $\frac{3}{4}$ in. wide, campanulate; ovary glabrous style very long. Convolvulus Stocksii *Boiss. Flor. Or.* iv., 110 [1879]. C. Rottlerianus VAR. tenella *Clarke, Flor. Brit. Ind.* iv., 219.

SCINDE: Cutch, *Stoliczka!* DISTRIB. Beluchistan (*Stocks! Ball!*)

Erect strictly branched, stems and branches wiry; leaves $\frac{3}{4}$ in. very narrowly linear; peduncles long, 2–2½ in.; sepals $\frac{1}{6}$ in., corolla rose, $\frac{3}{4}$ in. at mouth, very sparingly hispid along the angles.

This is extremely distinct from *C. Rottlerianus*, and may be at once recognised by its glabrous calyx and its much longer scarcely hirsute corolla.

Boissier's name, *C. Stocksii*, is given because there is a prior name *C. tenella* (*Desr.* in *Lamk. Encycl.*) As the "C. tenellus" of Desrousses is a *Breweria* and not a *Convolvulus*, there is no reason why Stock's name should not be used.

7 *c*. CONVOLVULUS SINUATO-DENTATUS, *Coll. & Hemsl., Journ. Linn. Soc.*, xxviii., 98; pubescent, leaves petioled thick cordate-

oblong sub-obtuse sinuate-toothed; flowers axillary solitary or pubescent; pedicels as long as the leaves bracteolate near the middle; sepals coriaceous ovate-obtuse pubescent externally; corolla twice as long as the calyx, externally hirsute; ovary glabrous.

UPPER BURMA: Shan Hills, at Pwehla, *Collett!* at Koni, *Prazer!*

Root-stock thick woody; stems slender prostrate internodes short; leaves ½–1 in. long, ¼–½ in., across, petioles ¼ in. or less; pedicels sometimes 1½ in. long, bracteoles 2 or 1; sepals ¼ in.; corolla white, ½ in.

* * *Stems twining; stigmas narrowly oblong or linear, shorter than the style.*

9. CONVOLVULUS FLAVUS *Willd.*

Add to localities of *F. B. I.*:—

RAJPUTANA: Mt. Aboo, *King!*

11. CONVOLVULUS MICROCALYX *Clarke.*

Substitute for localities of *F. B. I.*:—

MISHMI: *Griffith* (mixed with *Porana paniculata*)! ASSAM: *Jenkins!*

11. PORANA BURM.

3. PORANA SPECTABILIS *Kurz.*

Add to localities of *F. B. I.*:—

ASSAM: Naga Hills, at Nichuguard, *Clarke;* Lushai Hills at Changsil, *Prazer!* BURMAH: Shan Hills, *Collett!* ANDAMANS: Coco Islands, *Prain!* S. Andaman, *Prain! King's collectors!*

13 *b*. DICHONDRA FORST.

Prostrate creeping small herbs; leaves entire, flowers small axillary; corolla campanulate deeply 5-lobed; ovary of 2 distinct carpels, each with an almost basal style, and 1 or 2 ovules; stigmas capitate. Fruit of 1 or 2 membranous capsules, each with 1 or rarely 2 seeds.—Species 2, one tropical American, the other cosmopolitan in the tropics.

1. DICHONDRA REPENS *Forst; Choisy, DC. Prodr.*, ix, 451; a slender creeping perennial, rooting at the nodes, hoary with minute pubescence, or silky; leaves long-petioled, orbicular or reniform; flowers solitary on peduncles shorter than the petioles; sepals obovate, very short; corolla yellow rather shorter than the calyx; carpels about as long as the calyx, nearly globular. *R. Br., Prodr.*, 491; *Wall. Cat.* 1339; *Benth. Flor. Austral.* iv, 438; *Coll. & Hemsl., Journ. Linn. Soc.* xxvii., 99.

UPPER BURMA: Taong-Doung Mts., *Wallich!* Shan Hills, *Collett!*

King's Collectors! DISTRIB. Tropical and sub-tropical regions of both hemispheres.

Leaves ⅓–1 in. diam.; petioles sometimes 2 in. (in Wallich's specimens as much as 4 in.) long, sepals about 1 line long.

15. CUSCUTA LINN.

1. CUSCUTA REFLEXA *Roxb.*

Add to localities of F. B. I.:—

UPPER BURMAH: Karen Hills, *Mason!* Shan Hills, *Collett! King's Collectors!* Hotha, *J. Anderson!*

Add to distribution:—China.

4. CUSCUTA CHINENSIS *Lamk.*

Add to localities of F. B. I.:—

UPPER BURMHA: Shan Hills, *King's Collectors!*

Natural History Notes from H. M. Indian Marine Survey Steamer 'Investigator,' Commander C. F. Oldham, R. N., Commanding. Series II., No. 11. *An Account of a Recent Collection of Bathybial Fishes from the Bay of Bengal and from the Laccadive Sea.—By* A. ALCOCK, M. B., C. M. Z. S., *Superintendent of the Indian Museum.*

Plates VI & VII.

[Received 31st May:—Read 6th June.]

INTRODUCTION.

The collection of deep-sea fishes recently added to the Indian Museum through the exertions of the Marine Zoological Survey is a large one and numbers many species, of which only those that appear to be either hitherto unknown or new to the Indian record are here noticed.

In the list of these new forms it is interesting to find *Hoplostethus*, *Thyrsites*, *Bembrops*, *Pœcilopsetta*, *Chlorophthalmus*, *Xenomystax*, (a remarkable deep-sea Eel of the Sauromurænesocine alliance, lately discovered by the U. S. Steamer '*Albatross*' off the coast of Ecuador, and now appearing in the Laccadive Sea), *Nemichthys*, and *Triacanthodes*.

The discovery in these waters of representatives of these genera shows that the exploration of the Indian Seas is still far from complete, and leads us to hope that other unaccountable gaps in our knowledge of the geographical relations of the fish fauna of India may yet be filled up.

From recent experience, as from experience gathered in the past, it appears that the most promising ground for exploration, in these Seas, is that which lies between 150 and 250 fathoms.

I may state, in conclusion, that the species here described, but not figured, will in all probability be figured in next year's issue (Part III.) of *Illustrations of the Royal Indian Marine Steamer 'Investigator.'*

ACANTHOPTERYGII.

Family **Percidæ.**

Acropoma, Schleg.

Parascombrops, Alcock, J. A. S. B., Vol. LVIII, pt. ii., p. 296: ?*Melanostoma*, Död., Denk, Ak. Wien, XLVIII., p. 5.

1. *Acropoma philippinense*, Gthr.

Acropoma philippinense, Gthr. Zool. Chall. Exp. Vol. I., pt. vi., p. 51.

Parascombrops pellucidus, Alcock, J. A. S. B., 1889, Vol. LVIII., part ii., p. 296, Pl. XXII., fig. 1.

This species is characteristic of the Bay of Bengal in water between 75 and 150 fathoms deep.

I take this opportunity of stating that the generic name *Parascombrops* proposed by me in 1889 for this species is only a synonym of *Acropoma*, and must therefore be withdrawn.

Family **Scorpænidæ.**

Minous, C. V.

2. *Minous inermis*, Alcock.

Minous inermis, Alcock, J. A. S. B., 1889, Vol. LVIII., pt. ii., p. 299, Pl. XXII., fig. 4; and Annals and Magazine of Natural History, Sept. 1892, p. 207.

Specimens of this species dredged this year in the Bay of Bengal off Madras, at 133 fms., are encrusted with the same commensal Hydroid (*Stylactis minoi*) as the specimens dredged off the Máhánaddi, off the Godávari, and off the Malabar Coast in previous years. This confirms the already fairly well established opinion that the relation between the Hydroid and the Fish is a fixed and definite one.

Family **Berycidæ.**

Hoplostethus, C. V.

3. *Hoplostethus mediterraneum*, C. V.

For Synonomy, *vide* Günther, 'Challenger' Deep-sea Fishes, p. 21.

A fine specimen dredged in the Bay of Bengal at Station 162, 145–250 fms., is a new addition to the record of the Indian Fauna.

Family **Trichiuridæ.**

Thyrsites, C. and V.

4. *Thyrsites bengalensis*, n. sp., Pl. VI., fig. 1.

Closely related to *Thyrsites prometheoides*, Blkr.

B. 7. D. 18 $\left|\frac{2}{13\text{-}14}\right|$ ii. A. $\frac{2}{11\text{-}12}\Big|$ ii. P. 14. V. 1.

Length of head two-sevenths of the total (caudal included), and twice the greatest height of the body.

The snout, which has the usual Trichiurid form, is two-fifths of the head in length, and twice the diameter of the eye.

The nostrils are small pores situated well in front of the eye. The mouth is large, and the upper jaw-bones are massive: the maxilla reaches to a point midway between the anterior border of the orbit and the pupil. There is a single row of distant fang-like teeth in the premaxillary, which in front, to the number of three or four, are of great size: the mandibular teeth are similar in size form and arrangement, but only two—the front one on each side—are enlarged, and these but slightly. There is a single row of small sharp distant teeth on each palatine. Gill-opening extremely wide. Pseudobranchiæ large.

The head and body are invested in a thick silvery scaleless skin. The lateral line bifurcates at the level of the 5th or 6th dorsal spine, the upper branch running along the base of the dorsal fin, the lower descending with a curve to the middle line, or a little ventrad of it, and then taking a somewhat sinuous course to the caudal.

The longest (middle) spines of the long first dorsal fin are two-thirds the greatest body height in length: the second dorsal, like the anal, is low and short: the two spurious finlets are incompletely isolated in both fins.

The caudal is large and deeply forked.

The delicate pectorals are not quite half as long as the head. The ventrals, which arise close together on the abdominal profile a little in advance of the pectorals, are each reduced to a single fluted spine.

In correlation with the strong jaws and large fangs the stomach is huge, its length being one-third of the total (caudal included). In the specimen dissected there is a small air-bladder and seven large but delicate pyloric cæca.

Colours in spirit: burnished silver, with the mid-dorsal line, from snout to caudal, blue-black: fins hyaline, the spinous dorsal with a black edge which is broadest in front, the tips of the lobes of the caudal fin dusky.

The largest specimen measures 5·25 inches.

Loc. Bay of Bengal, Station 162, 145/250 fathoms. This species has the true bathybial *facies*.

Family **Trachinidæ.**

Group Trachinina.

Bembrops, Steindachner.

Bembrops, Steindachner, SB. Ak. Wien, 1877, Vol. LXXIV., pt. i., p. 211.
Bathypercis, Alcock, J. A. S. B. 1893, Vol. LXII., pt. ii., p. 177.

5. *Bembrops caudimacula*, Stdr.

Bembrops caudimacula, Stdr., SB. Ak. Wien, 1877, Vol. LXXIV., pt. i., p. 212.

Two small specimens of this species were dredged in the Bay of Bengal, at Station 170, 107 fathoms, this being the first report of the occurrence of the species in Indian waters.

6. *Bembrops platyrhynchus*, (Alcock).

Bathypercis platyrhynchus, Alcock, J. A. S. B., 1893, Vol. LXII., pt. ii., p. 178.

Bay of Bengal, 128 fathoms.

I must apologize to Professor Steindachner for having, when describing this species last year, overlooked his very clear and complete account of his new genus *Bembrops* from Japan; and I must now state that *Bathypercis* is merely a synonym of *Bembrops*, and must be withdrawn.

Family **Pediculati.**

Lophius, Art.

7. *Lophius lugubris*, n. sp.

Very closely allied to *L. mutilus*, mihi.

B. 6. D. 3/1/7-8. A. 5-6 C. 8. P. 13. V. 1/5.

Cephalic disk subcircular, its diameter not quite one-half the total (caudal included): its upper surface studded with scattered knobs and spines, none of which are of predominant size: the mouth-cleft traverses the whole breadth of the disk.

Depressible fangs in a single series along the premaxillary, except at the symphysis, where there are also a few small teeth of a second series; and in three irregular series in the mandible. A single rigid fang, or a pair, at either extremity of the head of the vomer; and an uneven row of 4 or 5 rigid fangs along each palatine.

Eyes small, their major diameter being about one-seventh the

length of the head: two diameters apart. Gill-cleft contracted: three gills. The skin is loose and glandular, and round the edge of the disk and along the sides of the tail there is a scanty fringe of cutaneous filaments. The dorsal spines are simple filaments, the first two of which stand close together on the snout: the third is about twice the length of the second and as long as the cephalic disk in the after half of which it arises. The second part of the spinous dorsal is represented by a single filament about two eye-lengths long, arising near the hinder limit of the cephalic disk.

Colours in spirit: very dark sepia mottled with black: tongue dusky. Length 4. 25 inches.

Loc. Station 151, off Colombo, 142 to 400 fms.

This species is very closely related to *Lophius mutilus*, mihi (J. A. S. B., Part II of 1893; and Zoology of the R. I. M. S. 'Investigator', Fishes, Part II, pl. X, fig. 2), from which it chiefly differs in having the second part of the spinous dorsal fin represented by a single well-developed spine, instead of by two hidden rudiments.

Halieutæa, C. & V.

8. *Halieutæa fumosa*, n. sp.

B. 6. D. 4. A. 4. C. 9. P. 13. V. 5.

Body remarkably thin and depressed. The greatest length of the cephalic disk, which is half the total, caudal included, is only four-fifths of its greatest breadth.

The spines on the dorsal integument, with the exception of those along the rostral and supra-orbital margin and those on the edge of the disk and along each side of the tail, are mere spicules, quite different from the large stellate spines of the other species; and the ventral integument is thick, soft and glandular, and is absolutely smooth. The cleft of the mouth is two-fifths the breadth of the wide disk.

Eyes large, their diameter being between one-seventh and one-eight the length of the cephalic disk: interorbital space very slightly concave.

The caudal fin is half the length of the tail, or one-fourth the total, itself included, and is equal in length to the pectorals: the long narrow ventrals are just over two-thirds the length of the pectorals.

Colours in spirit: upper surface smoky blue becoming hyaline round the edge of the disk, under surface hyaline, finely and closely speckled with silver: dorsal fin blackish: pectorals and caudal broadly and darkly banded in the distal half, and often milk-white at tip: numerous fine jet black filaments on the upper surface of the disk: a black ring round the orbit.

The largest specimen—a mature female—is about 4 inches long, and 2·4 inches across the disk.

Loc. Bay of Bengal, Station 162, 145 to 250 fms.

Synopsis of the Indian Species of *Halieutæa.*

I. Disk markedly broader than long, with the spinature of its dorsal surface remarkably feeble, and with the skin of its ventral surface soft, thick, glandular and absolutely smooth.

[Interorbital space rather broad and very slightly concave eyes large: mouth-cleft wide, two-fifths of the width of the very wide disk: four rays in the dorsal fin: colour smoky blue].—*H. fumosa.*

II. Disk nearly circular, or only slightly broader than long, with the spinature of its dorsal surface strong and coarse, and with the skin of its ventral surface leathery and either spiny or granular.

- i. Under surface of disk granular or with scattered spines: interorbital space rather narrow and markedly concave: eyes small.
  - *a.* Under surface of disk with scattered spines between which the skin is rough cleft of the mouth narrow, about one-third the width of the disk: four rays in the dorsal fin: ventral fins broad: colour pink.—*H. stellata, C. & V.*
  - *b.* Under surface of disk finely and very closely and uniformly granular: cleft of the mouth broad, nearly half the width of the disk: five rays in the dorsal fin: ventral fins long and slender: colour blue-black.—*H. nigra.*
- ii. Under surface of disk closely covered with stellate spines: interorbital space rather broad and slightly concave in front only: eyes large.

  [Mouth-cleft wide, nearly half the width of the disk: five rays in the dorsal fin: ventrals broadish: colour crimson to bright pink].—*H. coccinea.*

Family **Cataphracti.**

Peristethus, Lacép.

9. *Peristethus Rivers-Andersoni*, n. sp., Pl. VI., figs. 2, 2a, 2b.

D. 6/22. A. 21. L. lat. 32.

The pre-orbital processes, which are bluntly pointed depressed and hollow—their cavity opening below by several large pores—are in length nearly half the distance between their tip and the anterior border of the orbit, and each has upon its base a small upstanding hook.

The pre-opercular ridge is remarkably salient but is sharply truncated, not forming a spine. The opercular ridge forms a short bluntly rounded spine.

The lower jaw is thickly fringed with small tentacles. The labial tentacles when laid back hardly surpass the angle of the mouth.

The interorbital space, the breadth of which is equal to the major diameter of the orbit, is deeply concave, and is traversed fore and aft by a deep median groove. Each supra-orbital margin is surmounted posteriorly by a strong recurved spine, and there is a similar spine on each side of the occiput.

The body-shields are in four rows on each side: each shield is strongly carinated, the carina being produced behind into a strong spine; and in the case of the shields of the posterior third of the lateral line the carinæ are slightly produced and pointed in front also.

The length of the anterior ventral shields is more than twice their greatest breadth.

Colours in spirit: body flesh-coloured; the pectorals with a broad jet-black band in their posterior half and with a milk white tip; the spinous dorsal black in its upper half, and the soft dorsal with a black edge.

Length 3·5 inches.

Loc. Station 151, off Colombo, 142 to 400 fms.

ANACANTHINI.

Family **Gadidæ.**

Physiculus, Kaup.

10. *Physiculus argyropastus*, Alcock.

Physiculus argyropastus, Alcock, J. A. S. B., 1893, Vol. LXII, Pt. ii, p. 180, pl. IX, fig. 2.

Several specimens were dredged in the Bay of Bengal at 162 and 170 fathoms.

This species is easily distinguished from *Physiculus roseus*—the only other Indian species ——as the following tabular statement shows:—

COMPARISON OF THE INDIAN SPECIES OF *Physiculus*.

Physiculus roseus.	*Physiculus argyropastus.*
Greatest height of the body a little over one-sixth of the total (with caudal).	Greatest height of the body a little over one-seventh the total (with caudal).
Jawbones broad and massive.	Jawbones thin and narrow.
Barbel stout and fleshy, about as long as the eye.	Barbel filiform and inconspicuous, never half the length of the eye.
First ray of first dorsal fin prolonged.	No prolonged dorsal ray.
Seven ventral rays, the longest, (outermost) of which only just surpasses the orgin of the anal.	Six ventral rays, the longest (outermost) of which reaches to the 12th or 13th anal ray.
Uniform rose red.	Body with a reddish tinge; fins scarlet.

Family **Ophidiidæ.**

GLYPTOPHIDIUM, Alcock.

11. *Glyptophidium macropus*, n. sp., Pl. VI., fig. 3.

In character quite similar to *Glyptophidium argenteum* (Ann. Mag. Nat. Hist., Nov. 1889, p. 390, and Zool. H. M. I. M. S. 'Investigator,' Fishes, Part I., Pl. II., fig. 3), from which it differs chiefly in having the ventral fins in the form of bifid instead of simple filaments, and in having the caudal fin confluent with the other vertical fins instead of being free a short distance from its base.

The head, which is higher than, and nearly twice as long as the trunk proper, is nearly one-fourth of the total, and has the muciferous channels greatly developed, but the frill-like crests which delimit them —with the exception of the one in the middle line—low. The short trunk falls abruptly to the low finely tapering tail.

The snout, which does not overhang the equal jaws, is a trifle more than one-fourth the length of the head, and not quite equal to the major diameter of the large subcutaneous eye, which latter is equal to the breadth of the interorbital space.

Mouth-cleft wide, the maxilla reaching beyond the middle of the eye: the jaw-bones, like all the bones of the head, are extremely delicate. Villiform teeth in very narrow bands in the jaws, palatines, and vomer.

Operculum with a feeble spine above: gill openings very wide, the

gill-membranes being separate throughout: gill-laminæ very narrow: gill-rakers on the outer side of the first arch numerous (over 25 in number), close-set, long, setiform: pseudobranchiæ moderately large. Scales small and extremely thin; larger and even thinner, but sparse and deciduous, on the head. No lateral line whatever.

The dorsal fin begins well on the occiput, and is much more developed than the anal, its rays in its anterior two-thirds being more than half of the greatest body-height in length: the caudal, which is only about one-third the length of the head, is confluent with the other vertical fins. Pectorals large and pointed, with a thick fleshy base: their length is nearly equal to that of the postrostral portion of the head. The ventrals arise close together at the pectoral symphysis: each consists of two long rays, the inner of which is an eye-length longer than the head.

Intestine long and much convoluted: 7 or 8 very small pyloric cæca: a large air-bladder.

Colours in spirit: head and eye and body silvery, the body finely peppered with black: vertical fins hyaline with blackish tips, pectorals blackish, ventrals white.

The largest specimen is nearly $5\frac{1}{2}$ inches long.

Loc. Bay of Bengal, Station 162, 145—250 fms.

NEOBYTHITES, Goode and Bean.

12. *Neobythites squamipinnis*, Alcock.

Pycnocraspedum squamipinne, Alcock, *Annals and Magazine of Natural History*, November 1889, p. 386.

Further specimens (from the Bay of Bengal 145–250 fms.), together with a better knowledge of the family, convince me that the characters upon which the genus *Pycnocraspedum* was founded are not of generic value. I therefore withdraw the name *Pycnocraspedum*.

Family **Macruridæ.**

MACRURUS, Bl.

Subgen. Cœlorhynchus.

13. *Macrurus flabellispinnis*, n. sp.

B. 6. D.*1/8. A. 95. P. 16. V. 7. Pyl. cæc. *circ.* 40.

Head massive, shark-like, deeper and broader than, and more than

* A rudimentary tubercle.

twice the length of the trunk proper, and more than half the length of the lash-like tail: its length in the total is nearly one-third.

The trihedral, rigid, and acutely-pointed snout is about two-fifths the length of the head, and about twice the major diameter of the large eye in length: about four-fifths of its extent is pre-oral. The nostril on either side has the form of a large pit (the vertical diameter of which is two-fifths the major diameter of the eye) with an anterior circular opening, and the posterior opening much larger and reniform—the two openings being separated by a narrow bridge of skin.

The mouth is quite inferior: the maxilla reaches almost to the vertical through the posterior border of the orbit. Villiform teeth in a narrow tapering band in the lower jaw; and in a broader and longer band in the upper jaw, where the outer row is slightly enlarged. Barbel slender, not much more than half an eye-length long.

Gill-openings wide, the membranes free: gill-rakers rudimentary: gill-laminæ large and broad.

The body and the head, except in the glosso-hyal region, are everywhere covered with large, stout, firmly adherent scales: those on the head, which are so intimately adherent to the bones beneath as to form a plate-armour, are furnished with from three to eight strong widely-radiating spiniferous ribs; while those on the body and tail have usually eight similar great spiniferous ribs, the radiate arrangement of which, though very distinct, is not quite so marked: occasionally the last spine of one rib or more projects beyond the edge of the scale.

There are four rows of scales between the base of the first dorsal fin and the scales of the lateral line.

The first spine of the first dorsal fin is a mere tubercle; the second, which is not quite five-sixths the length of the snout, is smooth throughout: the interval between the two dorsal fins is greater than the extent of the base of the first. The pectorals are narrow and pointed, and their length is not quite equal to that of the postorbital portion of the head. The outer ray of the ventrals is prolonged, but is not quite equal in length to the longest pectoral ray.

Stomach large and siphonal: at least 40 large long pyloric cæca: air-bladder small, and with a thin wall.

Colours: dark stone-grey; fins and pharyngo-branchial walls blue-black; parietal peritoneum silvery-grey.

Length 19 inches.

Loc. Station 150, Laccadive Sea, 719 fms.

This species is very closely allied to *M. japonicus* Schleg., *M. parallelus*, Gthr., and *M. quadricristatus*, mihi.

Subgen. **Macrurus**, Bl.

14. *Macrurus pumiliceps*, n. sp.

Closely allied to *M. smiliophorus*, Vaillant, from which it differs conspicuously in the structure of the scales.

B 7. D. 2/11. V. 12. P. 18.

The length of the head, which is a little more than the greatest height of the body, is only just over one-eighth of the total, the tail forming a long lash.

Snout trihedral, with strong median and lateral tubercles, its length is just exceeded by the major diameter of the eye,—the latter being not quite one-third the length of the head, and exceeding the width of the interorbital space by about one-fourth.

Mouth small and quite inferior, the maxilla only just passing the level of the front border of the orbit. Barbel about three-quarters the length of the eye. Villiform teeth in bands in both jaws.

Head and body covered with small scales, those on the head with rough radiating ridges, those on the body having usually six (sometimes, eight) nearly parallel rows of long slender spinelets — not more than five in the longest row. [In the specimens taken no lateral line is distinguishable.]

The first dorsal spine is rudimentary, the second is slightly elongate (not so long as the short head), and very closely and sharply serrated (about 35 serrations) except at extreme base and tip. The rays of the second dorsal fin are remarkably short, slender, and inconspicuous, those of the anal are remarkably long and stout. The outermost ventral ray is moderately prolonged, being as long as the upper pectoral rays, or equal in length to the postrostral portion of the head. [In the two immature specimens taken the ventral reaches to the sixth anal ray, and the pectoral to the ninth; the vent being not half an eye-length behind the base of the pectoral fin].

Nine or ten villiform (rudimentary) pyloric cæca.

Colour: silvery grey; throat, gill-membranes, belly, and paired fins black; vertical fins blackish.

Length 11 inches.

Loc. Laccadive Sea, Station 150, 719 fms.

THE INDIAN SPECIES OF *Cœlorhynchus* and *Macrurus*.

1. *Key to the Indian Species of the Sub-genus* Cœlorhynchus.

I. Scales of the body with distinctly *radiating* spiny ridges, all of which are uniform in size and spinature: pyloric cæca about forty in number.
- 1. Scales of the body with not more than five spiny ridges: six rows of scales between the after limit of the first dorsal fin and the lateral line: body with numerous cross-bands.—*Macrurus* (*Cœlorhynchus*) *quadricristatus*.
- 2. Scales of the body with usually eight spiny ridges: four rows of scales between the after limit of the first dorsal fin and the lateral line: colour uniform dark stone-grey...*Macrurus* (*Cœlorhynchus*) *flabellispinis*.

II. Scales of the body with *parallel* spiny ridges, the spinature of the middle one of which is by far the strongest: pyloric cæca twelve in number..... ..... 3. *Macrurus* (*Cœlorhynchus*) *parallelus*, Gthr.

2. *Key to the Indian Species of the Sub-genus* Macrurus.

I. Six branchiostegals: [seven to nine rays in the ventral fin].
- 1. Second spine of the first dorsal fin remarkably prolonged—more than twice the length of the head: eight rays in the ventral fin.
  - i. Scales small, with five or six well-spaced parallel rows of spinelets. *Macrurus (Macrurus) lophotes.*
  - ii. Scales large, with about seventeen oblique crowded rows of spinelets. *Macrurus (Macrurus) macrolophus.*
- 2. No greatly prolonged spine in the dorsal fin: seven to nine rays in the ventral fin.
  - i. Scales with rows of spinelets all of which are of uniform small size: greatest height of the body much exceeding that of the tail.
    - *a.* Seven rays in the ventral fin: snout blunt—not longer than the eye..... *Macrurus* (*Macrurus*) *hextii.*
    - *b.* Eight rays in the ventral fin: snout sharp—longer than the eye..*Macrurus* (*Macrurus*) *woodmasoni.*
  - ii. Scales with rows of spinelets of which those in the middle row are conspicuously larger than the others: body not abruptly delimited from the tail: nine rays in the ventral fin. ...*Macrurus* (*Macrurus*) *hoskynii.*

II. Seven branchiostegals: [eight to twelve rays in the ventral fin].

- 1. Usually eight rays in the ventral fin: scales with spinelets which may be in rows or not, but are never densely packed.
  - i. Mouth very large: snout remarkably shallow: barbel considerably longer than the eye: spinelets of the scales without any arrangement: a patch of enlarged cycloid scales behind the first dorsal fin: cheeks opercles and belly burnished silver: ventrals eight-rayed.....*Macrurus* (*Macrurus*) *petersoni.*
  - ii. Mouth very small: snout deep: barbel not half as long as the eye: spinelets of the scales arranged in definite rows: opercles and belly black: ventrals eight-rayed.....*Macrurus* (*Macrurus*) *investigatoris.*
- 2. Ten rays in the ventral fin: scales with densely packed spinelets which show no arrangement in rows: snout quite peculiar in being vertically truncated with an abruptly prominent median tubercle—its length without the tubercle being not much more than half that of the eye *Macrurus* (*Macrurus*) *brevirostris.*
- 3. Usually twelve rays in the ventral fin: scales with rows of spinelets which may be either close-set or open.
  - i. Tail lash-like and filiform: spinelets of the scales in definite short rows eight or nine in number.
    - *a.* Head large—its length about one fifth of the total: gill-openings extremely wide, the membranes being united only quite in front: ventrals (eleven or) twelve rayed..... *Macrurus* (*Macrurus*) *polylepis.*
    - *b.* Head singularly small—its length about one-eighth the total: gill-openings of the usual width, the membranes being broadly united: ventrals with twelve rays..... *Macrurus* (*Macrurus*) *pumiliceps.*
  - ii. Body of the usual tapering form: spinelets of the scales in densely crowded rows fifteen in number besides short rows in between: ventrals (eleven or) twelve rayed.....*Macrurus* (*Macrurus*) *semiquincunciatus.*

BATHYGADUS, Gthr.

15. *Bathygadus furvescens*, n. sp.

B. 7. D. 10. P. 15. V. 8. Pyl. cæc. 20.

The length of the head is a little more than one-fifth of the total (1: 4·75); and the height of the tapering body, immediately behind the gill-opening, is about three-fourths the length of the head.

The length of the snout is one-fourth that of the head, and is equal to the width of the interorbital space: the major diameter of the orbit is four-fifths the length of the snout. The nostrils are placed close together immediately in front of the eye, the anterior being a mere pore.

The mouth is very capacious, its cleft reaching to the vertical through the posterior border of the orbit. Villiform teeth in bands in the jaws only, the band in the upper jaw being very broad: there is a wide diastema between the two elements of the pre-maxillary, and a corresponding but much narrower edentulous interval at the mandibular symphysis. There is no barbel.

Gill-openings wide, the gill-membranes free. The gill-rakers are short, broad, clavate and remarkably spiny, except on the outer side of the 1st branchial arch where they are long and setiform,—the middle ten or twelve being three-fourths the diameter of the eye in length.

The body and the head, except in the glosso-hyal region, are covered with deciduous cycloid scales, of which there seem to be seven rows between the base of the 1st dorsal fin and the lateral line.

The 1st dorsal fin has the usual position, and the 2nd arises immediately behind it: an unbroken ray from the middle third of the well-developed 2nd dorsal is more than one-third of the greatest body-height in length. The rays of the anal fin are short and slender. The length of the pectorals is not quite equal to that of the postrostral portion of the head: when laid back, their tips reach beyond the origin of the anal. The ventrals, which are large, arise immediately below the pectorals.

The pyloric cæca, which are twenty in number, are of great size, as is also the pancreas. The air-bladder is large and spongy.

Colours: warm dusky brown; vertical fins blackish, paired fins black; gill-membranes, mouth and peritoneum black.

Length: 20·5 inches.

Loc. Station 150, off the Maldives, 719 fms.

Family **Pleuronectidæ.**

CHASCANOPSETTA, n. gen.

Mouth very wide, the maxillary being more than half the length

of the head. Jaws and teeth equally developed on both sides, each jaw being armed with a single row of long slender depressible teeth. Eyes on the left side. The dorsal fin commences near the tip of the snout, its rays, and those of the anal, being simple, slender, and scaleless. Scales minute, membranous, hardly imbricate. Lateral line with a strong curve above the pectoral. Gill-openings wide, the gill-membranes united to the isthmus in front. Gill-rakers none.

16. *Chascanopsetta lugubris*, n. sp., Pl. VI., fig. 4.

B. 7. D. 115. A. 80. C. 16. V. 6.

Body long, low, tapering, the dorsal profile considerably more convex than the ventral. The greatest height of the body is about one-fourth, and the length of the head about one-fifth of the total, caudal included.

Mouth-cleft very wide, oblique, with the lower jaw strongly projecting: the maxilla, which is hardly expanded posteriorly, is about three-quarters the length of the head,—reaching nearly to the angle of the properculum. Each jaw is armed with a single row of sharp curved teeth of two sizes, the larger fairly regularly alternating with the smaller: those of the lower jaw are very close-set, and are strongly depressible inwards across the floor of the mouth: those of the upper jaw are more distant, not so strongly depressible, and rather smaller. Tongue large, free, with a long styliform point.

The eyes, which are on the left side, are large (their major diameter being about two-sevenths of the length of the head), close-set (less than a-third of a diameter apart), and nearly equal in front. The snout proper is short—about two-thirds the length of the eye. The nostrils are minute pores situated in front of the interorbital space.

The gill-openings are wide, the gill-membranes being free posteriorly: the gill-arches are extremely weak and slender, the gill-laminæ are delicate, and there are no gill-rakers.

The body and the post-orbital portion of the head are covered with minute membranous hardly imbricating scales, which are somewhat enlarged along the lateral line. The lateral line on both sides has a strong sinuous curve above the pectoral fin.

The fin-rays are weak and filiform: the dorsal begins in front of the eye, on the snout. The caudal peduncle is strongly constricted, and expands again at the insertion of the fin, which is long and pointed,—$6\frac{1}{2}$ in. the total length. The pectorals are slender: that on the coloured side is much larger than its fellow, its upper rays being nearly as long as the caudal. Both ventrals are well developed.

Colours: dull dusky brown, the peritoneum showing through as a black patch; iris and fins black; tongue dusky brown.

The largest specimen is 5·75 inches long.

Loc. Bay of Bengal, Station 162; 145 to 250 fms.

POECILOPSETTA, Gthr.

17. *Poecilopsetta maculosa*, n. sp., Pl. VII., fig. 1.

D. 56. A. 46. V. 5. C. 18.

Height of the body about $1\frac{4}{5}$ in the total, without caudal; length of the head a little more than $3\frac{1}{2}$. The length of the snout is about half the major diameter of the lower eye, which latter is nearly one-third the length of the head—the upper eye being markedly larger. The eyes are on the right side, the lower hardly in advance, the upper strongly encroaching on the dorsal profile: they are separated by a flat scaly space, the breadth of which is nearly equal to the length of the snout. The mouth-cleft is oblique and narrow, the maxilla being hardly more than one-fourth the length of the head: the jaws are equal in front and equally developed on both sides, as are the teeth, which are villiform and in a crowded row in both jaws. The gill-membranes are broadly united below the throat.

The head, body, and caudal fin are covered with minute thin cycloid scales: the lateral line has a wide curve above the pectoral fin. The dorsal fin begins above the middle of the eye and extends to the base of the caudal peduncle: its rays, like those of the anal fin, are simple, the longest being less than one-fourth the greatest body height. The caudal fin is large and hastate, its length being nearly one-fourth the total. The right (coloured) pectoral is rather more developed than the left, but is not longer than the eye. The ventrals are quite equal, opposite, and symmetrical, and are about as long as the eye.

Colours: right side silvery-grey with numerous large, well-defined, more or less oval blotches, varying from dusky grey to jet-black—the black blotches, in regular alternation with lighter ones, forming a ring round the circumference of the body; pectoral with a black blotch, caudal with two—one above, the other below: left side with several longitudinal series of black blotches along the middle of the body, and with a series round the circumference of the body, corresponding blotch for blotch with those on the coloured side.

Length nearly 3·75 inches.

Loc. Bay of Bengal, Station 162; 145–250 fms.

18. *Pœcilopsetta prælonga*, n. sp., Pl. VII., fig. 2.

D. 58–60. A. 45–47. V. 6. C. 18.

Closely resembling *P. maculosa*, but very easily distinguished by the following differences:—The height of the body is only about one-

third of the total without the caudal: the length of the snout is only about one-third the major diameter of the eye, which is one-third the length of the head: the eyes are in the closest contact: the maxilla is one-third the head in length: the teeth are in a narrow but distinct band in either jaw: the dorsal fin begins above the hinder limit of the upper eye, and its longest rays are over one-third the greatest body-height in length: the caudal fin is narrow elongate and pointed.

Colours: right side hyaline grey, all the fins black; a series of black blotches round the circumference of the body, and two series along the middle of the body: the left side is coloured very much as in the preceding species.

The largest specimen measures 3·75 inches.

Loc. Off Colombo, Station 151; 142–400 fms.

Solea, Gthr.

19. *Solea umbralitis*, n. sp., Pl. VII., fig. 3.

D. 70. A. 50. C. 18. P. 0. V. 5. L. lat. circ. 80.*

The height of the body is $2\frac{1}{3}$ in the total without the caudal. The length of the head is sometimes a little more, sometimes a little less than a third of the total without the caudal (in adults). The snout is but slightly hooked: its length is twice that of the eye and from two-sevenths to a quarter that of the head. The eyes are nearly or quite a diameter apart. The nostril of both sides is a slender tube. The mouth-cleft reaches to the posterior limit of the lower eye.

No pectoral fins whatever.

Ventral fins symmetrical, separated from the anal by more than an eye-length.

Colours in spirit: warm olive brown with numerous large black blotches which form four or five irregular transverse series and three irregular longitudinal series: dorsal and anal fins bluish-black or black: underside smoky in rather more than the posterior half. The black blotches are sometimes circumscribed by a light areola.

Length of a nearly mature female, 4·25 inches.

Loc. Bay of Bengal, Stations 169 and 170; 91–107 fms.

In form and colour this species at first sight resembles *Solea cyanea* (Ann. Mag. Nat. Hist., Dec. 1890, p. 439), from which it is distinguished—specimens of equal size being compared—by the much larger head and mouth, by the larger and more widely separated eyes, and by the fewer rays in the dorsal and anal fins. It is however closely allied to *Solea cyanea*, and also to *Solea melanosticta*, Peters (MB. Ak.

* To its termination behind the upper eye.

Berl., 1876, p. 845), and *Solea kaiana*, Gthr. ('*Challenger*' Shore fishes, p. 49, pl. XXI., fig. C.)—all being comparatively deep-water forms of the East Indian Seas.

Aphoristia, Kaup.

20. *Aphoristia trifasciata*, n. sp., Pl. VII., fig. 4.

D. 87–89. A 75–77. V. 4. C. 12. L. lat 80 to 82. L. tr. 38 to 40.

The length of the head, which is a trifle less than the height of the body, is one-fourth the total without the caudal. The length of the snout, which is about one-third more than the major diameter of the eye, is from one-fifth to one-sixth the length of the head. The eyes are in contact and are situated between the same verticals. The cleft of the mouth reaches beyond the middle of the lower eye. A row of small equal setiform teeth in each jaw on the blind side. The nostrils, the gill-openings and gill-membranes, and the form and arrangement of the scales, are as in the other Indian species.

The longest (posterior) rays of the dorsal fin are more than half the greatest body-height, the corresponding anal rays being not quite so long. The ventral fin is about one-fourth the length of the head, and is separated from the anal by an interval equal to the length of the snout.

Colours: warm olive brown with three broad blackish cross-bands.

The largest specimens measure 4 to $4\frac{1}{2}$ inches.

Loc. Bay of Bengal, Station 162; 145–250 fms., and Station 164; 195–210 fms.

This species is akin to *Aphoristia septemstriata* and to *Symphurus levi*, Jordan and Bollman, *Symphurus fasciolaris*, Gilbert, and *Symphurus atramentatus*, Jordan and Bollmann. Its difference from the other Indian species, all of which also inhabit deep water, is shown in the following synoptical table.

Synopsis of the Indian Species of *Aphoristia*.

I. Both sides coloured, no cross-stripes: height of the body rather over one-fourth the total (with caudal).	1. The mouth-cleft extends to or beyond the middle of the lower eye, owing, not to the greater size of the mouth, but to the more anterior position of the eyes: the origin of the ventral fin is hardly an eye-length distant from that of the anal..... *A. gilesii.*
	2. The mouth-cleft, owing to the more posterior position of the eyes, hardly surpasses the front edge of the lower eye: the origin of the ventral fin is more than two eye-lengths distant from that of the anal. ... *A. wood-masoni.*

II. Only the left side coloured, striped with cross-bands: height of the body markedly less than one-fourth the total (with caudal).

1. The length of the head is one-fourth the total (without caudal): mouth-cleft large, reaching well beyond the middle of the lower eye: the largest rays of the vertical fins are more than half the greatest body-height: three cross-bands..... *A. trifasciata.*

2. The length of the head is one-fifth the total (without caudal): mouth-cleft small, hardly surpassing the front edge of the lower eye: the longest rays of the vertical fins are from two-fifths to one-third the greatest body height: six or seven cross-bands..... *A. septemstriata.*

PHYSOSTOMI.

Family **Scopelidæ.**

CHLOROPHTHALMUS, Bonap.

21. *Chlorophthalmus corniger*, n. sp., Pl. VI., fig. 5.

B. 8. D. 11. A. 9. P. 14. V. 1/8. L. lat. *circ.* 55.

Closely allied to *Chlorophthalmus productus*, Gthr. ('Challenger' Deep-Sea Fishes, p. 193, pl. L., D.), from which it appears to differ only in colour, and in having a pair of strong flat spines on either side of the salient mandibular symphysis.

Colours in spirit silvery-grey with numerous broad ill-defined dusky cross-bands: fins hyaline, the tip of the caudal and the base and tip of the dorsal black.

The largest specimen measures a little over 3 inches.

Loc. Bay of Bengal, Station 152; 145–250 fathoms.

Family **Murænidæ.**

Group Anguillina.

CONGROMURÆNA, Kaup.

22. *Congromuræna musteliceps*, n. sp., Pl. VII., fig. 5.

Allied to *C. megastoma*, Gthr., *C. squaliceps*, *C. nasica* and *C. macrocercus* (= *C. longicauda*, Alcock, *nec* Ramsay and Ogilby).

Head about an eye-length longer than the trunk, which is one-fourth the length of the tail.

The snout, which is long narrow and acutely pointed and far over-hangs the mouth, is between one-fourth and two-ninths the length of the head, and twice the major diameter of the eye. The anterior nostril is a short tube situated on the lip near the tip of the snout,

the posterior is a very wide foramen situated above and in front of the angle of the eye. The mouth-cleft reaches just behind the vertical through the middle of the eye, and the lips are large. Minute teeth in broadish bands in the jaws, in a rasp-like patch outside the closed mouth in the pre-maxillary, and in a broad band in about the anterior third of the vomer. Gill-openings wide, separate.

No scales: the lateral line is marked by a row of small pores.

Pectorals narrow, pointed, nearly half an eye-length longer than the snout. Vertical fins confluent, the dorsal beginning nearly an eye-length in advance of the gill-opening.

Colours in spirit: dark purple-brown, becoming silvery on the abdomen: opercle black: vertical fins with a broad black edge throughout their entire length.

The largest specimen measures 15 inches.

Loc. Bay of Bengal, Station 162; 165–250 fathoms.

SYNOPSIS OF THE INDIAN SPECIES OF *Congromuræna.*

I. Head much shorter than the trunk proper: tail but little longer than the head and trunk combined,—*C. anago*, Schleg.

II. Head nearly equal in length to the trunk proper: tail nearly twice as long as the head and trunk combined:—

i. Snout narrow, and tapering to a very sharp point,—its length between one-fourth and two-ninths that of the head: cleft of the mouth not extending much beyond the middle of the eye,—*C. musteliceps.*

ii. Snout broadish or broad, and blunt pointed: cleft of the mouth extending much beyond the middle of the eye:—

a. Snout one-fifth the length of the head, its mucous channels opening by small and inconspicuous pores: pectorals large, much longer than the snout,—*C. squaliceps.*

b. Snout one-fourth the length of the head, its mucous channels opening by large and conspicuous pores: pectorals small, about as long as the snout.

1. Eye in the adult half the length of the snout: one or two of the vomerine teeth conspicuously enlarged,—*C. nasica.*

2. Eye in the adult about two-thirds the length of the snout: no enlarged teeth on the vomer,—*C. macrocercus* (= *C. longicauda*, Alcock, *nec* Ramsay and Ogilby.

Group Murænesocina.

XENOMYSTAX, Gilbert.

Gilbert, Proc. U. S. Nat. Mus., Vol. XIV., 1891, p. 348.

23. *Xenomystax trucidans*, n. sp.

Head about equal in length to the trunk, the latter being about two-sevenths the length of the long tapering tail.

The depressed and sharply pointed snout is a little more than one-third of the head in length and nearly four times the major diameter of the eye: its mucous pores, like those of the mandible and of the rest of the head, are large slits: the anterior nostril is a large sub-tubular slit situated on the lip close to the tip of the snout, the posterior is a wide elliptical foramen situated, almost superiorly, partly in the posterior and partly in the middle third of the snout. The mouth-cleft is wide, extending an eye length behind the posterior border of the orbit, or more than half way along the head, and the maxillæ are most remarkably massive. The teeth are in broad crowded bands, acicular or caniniform, and for the most part depressible: those in the upper jaw are in two bands—an outer very broad-band of large depressible teeth in four series which increase in size from without inwards, and an inner narrow-band or very close-set row of small rigid teeth—the two bands being separated throughout their whole extent by a broad groove: the pre-maxillary teeth, which are much enlarged, are in a broad patch standing outside the closed mouth: the mandibular teeth are in at least five series increasing in size from without inwards, and at the symphysis, where they are greatly enlarged, they form a patch which fits into a wide notch in the upper jaw: the vomerine teeth form a short row of fangs. Tongue small and intimately adherent throughout to the floor of the mouth. Skin scaleless, glandular. Lateral line formed by a row of large brilliant close-set pores. Gill-openings wide, crescentic, separated by a very narrow interspace.

Vertical fins well developed, the dorsal beginning just in advance of the gill-opening. Pectorals narrow, pointed, more than half the snout in length.

The stomach is large, extending the whole length of the abdominal cavity, and is very distensible: the intestine in its posterior portion is coiled in a series of close pleats: only the left lobe of the liver is developed: pancreas large: a large air-bladder extending behind the vent.

Colour: body and fins blue-black; pectorals with narrow whitish edge and tip: margin of gill-opening and of all the mucous pores of the head and lateral line brilliant white.

A mature female between 25 and 26 inches long.

Loc. Laccadive Sea, Station 150; 719 fathoms.

This species appears to differ from *Xenomystax atrarius*, dredged by the U. S. Fish Commission in 401 fathoms off the coast of Ecuador, only in the greater relative length of the tail, the nearer approximation of the gill-openings, and the greater length of the pectoral fins.

Group Nemichthyina.

NEMICHTHYS, Richardson.

24. *Nemichthys acanthonotus*, n. sp.

The posterior third or so of the long slender body is rather abruptly constricted to form a lash-like tail.

The head, rather more than four-sevenths of which is formed by the long tapering snout, is between one-seventh and one-eighth of the total. The diameter of the subcutaneous eye is between one-third and one-fourth the length of the post-orbital portion of the head, and between one-sixth and one-seventh the length of the snout. The nostrils have the usual position, and the jaws are curved at tip as in *N. infans*. Small recurved asperities in crowded bands form the dentition of the jaws and vomer.

The vent is situated immediately behind the gill-opening and the root of the pectoral fin.

The gill-openings, which are wide, are separated from one another only by a thin fold of skin.

No scales. The lateral line is marked by a series of small glistening pores which are arranged with beautiful regularity in "fives" (quincunces). The head is studded with similar pores.

The dorsal fin commences on the occiput, and is continued to the tip of the tail: in a part of its extent somewhat less than the middle third the long slender rays are replaced by strong short spines—like those of *Notacanthus*—interconnected by a low membrane. The anal fin, which commences immediately behind the vent, has its rays well-developed throughout,—the longest rays being considerably more than half the length of the post-rostral portion of the head.

The pectorals are large, and are half as long as the post-orbital portion of the head.

Colours: uniform dark sepia becoming black ventrally: gill-covers and fins black.

A single well-preserved specimen 22 inches long.

Loc. Bay of Bengal, Station 165; 475 fathoms.

This species is distinguished from its congeners by the long series of stout sharp close-set spines in the middle of the dorsal fin.

Family **Halosauridæ.**

HALOSAURUS, Johnson.

25. *Halosaurus mediorostris*, Gthr.

Halosaurus mediorostris, Gthr. 'Challenger' Deep Sea Fishes, p. 239, pl. LIX, fig. C.

A single specimen was dredged in the Laccadive Sea, at Station

150, in 719 fathoms, and is now for the first time recorded in the Indian Fauna.

PLECTOGNATHI.

Family **Sclerodermi.**

TRIACANTHODES, Blkr.

26. *Triacanthodes ethiops*, n. sp., Pl. VII., fig. 6.

D. 6/14. A. 14. P. 11–12. V. 1/1.

In a young specimen the height of the body is one-half the total length—caudal included.

The integument is everywhere closely covered with acicular spinelets, each of which is deeply imbedded in a fleshy papilla. The first dorsal spine is of pre-eminent size,—more than half the height of the body, but is neither so long nor so stout as the single recurved spine of the ventrals. All the spines are armed with numerous small barbs. In the axil of each ventral spine is a single minute filiform ray.

Colours: uniform blue-black, the spiniferous papillæ milk-white.

A single specimen not much over an inch and a half long.

Loc. Bay of Bengal, Station 162, 145–250 fathoms.

EXPLANATION OF PLATES.

PLATE VI.

Fig. 1. Thyrsites bengalensis.

Figs. 2, 2a, 2b. } Peristethus rivers-andersoni.

Fig. 3. Glyptophidium macropus.

Fig. 4. Chascanopsetta lugubris.

Fig. 5. Chlorophthalmus corniger.

PLATE VII.

Fig. 1. Poecilopsetta maculosa.

Fig. 2. Poecilopsetta prælonga.

Fig. 3. Solea umbratilis.

Fig. 4. Aphoristia trifasciata.

Fig. 5. Congromuræna musteliceps.

Fig. 6. Triacanthodes ethiops.

Natural History Notes from the Royal Indian Marine Survey Steamer 'Investigator,' Commander C. F. Oldham, R. N., commanding.— Series II., No. 12. *Note on the sound produced by the Ocypode Crab,* Ocypoda ceratophthalma. *By* SURGEON-CAPTAIN A. R. ANDERSON, B.A., M.B., NATURALIST TO THE INDIAN MARINE SURVEY.

[Received and Read 4th July.]

Although in several Brachyurous Decapod Crustaceans stridulating ridges have been most carefully described and figured, in only one solitary instance can I find any observations regarding the sounds produced by these ridges. Indeed they appear to have derived their designation rather from the resemblance they bear to the stridulating organs of insects than from any stridulating function they themselves had been observed to possess. In this note I venture, therefore, to describe the sound produced by the well-known stridulating organ of *Ocypoda ceratophthalma*, Pallas, a description of which, as well as of the ridges found in such other species of *Ocypoda* as possess them, will be found given by Miers in the Annals and Magazine of Natural History Vol. X, 1882. Dana, in the volume describing the *Crustacea* of the United States Exploring Expedition, writes of the genus *Ocypoda*:—"These species are able to make a sound, by means of a series of minute ridges on the inner surface of the hand, which acts like a rasp against a prominent edge on the second joint of the same pair of legs." He however gives no description of the sound produced. In the Administration Report of the Marine Survey of India for 1891-92, Surgeon-Captain A. Alcock relates his experiences of the musical powers of the red *Ocypoda macrocera*, and with this solitary exception, I am unable to find any record of similar powers having been observed in any other of the Ocypodes.

In *Ocypoda ceratophthalma* the stridulating organ consists of a ridge coarsely striated above, finely striated below, borne on the inner surface of the hand of the larger chela. This ridge is rubbed across a smooth raised ridge on the ischium of the same chela, and by slowly rubbing the opposed ridges together, and placing the crab over the mouth of a wide-necked bottle to act, like the crab's burrow, as a resonator, an exact reproduction of the sound emitted by the crab, during life, can be obtained. One bright hot sunshiny morning in November, as I was walking along the shore of Bingaroo, one of the Lakadive Islands, which is only occasionally visited by the inhabitants of the other islands of the same atoll, I was surprised to hear a loud croaking noise, that appeared to proceed from the edge of the scrub jungle

that covers the island. At first I imagined it must be caused by frogs, so perfectly did it resemble the croaking of these animals. However, on tracing the sound to its source, I discovered that it proceeded from the burrows of the Ocypode crabs which here fringed the beach at high-water mark. These burrows are frequently, in coral sand, very wide at their mouths (6 to 8 ins.), and then taper gradually downwards, so that they act as excellent resonators. The cause of the stridulation of the crabs was by no means apparent, the animals were all lying hidden in their burrows, and several were croaking at the same time, as if in concert.

Natural History Notes from the Royal Indian Marine Survey Steamer 'Investigator,' Commander C. F. Oldham, R. N., commanding.—Series II., No. 13. *A New Brachiopod.* By A. Alcock, Superintendent of the Indian Museum.

PLATE VIII.

[Received and Read, 4th July.]

Of the *Brachiopoda* of Indian waters but little appears to be known. *Lingula* and *Crania* have been reported from the shallows, and a small species of *Terebratula* has—but not very commonly—been met with off Ceylon in 20–30 fathoms. I myself, in the course of four seasons systematic dredging, 1888–1892, on board the "Investigator," only once met with a Brachiopod — a minute species of *Terebratula*—dredged in 1891 in the Laccadive Sea, at 865–880 fathoms, on a bottom of Globigerina ooze. A certain amount of interest, therefore, attaches to any "finds" in these waters of representatives of this ancient class of animals.

The species described in the sequel is a *Terebratula* of remarkable size, dredged in the Laccadive-Maldive basin, off the island Uligánu of the Northern Maldive atoll, at a depth of 719 fathoms, on a bottom of fine coral sand. The species is represented, unfortunately, only by a dead shell, which however was quite perfect.

TEREBRATULA, Llhwyd.

Terebratula Johannis-Davisi, n. sp., Plate VIII.

Shell pyriform, inequilateral, thin but strong, its surface smooth except for the concentric lines of growth, and microscopically punctate: in colour purple-brown.

The shell is remarkable in being inequilateral, having a well-marked bulge to the left side (the shell being held ventral valve downwards and beak pointing backwards) : and this asymmetry is shown by the lines of growth to have existed from an early period of life.

The dorsal valve is slightly more convex than the ventral; and both valves have the margin simple, entire, and broadly turned over and bevelled all round.

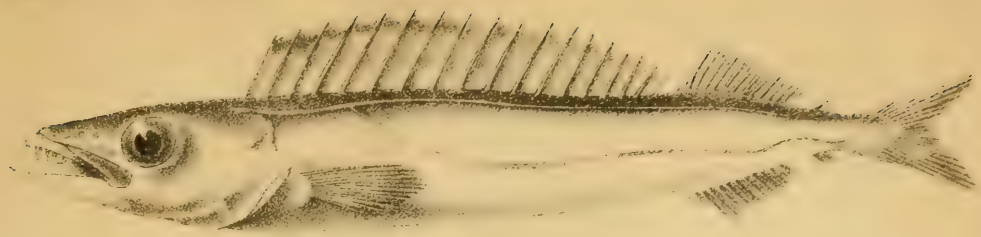
Internally, the dorsal valve has very prominent cardinal processes, and a small slender loop, the greatest convexity of which does not reach forward beyond the first fifth of the length of the shell.

The ventral valve has a re-curved beak which conceals the small deltidium, the latter consisting of a single piece transversely striated, and the beak being truncated by a thick-edged foramen.

Greatest length of the shell 73 millim., greatest breadth 68 millim.

I have named this species after the great Elizabethan navigator John Davis, who appears to have been the first English explorer to take an interest in the Maldive Islands.

The plate explains itself.



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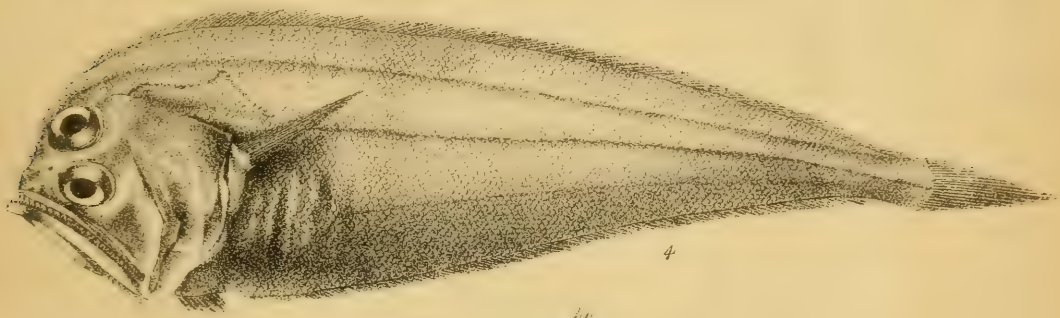
2a

2

2d



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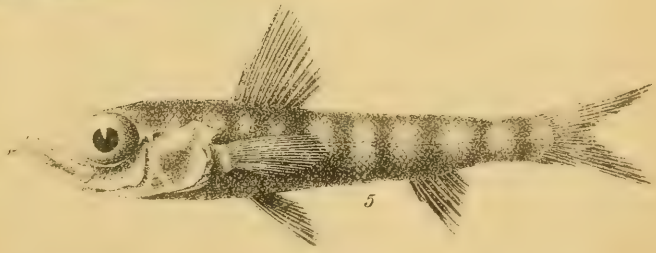

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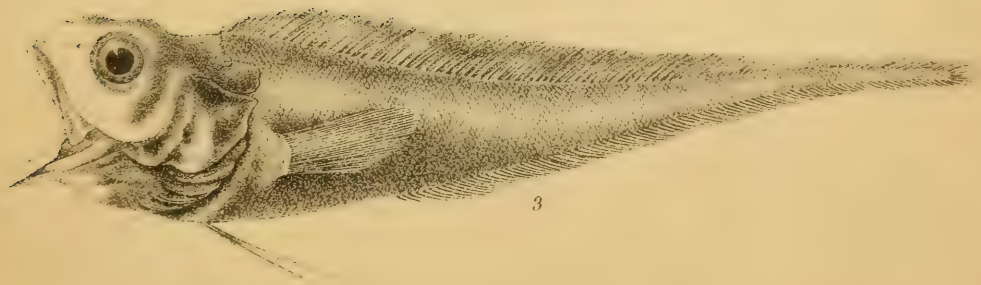

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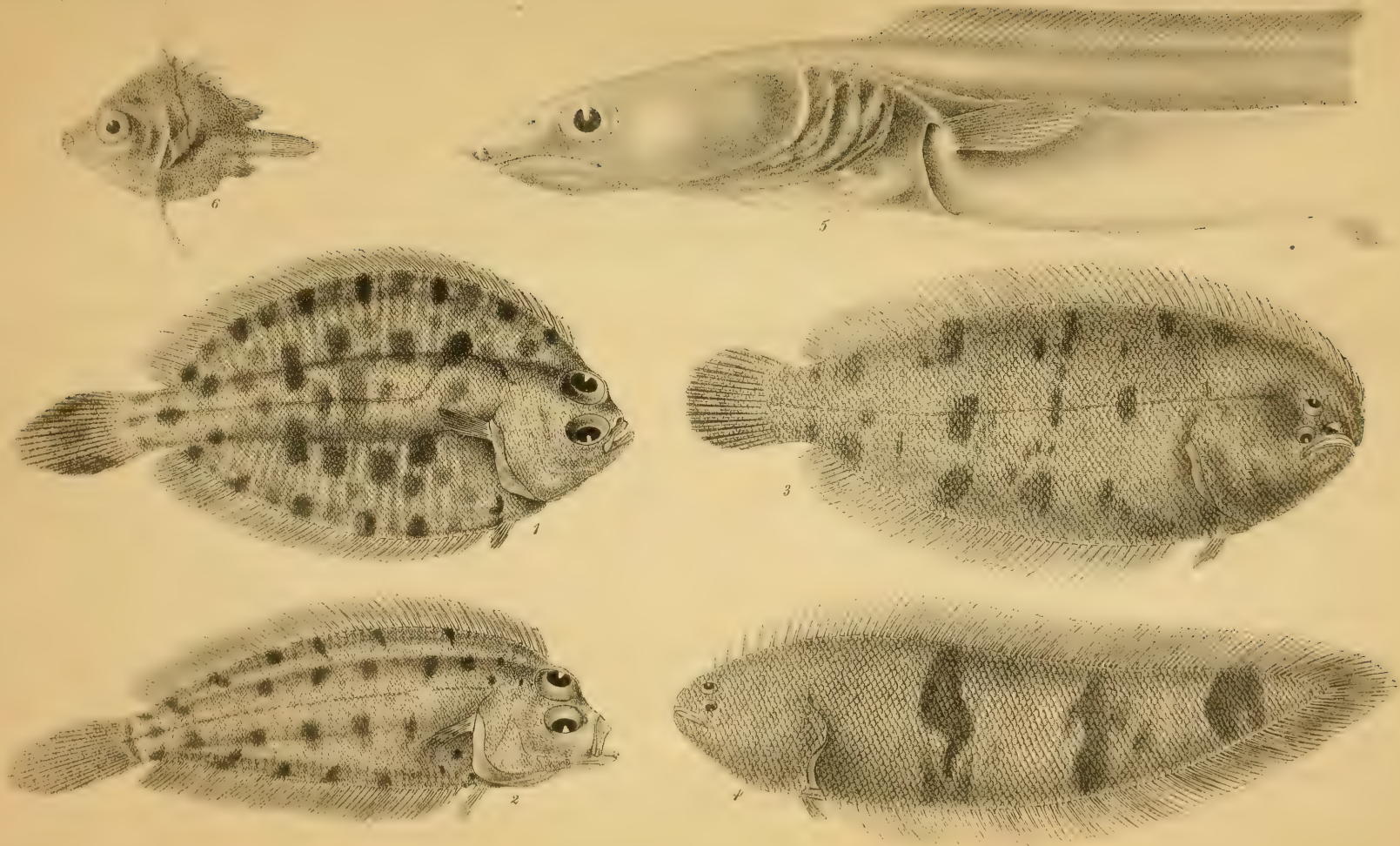
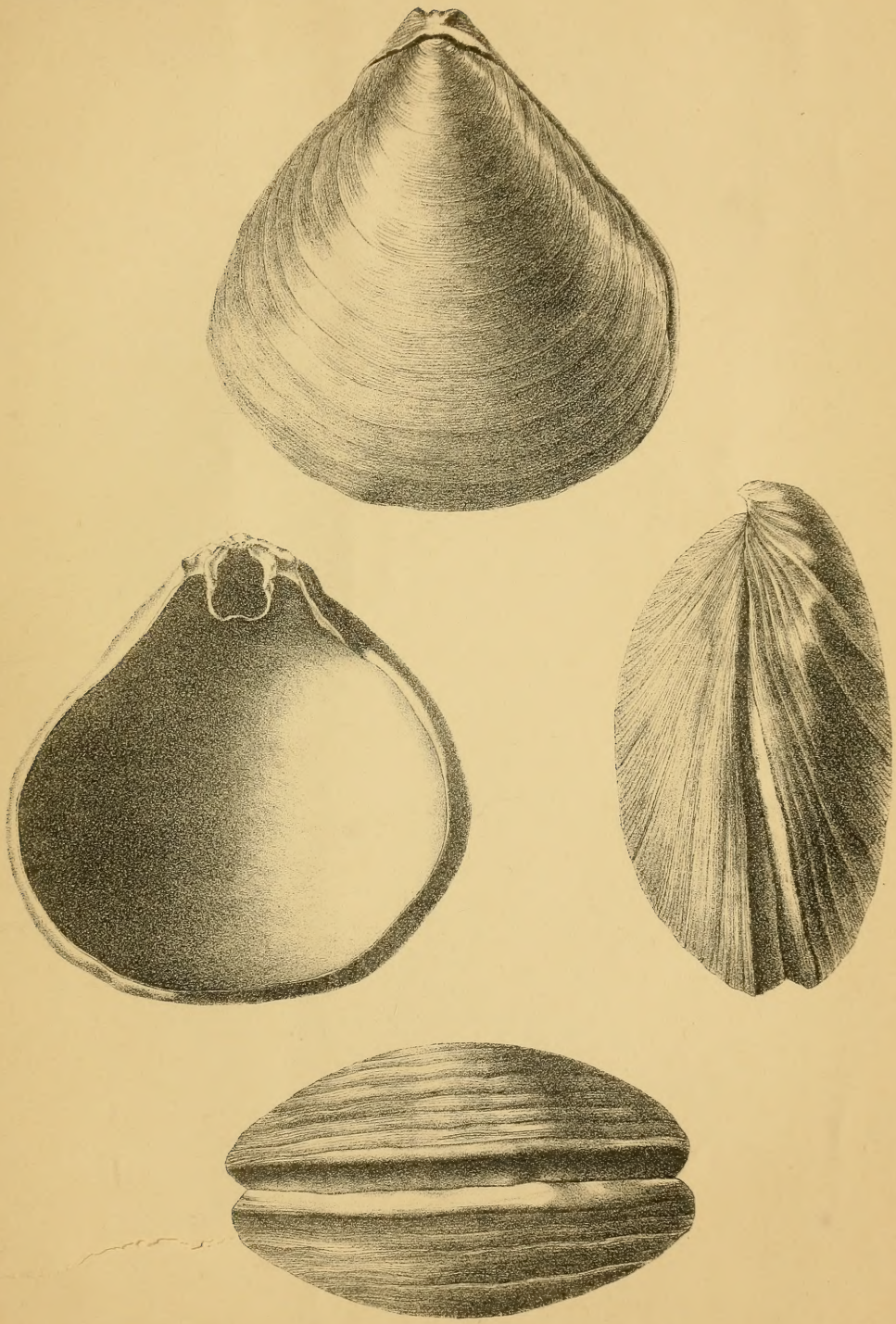
A.C. Chowdhary &
S. C. Mondul del. et lith.

INDIAN DEEP SEA FISHES



INDIAN DEEPSEA FISHES



S. C. Mondul del. A. C. Chowdhary lith.

TEREBRATULA JOHANNIS-DAVISI.