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

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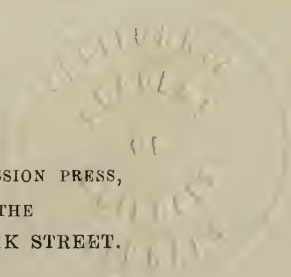
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# JOURNAL

ON THE

## ASIATIC SOCIETY OF BENGAL.



Vol. LXVIII. Part II.—NATURAL SCIENCE.

No. I.—1899.

*Materials for a Carcinological Fauna of India. No. 4. The Brachyura Cyclometopa. Part II. A Revision of the Cyclometopa with an Account of the Families Portunidae, Cancridae and Corystidae. By A. ALCOCK, M.B., C.M.Z.S., Superintendent of the Indian Museum.*

[Received 16th March. Read 5th April, 1899.]

In correction of my previously expressed opinion (*Journal* 1898, Vol. LXVII, pt. II, pp. 68 and 69) I now have no hesitation in accepting the limits of the Cyclometopa that have been fixed by Miers in *Challenger Brachyura*, pp. 106–215. I am not, however, in agreement with Miers subdivision of this great group.

It seems to me that Ortmann (*Zool. Jahrb., Syst., &c., VII, 1893-94 and IX, 1895-97*) has struck out a much more natural classification of the Cyclometopa; but as he includes the *Parthenopidae* and excludes the *Corystidae*, I am unable to adopt it in its entirety. There can be little doubt, however, that Ortmann's conceptions of *Xanthini* and *Cancrini* agree with nature.

The present paper contains (1) a statement of my own views as to the classification of the Cyclometopa, and (2) diagnoses of the Indian genera and species of three of the constituent families, namely, the *Portunidae*, the *Cancridae* and the *Corystidae*.

The Indian species of *Portunidae*, as far as I know, number 67 or 68, of which 65 are represented in the Indian Museum: of *Cancridae* 4, all of which are in the Indian Museum: of *Corystidae* only one—a new species of *Nautilocorystes* dredged by the R. I. M. S. "Investigator."

## Tribe CYCLOMETOPA, or CANCROIDEA.

*Cyclometopes*, *Telphusiens* and *Corystiens*, Milne Edwards, Hist. Nat. Crust. I, 264 and 363, II. 7 and II. 139.

*Cancroidea* and *Corystoidea*, Dana, U. S. Expl. Exped., Crust. pt. I, pp. 142 and 296.

*Cyclometopes* and *Corystiens*. A. Milne Edwards, Ann. Sci. Nat. Zool. (4) XIV, 1860, p. 185.

*Cyclometopa* or *Cancroidea*, Miers, Challenger Brachyura, pp. 106-215.

*Maiioidea-corystoidea*, pp. 26 and 28; *Cancroidea-portuninea*, pp. 27 and 65; and *Cancroidea-cyclometopa* (*Cancrini* and *Xanthini* only), pp. 412, 421, 428: Ortman, Zool. Jahrb., Syst., etc., VII, 1893-94.

*Oxyrhyncha-corystidæ* and *Cyclometopa* or *Cancroidea* Ortman, in Bronn's Thier-Reich V. ii. Arthropoda, pp. 1166 and 1165.

Carapace variable, either broader than long (almost all *Telphusidæ* *Xanthidæ* and *Portunidæ*, and some *Cancridæ*) or longer than broad (*Corystidæ* and most *Cancridæ*), the antero-lateral borders generally arched, sometimes very strongly so, the postero-lateral borders generally convergent, sometimes very strongly so. Front broadish or broad, horizontal or obliquely deflexed, occasionally prominent (but never forming a pointed rostrum with the basal antenna-joints for pillars as in the *Oxyrhyncha*).

Buccal orifice square-cut—only in the *Corystidæ* may its anterior angles be rounded off and a little convergent and its anterior boundary be indefinite: palp of external maxillipeds almost always articulating with the antero-internal angle of the merus.

Epistome transverse, never long fore and aft, sometimes linear and sunken (not distinguishable in the *Corystidæ*).

Antennules folding either nearly transversely or longitudinally.

Branchiæ nine on either side, their efferent channels opening on either side of the palate.

The abdomen of the male occupies all the space between the last pair of legs.

The genital ducts of the male open on the bases of the last pair of legs.

The *Cyclometopa* may be divided into the following 5 families:—

Family I. TELPHUSIDÆ. Carapace usually transverse, broader than long, subquadrilateral or oblate-oval, the antero-lateral borders short, the regions not well delimited (although the cervical suture may be deep and conspicuous) and never areolated. Front broad, not separated from the inner supra-orbital angles, obliquely deflexed (occasionally horizontal), commonly entire (occasionally lobed).

The antennules fold transversely in narrow fossæ.

The antennal flagella short.

• Epistome of fair length fore and aft, well demarcated and never encroached upon by the external maxillipeds.

Buccal orifice quadrate, a little elongate and a little bit rounded and contracted at the anterior angles.

Legs gressorial.

Sternum broad.

The Telphusidæ are the highest Cyclometopes, and approach the *Catometopa*. They appear to me, from consideration both of structure and of habitat, to have branched off from the Oziine or Eriphiine stocks, but are now inhabitants of fresh-water or damp jungle.

I do not propose to treat this family further, in this series of papers, until I have finished the other Brachyura.

Family II. XANTHIDÆ. Carapace transversely oval, or transversely hexagonal, or subquadrilateral, or (rarely) subcircular, but almost always broader than long; the regions very often, but by no means always, well defined and multi-areolate. Front broadish or very broad, oftener than not it is *not* sharply separated from the supra-orbital angles, often obliquely deflexed, usually showing a division into two lobes (each of which may, in some cases, show a further subdivision into two lobules).

The antennules fold either quite transversely or obliquely transversely.

Antennal flagella short or slender.

Epistome of fair length fore and aft, well demarcated, not encroached on by the external maxillipeds.

Buccal orifice quadrate, commonly broader than long.

Legs gressorial.

Sternum moderately broad—much narrower than in the *Telphusidæ*.

I have already in this *Journal*, Vol. LXVII, part 2, 1898, pp. 69–233, dealt with the family *Xanthidæ* in detail.

The family is there divided into the following 7 sub-families:—

Sub-family	I.	<i>Xanthinæ</i> ,	loc. cit.	p.	77.
„	II.	<i>Actæinæ</i>	„	p.	137.
„	III.	<i>Chlorodinæ</i>	„	p.	156.
„	IV.	<i>Menippinæ</i>	„	p.	177.
„	V.	<i>Ozinæ</i>	„	p.	181.
„	VI.	<i>Pilumninæ</i>	„	p.	190.
„	VII.	<i>Eriphiinæ</i>	„	p.	213.

In the *Oziinæ* and *Eriphiinæ* this family approaches the *Telphusidæ*: by the *Pilumninæ* and *Xanthinæ* it is linked with the section *Carcininæ* of the *Portunidæ* and, through these, with the *Cancriidæ*.

Family III. PORTUNIDÆ. Carapace transversely hexagonal, sometimes subquadrate, occasionally elongate-obovate or even subcircular, but generally broader (typically much broader) than long, the regions often not well defined and seldom areolated. Front remarkably broad, generally well separated from the supra-orbital angles and almost always cut into teeth or lobes which are from two to six in number exclusive of the supra-orbital angles.

The antennules fold transversely or obliquely transversely.

The antennal flagella are almost always long and slender.

The epistome may be of fair length fore and aft, or may be linear: it may be, but is not usually, encroached upon by the external maxillipeds.

Buccal orifice quadrate, well defined anteriorly, usually, but by no means always, broader than long.

The last pair of legs are (with a few exceptions in which their dactylus is hook-like or is merely lanceolate) peculiarly modified for swimming, having at least the last two joints compressed, broadly-foliaceous, and paddle-like.

Sternum broad.

This family is here divided into 4 sub-families, namely:—

- |            |      |                  |           |           |
|------------|------|------------------|-----------|-----------|
| Sub-family | I.   | <i>Carcininæ</i> | see ahead | pp. 6, 7. |
| „          | II.  | <i>Portuninæ</i> | „         | pp. 6, 7. |
| „          | III. | <i>Caphyrinæ</i> | „         | pp. 6, 8. |
| „          | IV.  | <i>Lupinæ</i>    | „         | pp. 6, 8. |

The *Carcininæ*, by way of *Carcinus*, approach the *Xanthidæ*, by way of *Hoplozanthus*.

Family IV. CANCRIDÆ. Carapace either transversely oval (*Cancriinæ*) or, more commonly, elongate-oval or subcircular, the regions rarely strongly delimited and areolate. Front not very broad, very often cut into 3 (sometimes 2 or 4) sharp teeth, sometimes rather prominent.

The antennules fold longitudinally.

Antennal flagella usually long, coarse, and setaceous.

Epistome usually of fair length, often sunken, always overlapped, more or less, by the external maxillipeds, which are commonly, though not always, elongate. Buccal orifice quadrate, commonly a little elongate.

Legs gressorial.

Sternum narrow.



The family is here divided into 6 sub-families :—

Sub-family	I. <i>Cancrinæ</i>	sec ahead	p. 95.
„	II. <i>Pirimelinæ</i>	„	p. 95.
„	III. <i>Thiinæ</i>	„	p. 96.
„	IV. <i>Atelecyclinæ</i>	„	p. 96.
„	V. <i>Acanthocyclinæ</i>	„	p. 96.
[? Subfamily	VI. <i>Trichiinæ</i>	„	p. 96.]

In the *Pirimelinæ* and *Thiinæ* this family approaches the *Carcininæ* among the *Portunidæ*; and by the *Atelecyclinæ* it is allied to the *Corystidæ*.

Family V. CORYSTIDÆ. Carapace a good deal longer than broad, elongate-oval, the regions fairly well defined or not, not areolated. Front rather prominent, not very broad, cut into 2 or 3 teeth.

The antennules are small and fold longitudinally.

The antennal flagella, when present, are long—sometimes longer than the carapace—coarse, and setaceous.

There is no epistome, and the maxillipeds, which occasionally have a pediform cast, are elongate and extend almost up to the antennules.

Buccal cavern rather elongate, its sides slightly convergent quite at their anterior end.

Legs either gressorial, or the last pair modified for swimming.

Sternum narrow and elongate.

In some of the genera of this group the antennal flagella are as long as the carapace and the dactyli of the legs are almost styliform: in others the dactyli are larceolate—the last pair broadly so—and the antennal flagella are not more than half as long as the carapace.

The *Corystidæ* are the lowest *Cyclometopa* and have much the same relative position to the higher families of *Cyclometopes* as the *Raninidæ* have to the higher families of *Oxystomes*.

#### Family PORTUNIDÆ.

*Portuniens*, Milne Edwards, Hist. Nat. Crust. I. 432: A. Milne Edwards, Ann. Sci. Nat., Zool., (4) XIV. 1860, p. 195; and Archiv. du Mus. X. 1861, p. 310.

*Portunidæ* and *Platyonychidæ*, Dana, U. S. Expl. Exp. Crust. pt. I. pp. 267, 290.

*Portunidæ*, Miers, Challenger Brachyura, p. 169.

*Portuninea*, Ortmann, Zool. Jahrb., Syst., VII. 1893, p. 65.

Carapace depressed, or little convex (strongly convex in *Sphærocarcinus*), hexagonal, sometimes subquadrate, occasionally elongate-obovate or even subcircular, but generally broader (typically much broader) than long; the regions most often not well defined, seldom areolated;

the antero-lateral borders cut into teeth which are from 5 (very rarely 4) to 9 in number (in *Podophthalmus* and some species of *Euphyllax*, in which the antero-lateral borders are excavated for the enormously prolonged orbits, the number of teeth is reduced further).

Front remarkably broad, generally well separated from the supra-orbital angles, almost always cut into teeth or lobes, which are from 2 to 6 in number exclusive of the supra-orbital angles.

The antennules fold transversely or obliquely transversely.

Antennal flagella almost always long and slender.

The epistome may be of fair length fore and aft, or may be linear and sunken, but the palate is well defined anteriorly.

Buccal cavern quadrate, commonly broader than long, the merus of the external maxillipeds never decidedly elongate.

The last pair of legs are, with few exceptions, modified for swimming, having at least the last two joints compressed, greatly broadened, and paddle-like. (In *Caphyra* and *Sphærocarcinus* the last pair of legs are much like the other three pairs, are subdorsal, and end in a hook-like dactylus. In *Carcinus*, *Nectocarcinus* and *Portumnus* the dactylus of the last pair of legs is merely lanceolate).

I would propose to divide the Portunidæ into four sub-families:—

1. Sub-family *Lupinæ*. The chelipeds are longer, usually much longer, than any of the legs, the first three pair of which have a tendency to be slender and the last pair of which end in typical swimming-paddles: the antero-lateral borders of the carapace are cut into from 5 (very rarely 4) to 9 distinct teeth. The carapace *may* be subrotund, but it is usually conspicuously broad.

2. Sub-family *Caphyrinæ*. The chelipeds and legs are short, but the chelipeds are distinctly, if only slightly, longer than the legs. The carapace is either as long as broad or very little broader than long, and is either smooth or is traversed on either side by a single ridge running inwards from the last of the (4 or) 5 teeth or puckers into which the antero-lateral border is divided. The last pair of legs are either swimming-paddles or are subdorsal and end in a prehensile dactylus.

3. Sub-family *Portuninæ*. The legs often have a tendency to be stout, and at least one pair of them is at least as long as the chelipeds: the last pair are typical swimming-paddles. The carapace is seldom very broad and its antero-lateral borders are cut into 5 teeth. The basal antenna-joint may be either fixed or movable: it is seldom broader than long, often longer than broad, and lies almost in the longitudinal axis of the carapace.

4. Sub-family *Carcininæ*. The legs have a tendency to be stout, and at least one pair of them is at least as long as the chelipeds: the

last pair end in a lanceolate dactylus and otherwise do not differ much from the other three pairs. Carapace not at all broad, its antero-lateral borders cut into 4 or 5 teeth. The basal antenna-joint is fixed: it is longer than broad and lies in the longitudinal axis of the carapace.

#### Sub-family I. CARCININÆ.

This sub-family comes nearest to the other Cancroid families. Of its constituent genera *Carcinus* touches the Cancridæ and Xanthidæ, *Nectocarcinus* touches the Xanthidæ, and *Portumnus* touches the Corys-tidæ.

It may be divided into two Alliances:—

Alliance 1. *Portumnoida*. Carapace as long as broad: antennæ setaceous: crests of endostome? For the single genus.

*Portumnus*, Leach, Malac. Pod. Brit. text of pl. iv. (= *Xaiva*, Macleay in Smith's Ill. Annulosa S. Africa, p. 62).

Alliance 2. *Carcinoida*. Carapace broader than long: antennæ not setaceous, the basal antenna-joint fixed: the palatal crests defining the efferent branchial channels are either interrupted or completely wanting. Constituent genera:—

1. \**Carcinus*, Leach.

2. \**Nectocarcinus*. A. Milne Edwards, Ann. Sci. Nat. Zool. (4) XIV. 1860, pp. 220, 228; and Archiv. du Mus. X. 1861, p. 404.

#### Sub-family II. PORTUNINÆ.

The material at my disposal is not sufficient to enable me with any confidence to separate the genera of this sub-family into groups, so that the following classification is meant to be merely a suggestion.

Alliance 1. *Portunoida*: The last pair of legs are typical swimming-paddles: the basal antenna-joint may be either fixed or movable: the palatal crests defining the efferent branchial channels may either be distinct and complete or be wanting. Constituent genera:—

1. *Bathynectes*, Stimpson, Bull. Mus. Comp. Zool. II. 1870-71, p. 145 (= *Thranites*, Bovallius, Ofversigt Kongl. Vetensk.-Ak. Forhandl. 1876, No. 9, p. 61).

2. \**Benthochascon*, Alcock.

3. \**Liocarcinus*, Stimpson, Bull. Mus. Comp. Zool. II. 1870-71, p. 146 (footnote).

4. \**Ovalipes*, M. J. Rathbun, Proc. U. S. Nat. Mus. XXI. 1898, p. 597 (for *Platyonychus* as restricted by Miers, Challenger Brachyura, p. 201; = *Anisopus* DeHaan Faun. Japon. Crust. p. 12).

5. \**Parathranites*, Miers, Alcock.

6. *Polybius*, Leach, Malac. Pod. Brit. text of pl. ix. B: and Milne Edwards, Hist. Nat. Crust. I. 438.

7. \**Portunus*, Fabr.: Milne Edwards, Hist. Nat. Crust. I. 439.

Alliance 2. *Cænophthalmoida*. As *Portunoida*, but the inner infra-orbital angle is fused with the inner supra-orbital angle. For the single genus.

*Cænophthalmus*, A. Milne Edwards, Miss. Sci. Mex. Crust. p. 237.

#### Sub-family III. CAPHYRINÆ.

The genus *Lissocarcinus* connects this sub-family, by means of *Thalamonyx*, with the Lupinæ. *Caphyra* is another link with the Lupinæ, and *Sphærocarcinus* connects *Lissocarcinus* and *Caphyra*.

The three constituent genera are as follows, and, in my opinion, each genus is equivalent to an "alliance" in the other sub-families:—

1. \**Lissocarcinus*, Adams and White. The basal antenna-joint has its antero-external angle produced to touch the front and occlude the orbital hiatus—much as in *Charybdis* (= *Goniosoma*): the last pair of legs are swimming paddles.

2. *Sphærocarcinus*, Zehntner, Rev. Suisse Zool., Ann. Mus. d' Hist. Nat. Genève, II. 1894, p. 163. As *Lissocarcinus*, but the last pair of legs are as in *Caphyra*, and the carapace is *very strongly convex*.

3. \**Caphyra*, Guérin, Ann. Sci. Nat. XXV. 1832, pp. 285, 286 (= *Camptonyx*, Heller SB. Ak. Wien, XLIII. 1861, i. p. 357). The last pair of legs are subdorsal in position, are almost similar to the other legs and end in a hook-like dactylus. The basal antenna-joint is as in *Charybdis* (= *Goniosoma*).

#### Sub-family IV. LUPINÆ.

The genera of this sub-family fall into the 3 following alliances:—

Alliance 1. *Lupoida*. The basal antenna-joint is short and squat and decidedly broader than long; or it has its greatest diameter transverse, or obliquely transverse, owing to the extension of its antero-external angle towards or into the orbit or up to the front.

The chelipeds are usually very much longer than the legs, of which the first 3 pairs have a tendency to be slender and the fourth pair usually has the last four joints much broadened.

The carapace is usually decidedly transverse with the antero-lateral borders longer than the postero-lateral, and is very often crossed by a few long definitely-placed transverse ridges, of which one that arches inwards from the last tooth or spine of the antero-lateral border on either side is the most constant.

The genera that constitute this Alliance are the following:—

1. \**Charybdis*, De Haan (or *Goniosoma*, A. Milne Edwards) with subgenera \**Gonioneptunus* Ortmann and \**Goniohellenus* (*nov.*).

2. *Cronius*, Stimpson, Ann. Lyc. Nat. Hist. New York, VII. 1860, p. 225 (*Charybdella*, M. J. Rathbun, Proc. Biol. Soc. Washington, XI. 1897, p. 166).

3. *Lupa*, De Haan, Faun. Japon. Crust. p. 11: A. Milne Edwards, Archiv. du Mus. X. 1861, p. 351 (*Lupella*, M. J. Rathbun, *tom. cit.* p. 155).

4. \**Neptunus*, De Haan (*Portunus*, M. J. Rathbun, *tom. cit.* p. 155, *nec auctorum*) with sub-genera \**Achelous*, \**Amphitrite*, \**Callinectes*, \**Hellenus* (including \**Xiphonectes*) and \**Lupocycloporus* (*nov.*).

5. \**Scylla*, De Haan.

6. \**Thalamita*, Latreille: with sub-genus *Thalamitoides* A. Milne Edwards, Nouv. Archiv. du Mus. V. 1869, p. 146.

7. \**Thalamonyx*, A. Milne Edwards.

[8. *Hedrophthalmus*, Nauck, Zeits. Wiss. Zool. XXXIV. 1880, p. 67].

Alliance 2. *Podophthalmoida*. As *Lupoida*, but the eyes are borne on basal stalks of enormous length and the orbits are continued along the whole of the antero-lateral borders of the carapace.

The genera that constitute this Alliance are:—

1. \**Podophthalmus*, Lamarck.

2. *Euphyllax*, Stimpson, Ann. Lyc. Nat. Hist. New York, VII. 1862, p. 225.

Alliance 3. *Lupocycloida*. The basal antenna-joint, though not long, is rather slender and does not lie transversely or have its antero-external angle produced to any extent.

The chelipeds are considerably, sometimes very much, longer than any of the legs, of which the first three pairs are slender.

In the fourth pair of legs the last two joints are much broadened, but the merus and carpus *may be* slender.

The carapace is of no very remarkable breadth, the antero-lateral borders are about as long as the postero-lateral, and at least one transverse ridge is present on either side.

Two genera enter into this Alliance, namely,

1. \**Carupa*, Dana (in which the merus and carpus of the last pair of legs are not broadened).

2. \**Lupocyclus*, Adams and White (in which the merus and carpus of the last pair of legs may either be broadened or not).

In the preceding scheme of classification the Indian genera are printed in Roman type and the genera known to me by autopsy are marked with an asterisk.

*Key to the Indian genera of the Sub-families Carcininæ and Portuninæ.*

- A. Propodite of the last pair of legs merely dilated, the dactylus lanceolate..... CARCINUS.  
 B. Propodite of the last pair of legs typically foliaceous and paddle-like:—  
 1. Carapace smooth; orbits with two very indistinct grooves in the upper margin: arm short, without spines; legs stout..... BENTHO-MARCON.  
 2. Carapace with definitely-disposed tubercles; orbits with two open fissures in the upper wall: arm longish, with a spine or spines; legs slender..... PARATHURANITES.

*Key to the Indian representatives of the Sub-family Caphyrinæ.*

Chelipeds and legs short: carapace as long as broad or not much broader than long, smooth or with a single transverse ridge on either side; eyes and orbits normal: fronto-orbital border very much less than the greatest width of the carapace: antero-external angle of basal antenna-joint produced to meet the front and fill the orbital hiatus to the exclusion of the flagellum: front cut into two broad lobes besides the inner supra-orbital angles, or subentire..... LISSOCARCINUS.

*Key to the Indian Genera of the Sub-family Lupinæ.*

- I. The eyes, eyestalks, and orbits are normal in size and position:—  
 A. The extent of the fronto-orbital border is decidedly less, and is commonly very much less than the greatest breadth of the carapace, so that the antero-lateral borders are oblique and more or less arched. The antennal flagellum is near the orbital hiatus and sometimes in it:—  
 1. The antero-external angle of the basal antenna-joint not appreciably produced, the flagellum standing in the orbital hiatus:—  
 i. Carapace very decidedly broader than long, its antero-lateral borders cut into seven rather irregular teeth..... CARUPA.  
 ii. Carapace little broader than long, its antero-lateral borders cut into nine teeth which are alternately large and small (the small teeth sometimes obsolescent) .. LUFOCYCLUS.

- 2. The prolongation of the antero-external angle of the basal antenna-joint is small and lies in the orbit, the flagellum standing in the orbital hiatus: antero-lateral borders of carapace cut into nine large teeth.—
    - i. Hand inflated and almost smooth: surface of carapace smooth and unbroken... broken.....
    - ii. Hand prismatic and costate: surface of carapace almost always in some way broken.....
  - 3. The prolongation of the antero-external angle of the basal antenna-joint is large and fills up either all or the greater part of the orbital hiatus:—
    - i. The prolongation of the basal antenna-joint does not reach the front, so that the flagellum stands in the upper part of the orbital hiatus: other characters as in *Charybdis*.....
    - ii. The prolongation of the basal antenna-joint fills up all the orbital hiatus to the complete exclusion of the flagellum:—
      - a. Front cut into six lobes or teeth besides the inner supra-orbital angles: antero-lateral borders cut into six teeth.....
      - b. Front cut into two broad lobes besides the inner supra-orbital angles: antero-lateral borders cut into five teeth.....
  - B. The extent of the fronto-orbital border is nearly equal to the greatest breadth of the carapace, so that the antero-lateral borders of the carapace are nearly at right angles with the front: the prolongation of the basal antenna-joint that meets the front and occludes the orbital hiatus is so long that the flagellum is far distant from the orbit. The antero-lateral borders are cut into five teeth of which the fourth is often small, or rudimentary, or sometimes obsolete.....
- II. The eyes are borne on basal stalks of enormous length, and the orbits extend along the entire length of the antero-lateral borders of the carapace.....

SCYLLA.

NEPTUNUS,

GONIOPEPTUNUS.

CHARYBDIS  
(= GONIOSOMA).

THALAMONYX.

THALAMITA.

PODOPHTHALMUS.

## Subfamily I. CARCININÆ.

## CARCINUS, Leach.

*Carcinus*, Leach, Malac. Podophth. Brit. Text of pl. V.: Desmarest, Consid. Gen. Crust. p. 90: Milne Edwards, Hist. Nat. Crust. I. 433: De Haan, Faun. Japon. Crust. p. 13: Bell, British Stalk-eyed Crust. p. 75: A. Milne Edwards, Ann. Sci. Nat., Zool., (4) XIV. 1860, pp. 228, 266; and Archiv. du Mus. X. 1861, p. 390.

*Carcinides*, M. J. Rathbun, Proc. Biol. Soc. Washington XI. 1897, p. 164 (*new name proposed*).

Carapace approaching the hexagonal, not broad, slightly but distinctly convex, the regions fairly well-defined (well-defined for a Portunoid), no distinct transverse ridges.

Front proper fairly well defined from the inner supra-orbital angles beyond which it projects slightly, three lobed, between a fourth and a fifth the greatest breadth of the carapace in width.

Antero-lateral borders thin, oblique, arched, cut into five teeth including the outer orbital angles, shorter than the postero-lateral borders.

Orbits with one faint notch in the upper and one in the concave lower border, the inner angle of the lower border dentiform but not very prominent. The antennules fold obliquely, but nearer the transverse than the longitudinal.

Basal antenna-joint slightly longer than broad, fixed; the flagellum, which is not very long, stands in the orbital hiatus.

Buccal cavern square, its greatest length a little more than its greatest breadth: the external maxillipeds are rather elongate, especially the merus which projects somewhat beyond the level of the edge of the endostome: epistome lozenge-shaped. The ridges that define the efferent branchial canals do not approach the edge of the endostome.

Chelipeds massive, just shorter than any of the first three pairs of legs, slightly unequal: arm short, without any spines: inner angle of wrist alone spiniform: no spines on the hand, which is deep and not prismatic: fingers stout, a little shorter than the palm, not very strongly toothed.

Legs stoutish: the last pair have the merus elongate and unarmed, the carpus not dilated, the propodite shortened and somewhat broadened, and the dactylus acutely lanceolate.

The abdomen of the male consists of five pieces, the 3rd-5th terga being fused.

*Carcinus* exhibits the relation of the Portunidæ to other Cyclo-metopan families, being related to *Pirimela* among the Cancridæ and to *Hoploxanthus* among the Xanthidæ.



1. *Carcinus mænas*, (Linn.).

*Cancer marinus sulcatus*, Rumph, Amboinsch. Rariteitk. pl. vi. fig. O.

*Cancer mænas*, Linnæus, Fauna Suecica p. 492; Mus. Ludov. Ulric. p. 436; and Syst. Nat. (xii) I. p. 1043: ["Pennant Brit. Zool. IV. p. 3, pl. iii. fig. 5" sec. Milne Edwards]: Baster, Naturkundige Uitspanningen Zeeplanten en Zee Insekten, Haarlem 1765, II. pl. ii. figs. 1-3: Herbst, Krabben, I. ii. 145, pl. vii. fig. 46: Fabricius, Ent. Syst. II. p. 450, and Suppl. p. 334: Bosc, Hist. Nat. Crust. I. p. 173, pl. iii. fig. 1: Latreille, Hist. Nat. Crust. V. p. 363: Risso, Hist. Nat. Crust. Nice, p. 12: Lamarck, Hist. Nat. Anim. sans Vertèbr. V. Crust. p. 270: Dumeril in Dict. Sci. Nat. XI. 1818, p. 299: de Brebisson, Mem. Soc. Linn. Calvados, 1825, p. 233.

*Portunus mænas* ["Leach, Edinb. Encycl. VII. p. 390" sec. Milne Edwards]: Costa, Faun. Regn. Napoli, Crust. Brach. p. 7.

*Carcinus mænas*, ["Leach, Edinb. Encycl. VII. p. 429" sec. Milne Edwards]; and Trans. Linn. Soc. XI. 1815, p. 314; and Malac. Pod. Brit. pl. v: Desmarest, in Dict. Sci. Nat. XXVIII. 1823, p. 217; and Consid. Gen. Crust. p. 91: Risso, Hist. Nat. Eur. Mérid. V. Crust. p. 7: Andouin, Explic. p. 84: Savigny Descr. Egypt. Crust. pl. iv. fig. 6: Milne Edwards in Cuvier Règne Anim. pl. x. fig. 3 and Hist. Nat. Crust. I. 434: ["Gould, Report on the Invertebrata of Massachusetts, p. 321" sec. A. Milne Edwards]: De Kay, Zoology of New York, pt. VI. Crust. p. 8, pl. v. figs. 5, 6: Lucas, Hist. Anim. Artic. in Expl. Sci. Algerie, Zool. I. i. p. 13; and Hist. Nat. Anim. Art. p. 95: Bell, British Stalk-eyed Crust. p. 76: Salter, Journ. Linn. Soc., Zool., IV. 1860, p. 34 (*process of moulting*): A. Milne Edwards, Archiv. du Mus. X. 1861, p. 391: Van Beneden, Rech. Faun. Litt. Belg. p. 133: Heller, Crust. Sudl. Europ. p. 91, pl. ii. figs. 14, 15; and Novara Crust. p. 30: W. C. McIntosh, Trans. Linn. Soc. XXIV. 1864, p. 79, pl. xix., xx. (*on the various kinds of hairs*): Sars, vide Zool. Rec. III. 1866, p. 224: Nardo, Annot. Crust. p. 87: Wood-Mason, Proc. Asiatic Soc. Bengal, 1873, p. 172, and Ann. Mag. Nat. Hist. (4) XII. 1874, p. 405: Brocchi, Ann. Sci. Nat. (6) II. 1875, Art. 2, p. 62, pl. xvi. figs. 89, 90, 100, 101. (*male parts*): Streets, Bull. U. S. Nat. Mus. VII. 1877, p. 109: Meinert, Nat. Tids., Copenhagen, (3) XI. 1877, p. 222, and (3) XII. 1879, p. 507: Kingsley, Proc. Ac. Nat. Sci. Philad. XXX. 1878, p. 321, and XXXI. 1879, p. 398; Nauck, Zeits. Wiss. Zool. XXXIV. 1880, p. 56 (*gastric teeth*): Boas, Stud. Decapod. (Vid. Selsk. Skr. (6) I. 2) p. 141: S. I. Smith, Trans. Conn. Acad. V. p. 34: Carrington and Lovett, Zoologist (3) VI. 1882, p. 12: Carus, Prodr. Faun. Medit. I. p. 518: Cano, Boll. Soc. Nat. Napoli. III. 1889, p. 222: Mobius, SB. AK. Berl. 1893, pp. 75, 76: Ortmann, Zool. Jahrb. Syst., etc., VII. 1893-94, p. 423: Birula, Ann. Mus. Zool. Petersb. 1897, p. 448.

Carapace about three-fourths as long as broad, the regions fairly well defined, the gastric being divided into three areolæ, the surface finely granular, especially in the anterior half.

Front cut into three lobes, of which the middle one is acuminate.

Antero-lateral borders rather shorter than the postero-lateral, cut into five anteriorly-acuminate teeth. Posterior border forming a curve with the postero-lateral borders.

Orbits without any particular dorsal inclination, their major diameter about half the width of the inter-orbital space. Antennal flagella about  $1\frac{1}{2}$  times the length of the orbit.

Chelipeds a little unequal, the longer one is less than  $1\frac{1}{2}$  times the length of the carapace: the inner angle of the wrist is spiniform and there are two costæ along the upper surface of the hand, otherwise they are smooth and unsculptured. Palm deep and full, but not inflated, fingers stout, nearly as long as the palm in the shorter cheliped only.

Legs stout, smooth, unarmed: the 2nd and 3rd pairs, which are the longest, are about  $1\frac{2}{3}$  times the length of the carapace: the fourth pair, which are also slightly longer than the larger cheliped, are a little shorter than the first pair.

Sixth abdominal tergum of male about twice as broad as long, with gradually convergent sides.

In the Indian Museum is a single male from Galle (Ceylon), besides numerous specimens from the Mediterranean and the North Sea.

The geographical distribution of *Carcinus mænas* has been referred to by several of the authors above-cited. The species has been found at various places on the Atlantic coast of the Northern United States and off the coast of Pernambuco (Brazil): it is the common shore-crab of the British Islands, and occurs in the North Sea almost up to Arctic limits, in the Baltic, and on the Atlantic coasts of the European continent: it is common in all parts of the Mediterranean, and has been found in the Black Sea and the Red Sea: it is an Indian species, though evidently a very rare one, and has been reported from the Hawaiian Islands, from the Bay of Panama, and—though there is doubt about this locality—from Australia.

Its range in fact corresponds very nearly with that of the Macruroid fish *Macrurus (Malacocephalus) lævis* Lowe, and recalls that of the Perciform fish *Lobotes surinamensis*.

In an *Account of the Investigator Deep Sea Madreporaria*, recently published by the Trustees of the Indian Museum, I have given lists of 43 species of marine animals that are common to the slopes (including both American and European sides) of the Atlantic and of the Oriental Region and Western Pacific, and in a subsequent *Account of the Investigator Deep Sea Brachyura*, also published by the Trustees of the Indian Museum, I have added several species of Crabs that are found both in American-Atlantic and in East-Indian waters: moreover, Captain A. R. S. Anderson, who is engaged in examining the Investigator Echinoids, has discovered some interesting affinities between the West-Indian, the Mediterranean, and the Oriental Echinoid fauna. So that the distribution of *Carcinus mænas* is not so singular as has been supposed.

The significance of this distribution has been discussed in the works just cited: it is emphasized by the fact that *Carcinus mænas* is a shore-crab.

## Sub-family II. PORTUNINÆ.

## BENTHOCHASCON, Alcock.

*Benthochascon Hemingi*, Alcock and Anderson, Ann. Mag. Nat. Hist., Jan. 1899, p. 10.

*Benthochascon*, Alcock, Investigator Deep Sea Brachyura, p. 68.

Carapace sub-quadrate, nearly as broad as long, its anterior portion arched and declivous, its posterior portion flat, the regions hardly defined: no transverse ridges.

Front not very well demarcated from the inner supra-orbital angles, about a fourth the greatest breadth of the carapace in width, cut into 3 (or 4) teeth.

Antero-lateral borders much shorter than the postero-lateral, cut into four teeth including the outer orbital angle. Posterior border broadly excised.

Orbits with indistinct traces of two grooves in the upper border, the lower border concave with the inner angle dentiform and prominent. The antennules fold nearly transversely.

Basal antennal joint short, but longer than broad, freely movable; the flagellum, which is not very long, stands in the orbital hiatus.

Epistome of good length fore-and-aft, not only in the middle but at the sides, well delimited from the palate, not encroached upon by the external maxillipeds. Buccal cavern square, rather broader than long; the external maxillipeds not elongate, their merus as broad as long. The efferent branchial channels defined by ridges.

Chelipeds massive, shorter than any of the first 3 pair of legs, slightly unequal: arm short, without spines: inner angle of wrist alone spiniform: hand deep, smooth or nearly so: fingers stout, as long as or longer than hand, strongly toothed.

Legs stoutish: in the last pair the merus is elongate, the carpus is shortened and somewhat broadened, and the propodite and dactylus are typically foliaceous for swimming.

2. *Benthochascon Hemingi*, Alcock and Anderson.

*Benthochascon Hemingi*, Alcock and Anderson, Ann. Mag. Nat. Hist., January, 1899, p. 10: Alcock, Investigator Deep Sea Brachyura, p. 69, pl. iii. fig. 2.

Carapace almost as broad as long, smooth (though finely frosted) except for slight inequalities of level that scarcely define the regions, strongly declivous in its anterior third.

Front cut into three lobes of which the middle one is bifid at tip: the front is separated from the inner supra-orbital angles by a groove, not by a notch.

Antero-lateral borders considerably less than two-thirds the length of the postero-lateral, cut into four teeth (including the outer orbital angle) of which the last is spiniform and is rather remote from the others.

Posterior border peculiar in being quite flush with the surface of the carapace, and concave or broadly excised.

Orbits large, their major diameter three-fourths the width of the front, without any dorsal inclination: there are two indistinct grooves in the upper border, and the lower border is concave with the inner angle prominent and acutely dentiform. Eyes large, placed mostly on the ventral surface of the eyestalk.

Antennal flagella not much longer than the orbit.

The external maxillipeds fall considerably short of the anterior edge of the palatē.

Chelipeds somewhat unequal, the larger one is between  $1\frac{1}{2}$  and  $1\frac{2}{3}$  times the length of the carapace: except for a sharp tooth at the inner angle of the wrist, and for a small sharpish tubercle at the far end of the sharply-defined inner border of the hand, they are smooth and unsculptured. The hands are full and very deep: the fingers are stout but end in acute hooked tips: in the smaller cheliped, but not in the larger cheliped, they are longer than the hand.

Legs stoutish, compressed, a notch and tooth at the far end of the anterior border of the merus of all. The 2nd pair, which are slightly longer than the 1st and 3rd, are from  $1\frac{2}{3}$  times to twice the length of the carapace: all three end in a very acute styliform dactylus. The 4th pair, which are about equal in length to the chelipeds, have the merus four times as long as broad, the carpus not particularly dilated, and the propodite and dactylus typically foliaceous and blade-like, the dactylus however ending in an acutely mucronate tip: the posterior border of the merus is unarmed.

In the Indian Museum are two specimens, both females, from the Andaman Sea 185 and 405 fms. The carapace of the larger one is 48 millim. long and 51 millim. broad.

#### PARATHRANITES, Miers.

*Lupocyclus (Parathranites) orientalis*, Miers, Challenger Brachyura, p. 186.

Carapace hexagonal, convex, moderately transverse, the regions well defined and with some definitely-placed tubercles but no transverse ridges.

The front, which projects beyond the ill-defined inner supra-orbital angles, is less than a fourth the greatest breadth of the carapace in width, and is cut into four teeth.

Antero-lateral borders oblique, not much curved, cut into five teeth including the outer orbital angles.

Orbits with two wide fissures in the upper margin, the lower margin concave with the inner angle dentiform and prominent. The antennules fold transversely.

Basal antennal joint longer than broad, slender, not nearly filling the orbital hiatus, movable; the flagellum, which stands in the orbital hiatus, long.

Epistome short fore and aft, sunk; though well enough delimited from the palate somewhat encroached upon by the external maxillipeds. Buccal cavern square, its greatest length about equals its greatest breadth: external maxillipeds rather elongate, especially the merus.

Chelipeds moderately massive, shorter than any of the first 3 pair of legs; arm wrist and hand with spines; hand prismatic, fingers stout and strongly toothed.

Legs long and slender: in the fourth pair the merus and carpus though shortened are not much broadened, and the propodite and dactylus are foliaceous and typically paddle-like.

The abdomen of the male consists of 5 segments, the 3rd-5th terga being fused.

As Miers says, this genus is allied to *Bathynectes*: in fact it is nearer to *Bathynectes* than to *Lupocyclus*.

### 3. *Parathranites orientalis*, Miers.

*Lupocyclus* (*Parathranites*) *orientalis*, Miers, Challenger Brachyura, p. 186, pl. xvii. fig. 1.

Carapace about three-fourths as long as broad (spines included), decidedly convex, the regions well demarcated, the surface granular and somewhat hairy—especially at the antero-lateral margins. There is always a tubercle in the middle line on the posterior part of the gastric region and sometimes three, in a transverse series, in front of it: there are one, or two close side-by-side, in the middle of the cardiac region, and from two to four in a fairly longitudinal series along the inner limit of either epibranchial region.

Front hardly delimited from the almost obsolete inner supra-orbital angles beyond which it projects, cut into four horizontal subacute teeth of nearly equal size.

Antero-lateral borders cut into 5 teeth, of which the first (the outer orbital angle) is remarkably prominent, the next three are very acutely anteriorly-acuminate, and the last—equally acute—stands out nearly at right angles to the others.

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Posterior border nearly straight, making a dentiform angle of junction with the postero-lateral borders.

Orbits deep, without any particular dorsal inclination, their major diameter nearly equal to the width of the front; the inner angle of the lower border bilobed, the inner lobe dentiform and projecting beyond the level of the tips of the frontal teeth.

Merus of external maxillipeds produced a good deal beyond the articulation of the flagellum.

Chelipeds moderately massive, their length not  $1\frac{2}{3}$  times that of the carapace: a spinule at the far end of the anterior border of the ischium: a spine near the middle of the anterior border, and a spinule near the far end of the posterior border, of the arm: the inner angle of the wrist is produced to form a spine nearly half as long as the palm, and on the outer surface of the wrist are 3 spinules of which one is almost a spine: hand not inflated, its upper surface with 2 costæ and 3 spines of which the one at the far end of the inner border is the largest; a faint ridge along the outer surface of the hand, and one or two along the inner surface: fingers stout, nearly as long as the hand.

First 3 pair of legs long and slender, the first pair well over twice the length of the carapace. The fourth pair are very little shorter than the chelipeds and have the merus slender and quite unarmed.

2nd and 3rd abdominal terga strongly carinated in both sexes: the 6th tergum of the adult male is nearly as long as broad and has nearly parallel sides.

Colours in life salmon-pink above, tips of spines red.

In the Indian Museum are 54 specimens from off the Malabar coast 56-68 fms., off the Coromandel coast 33 fms., and from the Andamans.

The carapace of the largest specimen is 12 millim. long and 17 millim. broad.

## Sub-family II. CAPHYRINÆ.

### LISSOCARCINUS. Adams and White.

*Lissocarcinus*, Adams and White, Samarang Crust. p. 45: A. Milne Edwards, Ann. Sci. Nat. Zool., (4) XIV, 1860, p. 228, and Archiv. du Mus. X. 1861, p. 417: Miers, Challenger Brachyura, p. 204.

*Asecla*, Streets, Bull. U. S. Nat. Mus. VII. 1877, p. 110.

Carapace either not, or very little, broader than long, smooth or with a single ridge running obliquely inwards from the last tooth of either antero-lateral border.

Front prominent beyond the inner supra-orbital angles which may be either well or rather ill defined, laminar, subentire or distinctly notched

in the middle line, its breadth (exclusive of the inner supra-orbital angles) is from half to a third the greatest width of the carapace.

Antero-lateral borders little oblique, moderately arched, cut into five lobes or teeth, including the outer orbital angle.

Basal antenna-joint short but not peculiarly broad, its outer angle is produced as a lobule that meets the front and fills the orbital hiatus so as to exclude the flagellum.

The two fissures in the upper edge of the orbit may be distinct, or may be almost indistinguishable. The antennules fold nearly transversely or a little obliquely.

Epistome short, and though well enough demarcated from the palate, somewhat overlapped by the external maxillipeds. Buccal cavern squarish, broader than long, the efferent branchial channels well defined.

Chelipeds short, but a little longer than the legs: arm short, without any distinct spines, only the inner angle of wrist dentiform; palm not prismatic, fingers stout and rather shorter than the palm.

The propodite and dactylus of the last pair of legs are typically foliaceous swimming paddles, but the carpus and merus are not particularly dilated.

The abdomen of the male consists of 5 pieces, the 3rd-5th terga being fused.

*Lissocarcinus* is distinguished from *Thalamonyx* chiefly by the sub-circular or obovate carapace and by the stumpy little sculptured chelipeds.

#### *Key to the Indian species of Lissocarcinus.*

- I. Carapace as long as broad, flat, obovate; front broadly triangular, notched at tip ... .. *L. polybioides*.
- II. Carapace broader than long, convex:—
  1. Carapace sub-rotund; front sub-entire, being dorsally grooved but not notched in the middle line, supra-orbital angles obscurely defined ... .. *L. orbicularis*.
  2. Carapace distinctly broader than long; front cut into two broad lobes exclusive of the well defined dentiform supra-orbital angles ... .. *L. lævis*.

#### 4. *Lissocarcinus polybioides*, Adams and White.

*Lissocarcinus polybioides*, Adams and White, Samarang Crust. p. 46, pl. xi. fig. 5; A. Milne Edwards, Archiv. du Mus. X. 1861, p. 417; Haswell, Cat. Austral. Crust. p. 83; Miers, Challenger Brachyura, p. 205; J. R. Henderson, Trans. Linn. Soc. Zool., (2) V. 1893, p. 378.

Carapace as long as broad, obovate with the posterior part truncated and much constricted, flat, smooth except for a low transverse ridge passing obliquely inwards from the last tooth of either antero-lateral border.

Front projecting far beyond the well pronounced inner supra-orbital angles, lamellar, horizontal, broadly triangular with the apex rather deeply notched: its breadth (not including the inner supra-orbital angles) is a little less than half the greatest breadth of the carapace.

Antero-lateral borders curved, cut into 5 anteriorly acuminate teeth (including the outer orbital angles) of which the first is the largest and the 5th the smallest.

Posterior border of dorsum of carapace forming a curve with the postero-lateral borders.

Orbits small, their major diameter less than a third the width of the inter-orbital space; two faint grooves in the upper border, the inner angle of the lower border dentiform but not prominent.

Chelipeds moderately stout, longer and stouter than the legs, a little longer than the carapace: inner angle of wrist dentiform, two or three little points—of which one is slightly larger than the others—on the outer angle: hand smooth, except for 2 crests—each of which ends in a tooth—on the upper surface, and for a small tubercle in front of the apex of the wrist-joint: fingers stout, a little shorter than the palm.

Merus of last pair of legs twice as long as broad, its posterior border, like that of the propodite, is smooth and unarmed.

6th abdominal tergum of male longer than broad, with slightly-curved gradually convergent sides.

Sternum elongate-oval particularly so in the male.

In the Indian Museum are 11 specimens, from Madras, from Orissa and Ganjam coasts 13–28 fms., from Malabar coast 28 fms., and from the Andamans.

A small species: the carapace of an egg-laden female is 7 millim. in both diameters.

##### 5. *Lissocarcinus orbicularis*, Dana.

*Lissocarcinus orbicularis*, Dana, Proc. Ac. Nat. Sci. Philad. 1852, p. 86, and U. S. Expl. Exp. Crust. pt. I. p. 238, pl. xviii. fig. 1a-e: A. Milne Edwards, Archiv. du Mus. X. 1861, p. 418: Richters in Mobius Meeresf. Maurit. p. 154: Miers, Zool. H. M. S. Alert, pp. 518, 541, and P. Z. S. 1884, pp. 10, 12, and Challenger Brachyura, p. 205: Ortmann, Zool. Jahrb., Syst., VII. 1893-94, p. 87.

*Lissocarcinus pulchellus*, Muller, Verh. Nat. Ges. Basel, VIII. pp. 475, 482, pl. v. fig. 6.



Carapace slightly broader than long, sub-circular, convex with thin edges, smooth except for a more or less distinct ridge or elevation running obliquely inwards from the last tooth of either antero-lateral border.

Front projecting a little beyond the supra-orbital angles (which are not well pronounced), arched, entire though dorsally concave in the middle line, its breadth is between a half and a third the greatest breadth of the carapace.

Antero-lateral borders curved, divided into five lobes, or, rather, broad flat puckers.

Orbits small, their major diameter is about a fourth the width of the inter-orbital space: two closed fissures near the outer end of the upper margin; inner angle of lower margin dentiform but not prominent.

Antennal flagella short.

Chelipeds a little longer than the carapace: inner angle of wrist dentiform: upper surface of hand with two carinæ, each ending in a blunt tooth, there is also a little tubercle in front of the apex of the wrist joint and an obscure ridge along the outer surface: fingers stout, a little shorter than the palm, the dactylus sharply carinate dorsally.

Legs stout, slightly shorter than the chelipeds, the merus of the last pair is about twice as long as broad and its posterior border, like that of the propodite, is smooth.

Colours very characteristic: carapace dark maroon (chocolate in spirit) with symmetrical yellow markings, chelipeds and legs cross-banded yellow and maroon.

In the Indian Museum is a single egg-laden female from Kiltán I. (Laccadives): its carapace is 10 millim. long and 11.5 millim. broad.

#### 6. *Lissocarcinus lævis*, Miers.

*Lissocarcinus lævis*, Miers, Challenger Brachyura, p. 205, pl. xvii, fig 3: J. R. Henderson, Trans. Linn. Soc. Zool., (2) V. 1893, p. 378.

Carapace distinctly broader than long, convex, perfectly smooth.

Front a little prominent beyond the well pronounced supra-orbital angles, divided into two broad lobes, its breadth (not including the supra-orbital angles) is barely a third the greatest breadth of the carapace.

Antero-lateral borders curved, cut into 5 blunt lobes, of which the first and last are the smallest.

Orbits large, their major diameter nearly half the width of the inter-orbital space, their upper border entire, though traces of the two sutures may be visible.

Chelipeds rather longer than the carapace; a small lobule at the far end of the anterior border of the arm, inner angle of wrist stoutly spiniform, hand smooth except for a tiny tubercle in front of the apex of the wrist joint.

First 3 pairs of legs slender: merus of last pair less than twice as long as broad, its posterior border ending in an almost dentiform carina.

6th abdominal tergum of male broader than long, broadest in the middle, its sides therefore curved.

In spirit the carapace is white with some purplish-brown markings.

In the Indian Museum are 9 specimens, from off Ceylon  $26\frac{1}{2}$  fms., off the Malabar coast 26–31 fms., off Mergui 40 fms. and from the Andamans.

The largest specimen has a carapace 9.5 millim. long and 11 millim. broad.

### Sub-family III. LUPINÆ.

#### Alliance I. *Lupocycloida*.

#### LUPOCYCLUS, Adams and White.

*Lupocyclus*, Adams and White, Samarang Crust. pp. 46, 47: A. Milne Edwards, Ann. Sci. Nat., Zool., (4) XIV. 1860, p. 228, and Archiv. du Mus. X. 1861, p. 337: Miers, Challenger Brachyura, p. 185 (not subgenus *Parathranites*).

Carapace little broader than long, or even sub-circular, convex, the regions faintly indicated, with granular transverse ridges of definite position.

Front proper (not including the rather obscurely defined reduplicated inner supra-orbital angles) prominent and cut into 4 teeth.

Antero-lateral borders moderately oblique and moderately curved, about equal in length to the postero-lateral, cut into 5 or 6 teeth (including the outer orbital angle) with little denticles in some or all of the interdental spaces, bringing the total number to 9. (The denticles are sometimes so small as to escape notice).

Orbits large with a considerable dorsal inclination: the upper border with 2 fissures: the inner angle of the lower border though dentiform does not project anywhere near the level of the tips of the middle frontal teeth. The antennules fold transversely.

Basal antenna-joint about as long as broad, filling the orbital hiatus; not quite firmly fixed; flagellum long, standing in the orbital hiatus.

Epistome short, somewhat sunken. Buccal cavern somewhat broader than long: efferent branchial channels well defined.

Chelipeds very long, much longer than any of the legs, rather slender, the hand slenderer than the arm: the arm with spines, both inner and outer angles of wrist spiniform, the hand with spines and costæ, the fingers long and slender.

Legs slender: propodite and dactylus of last pair typically foliaceous and blade-like for swimming.

Abdomen of male five-jointed the 3rd-5th terga being fused: the first tergum almost concealed beneath the carapace.

*Key to the Indian species of Lupocyclus.*

- I. Frontal teeth blunt-pointed; chelipeds less than three times the length of the carapace, the arm being stout and prismatic: merus of last pair of legs broadened and compressed ... .. *L. rotundatus.*
- II. Frontal teeth acutely pointed: chelipeds more than three times the length of the carapace, the arm being slender and cylindrical: merus of last pair of legs slender ... .. *L. strigosus.*

7. *Lupocyclus rotundatus*, Adams and White.

*Lupocyclus rotundatus*, Adams and White, Samarang Crust. p. 47, pl. xii. fig. 4: A. Milne Edwards, Arch. du Mus. X. 1861, p. 387: de Man, Notes Leyden Mus. V. 1883. p. 153: Miers, Zool. H. M. S. Alert, pp. 184, 234, and Challenger Brachyura, p. 186. See also de Man, Zool. Jahrb., Syst. etc., II. 1886-87, p. 718.

? *Goniosoma inæquale*, Walker, Journ. Linn. Soc., Zool., XX. 1886-90 (1887) p. 116, pl. viii. fig. 4.

? *Lupocyclus inæqualis*, Henderson, Trans. Linn. Soc. Zool. (2) V. 1893, p. 378.

Carapace sub-circular in the young but becoming as much as five-sixths as long as broad in large individuals, convex, subtomentose, its surface broken by transverse granular ridges which are similar in number and position to those of *Neptunus (Lupocycloporus) whitei* A. M. Edw. but are more elevated and discontinuous and therefore look more like series of tubercles.

Front prominent beyond the dorsally-grooved, or reduplicated, inner supra-orbital angles, cut into four teeth of not very unequal size, of which the middle two are the most prominent and the most acute. Supra-orbital margin with two sutures or not very open fissures.

Antero-lateral borders cut into five rather coarse teeth (including the outer orbital angle), and in every one of the interdental spaces there is a denticle: these intervening denticles are so small in young individuals that some of them may escape notice, but in large individuals they are all very distinct. Posterior border straight, but forming a curve with the postero-lateral borders.

Antennal flagella more than half as long as the carapace.

Chelipeds rather more than  $2\frac{1}{2}$  times the length of the carapace in the male, and having the same form and proportions as those of *Neptunus* (*Lupocycloporus*) *whitei*, the arm being much stouter than the hand and the surface of most of the segments being granular with a squamiform sculpture: 5 spines on the anterior border of the arm and 2 in the distal third of the posterior border: hand and wrist slender, costate—the costæ granular: a spine at the inner and the outer angles of the wrist: hand with 3 spines, one being in front of the apex of the wrist-joint, the other two being side by side some little distance behind the finger-joint. The fingers are stoutish, as long as the hand, and are gently incurved, but have the extreme tips sometimes slightly bent outwards: their opposed edges have jagged teeth like those of any *Neptunus*.

The first three pair of legs are slender. The fourth pair have all their joints broadened as in any *Neptunus*, though the merus and carpus are not quite so broad, relatively, as in that genus; there is a spine near the far end of the posterior border of the merus of this pair.

The 2nd and 3rd abdominal terga are sharply and decidedly carinate.

In the Indian Museum are 14 specimens representing both sexes and several ages, from the Andaman Sea up to 55 fms. and from off Ceylon  $26\frac{1}{2}$ –32 and 34 fms. The largest male has the carapace 15 millim. long and 19 millim. broad, but there are two egg-laden females only about half this size.

The four smallest specimens are identical with White's figure of *Lupocyclus rotundatus*, the two largest specimens agree with Walker's description and figure of *Goniosoma inæquale*, the six middle-sized specimens cannot be decisively separated from either: I therefore think that all belong to one species.

#### 8. *Lupocyclus strigosus*, n. sp.

(an *Lupocyclus philippinensis*, Semper, Nauck ?)

Except in the form of the chelipeds (which are even slenderer than those of *Lupa forceps*) and last pair of legs, this species is very much like *L. rotundatus*, from which it differs in the following characters:—

(1) the carapace is perhaps a little more nearly circular, and is distinctly more convex:

(2) the front is more prominent, is practically confluent with the inner supra-orbital angles, and is cut into four sharp teeth, of which the middle two are much smaller than the others:

(3) the antero-lateral borders are armed with five slender spini-form teeth *not* including the outer orbital angle, and the denticles of the interspaces are represented by granules or are quite inconspicuous :

(4) the chelipeds in the male are  $3\frac{3}{4}$  times the length of the carapace and are very slender, especially in the palm : there are 6 or 7 spines along the anterior border of the arm, which is a slender cylindrical joint, and two much smaller ones in the distal fourth of the posterior border : the fingers are considerably longer than the palm, are extremely slender, and their opposed edges are armed with close-set fine regular teeth having larger acicular teeth at fairly regular intervals—much as in the Leucosine genus *Arcania* :

(5) the last pair of legs, though otherwise similar to those of *L. rotundatus*, have the basal joints, up to and including the carpus, slender, sub-cylindrical, and, in fact, hardly stouter than the corresponding joint of the other legs.

In other respects this species agrees with *L. rotundatus*.

In the Indian Museum are five specimens—from the Andaman Sea 15 fms., from off the Madras coast, 33 fms., and from off the Konkan coast, 56–58 fms.

In the type specimen the carapace is 8 millim. long and 9 millim. broad.

#### CARUPA, Dana.

*Carupa*, Dana, Silliman's Amer. Journ. Sci. and Arts (2) XII. 1850, p. 129 ; Proc. Ac. Nat. Sci. Philad. 1852, p. 85 ; and U. S. Expl. Exp. Crust. pt. I. p. 279 ; A. Milne Edwards, Ann. Sci. Nat., Zool., (4) XIV. 1860, p. 228, and Archiv. du Mus. X. 1861, p. 386.

Carapace transverse, broad, moderately convex, with smooth unbroken surface.

The front proper projects slightly beyond the rather ill-defined inner supra-orbital angles, and is either broadly bilobed or cut into four shallow lobes : its breadth is about a fourth the greatest breadth of the carapace.

Antero-lateral borders moderately oblique and arched, about the same length as the postero-lateral, cut into 7 rather irregular lobes (including the outer orbital angles).

The orbit, which has little or no dorsal inclination, has two notches in its upper border ; the lower border crenulate. The antennules fold almost transversely.

Basal antenna-joint as long as broad, rather slender ; the flagellum, which is of moderate length, stands in the orbital hiatus.

Epistome sufficiently long. Buccal cavern squarish, broader than long, the efferent branchial channels very well defined.

Chelipeds longer and vastly more massive than the legs: arm with spines, one or both angles of wrist spiniform; palm inflated, massive, nearly smooth: fingers stout, hardly as long as palm, strongly toothed.

Legs slender: in the fourth pair the merus is elongate and the carpus slender, but the propodite and dactylus are typical swimming paddles.

First abdominal tergum narrow, almost hidden by the carapace: in the male the 2nd–5th terga are fused—though the suture between the 2nd and 3rd may be visible—so that the abdomen consists of 4 pieces only.

### 9. *Carupa læviuscula*, Heller.

*Carupa læviuscula*, Heller, Verh. zool. bot. Ges. Wien, XII. 1862, p. 520, and Novara Crust, p. 27, pl. iii. fig. 2: de Man, Notes Leyden Mus. V. 1883, p. 152, and Archiv. f. Naturges. LIII. 1887, i. p. 336: Ortmann, Zool. Jahrb., Syst. VII. 1893-94, p. 68 and in Semon's Forschungr. Crust. (Jena. Denk. VIII) p. 44: Zehntner, Rev. Suisse Zool. II. 1894, p. 161.

Carapace about  $\frac{2}{3}$  as long as broad, perfectly smooth to the naked eye, frosted with minute granules under the lens.

Front cut into 4 shallow lobes, of which the middle two are the narrowest. Supra-orbital margin with two notches, infra-orbital margin cut into four lobes of which the middle two are the narrowest.

Antero-lateral borders cut into 7 teeth (including the outer orbital angle), of which the 5th is the smallest and the 6th the largest and most acute. The postero-lateral angles of the carapace are well defined.

Antennal flagella more than half the length of the carapace.

Chelipeds about  $2\frac{1}{4}$  times the length of the carapace, in the male: arm short with 3 claw-like spines on the anterior border, the posterior border being smooth: inner angle of wrist strongly spiniform, the outer angle rounded, but armed with a spinule below: hand smooth, its upper border well defined.

In young specimens, as in the young of *Scylla serrata*, there may be two faint costae or two lines of small granules along the upper surface of the hand, and also there may be some costiform lines of small granules on the upper surface of the wrist.

The legs are slender and smooth: the last pair have only the last two joints dilated for swimming.

In the Indian Museum are two specimens (one badly damaged) from the Andamans and one from the Madras coast—besides one from Samoa and one from Mauritius.

Alliance II. *Lupoida.*

## SCYLLA, De Haan.

*Scylla*, De Haan, Faun. Japon. Crust. p. 11: A. Milne Edwards, Ann. Sci. Nat., Zool., (4) XIV. 1860, pp. 228, 249, and Archiv. du Mus. X. 1861, p. 347: Miers, Challenger Brachyura, p. 184.

Carapace transverse, broad, moderately convex, with an almost unbroken surface.

Front proper well delimited from the inner supra-orbital angles, cut into four teeth: its breadth (not including the supra-orbital angles) is between a fourth and a fifth the greatest breadth of the carapace.

Antero-lateral borders oblique, arched, longer than the postero-lateral, cut into 9 teeth of nearly equal size.

Orbit without any dorsal inclination: two nearly closed fissures in its upper wall: the inner angle of the lower border dentiform and prominent. The antennules fold nearly transversely.

Basal antenna-joint short and broad, its antero-external angle produced to form a lobule lying in the orbit: the flagellum, which is of good length, stands in the orbital hiatus.

Epistome sufficiently long fore and aft, not sunken. Buccal cavern squarish, broader than long: the efferent branchial channels cavernous, but not defined by ridges.

Chelipeds massive, longer than any of the legs: arm wrist and hand with definitely placed spines: hand deep and full, not prismatic, not costate.

Legs stout, moderately compressed: in the fourth pair the merus and carpus are shortened and broadened, and the propodite and dactylus are typically foliaceous for swimming.

Abdomen of male rather broadly triangular, consisting of 5 segments, the 3rd-5th terga being fused. The first tergum is much concealed beneath the carapace.

10. *Scylla serrata* (Forsk.) De Haan.

*Cancer serratus*, Forskal, Descr. Anim. p. 90.

*Cancer olivaceus*, Herbst, Krabben, II. V. 157, pl. xxxviii. fig. 3.

*Portunus tranquebaricus*, Fabricius, Ent. Syst. Suppl. p. 366; Bosc, Hist. Nat. Crust. I. p. 219; Latreille, Hist. Nat. Crust. VI. p. 16 and Encycl. Meth. X. p. 191.

*Portunus serratus*, Rüppell, 24 Krabben roth. Meer. p. 10, pl. ii.

*Lupea tranquebarica*, Milne Edwards, Hist. Nat. Crust. I. 448.

*Lupea lobifrons*, Milne Edwards, Hist. Nat. Crust. I. 453 (*vide* A. M. Edw.).

*Scylla serrata* De Haan, Faun. Japon. Crust. p. 44: Krauss, Sudaftr. Crust. p. 25: A. Milne Edwards, Ann. Sci. Nat. Zool. (4) XIV. 1860, p. 252, and Archiv. du Mus. X. 1861, p. 349, and Nouv. Archiv. du Mus. IX. 1873, p. 162, and in Maillard's

Pile Réunion, Annexe F p. 2: Hess Archiv. f. Naturges. XXXI. 1865, i. pp. 139, 172: Heller, Novara Crust. p. 27: Miers, Crust. New Zealand, p. 27: Hilgendorf, MB. AK. Berl. 1878, p. 799: E. Nauck, Zeits. Wiss. Zool. XXXIV. 1880, p. 59, pl. i. figs. 22, 24 (*gastric teeth*): Haswell, Cat. Austral. Crust. p. 79: Miers, Ann. Mag. Nat. Hist. (5) V. 1880, p. 238; and Zool. H. M. S. Alert, pp. 518, 538; and Challenger Brachyura, p. 185: Filhol, Crust. N. Zel., Miss. ile Campbell, p. 382: de Man, Archiv. Naturges. LIII. 1887, i. p. 332; and in Weber's Zool. Ergebn. Niederl. Ost. Ind. II. 1892, p. 285: Cano, Boll. Soc. Nat. Napol. III. 1889, p. 215: Ortman, Zool. Jahrb. Syst. VII. 1893, p. 78, and in Semon's Forschungr. (Jena-Denk. VIII.) Crust. p. 45: Henderson, Trans. Linn. Soc. Zool., (2) V. 1893, p. 372.

*Scylla tranquebarica*, Dana, U. S. Expl. Exp. Crust. pt. I. p. 270: Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 38.

? *Achelous crassimanus*, Macleay III. Annulosa. S. Afr. p. 61, (*sec. A. M. E.*).

Carapace about  $\frac{2}{3}$ , or a little less, as long as broad, practically smooth, except for a faint granular ridge running obliquely inwards across either branchial region from the last spine of the antero-lateral border.

Front cut into four lobes or bluntish teeth of about equal size and prominence. Antero-lateral borders cut into 9 sharply acuminate teeth of about equal size: posterior border forming a curve with the postero-lateral borders, the points of junction sometimes slightly thickened.

Merus of external maxillipeds oblique but not having the antero-external angle distinctly produced in a lateral direction.

Chelipeds not quite twice the length of the carapace in the adult male, but shorter than this in the female and young male. Arm with 3 spines on the anterior border, and 2 on the posterior border—one terminal, the other submedian: a strong spine at inner angle of wrist, the outer angle being rounded and armed with one, or sometimes two, small spines or teeth: hand with 3 spines or tubercles, one being in front of the apex of the wrist-joint, the other two being side by side behind the finger-joint—(the outer of these two is sometimes obsolescent).

Legs unarmed.

Abdomen of male broadly triangular.

An extremely common crab in all the estuaries and backwaters of India, from Karachi to Mergui. It grows to a large size.

In young specimens the frontal lobes are broad and indistinct, the upper surface of the palm is traversed by two faint but distinct longitudinal costæ, and there may be a transverse granular line across the gastric region.

This is the common edible crab of India,

NEPTUNUS, De Haan, A. Milne Edwards, Miers.

*Neptunus*, De Haan, A. Milne Edwards, Ann. Sci. Nat., Zool., (4) XIV. 1860, p. 226 and Archiv. du Mus. X. 1861, p. 314 (*ubi syn.*)



*Neptunus, Achelous, Amphitrite, Pontus*, De Haan, Faun. Japon. Crust. pp. 7, 8, 9.

*Posidon*, Herklots, Add. Faun. Carcin. Afric. Occ. p. 3.

*Lupa, Arenaeus, Amphitrite*, Dana, U. S. Expl. Exp. Crust. pt. I. pp. 270, 275, 289.

*Euctenota*, Gerstaecker, Archiv. f. Naturges. XXII. 1856, i. p. 131.

*Neptunus, Achelous*, A. Milne Edwards *op. cit.*

*Callinectes*, Stimpson, Ann. Lyc. Nat. Hist. New York, VII. 1860, p. 220.

*Xiphonectes*, A. Milne Edwards, Nouv. Archiv. du Mus. IX. 1873, p. 157.

*Hellenus*, A. Milne Edwards, Miss. Sci. Mex., Crust. pp. 210, 221.

*Neptunus, Xiphonectes*, Miers, Challenger Brachyura, pp. 171, 183.

*Portunus*, M. J. Rathbun, see Proc. Biol. Soc. Washington, June, 1897, pp. 155, 160.

Carapace usually transverse, broad, and depressed or little convex, often with the surface areolated.

Front proper well delimited from the inner supra-orbital angles and cut into from 3 to 6—usually *four*—teeth: its breadth (not including the supra-orbital angles) is from a sixth to a fifth the greatest breadth of the carapace (lateral epibranchial spines not included), and it is often somewhat receding.

Antero-lateral borders oblique, arched, longer than the postero-lateral, cut into 9 regular teeth (including the outer orbital angle) of which the 9th may be enlarged or not.

The orbit usually has 2 fissures or sutures in the upper border, which border is less prominent than the lower border, so that the orbit very often has a dorsal inclination: the lower border has a fissure or suture near the outer angle, and the inner angle is dentiform and usually very prominent. The antennules fold transversely.

The basal antenna-joint is peculiarly short and has its antero-external angle produced to form a lobule or spine extending into the orbit: the flagellum, which is of fair length, stands in the orbital hiatus.

Epistome short or even linear, sometimes prolonged in the middle line to form a spine lying below the inter-antennular septum. Buccal cavern squarish, broader than long, the efferent branchial channels almost always very well defined.

Chelipeds longer, usually much longer, than any of the legs, and massive: arm with spines, both inner and outer angles of wrist spini-form, palm prismatic costate and usually with spines, fingers usually nearly as long as the palm and strongly toothed.

Legs compressed: in the last pair the merus and carpus are short and broad, and the propodite and dactylus are typically foliaceous and paddle-like for swimming.

The abdomen of the male is five-jointed, the 3rd-5th terga being fused: the 1st tergum in both sexes is almost entirely concealed beneath the carapace.

The Indian species of the genus *Neptunus* fall into five groups, or subgenera, which are characterized as follows:—

- I. Carapace very broad, little convex, and having the junction of the posterior with the postero-lateral angles rounded. Front not projecting beyond, or even receding behind, the internal supra-orbital angles: the last spine of the antero-lateral borders enormously larger than any of the others. Orbits of moderate size and having only a slight dorsal inclination. Antero-external angle of basal antenna-joint produced to a spiniform process lying in the orbit. Epistome produced in the middle line to form a very prominent spine: the antero-external angle of the merus of the external maxillipeds rounded, not produced laterally. Hand at least as massive as the arm..... NEPTUNUS.
- II. Carapace moderately broad, little convex, and having the postero-lateral junctions rounded. Front hardly projecting beyond the internal supra-orbital angles, but not receding: the last spine of the antero-lateral borders a good deal the largest. Orbits large, with a very strong dorsal inclination. Antero-external angle of basal antenna-joint forming a blunt lobe-like process. Epistome slightly produced in a spiniform manner: the antero-external angle of the merus of the external maxillipeds strongly produced in a lateral direction. Hand at least as massive as arm ..... AMPHITRITE.
- III. Carapace suborbicular or not very broad, flat, the postero-lateral junctions rounded. Front slightly projecting beyond the internal supra-orbital angles: the last spine of the antero-lateral border either hardly larger or actually smaller than any of the others. Orbits of moderate size and with a moderate dorsal inclination. Antero-external angle of basal antenna-joint forming a lobe-like process. Epistome hardly produced in the middle line: antero-external angle of merus of external maxillipeds strongly produced in a lateral direction. Hand hardly less massive than the arm ..... ACHELOUS.
- IV. Carapace moderately broad, flat or little convex, and having the postero-lateral junctions angular or actually spiniform. Front decidedly prominent beyond the inner supra-orbital angles: the last spine of the antero-lateral borders very much the largest. No free prolongation of the epistome in the middle line. Hand about as massive as arm. [Except in *N. spinipes*, the angle of the basal antenna-joint is a lobe-like process. Except in *N. tuberculosus* and *brockii*, the orbits are large with a very strong dorsal inclination. Except in *N. hastatooides*, the antero-external angle of the

merus of the external maxillipeds is not produced in a lateral direction] ..... HELLENUS.

- V. Carapace moderately broad, distinctly convex, rounded postero-laterally. Front projecting beyond the inner supra-orbital angles: the last spine of the antero-lateral borders slightly the largest. Orbits large, with strong dorsal inclination. Basal antenna-joint longitudinally grooved on ventral surface. No free prolongation of the epistome in the middle line: no lateral expansion of the antero-external angle of the merus of the external maxillipeds. Hand much slenderer than the arm ..... LUPOCYCLOPORUS.

*Key to the Indian species of the genus Neptunus.*

- I. Hand either more, or but little less, massive than arm:—
- A. Last spine of antero-lateral border much the largest:—
1. Posterior angles of carapace rounded (NEPTUNUS):—
- i. Antero-external angle of merus of external maxillipeds rounded:—
- a. No spine on the posterior border of the arm ..... *N. sanguinolentus.*
- b. A spine at far end of posterior border of arm ..... *N. pelagicus.*
- ii. Antero-external angle of merus of external maxillipeds strongly produced in a lateral direction (AMPHITRITE):—
- a. No spot on dactylus of last pair of legs..... *N. gladiator.*
- b. A spot on dactylus of last pair of legs: crests of hands and abdomen with a pearly sheen ..... *N. argentatus.*
- c. Spine at inner angle of wrist two-thirds as long as palm ..... *N. petreus.*
2. Posterior angles of carapace square or spiniform (HELLENUS):—
- i. Posterior angles square: front cut into 3 teeth ..... *N. tenuipes.*
- ii. Posterior angle spiniform: front cut into 4 teeth:—
- a. Two distinct spines on posterior border of arm:—
- π. After half of distal border of merus of last pair of legs finely serrulate ..... *N. hastatoides.*
- β. After half of distal border of merus of last pair of legs smooth..... *N. andersoni.*

- φ. A spine near far end of posterior border of merus of last pair of legs ..... *N. spinipes.*  
 b. A single true spine on posterior border of arm:—  
   π. Middle teeth of front very much smaller and less prominent than the outer: three spines on hand ..... *N. longispinosus.*  
   β. Middle teeth of front nearly as large as, and more prominent than, the outer: two spines on hand ..... *N. tuberculosus.*  
   φ. Teeth of front obsolescent: no spines on hand ..... *N. brockii.*  
 B. Last spine of antero-lateral border either hardly larger or even smaller than any of the others (ACHELOUS):—  
   1. Carapace granular, last spine of antero-lateral border slightly the largest ..... *N. granulatus.*  
   2. Carapace polished, last spine of antero-lateral border slightly smaller than the others ..... *N. orbicularis.*  
 II. Hand slender, much less massive than arm (LUPOCYCLOPORUS):  
   1. Front cut into four teeth of nearly equal size, of which the middle two are the most prominent ..... *N. whitei.*  
   2. Front cut into four lobes, of which the middle two are much the smaller and are hardly more prominent than the others ..... *N. gracilimanus.*

Dr. J. R. Henderson includes *Neptunus sieboldi*, A. Milne Edwards (Archiv. du Mus. X. 1861, pp. 323, 339, pl. xxxv. fig. 5), which according to de Man is identical with *N. convexus* De Haan, in the Indian Fauna. It appears to belong to the subgenus *Neptunus*, and is distinguished by the uniformity of size and shape of the frontal teeth, by the small size of the last spine of the antero-lateral border, and by the absence of any spine on the posterior border of the arm.

### 11. *Neptunus sanguinolentus*, (Herbst).

*Cancer pelagicus*, (part), Fabricius, Mant. Ins. I. p. 318, and Ent. Syst. II. 447.

*Cancer sanguinolentus*, Herbst, Krabben, I. ii. 161, pl. viii. figs. 56, 57.

*Portunus sanguinolentus*, Fabricius, Ent. Syst. Suppl. p. 367: Bosc, Hist. Nat. Crust. I. p. 220: Latreille, Encyc. Meth. X. p. 190.

*Lupa sanguinolenta*, Desmarest, Dict. Sci. Nat. XXVIII. p. 224, and Consid. Gen. Crust. p. 99: Milne Edwards, Hist. Nat. Crust. I. 451 and in Cuvier Règne An. pl. x. fig. 1: Lucas Hist. Nat. Anim. Art. Crust. p. 101: Dana, U. S. Expl. Exp. Crust. pt. I. p. 271: Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 38: Tozzetti, "Magenta" Crust. p. 68.

*Neptunus sanguinolentus*, De Haan, Faun. Japon. Crust. p. 38: A. Milne Edwards, Archiv. du Mus. X. 1858-1861, pp. 319, 339, and in Maillard's l'île Réunion,

Annexe F. p. 2: Heller, "Novara" Crust. p. 26: Brocchi, Ann. Sci. Nat. (6) II. 1875. Art 2, p. 55, pl. xvi. figs. 83, 84 (*male appendages*): Miers, Cat. New Zealand Crust. p. 26, and Ann. Mag. Nat. Hist. (5) V. 1880, p. 238, and Challenger Brachyura, p. 174: Streets, Bull. U. S. Nat. Mus. VII. 1877, p. 106: Haswell, Cat. Austral. Crust., p. 77: Filhol, Crust. Nouv. Zél., Miss de l'île Campbell, p. 382, F. Muller, Verh. Naturf. Ges. Basel, VIII. 1886, p. 475: de Man, Archiv. f. Naturges. LIII. i. 1887, p. 328, and in Weber's Zool. Ergebn. Niederl. Ost-Ind. II. 1892, p. 285 and Zool. Jahrb., Syst. etc., VIII. 1894-95, p. 556: Cano, Boll. Soc. Nat. Napol. III. 1889, p. 212: Pfeffer, Mitt. Nathist. Mus. Hamburg VII. 1889 (1890), No. 8, p. 6 (*female dimorphism*): J. R. Henderson, Tr. Linn. Soc. Zool. (2) V. 1893, p. 368: Ortmann, Zool. Jahrb., Syst. etc., VII. 1893, p. 75, and in Semon's Forschunger. (Jena. Denk VIII) Crust. p. 45.

Carapace very broad, little convex, its length in the middle line half its breadth excluding the great lateral spines, finely granular everywhere in the young but only in the anterior half in the adult, crossed transversely by some slightly-raised granular lines—two on the gastric, one on either branchial region—conspicuously marked posteriorly by three large blood-red spots.

Front cut into four sharp and very distinct teeth—not counting the inner supra-orbital angles—of which the middle two are the less prominent and have projecting between and far beyond them the spine-like process of the epistome. Supra-orbital borders cut by 2 fissures into 3 lobes, the angles of the middle lobe not conspicuous.

Antero-lateral borders very long and oblique, cut into 9 teeth including the outer orbital angle) the last of which is about four times as long as any of the others. The posterior border, which is smooth, forms a common curve with the postero-lateral borders.

Antero-external angle of merus of external maxillipeds not produced.

Chelipeds in the adult male about  $2\frac{2}{3}$  times the length of the carapace, but rather less in the female and young male: the hand is the most massive segment. Arm with 3 or 4 large spines on the anterior (inner) border, but without any on the posterior border. Hand and outer surface of wrist costate, the costæ smooth: both inner and outer angle of wrist strongly spiniform: the palm, which is not, or only slightly, longer than the fingers has two spines dorsally, one being in front of the apex of the wrist-joint, the other just behind the finger-joint.

Legs smooth: a spinule near the far end of the posterior border of the carpus of the first two pairs.

A large species.

In the Indian Museum are 60 specimens, from Penang, Nicobars, east and west coasts of the Peninsula, Ceylon, and Karáchi.

12. *Neptunus pelagicus*, Linn.

*Pagurus reidjungan*, Rumph, Amboinsch. Rariteitk. I. p. 11 (which also seems to include *N. sanguinolentus*), pl. vii. fig. R.

*Cancer pelagicus*, Linnæus, Mus. Lud. Ulr. p. 434, and Syst. Nat. (xii. ed.) p. 1042: Forskal, Descr. Anim. p. 89: Fabricius, Ent. Syst. II. p. 447 (part).

*Cancer cedo-nulli*, Herbst, Krabben, II. ii. 157, pl. xxxix.

*Cancer reticulatus*, Herbst, Krabben, III. i. 65, pl. l.

*Portunus pelagicus*, Fabricius, Ent. Syst. Suppl. p. 367: Latreille, Hist. Nat. Crust. VI. 16, and Encycl. Meth. X. p. 188: Savigny, Descr. Egypt. pl. iii. fig. 3 (Audouin, Expl. p. 83).

*Portunus cedo-nulli*, Bosc, Hist. Nat. Crust. I. p. 221.

*Lupa pelagica*, Desmarest, Dict. Sci. Nat. XXVIII. p. 223 and Consid. Gen. Crust. p. 98, pl. vi. fig. 2: Milne Edwards, Hist. Nat. Crust. I. 450: Lucas, Hist. Nat. Anim. Art. Crust. p. 101, pl. vii. fig. 2: Dana, U. S. Expl. Exp. Crust. pt. I. p. 271: Stimpson, Proc. Acad. Nat. Sci. Philad. 1858, p. 38: Heller, SB. AK. Wien, XLIII. 1861, p. 355: Hilgendorf in v. d. Decken's Reisen Ost-Afr. III. i. p. 77: Tozzetti, 'Magenta' Crust. p. 66, pl. v. fig. 3a-b.

*Neptunus pelagicus*, DeHaan, Faun. Jap. Crust. p. 37, pl. ix, x: Krauss, Sudafr. Crust. p. 23: A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 320, 329, and Nouv. Archiv. du Mus. IV. 1868, p. 70, and IX. 1873, p. 156: Heller, Novara Crust. p. 27: Hess, Archiv. f. Naturges. XXXI. 1865, i. pp. 138, 172: Brocchi, Ann. Sci. Nat. (6) II. 1875, Art. 2, p. 52, pl. xv. fig. 74, 75 (*male appendages*): Miers, Cat. New Zealand Crust. p. 25, and Ann. Mag. Nat. Hist. (4) XVII. 1876, p. 221, and (5) V. 1880, p. 238, and Zool. H.M.S. Alert, pp. 183, 289, and Challenger Brachyura, p. 173: Kossmann, Reise roth Meer. Crust. p. 46: Neumann, Cat. Crust. Heidelb. Mus. p. 24: Hilgendorf, MB. AK. Berl. p. 799: Nauck, Zeits. Wiss. Zool. XXXIV. 1880, p. 62 (*gastric teeth*): de Man, Notes Leyden Mus. II. 1880, p. 183, and Archiv. f. Naturges. LIII. 1887, i. p. 328, and Journ. Linn. Soc., Zool., XXII. 1888, p. 69, and in Weber's Zool. Ergebn. Niederl. Ost-Ind. II. 1892, p. 284: Haswell, Cat. Austral. Crust. p. 77: Filhol, Crust. Nouv. Zél. p. 381: Cano, Boll. Soc. Nat. Napoli, III. 1889, p. 212: Pfeffer, Mitteil. Nat. Hist. Mus. Hamb. XII. 1889, No. 8, p. 6: A. O. Walker, Journ. Linn. Soc., Zool., XX. 1890, p. 110: J. R. Henderson, Trans. Linn. Soc. Zool., (2) V. 1893, p. 367: Ortman, Zool. Jahrb., Syst., VII. 1893, p. 74, and in Semon's Forschungr. (Jena. Denk. VIII.) Crust. p. 45.

? *Neptunus armatus*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 322, 339, pl. xxxiii. fig. 2: Miers, Zool. H. M. S. Alert, pp. 183, 229: Cano, Boll. Soc. Nat. Napol. III. 1889, p. 212: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 370: Ortman, Zool. Jahrb. Syst. VII. 1893-94, p. 75.

*Neptunus trituberculatus*, Miers, Ann. Mag. Nat. Hist., (4) XVII. 1876, p. 221 and (5) V. 1880, p. 238, and Cat. Crust. New Zealand, 1876, p. 25, and Challenger Brachyura, p. 172: Ortman, Zool. Jahrb. Syst. VII. 1893, p. 74.

Carapace broad, little convex, its length a little more than half its breadth without the great lateral spines, at all ages closely covered with largish miliary granules: two transverse lines on the gastric, one on either branchial region: sometimes two lumps on the cardiac and one on the post-gastric region, these being very variable in size and distinctness.

Front cut into four teeth—not counting the inner angles of the orbit—of which the middle two are small and little prominent, or obsolescent, or even confluent and obsolete: between and far beyond them projects the spine-like process of the epistome. Supra-orbital borders cut by two fissures into three lobes, the outer angle of the middle lobe being usually dentiform.

Antero-lateral and posterior borders and external maxillipeds almost as in the preceding species.

Chelipeds in the adult male more than 3 times, in the female and young male not quite  $2\frac{1}{2}$  times the length of the carapace—the hand the most massive segment. Arm with 3 large spines on the anterior (inner) border and with 1 at the far end of the posterior border. Wrist and hand much as in the preceding species, but the costæ are, for the most part, granular, and the hand carries 3 spines two of which stand side by side behind the finger-joint.

Legs as in *N. sanguinolentus*.

Colours in spirit yellowish, the carapace chelipeds and proximal joints of the last pair of legs having the dorsal surface copiously and coarsely reticulated with bluish and purplish green.

A large species.

In the Indian Museum are 46 specimens from all parts of the coasts of the Indian Seas, from Penang to the Persian Gulf, besides 13 from Japan, Hongkong, Australia and Suez.

### 13. *Neptunus (Amphitrite) gladiator* (Fabr.).

*Portunus gladiator*, Fabricius, Ent. Syst. Suppl. p. 368: Bosc, Hist. Nat. Crust. I. p. 219: Latreille, Hist. Nat. Crust. VI. p. 19, and Encycl. Meth. X. p. 189.

*Cancer menestho*, Herbst, Krabben, III. iii. 34, pl. lv. fig. 3.

*Lupea gladiator*, Milne Edwards, Hist. Nat. Crust. I. 456.

*Amphitrite gladiator*, De Haan, Faun. Jap. Crust. p. 39, pl. i. fig. 5: Haswell, Cat. Austral. Crust. p. 84.

*Neptunus gladiator*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 330, 339: Richters in Möbius Meeresf. Maurit. p. 152: Muller Verh. Nat. Ges. Basel, VIII. 1886, p. 475: Miers, Challenger Brachyura, p. 177: de Man, Journ. Linn. Soc., Zool., XXII. 1888, p. 69: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 367: Ortmann, Zool. Jahrb. Syst. VII. 1893-94, p. 73.

*Amphitrite Haanii*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 38.

? *Amphitrite media*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 39 (v. A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 331, 339 and Ortmann, Zool. Jahrb. Syst. VII. 1893-94, p. 73).

Carapace depressed, finely subtomentose, its length about two-thirds its breadth without the great lateral spines, its surface broken by low symmetrically disposed sub-regional elevations the summits aloze of which are granular.

Front cut into four acute teeth (not counting the inner supra-orbital angles) of which the middle two are the smaller and less prominent and have projecting between them the dentiform process of the epistome. Supra-orbital margin cut by two fissures into three lobes, the outer angle of the middle lobe strongly dentiform.

Antero-lateral and posterior borders much as in the preceding species except that the great lateral spines are only about  $2\frac{1}{2}$  times the length of any of the others.

Eyes large, reniform, not concealed to dorsal view by the orbits, which are large and almost entirely dorsal in position.

Antero-external angle of merus of external maxillipeds very strongly produced in a lateral direction.

Chelipeds in the adult male a little over  $2\frac{1}{2}$  times the length of the carapace, somewhat shorter in the female—the hand the most massive segment: granular in places, the granules on the upper surface of the arm and under surface of the hand forming sub-squamiform lines. Arm with 4 spines on the anterior (inner) border and 2 near the far end of the posterior border. Wrist and hand costate, the costæ granular. Both inner and outer angle of wrist strongly spiniform, the former very strongly so. Two spines on the hand, one being just in front of the apex of the wrist-joint, the other being a short distance behind the finger-joint: the carina that forms the outer boundary of the lower surface of the hand is very salient.

Legs, like the arm, tomentose in places, but very strongly so along the anterior (inner) border: no spinule on the posterior border of the carpopodites.

The abdomen in the male has remarkably sinuous lateral borders: the 2nd and 3rd abdominal terga in both sexes are very strongly carinated.

Colours in spirit yellow, often with some red markings on edges of carapace and on fingers and on spines of chelipeds.

A species of medium size, adult males having the carapace about 33 millim. long and about 65 millim. broad including the great lateral spines.

In the Indian Museum are 13 specimens from Ceylon, Madras, Sunderbunds, and Mergui.

#### 14. *Neptunus (Amphitrite) argentatus* (White) A. M. Edw.

[“*Amphitrite argentata*, White List. Crust. Brit. Mus. p. 126”.]

*Neptunus argentatus*, A. Milne Edwards, Arch. du Mus. X. 1861, pp. 332, 339, pl. xxxi. fig. 4: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 368.

*Neptunus gladiator*, var. *argentatus*, Miers, Challenger Brachyura, p. 177: Cano, Boll. Soc. Nat. Napoli. III. 1889, p. 214: Ortmann, Zool. Jahrb. Syst., VII. 1893-94, p. 73.



Very like *N. gladiator* but easily distinguished by the following characters:—

(1) the carapace is longer and narrower, its length being three-fourths its breadth without the great lateral spines; and its sub-regional convexities are in much stronger relief and much better defined:

(2) the median frontal teeth are smaller and less prominent, and the outer angle of the middle lobe of the supra-orbital margin is less acute:

(3) the crests of the outer surface of the palm and immobile finger and of the third abdominal segment are not only more salient and trenchant, but also have a curious silvery or coppery pearly sheen:

(4) the chelipeds are shorter; and there is a dark round spot near the tip of the dactylus of the last pair of legs.

It is a very much smaller species; only one of numerous egg-laden females in the Indian Museum has the carapace more than 20 millim. long and 30 millim. broad (including spines). Specimens of *N. gladiator* of this size are obviously immature.

In the Indian Museum are 63 specimens from the Andamans, Mergui (Marine Survey), Arakan coast, Ganjam coast, Ceylon, and Malabar coast. Nearly half the specimens are recorded from depths of 18 to 33 fathoms.

#### 15. *Neptunus (Amphitrite) argentatus* var. *glareosus*.

In this variety the carapace is even narrower and more elongate, its subregional convexities are hardly less salient and well defined than those of *N. tuberculosus*, and its surface is almost free of tomentum. The carina of the 3rd abdominal tergum is about twice as prominent as it is in the typical form, having the shape of a prominent foliaceous lobe. The dorsal surface of the body and chelipeds is profusely speckled.

26 specimens, including egg-laden females, were dredged from a bottom of sand and stones off the Andamans at 55 fathoms.

#### 16. *Neptunus (Amphitrite) petreus*, n. sp.

This species differs from *N. gladiator*, and approaches *N. spinicarpus* Stimpson, in the enormous development of the spine at the inner angle of the wrist.

It will be sufficient to point out the characters that distinguish it from *N. gladiator*, of which it may prove to be only a variety.

The length of the carapace is nearly  $\frac{3}{4}$  the breadth without the lateral spines. The frontal teeth are blunt and the epistome is not

produced. The last spine of the antero-lateral border is hardly twice the length of any of the others. The costæ of the wrist and hand are low, and the spine at the inner angle of the wrist is about two-thirds the length of the palm.

A single male specimen from the Pedro Shoal north of the Laccadive Islands. The carapace is 12 millim. long and 18 millim. broad including the spines.

17. *Neptunus (Hellenus) hastatoides* (Fabr.) A. M. Edw.

*Portunus hastatoides*, Fabricius, Ent. Syst. Suppl. p. 368.

*Cancer hastatus*, Herbst, Krabben, III. iii. 3, pl. lv. fig. 1.

*Amphitrite hastatoides*, De Haan, Faun. Jap. Crust. p. 39, pl. i. fig. 3: Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 38.

*Neptunus hastatoides*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 332, 338: Miers, Zool. H. M. S. Alert, pp. 183, 229, and Challenger Brachyura, p. 175: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 368: Ortman, Zool. Jahrb., Syst., VII. 1893-94, p. 74: de Man, Zool. Jahrb., Syst., VIII. 1894-95, p. 557.

Carapace very flat, its length in the middle line is about two-thirds its breadth not counting the great lateral spines, finely subtomentose, its surface symmetrically broken up into low subregional convexities the summits alone of which are granular.

Front slightly prominent beyond the inner supra-orbital angles and cut into four teeth, the middle two of which are very much narrower and acuter than, and are usually as prominent as or even more prominent than, the others: the inconspicuous apical prolongation of the epistome can be seen between, but does not project beyond, the middle teeth. Supra-orbital border cut by two fissures into three lobes, the outer angle of the middle lobe being dentiform.

Antero-lateral borders of moderate length and obliquity, cut into 9 teeth (including the outer angle of the orbit) the last of which is less than three times the length of any of the others in adults, but is longer in the young. The finely-beaded posterior border is practically straight, and forms a sharp or claw-like angle of junction with the postero-lateral borders.

Eyes large and reniform, not concealed by the entirely-dorsal orbits. The antero-lateral angle of the merus of the external maxillipeds is acutely produced in a lateral direction.

Chelipeds in the adult male slightly more than twice the length of the carapace, finely subtomentose, the hands little if at all less massive than the arm. 3 or 4 spines on the anterior (inner) border of the arm, 2 near the far end of the posterior border: hand and upper surface of wrist costate, the costæ granular: inner and outer angles of wrist strongly spiniform: two spines on the hand, one being in front of the apex of the wrist-joint the other just behind the finger-joint.

Legs more or less subtomentose, quite unarmed, but the after half of the distal border of the merus of the last pair is finely serrulate.

The 3rd segment of the abdomen of both sexes is strongly and sharply carinate: the length of the 6th segment of the male is nearly twice its greatest breadth.

Colours of good fresh spirit specimens, greenish yellow more or less mottled: tip of dactylus of last pair of legs blackish brown.

A small species: egg-laden females have the carapace 22 millim. long and 42 millim. broad including spines.

In the Indian Museum are 137 specimens from the Madras coast, Andamans, G. of Martaban, Penang, and Persian Gulf, besides 6 from Hongkong.

#### 18. *Neptunus (Hellenus) andersoni*, de Man.

*Neptunus andersoni*, de Man, Journ. Linn. Soc., Zool., XXII. 1888, p. 70, pl. iv. figs. 3, 4: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 368.

This species differs from *N. hastatoides* in the following characters:—

The carapace is more convex, the subregional elevations, instead of being low and ill-defined, are sharply-defined tubercles, and the oblique ridge that traverses either epibranchial region is particularly salient. The front is more prominent beyond the inner supra-orbital angles and the two middle teeth are less prominent than the others. The posterior angles of the carapace are much less acute. The antero-external angle of the merus of the external maxillipeds is less produced in a lateral direction. The chelipeds are shorter, being less than twice the length of the carapace in the male, and the costæ of the wrist and hand are smooth. The 6th segment of the male abdomen is less elongate than in *N. hastatoides*.

The colour of good fresh spirit specimens is biscuit yellow without any mottling or marking.

In the Indian Museum are 4 specimens from the Persian Gulf.

#### 19. *Neptunus (Hellenus) spinipes*, Miers.

*Neptunus spinipes*, Miers, Challenger Brachyura, p. 178, pl. xv. fig. 1.

This species has a strong superficial resemblance to *N. hastatoides*, but is easily distinguished (1) by the more convex carapace (2) by the non-fissured supra-orbital border (3) by the form of the merus of the external maxillipeds which has its antero-external angle rounded not produced laterally (4) by the spine on the posterior border of the merus of the last pair of legs, and (5) by the position of the anterior spine of the hand, which is placed a good way back instead of immediately behind the finger-joint.

Carapace appreciably convex, but shaped and sculptured as in *N. hastatoides*. Front very distinctly prominent beyond the inner supra-orbital angles and beyond the epistome, cut into four teeth of which the middle two are somewhat smaller narrower and less prominent than the others.

The supra-orbital border is not fissured, but the orbits otherwise, and the eyes, are as in *N. hastatoides*.

Antero-lateral border cut into 9 teeth (including the outer orbital angle) of which the first 2 or 3 are very small and inconspicuous and the next 5 or 6 small, the last being a spike usually from a third to half the breadth of the carapace proper in length. The posterior border is straight and forms an acutely dentiform angle of junction with the postero-lateral borders.

The merus of the external maxillipeds is narrow and has its antero-external angle simply rounded, not produced laterally.

The chelipeds in the adult male are rather more than  $2\frac{1}{2}$  times the length of the carapace, but are otherwise similar to those of *N. hastatoides*, except that the second spine of the hand is placed a good way behind the finger-joint.

There is a spine near the far end of the posterior border of the merus of the last pair of legs.

The 2nd and 3rd abdominal terga in both sexes are transversely carinate, the carinæ being of no great depth but very elegantly denticulate. The length of the 6th tergum of the male is not much more than its greatest breadth.

A small species: egg-laden females are 6.5 millim. long and 16 millim. broad including spines, but males are nearly twice this size.

In the Indian Museum are 66 specimens, from the Madras coast, Andamans, G. of Martaban, Arakan coast, and Muscat. Most of them come from over 20 fathoms.

The specimen figured by Miers has abnormally short lateral epibranchial spines.

## 20. *Neptunus (Hellenus) longispinosus* (Dana).

*Amphitrite longispinosa*, Dana, Proc. Ac. Nat. Sci. Philad. 1852, p. 84, and U. S. Expl. Exp. Crust. pt. I. p. 277, pl. xvii. figs. 2 a-c.

*Neptunus longispinosus*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 337, 339.

*Xiphonectes longispinosus*, Miers, Challenger Brachyura, p. 183: J. R. Hender-son, Trans. Linn. Soc., Zool., (2) V. 1893, p. 370.

*Amphitrite vigilans*, Dana, Proc. Ac. Nat. Sci. Philad. 1852, p. 84, and U. S. Expl. Exp. Crust. pt. I. p. 278, pl. xvii. figs. 3 a-d.

*Neptunus vigilans*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 336, 339.

and in Maillard's Île Réunion, Annexe F. p. 2: Richters in Möbius, Meeresf. Maurit. p. 152: var. *obtusidentatus*, Miers. Zool. H. M. S. Alert, p. 538, pl. xlviii. fig. A.

*Xiphonectes leptocheles*, A. Milne Edwards, Nouv. Archiv. du Mus. IX. 1873, p. 159, pl. iv. fig. 1.

Carapace flattish, its length is from  $\frac{2}{3}$  to  $\frac{3}{4}$  its breadth without the spines, its surface is subtomentose and is cut up into well defined sub-regional elevations, the convexities of which are granular.

Front prominent beyond the hardly independent inner supra-orbital angles and beyond the epistome, cut into four usually acute, triangular teeth—the middle two small and receding, the outer ones very large and prominent. Supra-orbital margin cut by 2 fissures.

Antero-lateral borders moderately oblique, armed with a variable number of small and inconspicuous teeth, and ending in a lateral epibranchial spine that is about half the breadth of the carapace in length. The number of teeth, including the outer orbital angle and the lateral spine, varies from 6 in the young to 9 in the adult, though there are adults with less than 9.

The posterior border is nearly straight and makes a dentiform or sub-dentiform angle of junction with the postero-lateral borders.

Orbits dorsal not concealing the large reniform eyes. Antero-external angle of merus of external maxillipeds not produced in a lateral direction.

Chelipeds of male about  $2\frac{1}{2}$  times the length of the carapace, granular, the granules being in places sub-squamiform, the hand as a whole not less massive than the arm: 3 or 4 spines on the anterior (inner) border of the arm and one at the far end of the posterior border: inner and outer angles of wrist spiniform: hand and fingers costate, the costæ granular, there are 3 spines on the hand, one being in front of the apex of the wrist-joint, the other two standing side by side (the inner the larger) in the distal half of the upper surface.

First three pair of legs slender.

2nd and 3rd abdominal terga transversely carinate, the carinæ not being very prominent: the sides of the male abdomen sinuous.

A small species: egg-laden females have the carapace 9 millim. long and 20 millim. broad including the spines, but many males are a good deal larger, and, on the other hand, egg-laden females are occasionally much smaller.

Colours of good fresh spirit specimens yellow, with much brown and green mottling on dorsal surface of carapace, chelipeds and legs.

In the Indian Museum are 81 specimens from the Andamans, Maldives, and Persian Gulf, besides 2 from Mauritius.

For a long time I thought I could recognize three distinct species differing from one another (1) in relative length of carapace, (2) in relative length and in sculpture of chelipeds, especially of the hands, and (3) in the degree of prominence of the inner supra-orbital angle. But after a careful examination of 83 specimens I find that all these differences are inconstant, as Miers has already said.

## 21. *Neptunus (Hellenus) tenuipes*, De Haan.

*Amphitrite tenuipes*, De Haan, Faun. Japon. Crust. p. 39, pl. i. fig. 4: Haswell, Cat. Austral. Crust. p. 83.

*Neptunus tenuipes*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 335, 339: Thallwitz, Abh. Zool. Mus. Dresden, 1890-91, No. 3. p. 48: Ortman, Zool. Jahrb., Syst. VII. 1893, p. 74.

Carapace little convex, its length about  $\frac{2}{3}$  its breadth without the spines, its surface sufficiently tomentose to appear almost smooth, but when denuded it is found to be cut up into well defined sub-regional elevations the convexities alone of which are granular.

Front prominent beyond the inner supra-orbital angles and beyond the epistome, cut into *three* bluntly triangular teeth, of which the middle one is slightly the smaller and less prominent. Supra-orbital border cut by two-fissures.

Antero-lateral border cut into 9 close-set teeth (including the outer orbital angle) of which the last is about three times as long as any of the others. The posterior border is slightly curved and meets the postero-lateral borders at a well-marked angle, which is sometimes slightly turned up.

Eyes large, reniform, not concealed by the almost completely dorsal orbits. Outer angle of merus of external maxillipeds not produced laterally.

Chelipeds in the adult male about  $2\frac{1}{4}$  times the length of the carapace, the hand being the most massive segment. Arm with 3 spines on the anterior (inner) border and 1 at the far end of the outer border: both inner and outer angle of wrist spiniform, the inner most conspicuously so. Hand costate, the costæ serrulate; armed with 2 spines, one being in front of the apex of the wrist-joint, the other slightly behind the finger-joint.

First 3 pair of legs slender, the first pair hardly shorter than the chelipeds.

Abdomen of male sinuous.

In the Indian Museum are 14 specimens from the Andamans.

## 22. *Neptunus (Hellenus) tuberculosus*, A. M. Edw.

*Neptunus tuberculosus*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 333, 339,

pl. xxxi. fig. 5 : Miers, Challenger Brachyura, p. 176 : J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 369.

Carapace flat, its length in the middle line between  $\frac{2}{3}$  and  $\frac{3}{4}$  its breadth without the great lateral spines, its surface rough, granular, and symmetrically puckered or tubercled.

Front prominent beyond the inner supra-orbital angles and beyond the epistome, cut into four bluntly triangular teeth of nearly equal size, of which the middle two are the more prominent. Supra-orbital margin cut by two fissures.

Antero-lateral borders rather long, moderately oblique, cut into 9 teeth (including the outer orbital angle) the last of which is about 3 times longer than any of the others : the teeth are often rather irregular. Posterior border nearly straight and forming a dentiform angle of junction with the postero-lateral borders.

The orbits are not completely dorsal. The merus of the external maxillipeds is elongate, but has not the antero-external angle produced laterally.

Chelipeds of the male a little over twice the length of the carapace, granular, the hand the most massive joint. 3, occasionally 4, teeth on the anterior (inner) border of the arm, and 1 at the far end of the posterior border. Hand and upper surface of wrist costate, the costæ granular: both inner and outer angle of wrist spiniform: two spinules, which are often blunt and inconspicuous, on the hand in the usual position: fingers a good deal shorter than the palm.

Legs unarmed: sternum granular.

A small species; ovigerous females have the carapace 11 millim. long and 21 millim. broad including spines.

Colours of good fresh spirit specimens yellow, profusely mottled and speckled with brown green and purple.

In the Indian Museum are 43 specimens from the Andamans, off Ceylon 28 fathoms, and the Persian Gulf.

### 23. *Neptunus (Hellenus) Brockii*, de Man.

*Neptunus brockii*, de Man, Archiv. f. Naturges. LIII. 1887, i. p. 328, pl. xiii. fig. 4.

Closely resembles *N. tuberculosus*, but is distinguished by the following characters, specimens of the same size and sex being compared:—

(1) the front is not cut into teeth, but forms a simple lamina that projects slightly beyond the inner supra-orbital angles;

(2) the surface of the carapace is cut up into low granular sub-regional elevations, but the tubercles characteristic of *N. tuberculosus* are absent:

(3) there are no spines on the hand. [But there are specimens of *N. tuberculatus* in which the spines of the hand are blunt and inconspicuous].

In the Indian Museum are two males from the Andamans. After comparing these with 43 specimens, of both sexes and all sizes, of *N. tuberculatus* I think they should be kept distinct.

#### 24. *Neptunus (Lupocycloporus) Whitei.*

*Achelous Whitei*, A. Milne Edwards, Archiv. n. Mus. X. 1861, pp. 343, 347, pl. xxxi. fig. 6: A. O. Walker, Journ. Linn. Soc., Zool., XX. 1886-90, p. 110: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 371.

*Neptunus Whitei*, Miers, Challenger Brachyura, p. 171.

Carapace fairly convex, its length about  $\frac{2}{3}$  its breadth without the spines, its surface finely pilose, but not sufficiently so to conceal a characteristic series of transverse finely-beaded ridges, of which there are 3 on the gastric, 3 on either branchial region, and one on the cardiac.

The front, which is prominent beyond the bluntly dentiform inner supra-orbital angles and beyond the epistome, is cut into four very definite teeth of nearly equal size, of which the middle two are slightly the more prominent. Supra-orbital border cut by two fissures.

Antero-lateral borders moderately oblique, cut into nine regular teeth (including the outer orbital angle) of which the last is barely twice the length of the others in the adult, though in the young it is a good deal longer. Posterior border finely beaded, and forming a common curve with the postero-lateral borders.

Orbits large, almost entirely dorsal in position, not concealing the large reniform eyes from dorsal view.

Chelipeds nearly 3 times the length of the carapace in the adult male, more or less covered with squamiform granules, the wrist and hand much slenderer than the arm. 4 to 6 spines on the anterior border of the arm; 2 on the posterior border, one being terminal the other submedian. Hand and upper surface of wrist costate, the costæ granular: both inner and outer angle of wrist spiniform: at least 3 spines on the hand, one being in front of the apex of the wrist-joint and two side by side some distance behind the finger-joint. Fingers slender, compressed, ending in long needle-like points, the tips being slightly but very characteristically bent outwards; otherwise the dactylus is nearly straight and the immobile finger gently upcurved.

Legs, like the chelipeds, more or less pubescent: there is a spine near the far end of the posterior border of the merus of the last pair.

Abdomen of male pointed: in both sexes the 2nd and 3rd abdominal terga are transversely, but not very strongly, carinate.



The largest specimen (male) in the Indian Museum has the carapace 24 millim. long and 44 millim. broad including the spines, but there are numerous egg-laden females that are much smaller than this.

In the Indian Museum are 33 specimens, from the Madras coast and the Andamans, besides one of the Challenger duplicates from New-Guinea.

25. ? *Neptunus (Lupocycloporus) gracilimanus*, (Stimpson).

? *Amphitrite gracilimanus*, Stimpson, Proc. Acad. Nat. Sci. Philad. 1858, p. 38.

? *Neptunus gracilimanus*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 336, 339.

This species, if my identification be correct, though much like *N. whitei*, is easily distinguished by the following difference:—

(1) the transverse beaded ridges of the carapace are much less distinct and are less numerous: they are six in number, the anterior gastric one being absent: the carapace also is decidedly more convex:

(2) the shape of the front is entirely different, for instead of being cut into four subacute teeth of nearly equal size, it is cut into four lobes of which the outer ones are broad and shallow while the middle two are narrow and dentiform: the inner supra-orbital angles also are much blunter:

(3) the last spine of the antero-lateral border is always in adults more than twice the length of any of the others:

(4) both the spines on the posterior border of the arm are near the far end of that border:

(5) the fingers are incurved, and the bending outwards at tip is inappreciable:

(6) it is a much smaller species: the largest egg-laden female has the carapace 11 millim. long and 21 millim. broad including the spines, and there are numerous egg-laden females much smaller than this.

The differences are constant throughout the whole series of specimens of both sexes.

In the Indian Museum are 45 specimens from the Andamans, G. of Martaban, Arakan coast, and from the east coast of the Peninsula at 15–35 fms.

26. *Neptunus (Achelous) granulatus* (Edw.) A. M. Edw.

*Lupea granulata*, Milne Edwards, Hist. Nat. Crust. I. 454.

*Amphitrite gladiator*, De Haan, Faun. Jap. Crust. p. 65, pl. xviii. fig. 1.

*Amphitrite speciosa*, Dana, Proc. Ac. Nat. Sci. Philad. 1852, p. 84, and U. S. Expl. Exp., Crust. pt. I. p. 276, pl. xvii. fig. 1.

*Achelous granulatus*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 344, 347, and in Maillard's *Île Réunion*, Annexe F. p. 2, and Nouv. Archiv. du Mus. IV.

1868, p. 70 and IX. 1873, p. 161 : Streets, Bull. U. S. Nat. Mus. VII. 1877. p. 109 : Miers, Phil. Trans. Roy. Soc. Vol. 168, 1879, p. 488, and Zool. H. M. S. Alert, pp. 230, 538 : Richters in Möbius Meeresf. Maurit. p. 152 : Muller, Verh. Nat. Ges. Basel VIII. 1886, p. 475 : de Man, Archiv. f. Naturges. LIII. 1887, i. p. 331 : Cano. Boll. Soc. Nat. Napol. III. 1889, p. 214 : J. R. Henderson, Trans. Linn. Soc. Zool. (2) V. 1893, p. 371.

*Neptunus (Achelous) granulatus*, Miers, Challenger Brachyura, p. 180 : Thallwitz, Abh. Zool. Mus. Dresden, 1890-91, No. 3, p. 48 : Ortmann, Zool. Jahrb. Syst. VII. 1893-94, p. 72, and in Semon's Zool. Forschungr. (Jena. Denk. VIII.) Crust. p. 45 : de Man, Zool. Jahrb. Syst. VIII. 1894-95 p. 558.

Carapace depressed, a little over three-quarters as long as broad, finely subtomentose, its surface cut up into well-defined sub-regional elevations the convexities of which are granular.

Front slightly receding, slightly prominent beyond the blunt inner supra-orbital angles and beyond the epistome, cut into four lobes (not counting the inner supra-orbital angles) of which the middle two are the smaller and less prominent and are often almost coalescent. Supra-orbital border with two distinct fissures.

Antero-lateral borders very slightly oblique, cut into 9 teeth (including the outer orbital angle) of which the last is but little bigger than any of the others which it quite resembles in shape. The posterior border forms a common curve with the postero-lateral borders.

Orbits not completely dorsal : eyes not very large. Antero-external angle of merus of external maxillipeds considerably produced in a lateral direction.

Chelipeds in the male about  $2\frac{1}{2}$  times the length of the carapace, more or less granular, the hand not or little less massive than the arm. Arm with 4 or 5 spines on the anterior border, and with 2 on the posterior border—one submedian the other subterminal : outer border of wrist subcarinate up to a terminal spinule, inner angle of wrist strongly spiniform : hand costate, with a blunt spinule in front of the apex of the wrist-joint and a sharp spine some distance behind the finger-joint.

First three pair of legs rather slender.

Third abdominal tergum in both sexes strongly and sharply carinate.

Colours of good fresh spirit specimens pale yellow, the dorsal surface of the carapace and chelipeds profusely mottled and speckled with grey and dark red.

A small species : egg-laden females have the carapace 12 millim. long and 15 millim. in total breadth, but adult males are half again as big.

In the Indian Museum are 140 specimens from the Andamans and Nicobars, Persian Gulf, Mergui, Ceylon, and Malabar coast, (besides 3 from Mauritius and 2 from Upolu).

27. *Neptunus (Achelous) orbicularis*, Richters.

*Achelous orbicularis*, Richters in Möbius Meeresf. Maurit. p. 153, pl. xvi. figs. 14, 15: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 371.

Differs from *Neptunus (Achelous) granulatus* in the following characters:—

(1) the carapace is extremely thin and depressed, is perfectly smooth—except for faint marginal depressions—and bare, and is sub-circular in shape, its length being  $\frac{6}{7}$  its breadth:

(2) the outer fissure of the supra-orbital margin is obsolete, and the inner fissure is represented by a closed suture:

(3) the antero-lateral borders are cut into 9 teeth which gradually decrease in size from before backwards:

(4) the chelipeds in the male are about twice the length of the carapace, their surface is non-granular, and the posterior border of the arm is more expanded than in *N. granulatus*.

In the Indian Museum are 6 specimens from the Pedro Shoal (Laccadives) and 2, including an egg-laden female, from the Andamans.

## CHARYBDIS, De Haan (GONIOSOMA, A. Milne Edwards).

*Charybdis* and *Oceanus*, De Haan, Faun. Japon. Crust. pp. 10, 9.

*Goniosoma*, A. Milne Edwards, Ann. Sci. Nat., Zool., (4) XIV. 1860, p. 263, and Archiv. du Mus. X. 1861, p. 367: Miers, Challenger Brachyura, p. 189.

*Charybdis*, M. J. Rathbun, Proc. Biol. Soc. Washington, XI. 1897, p. 161.

Carapace hexagonal, moderately broad, depressed or little convex, usually with transverse granular ridges at any rate in its anterior half.

Front proper (not including the inner supra-orbital angles from which it is distinctly separated) usually between a fourth and a third the greatest breadth of the carapace, cut into six lobes or teeth (exclusive of the supra-orbital angles).

Antero-lateral borders oblique, moderately arched, longer than the postero-lateral, cut into from 5 to 7—usually six—teeth including the outer orbital angles.

Upper border of orbit with two notches or fissures; there is a gap in the lower border, and the inner angle of this border is usually dentiform and moderately prominent. The antennules fold transversely.

Basal antenna-joint short and broad; its outer angle forms a lobule which usually fills the orbital hiatus and meets the front, excluding the flagellum from the hiatus.

Epistome sufficiently long: buccal cavern squarish, broader than long: the efferent branchial canals usually well defined.

Chelipeds massive, longer than any of the legs, usually a little unequal: arm with spines; the inner angle of the wrist strongly spiniform, the outer angle usually armed with spinules; palm prismatic or tumid, generally with costæ and some definitely placed spines; fingers strong, usually about as long as palm, strongly toothed.

Legs compressed: in the last pair the merus and carpus are shortened and broadened (the merus usually having a spine at the far end of the posterior border) and the propodite and dactylus typically foliaceous for swimming.

The abdomen is as in *Neptunus*.

Although the name *Charybdis* has the priority, and although I cannot admit that anything short of absolute identity—letter for letter—justifies any charge of “preoccupation,” I regret to discard a name that, like *Goniosoma*, has been in use without any shadow of misunderstanding, for nearly 40 years.

I do so only because I believe that *Goniosoma*, if the name be accepted, might with perfect propriety be merged again in *Thalamita*, and because, in any case, the name *Goniosoma* may conveniently be used for a subgenus.

I agree with Ortmann that *Thalamonyx* may quite reasonably be regarded as a subgenus of *Charybdis*, but for mere convenience I should prefer to subdivide the latter genus into three sections, or subgenera, characterized as follows:—

- I. The lobule at the external angle of the basal antenna-joint joins the front and completely excludes the flagellum from the orbital hiatus. The posterior angles of the carapace may be accented or not, but the line that bounds the dorsum of the carapace posteriorly forms a curve with the postero-lateral borders. The four median teeth of the front are not very dissimilar from the two outermost on either side. No spine on the posterior border of the arm..... GONIOSOMA.
- II. The lobule at the external angle of the basal antenna-joint is as in *Goniosoma*; but the posterior border of the dorsum of the carapace is straight and forms a well-marked dog's-eared angle of junction with the postero-lateral borders. The four median frontal teeth are broad and truncated. A spine at the end of the posterior border of the arm..... GONIOHELLENUS.
- III. The lobule at the external angle of the basal antenna-joint does not nearly touch the front, so that the flagellum stands in the upper part of the orbital hiatus. The posterior border of the dorsum of the carapace is straight and forms either an angular junction, or a curve, with the postero-lateral borders. The four

median frontal teeth are larger and broader than the two outermost pairs. A spine at the end of the posterior border of the arm may be present, or not..... GONIONEPTUNUS.

*Key to the Indian species of the genus Charybdis (= Goniosoma.)*

- I. The antennal flagellum is completely excluded from the orbital hiatus: the ridge that bounds the dorsum of the carapace posteriorly forms a curve with the postero-lateral borders: no spine on posterior border of arm (*Goniosoma*):—
  - A. No distinct transverse ridges on the carapace behind the level of the last spine of the antero-lateral borders:—
    - 1. Not more than three large spines on the anterior border of the arm: the orbits have no decided dorsal inclination and their major diameter is never more than one-third the width of the interorbital space:—
      - a. First spine of antero-lateral border anteriorly truncated and notched: sixth abdominal tergum of male with curved and gradually convergent sides ..... *G. cruciferum.*
      - b. First spine of antero-lateral border obliquely truncated with the inner angle acute: sixth abdominal tergum of male with curved and gradually-convergent sides: epi-branchial regions extremely tumid dorsally .... *G. Rivers-Andersoni.*
      - c. First spine of antero-lateral border acute: the sides of the sixth abdominal tergum of male parallel or slightly divergent in two-thirds or more of their extent:—
        - i. An acute spine on the posterior border of carpus of last pair of legs ..... *G. merguense.*
        - ii. A sharply dentiform lobule at the outer end of the lower border of the orbit ..... *G. quadrimaculatum.*
        - iii. The major diameter of the true orbital cavity is barely a fourth the width of the interorbital space ..... *G. annulatum.*
    - 2. Four or more large spines on the anterior border of the arm: the orbits have a strong dorsal inclination and their major

diameter is nearly half the width of the interorbital space: first tooth of antero-lateral border anteriorly truncated and notched ..... *G. miles.*

B. A transverse ridge on the cardiac region, as well as one or two in the posterior half of either branchial region:—

1. Two additional ridges in the posterior half of either branchial region; all the spines of the antero-lateral border well developed:—

a. Carapace moderately broad: first spine of antero-lateral border truncated, the last not enlarged: orbits without dorsal inclination: chelipeds strongly granular and nodular ..... *G. natator.*

b. Carapace very broad: last spine of the antero-lateral border twice as long as any of the others: orbits with strong dorsal inclination: a stout tooth on the lobule of the basal antenna-joint ..... *G. variegatum.*

2. One additional ridge on either branchial region: second spine of antero-lateral border rudimentary ..... *G. orientale.*

C. A transverse ridge on the cardiac region, but none on the posterior half of the branchial region:—

1. Carapace flat: 3 spines on anterior border of arm, 5 on upper surface of hand: sides of 6th abdominal tergum of male curved and gradually convergent ..... *G. affine.*

2. Carapace convex: 2 (hardly ever 3) spines on anterior border of arm:—  
a. Carapace about two-thirds as long as broad: 3 spines on the hand: sides of 6th abdominal tergum of male parallel for half their extent ..... *G. callianassa.*

b. Carapace about four-fifths as long as broad: 2 spines on the hand: sides of 6th abdominal tergum of male curved: the two middle frontal teeth remarkably prominent ..... *G. rostratum.*

II. Antennal flagellum completely excluded from orbital hiatus: posterior border of dorsum of carapace straight and forming a dog's-eared angular junction with the postero-lateral borders: the posterior border of the arm ends in a spine (*Goniohellenus*):—

A. Last spine of the antero-lateral border smaller than any of the others ..... *G. ornatus.*

- B. Last spine of the antero-lateral border far larger than any of the others ..... *G. koplites.*
- III. The lobular process of the basal antenna-joint does not nearly touch the front, so that the flagellum stands in the upper part of the orbital hiatus (*Gonioneptunus*):—
- A. Posterior border of dorsum of carapace forming an angular junction with the postero-lateral borders: the posterior border of the arm ends in a spine:—
1. Transverse ridges of carapace faint: a large red impermanent spot on either branchial region ..... *G. truncatus.*
  2. Transverse ridges of carapace prominent: a persistent small dark brown spot on either branchial region ..... *G. bimaculatus.*
- B. Posterior border of dorsum of carapace forming a curve with the postero-lateral borders: no spine on the posterior border of the arm: carapace little transverse, the extent of the fronto-orbital border nearly equal to the greatest breadth of the carapace ..... *G. investigatoris.*

[Besides the species mentioned in the above Key, other two, which I have not seen, are included in the Indian Fauna by other authors. They are *G. erythrodactylum* (Lamk.) and *G. sexdentatum* (Herbst) A. M. E.

*G. erythrodactylum* is recognized, according to A. Milne Edwards, by having seven teeth, of which the second and fourth are rudimentary, on the antero-lateral borders.

*G. sexdentatum*, A. Milne Edwards, if not of Herbst, is very probably the same as de Man's *G. merguense*.]

28. *Charybdis* (*Goniosoma*) *crucifera*, (Fabr.) A. M. Edw.

Rumph, Amboinsche Rariteitk. pl. VI. fig. P.

*Cancer sexdentatus*, Herbst, Krabben pl. viii. fig. 53 (1790).

*Cancer cruciatus*, Herbst, Krabben pl. II. V. 155, pl. xxxviii. fig. 1 (1794.)

*Portunus crucifer*, Fabricius, Ent. Syst. Suppl. p. 364 (1798); Bosc, Hist. Nat. Crust. I. p. 218; Latreille, Hist. Nat. Crust. VI. p. 14 and Encycl. Meth. X. p. 191.

*Thalamita crucifera*, Milne Edwards, Hist. Nat. Crust. I. 462; Lucas, Hist. Nat. Anim. Art. Crust. p. 104; Haswell, Cat. Austral. Crust. p. 81.

*Oceanus crucifer*, De Haan, Faun. Japon. Crust. p. 40.

*Charybdis crucifera*, Dana, U. S. Expl. Exp. Crust. pt. I. p. 286, pl. xvii. fig. 11 a-c; Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 39.

*Goniosoma cruciferum*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 371. 385; Tozzetti, "Magenta" Crust. p. 82, pl. vi. fig. 2 a-g; Nauck, Zeits. Wiss. Zool. XXXIV. 1880, p. 61, pl. i. fig. 27. (*gastric teeth*): Muller, Ver. Ges. Nat. Basel, VIII. 1886. p. 475; Miers, "Challenger" Brachyura p. 191; de Man, Archiv. f. Naturges. LIII. 1887, l. p. 334, and Journ. Linn. Soc. Zool., XXII. 1887,

1888, p. 79, pl. v. fig. i, and Zool. Jahrb., Syst., VIII. 1895, p. 559: Cano, Boll. Soc. Nat. Napol. III. 1889, p. 218: Walker, Journ. Linn. Soc., Zool., XX. 1886-90, p. 110: Ortman, Zool. Jahrb., Syst., VII. 1893-94, p. 81: Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 374.

Carapace not distinctly pilose, about two-thirds as long as broad, slightly convex, nearly smooth to the naked eye, the regions ill-defined. A finely granular curved line—broken on the gastric region—traverses it between the last spines of either antero-lateral border, and two similar lines—the anterior widely broken in the middle—cross the anterior part of the gastric region: these are the only ridges on the carapace, and they become faint with age.

The front is rather deeply cut into six prominent regular blunt-pointed teeth, *not* including the inner supra-orbital angles, none of which project much beyond the others.

The antero-lateral borders are cut into six teeth including the outer orbital angles, of which the first is truncated and notched or bifid, the last is almost spine-like but is little more salient than the others, while the other four are broad anteriorly-acuminate lobes.

The posterior border of the dorsal surface of the carapace forms a curve with the postero-lateral borders.

The orbits have but little dorsal inclination: the major diameter of their cavity is a third the width of the inter-orbital space: neither the inner angle nor the lobule at the outer end of their lower border are dentiform, though the latter lobule is well defined.

The lobule at the antero-external angle of the basal antenna-joint has a ridge, but not a tooth.

The chelipeds are nearly  $2\frac{1}{2}$  times the length of the carapace (in the male) and except for definitely placed costæ and spines are smooth: the hands are a little unequal in size. The arm has three enlarged spines on the anterior (inner) border and a spinule at the far end of the inferior border, but the posterior border is unarmed. The wrist has the inner angle strongly spiniform and has three spinules and some smooth ridges on the outer surface. The hands are tumid but not inflated: they are 5-costate and have 4 spines on the upper surface. In both hands the fingers, which are strongly toothed, are as long as their palm.

In the last pair of legs the merus is about three-fourths as long as broad and has a spine at the far end of the posterior border; the carpus is unarmed, and there are one or two inconspicuous denticles near the far end of the posterior border of the propodite.

The abdomen in both sexes has the 2nd and 3rd terga bluntly carinate: in the male the 6th tergum is much broader than long and has curved and gradually convergent sides.



In spirit the gastric region is purplish brown with a large yellow cross.

Size large: good specimens in the Indian Museum have the carapace 65 millim. in extreme length and 95 millim. in extreme breadth.

29. *Charybdis (Goniosoma) Rivers-Andersoni*, n. sp.

Very closely related to *C. crucifera*, from which it only differs in coloration, in having the epibranchial regions most remarkably swollen above the general dorsal surface of the carapace, in having the frontal teeth very acute, the first tooth of the antero-lateral border not emarginate, and the transverse ridges of the carapace even more obscure.

Carapace perfectly free from pubescence, smooth and polished; its length is a little more than two-thirds its breadth; the gastric region is slightly tumid and the epibranchial regions are very strongly tumid above the rest of its surface. A fine and very faint strongly-arched line crosses the carapace between the last spine of either antero-lateral border, and a still fainter one crosses the gastric region anteriorly: these are the only lines on the carapace and are as faint in the young as in the adult.

Front cut into 8 acute teeth—including the inner supra-orbital angles—arranged in four distinct pairs, the outer pair on either side being almost spine-like.

Antero-lateral borders quite like those of *C. crucifera*, except that the first tooth is obliquely truncated with the inner angle very acute.

Posterior border curved as in *C. crucifera*.

Inner angle of lower border acutely dentiform: the orbits otherwise as in *C. crucifera*.

Chelipeds exactly as in *C. crucifera* except that the hands are less inclined to be tumid.

Last pair of legs as in *C. crucifera* except that the merus is hardly two-thirds as broad as long.

Abdomen in both sexes as in *C. crucifera*.

Colours in spirit: salmon-red, the frontal and antero-lateral borders and the boundary between the branchial and hepatic regions with numerous large creamy spots; four similar spots in a square on the gastric region and a very large one on either branchial region near the middle of the postero-lateral border; fingers blood-red in their distal half, the extreme tips milk-white.

In the Indian Museum are 9 specimens from off the Konkan coast, 56-58 fms., on a bottom of fine sand. The carapace of the largest specimen is 50 millim. in length and 78 millim. in extreme breadth.

30. *Charybdis (Goniosoma) quadrimaculata*, A. M. Edw.

*Goniosoma quadrimaculatum*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 375, 385, pl. xxxiv. fig. 3 : Ortmann. Zool. Jahrb., Syst., VII. 1893, p. 82.

*Goniosoma quadrimaculatum*, A. M. Edw. *Portunus lucifer* Fabr., de Man, Journ. Linn. Soc., Zool. XXII. 1887-88, p. 83 footnote.

*Goniosoma luciferum*, J. R. Henderson, Trans. Linn. Soc. Zool., (2) V. 1893, p. 374.

Differs from *C. crucifera* in the following particulars:—

(1) the carapace though in sculpture of surface similar, is very much broader, its length being much less than two-thirds its breadth :

(2) the frontal teeth are deeper cut and those of the second pair slope outwards rather more :

(3) the teeth of the antero-lateral borders are regular and are claw-shaped, instead of being broad anteriorly-acuminate lobes ; the first is acute and except in its smaller size is similar to the next four, and the last is more spine-like and more prominent :

(4) the orbits are smaller, their diameter being only two-sevenths the width of the inter-orbital space ; *both the inner angle and the lobule at the outer end of the lower border are acutely dentiform* :

(5) the chelipeds in the male are not very much more than twice the length of the carapace ; the hand is 6-costate and the costæ are commonly milled in their proximal half, and there are 5 spines on the upper surface of the hand ; the fingers of the larger cheliped are shorter than the palm :

(6) in the last pair of legs the merus is nearly twice as long as broad, and the posterior border of the propodite is strongly serrated throughout :

(7) the 6th tergum of the male abdomen has its sides parallel or even slightly divergent in at least two-thirds of its extent :

Colours in spirit yellowish brown with 2 large white spots on either branchial region.

In the Indian Museum are 20 specimens from all parts of the coast of the peninsula : the carapace of the largest specimen is 60 millim. long and 98 millim. in extreme breadth.

31. *Charybdis (Goniosoma) annulata* (Fabr.) A. M. Edw.

*Portunus annulatus*, Fabricius, Ent. Syst. Suppl. p. 364 (sec. A. Milne Edwards.).

?? *Cancer fasciatus*, Herbst Krabben, III. i. 62, pl. xlix. fig. 5. (sec. A. M. Edw.).

? *Cancer sexdentatus*, Herbst, Krabben, pl. vii. fig. 52.

*Portunus annulatus*, Latreille, Hist. Nat. Crust. VI. p. 15 (sec. A. Milne Edwards.).

*Thalamita annulata*, Milne Edwards, Hist. Nat. Crust. I. 463 (sec. A. M. Edw.).

*Goniosoma annulatum* (Fabr.), A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 374, 385 : Miers, Ann. Mag. Nat. Hist. (5) V. 1880, p. 238 : de Man, Notes Leyden

Mus. V. 1883, p. 151 and Zool. Jahrb., Syst., VIII. 1894-95, p. 561: Ortmann, Zool. Jahrb., Syst., VII. 1893-94, p. 82: J. R. Henderson, Trans. Linn. Soc. Zool., (2) V. 1893, p. 375.

*Goniosoma orientale* Heller (*nec* Dana), "Novara" Crust. p. 29, pl. iii. fig. 3 (*sec. de Man*).

Differs from *C. crucifera* in the following particulars:—

(1) the carapace is more convex, and the transverse lines are even fainter, especially on the gastric region:

(2) the frontal teeth are deeper-cut and sharper (in adults):

(3) the teeth of the antero-lateral borders are regular; the first is small and acute, the second is not much larger than the first, and the last (in adults) is smaller than any of the three immediately in front of it:

(4) *the major diameter of the orbit is only a fourth the width of the inter-orbital space*: the inner angle of the lower border of the orbit is dentiform and strongly salient, and the lobule at the outer end of this border is ill-defined:

(5) the chelipeds are not much more than twice the length of the carapace (in the male); the hand has 5 spines on the upper surface, but two of them—those immediately behind the finger-joint—are tubercles rather than spines; the fingers of the larger cheliped are as long as the palm, those of the smaller cheliped are longer than the palm:

(6) in the last pair of legs the merus is nearly twice as long as broad and the posterior border of the propodite is serrated in a large part of its extent:

(7) the 6th abdominal tergum of the male is as long as or nearly as long as broad and has its sides parallel in about three-fourths of their extent.

From *Charybdis quadrimaculata* this species is distinguished by the narrower carapace, by the smaller orbits and the different form of the lower orbital border, and by the greater length of the 6th tergum of the male abdomen.

In the Indian Museum are 7 specimens from Karachi and 1 from Bimlipatam, besides 1 from Penang. The carapace of the largest specimen is 48 millim. long and 70 millim. in extreme breadth.

But for high contrary authority, I should consider this species to be identical with the *Cancer sedentatus* of Herbst's pl. vii. fig. 52.

### 32. *Charybdis* (*Goniosoma*) *merguiensis*, de Man.

*Goniosoma merguense*, de Man, Journ. Linn. Soc., Zool., XXII. 1887-88, p. 82, pl. v. fig. 3, 4, and Zool. Jahrb., Syst., 1894-95 p. 560.

*Goniosoma Helleri*, Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 375.

Very closely resembles *C. quadrimaculata*, but may be distinguished from that species by the following characters:—

- (1) the length of the carapace is two-thirds the breadth:
- (2) the frontal teeth, in the adult are more acute:
- (3) the little lobule at the outer end of the lower border of the orbit is not dentiform:
- (4) there is an acute spine on the posterior border of the carpus of the last pair of legs (as well as the usual one on the merus):
- (5) the 6th abdominal tergum of the male is, like that of *C. annulata*, as long as broad, or nearly so, with the sides parallel or slightly divergent in about three-fourths of their extent.

For the rest, this species differs from *C. crucifera* in the same particulars as *C. quadrimaculata* does, though the last spine of the antero-lateral border is often more prominent than in *C. quadrimaculata*.

In the Indian Museum are specimens, 22 in number from Mergui, Andamans, Karachi and the Persian Gulf—besides 1 from Singapore 2 from Hongkong. The largest has the carapace 46 millim. long and 69 millim. in extreme breadth.

But for high contrary authority I should have felt inclined to refer this species to the *Cancer fasciatus* of Herbst (Krabben III. i. 62, pl. xlix. fig. 5).

### 33. *Charybdis (Goniosoma) affinis*, Dana.

*Charybdis affinis*, Dana, Proc. Ac. Nat. Sci. Philad. 1852, p. 85, and U. S. Expl. Exp. Crust. pt. I. p. 286, pl. xvii. figs. 12 a-c.

*Goniosoma affine*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 384, 385: de Man, Journ. Linn. Soc., Zool. XXII. 1887-88, p. 80, pl. V. fig. 2. and Zool. Jahrb., Syst., VIII. 1894-95, p. 559: J. R. Henderson, Trans. Linn. Soc., Zool. (2) V. 1893, p. 374.

Differs from *C. crucifera* in the following particulars:—

- (1) the carapace is flatter, its transverse ridges are much more distinct and there is an additional one across the cardiac region, and the regions are better defined:
- (2) the frontal teeth are more acute and are not so parallel:
- (3) the first tooth of the antero-lateral border though distinctly emarginate anteriorly has its inner angle acute, and the last tooth is conspicuously larger and more prominent than the last but one, the other teeth are more regularly cut and the antero-lateral border as a whole is less oblique:
- (4) the inner angle of the lower border of the orbit is distinctly dentiform:
- (5) the chelipeds are only about twice the length of the carapace in the male: the hands are 6 or 7-costate and have 5 spines on the

upper surface, the palms are more swollen (in the adult) and in the smaller cheliped the fingers are decidedly longer than the palm :

(6) the surface of the carapace and chelipeds is much more pubescent, and the size is much smaller.

In the Indian Museum there are 6 specimens, from Mergui, Akyab, and the Orissa coast: the carapace of the largest is 32 millim. long and 48 millim. in extreme breadth.

34. *Charybdis (Gonicsoma) callianassa* (Herbst) A. M. Edw.

? *Cancer callianassa*, Herbst, Krabben. III. ii. 45, pl. liv. fig. 7.

*Goniosoma callianassa*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 382, 385 (part).

*Goniosoma variegatum*. Miers, Zool. H. M. S. Alert p. 232: Cano, Boll. Soc. Nat. Napoli, III. 1889, p. 219: Thallwitz, Abh. Zool. Mus. Dresden, 1890-91, No. 3, p. 47: Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 376.

A small species, the carapace usually being about 23 millim. long and about 36 millim. in extreme breadth.

Length of carapace about two-thirds the extreme breadth (except in the majority of adult females, in which the last spine of the antero-lateral borders is much prolonged).

Carapace decidedly convex, especially in its posterior half, covered with short pile and crossed transversely by fairly well marked very faintly granular ridges, which are disposed as in *C. crucifera*, except that there is an additional one across the cardiac region.

Front cut into six teeth (*not* including the inner supra-orbital angles) of which the middle two are slightly the most prominent, the second on either side are broadish with a strong outward slope, and the third on either side are the narrowest and most acute.

Antero-lateral borders cut into six teeth (including the outer orbital angle) of which the first is anteriorly notched with the inner angle acute, and the last is spinelike and from  $1\frac{1}{3}$  to twice (in many adult females nearly three times) the length of the last but one: all the teeth have their free edges finally serrulate (except in the case of the posterior edge of the last).

The posterior border of the dorsal surface of the carapace forms a curve with the postero-lateral borders.

Orbits with a perceptible, but not strong, dorsal inclination: the major diameter is a little more than a third the width of the interorbital space: the inner angle of the lower border is dentiform, but the lobule at the outer end of this border is hardly distinguishable.

There is a granular ridge, but no tooth, on the lobule at the outer angle of the basal antenna-joint.

The chelipeds are about  $2\frac{1}{4}$  times the length of the carapace (in the adult male), and when denuded are smooth and polished except for costæ on the wrist and hand, and for granules on the far end of the upper surface of the arm. There are only two enlarged spines on the anterior border of the arm, and the posterior border of the arm is spineless. Wrist with granular costæ on the upper and outer surface, with the inner angle strongly spiniform, and with three spinules at the outer angle. Palm inflated, barrel-shaped, 6-costate, the four upper costæ granular; only three spines—and those small—on the upper surface. Fingers of the larger cheliped a good deal shorter than the palm.

Merus of last pair of legs  $\frac{2}{3}$  to  $\frac{3}{4}$  as broad as long, with a spine, as usual, near the far end of the posterior border: the same border of the propodite is smooth.

The 2nd and 3rd abdominal terga in both sexes—as well as, to a less extent, the 4th in the female—are transversely carinate: the 6th tergum in the male is transversely oblong with the anterior (true posterior) angles rounded.

In the Indian Museum are 66 specimens, chiefly from the Madras and Orissa coasts, but also from Bombay and Karáchi.

The carapace of an exceptionally large male is 29 millim. long and 46 millim. in extreme breadth.

This species is easily distinguished from *C. variegata* De Haan, with which it appears to have been confounded, by the following characters:—

(1) the carapace is very decidedly convex in its posterior half, the regions are less clearly defined, and there is only one transverse ridge on the epibranchial regions—namely the usual one that runs in from the last antero-lateral tooth:

(2) the four middle frontal teeth are blunter and more divergent, and the third on either side is larger and more prominent:

(3) the edges of the teeth of the antero-lateral border are serrulate:

(4) the eyes are smaller and the orbits have a much less marked dorsal inclination; the little lobule at the outer end of the lower border of the orbit is obsolete, instead of being a sharp independent denticle.

(5) there is a ridge, but no tooth, on the lobe of the basal antenna-joint.

(6) there are only 2 large spines on the anterior border of the arm, there are no squamiform granules on the under surface of the arm and hand, there are three spinules on the outer surface of the wrist; the palms are more inflated, their costæ less numerous and less salient, and both the spines immediately behind the finger-joint are obsolete:

(7) the sixth abdominal tergum of the male is transverse oblong with the anterior angles rounded off.

*C. callianassa* has a considerable resemblance to *C. affinis* Dana, from which it may be distinguished by the following characters:—

(1) the carapace is convex instead of nearly flat, the frontal teeth differ, and the teeth of the antero-lateral border are serrulate :

(2) the orbit is more dorsally inclined :

(3) there are only two enlarged spines on the anterior border of the arm : the hands are barrel-shaped and have only 3 spines on their upper surface :

(4) the 6th abdominal tergum of the male has the sides parallel or almost divergent in two-thirds of their extent, whereas in *C. affinis* they form gradually converging curves.

### 35. *Charybdis (Goniosoma) rostrata*, A. M. Edw.

*Goniosoma rostratum*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 379, 385, pl. xxxv. fig 2 : J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 377.

A small species : the length of the carapace in adults being somewhere about 20 millim., and the extreme breadth about 25 millim.

Carapace about four-fifths as long as broad in the male, but not quite so long in the female, moderately convex, crossed transversely by granular ridges which are disposed as in *C. crucifera*, except that there is an additional one across the cardiac region (just as in *C. affinis* and *C. callianassa*), densely though finely pilose.

Front as a whole decidedly prominent, cut into six teeth (*not* including the inner supra-orbital angles), of which the middle two are bluntly pointed and project far beyond the others, the next on either side are broad and slope outwards, and the third on either side are small narrow and nearly straight.

Antero-lateral borders cut into six serrulate teeth, of which the first is very acute and the last is more spinelike than the others.

The posterior border of the dorsal surface of the carapace forms a curve with the postero-lateral borders.

Orbits without any particular dorsal inclination, the major diameter not much less than half the width of the interorbital space, the inner angle of the lower border dentiform, the lobule at the outer end of the lower border distinct but not dentiform.

A strongish granular ridge on the lobule of the basal antenna-joint.

Chelipeds less than twice as long as the carapace even in the male, nearly smooth when denuded. Arm with 2 spines on the anterior border and none on the posterior border. Wrist with a strong spine at the inner angle and with two—less commonly three—spinules at the outer angle. Hands inflated in the male, but not much so in the female,

6-costate, the four upper costæ granular; only two spines—and those small—on the upper surface of the hand. Fingers longer than the palm in the smaller cheliped, as long as the palm in the larger cheliped.

The merus of the last pair of legs is nearly as broad as long and has the usual spine on its posterior border; the posterior border of the propodite is smooth.

The 6th tergum of the male abdomen is broader than long and has curved and gradually convergent sides.

In the Indian Museum are 98 specimens, chiefly from the northern parts of the Bay of Bengal, Mergui, and the Gulf of Martaban, but also from off the Andamans and off Ceylon.

### 36. *Charybdis (Goniosoma) variegata* (De Haan).

? *Portunus variegatus*, Fabricius, Ent. Syst. Suppl. p. 364.

??? *Cancer callianassa*, Herbst. III. ii. 45, pl. liv. fig. 7.

? *Thalamita callianassa*, Milne Edwards, Hist. Nat. Crust. I. 464.

*Charybdis variegatus*, De Haan, Faun. Japon. Crust. pl. i. fig. 2: Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 39.

*Goniosoma callianassa*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 382, 385 (part).

*Goniosoma variegatum*, var. *callianassa*, J. B. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 377.

A small species: the carapace in the adult about 20 millim. long and about 35 millim. in extreme breadth.

Carapace about four-sevenths as long as broad (or about two-thirds as long as broad without the enlarged lateral spines), slightly convex, the regions for a *Goniosoma* well defined, crossed transversely by numerous salient granular ridges arranged as in *G. natator*—the ridges standing out from the copious short pile with which the carapace is covered.

Front cut into 6 rather pointed teeth (*not* including the inner supra-orbital angles) of which the middle two are the most prominent and the outer one on either side is the least prominent *and much the slenderest*.

Antero-lateral borders cut into six teeth (including the outer orbital angle) which gradually increase in size from before backwards, the last being a salient spine about twice as long as the last but one—*Neptunus* like.

The posterior border of the dorsal surface of the carapace forms a curve with the postero-lateral borders.

Eyes large: the orbit, *which has a strong dorsal inclination*, is about two-fifths the width of the interorbital space; the inner angle of its



lower border, though not prominently dentiform, is acuminate, and the lobule at the outer end of this border is sharply dentiform.

*There is a prominent tooth on the lobule at the outer angle of the basal antennal joint*: this is present in no other Indian species.

Chelipeds about  $2\frac{1}{3}$  times the length of the carapace (in the male): all three surfaces of the arm and almost all parts of the surface of the hand are covered with granular squamiform markings. Arm with 3 enlarged spines on the anterior border, the posterior unarmed. Wrist costate on the upper and outer surface; the inner angle spiniform; *only two spinules* at the outer angle. Hands (in adults only) more than usually unequal for a *Goniosoma*: in one cheliped (adult) the palm is swollen and markedly longer than the fingers, in the other it is not swollen and is not much longer than the fingers: the hand is 7-costate and there are 4 spines on its upper surface.

The merus of the last pair of legs is about four-fifths as broad as long and has a spine near the distal end of its posterior border, the propodite has one or two inconspicuous spinules near the far end of its posterior border.

In both sexes the 2nd and 3rd abdominal terga are transversely keeled: in the male the 6th tergum is a good deal broader than long and has strongly curved sides.

In the Indian Museum are 43 specimens from the Madras coast and the Persian Gulf, besides one from Nagasaki and one from Hongkong.

### 37. *Charybdis (Goniosoma) natator* (Herbst) A. M. Edw.

*Cancer natator*, Herbst, Krabben. II. v. 156, pl. xl. fig. 1.

*Portunus sanguinolentus*, Bosc, Hist. Nat. Crust. I. p. 218.

*Thalamita natator*, Milne Edwards, Hist. Nat. Crust. I. 463, pl. xvii. figs. 13, 14.

*Charybdis natator*, De Haan, Faun. Japon. Crust. p. 10.

*Charybdis granulatus*, De Haan, Faun. Japon. Crust. p. 42, pl. i. fig. 1: Krauss, Sudafr. Crust. p. 24: Stimpson, Proc. Ac. Nat. Sci. Philad. 1853, p. 39.

*Goniosoma natator*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 370, 385: Hilgendorf, MB. Ak. Berl. 1878, p. 801: Miers, Zool. H. M. S. Alert, pp. 518, 539: F. Muller, Verh. Ges. Nat. Basel, VIII. 1886, p. 475: de Man, Archiv. f. Naturges. LIII. 1887, i. p. 334, pl. xiii. fig. 5, and in Weber's Zool. Ergebn. Niederl. Ost.-Ind. II. 1892, p. 285: Walker, Journ. Linn. Soc. Zool. XX. p. 110: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 374.

Length of carapace about five-sevenths the breadth.

Carapace slightly convex, with a somewhat mangy pile, crossed transversely by several rather coarse granular more or less broken ridges: the most conspicuous of these ridges runs—broken only by the cervical groove—right across between the last teeth of the antero-lateral borders, and in front of this are two—the anterior one widely divided in the middle—on the gastric region, while behind it are two short ones

on either branchial region and a bow-shaped one on the cardiac region.

Front cut into 6 bluntly-rounded teeth (*not* including the inner supra-orbital angles) of nearly equal size.

Antero-lateral borders cut into 6 teeth, of which the first (the outer orbital angle) is blunt or truncated, the last is rather smaller than those immediately in front, and the intervening four though anteriorly acute—especially in the young—tend to grow blunt.

The posterior border of the dorsal surface of the carapace forms a curve with the postero-lateral borders.

Orbit without any particular dorsal inclination, its major diameter is about two-sevenths the width of the interorbital space: the inner angle of the lower border is not prominent and hardly dentiform, the lobule at the outer end of this border though well defined is not dentiform.

Chelipeds about  $2\frac{2}{3}$  times as long as the carapace (in the adult male), their under surface is covered with transverse squamiform tubercles which are specially regular and distinct on the hand, their other surfaces also are beset with tubercles which are more or less distinctly squamiform: the space between the tubercles is furred. Three *enlarged* teeth (besides smaller ones) on the anterior border of the arm, the posterior border unarmed. Inner angle of wrist strongly spiniform, outer angle with three small spines. Hand beset with longitudinal series of tubercles, and having 4 or 5 spines on the upper surface: fingers about as long as hand.

The merus of the last pair of legs is about two-thirds as broad as long and has a strong spine on the posterior border, and the same border of the propodite is armed with spinules that become very indistinct with age.

In both sexes the 2nd-4th abdominal terga are transversely keeled: in the male the 6th tergum is as long as broad and has the sides parallel or even slightly divergent in three-fourths of their extent.

Colours in spirit, mottled, with much admixture of red, the ridges of the carapace dark red.

In the Indian Museum are 10 specimens from Ceylon, Madras, and Pondicherry, besides 1 from Singapore. In the largest specimens the carapace is about 70 millim. long and about 100 millim. broad.

### 38. *Charybdis (Goniosoma) miles* (De Haan).

*Portunus (Charybdis) miles*, de Haan, Faun. Japon. Crust. p. 41, pl. xi. fig. 1: Stimpson Proc. Ac. Nat. Sci. Philad. 1858, p. 39.

*Goniosoma miles*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 378, 385: Orlmann, Zool. Jahrb., Syst., VII. 1893, p. 81.

Size medium: an adult female in the Indian Museum has the carapace 43 millim. long and 59 millim. broad.

Carapace not very broad, its length about three-fourths its breadth, little convex, smooth or granular in places when denuded of copious short pile; its anterior half only is crossed transversely by faint granular lines disposed as in *C. crucifera*.

Front cut into six acute teeth, *not* including the acutely dentiform inner supra-orbital angles, of which the two middle ones hardly project beyond the others and the outermost on either side are the narrowest and most acute.

Antero-lateral borders very little oblique, cut into 6 acutely acuminate teeth, of which the first (the outer orbital angle) is broad and anteriorly notched with the inner angle acuminate, and the last is not larger or more prominent than the others.

The posterior border of the dorsal surface of the carapace forms a curve with the postero-lateral borders.

Eyes large: the orbit has a considerable dorsal inclination and its major diameter is nearly half the width of the interorbital space; of the two fissures in its roof the inner is a distinct gap; the inner angle of the lower border is acutely dentiform.

The antero-external angle of the merus of the external maxillipeds is somewhat produced laterally.

The chelipeds are long and, for a *Goniosoma*, are slender; their undersurface is finely granular (as also is a large part of the upper surface of the arm) the granules of the hand showing a squamiform arrangement. The arm has four *large* spines on the anterior border and a spinule at the end of the lower border, but the posterior border is unarmed. The hand is 6-costate, most of the costæ being finely granular, and has 4 acute spines on the upper surface. Fingers slender, very acute, sharply toothed, longer than the palm, which is not swollen.

The last pair of legs have the merus about two-thirds as long as broad and are unarmed except for a spine on the posterior border of the merus and two or three denticles near the far end of the posterior border of the propodite.

The 6th tergum of the male abdomen is much broader than long and has curved and gradually converging sides.

Colours in life red, the tips of spines light, chelipeds mottled red, fingers banded dark and light red.

In the Indian Museum are a male and egg-laden female from the Gulf of Martaban, 53 and 67 fms.

### 39. *Charybdis (Goniosoma) orientalis* (Dana).

? *Charybdis orientalis*, Dana, Proc. Ac. Nat. Sci. Philad. 1852, p. 85, and U. S. Expl. Exp. Crust. pt. I. p. 285, pl. xvii. fig. 10.

*Goniosoma orientale*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 383, 385 :

de Man, Notes Leyden Mus. I. 1879, p. 60, V. 1883, p. 151, and XV. 1893, p. 286 : Lenz and Richters, Abh. Senck. Nat. Ges. Frankfurt, XII. 1881, p. 422 : Cano, Boll. Soc. Nat. Napol. III. 1889, p. 220 : J. R. Henderson, Trans. Linn. Soc. Zool. (2) V. 1893, p. 375.

? *Goniosoma dubium*, Hoffmann in Pollen and Van Dam, Rech. Faun. Madagasc., V. 2, 1874, p. 11, pl. ii. figs. 6-8.

Carapace about two-thirds as long as broad, crossed transversely by salient granular lines which have the same disposition as in *C. variegata* De Haan, except that there is only one on either branchial region behind the level of the last spine of the antero-lateral borders.

Front cut into 6 truncated teeth, *not* including the inner supra-orbital angles.

Antero-lateral borders very little oblique, cut into six teeth (including the outer orbital angles) *of which the second is rudimentary and looks like a denticle cut out of the base of the first*, while the last is not enlarged in adults, though in the young it *may* be.

The posterior border of the dorsal surface of the carapace though straight forms a curve with the postero-lateral borders.

Orbit without any particular dorsal inclination, its major diameter a little more than a third the width of the inter-orbital space, the inner angle of the lower border broadly dentiform, the lobule at the outer end of this border distinct but not dentiform.

Arm with 3 spines on the anterior border and none on posterior border: wrist with a strong spine at the inner angle and 2 or 3 spinules on the outer: hand not tumid, 5 spines, of which 4 are large, on the upper surface.

In the fifth pair of legs the merus is nearly twice as long as broad, and has the usual spine on the posterior border: the same border of the propodite is serrated.

In the Indian Museum are five specimens, from the Pedro Shoal, from the Madras coast of the Gulf of Manár, and from off the Arakan coast.

This species is distinguished from *C. anisodon*, which, though not known to occur in Indian Seas, is found at Singapore, by the presence of granular ridges on the carapace, by the five spines (instead of 2) on the hand, and by the serrated (instead of smooth) posterior border of the propodite of the last pair of legs. It is one of the conspicuous links between *Goniosoma* and *Thalamita*.

#### 40. *Charybdis* (*Goniokellenus*) *ornata*, A. M. Edw.

*Thalamita truncata*, De Haan, Faun. Japon. Crust. p. 43, pl. ii. fig. 3 and pl. xii. fig. 3 only ♂.

*Charybdis truncata*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 39.

*Goniosoma ornatum*, A. Milne Edwards. Archiv. du Mus. X. 1861, pp. 376, 385 : Miers, P. Z. S. 1879, pp. 20, 33, and Challenger Brachyura p. 191 : Ortmann, Zool. Jahrb., Syst., VII. 1893, p. 83 : J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 376 : de Man, Zool. Jahrb., Syst., VIII. 1895, p. 562.

A smallish species : the length of the carapace in adults is about 26 millim., its extreme breadth about 36 millim.

Length of carapace rather over two-thirds the extreme breadth. Carapace moderately convex with the regions fairly well defined, crossed transversely by well marked granular ridges which have much the same disposition as those of *C. crucifera*, except that there are in addition (1) a broad one—divided in the middle line—on the cardiac region, and (2) a short and broad one—or traces of two—on either branchial region.

The front is cut into eight lobes (*including* the inner supra-orbital angles) arranged in four pairs, of which the outermost pair on either side are bluntly dentiform, and the two middle pairs are broad shallow and lobe-like.

The antero-lateral borders are cut into six teeth (*including* the outer orbital angles) of which the first is obliquely truncated and the last is the smallest ; the edges of all are entire.

The posterior border of the dorsum of the carapace is straight, and forms a somewhat up-turned or dog's-eared angle of junction with the postero-lateral borders.

The orbits have a strong dorsal inclination and their major diameter is not much less than half the width of the inter-orbital space : the inner angle of their lower border is broad and hardly dentiform.

The chelipeds are about  $2\frac{1}{3}$  times the length of the carapace (in the male) and all their surfaces are covered with granular transverse squamiform markings. There are 2—less commonly 3—enlarged spines on the anterior border of the arm and the posterior border ends in a spinule. Inner angle of wrist strongly spiniform, three spinules on the outer angle. Hand 6 or 7 costate—the costæ with squamiform crenations—and with 4 spines on the upper surface. In adults the palm is full and is longer than the fingers in the larger cheliped, but shorter than the fingers in the smaller cheliped.

Merus of last pair of legs about two-thirds as broad as long, with the usual strong spine on the posterior border : the same border of the propodite is finely serrated.

In both sexes the 2nd and 3rd—and to a much less extent the 4th—abdominal terga are transversely keeled : the 6th tergum in the male is broader than long and has strongly curved sides.

In the Indian Museum are 6 fine specimens from the mouth of the

Hughli and Coromandel coast and 1 from the Arakan coast—also 1 from Hongkong and 1 from Java.

41. *Charybdis (Gonihellenus) hoplites*, Wood-Mason.

*Goniosoma hoplites*, Wood-Mason, Ann. Mag. Nat. Hist. (4) XIX. 1877, p. 422 : Alcock and Anderson, J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 184, and Ill. Zool. Investigator, Crust. pl. xxiii. fig. 6 : Alcock, Investigator Brachyura, p. 67.

A small or smallish species.

The length of the carapace is not much more than half the extreme breadth measured between the tips of the last spine of the antero-lateral borders.

Carapace covered with a dense short tomentum, convex, the regions well defined and fairly well areolated—the convexities of many of the areolæ granular. The gastric region is divided into three sub-regions, the cardiac into two, and there is a very pronounced and independent swelling on the inner part of either branchial region.

A granular ridge crosses the middle of the gastric region transversely, and a similar ridge—strongly arched forwards—crosses each branchial region, beginning on the tip of the last epibranchial spine : these are the only transverse ridges on the carapace, although it sometimes happens that two of the granular subregional convexities of the anterior part of the gastric region are ridge-like.

The front is exactly like that of *C. ornata*, except that the outermost pair of teeth on either side are rather sharper.

The antero-lateral borders are cut into six teeth (including the outer orbital angle) of which the last is a *Neptunus*-like spine at least twice as long as those in front of it : the other 5 are square-cut lobules separated by wide and deep notches, and having their outer edge serrate and their anterior angle acuminate.

The posterior border of the dorsum of the carapace forms a strong dog's-eared angle of junction with the postero-lateral borders.

The orbits are exactly as in *C. ornata*, except that the inner fissure of the roof is wider and the outer fissure less distinct.

The chelipeds in typical specimens are exactly as in *C. ornata*, but it sometimes happens that the granulation of the arm does not cover the whole surface of that joint.

The last pair of legs are as in *C. ornata*, but the breadth of the merus varies from half to two-thirds the length of that joint.

The 6th tergum of the abdomen of the male is truncate-triangular, having almost no curve to the sides.

In the Indian Museum are 45 specimens from off the Coromandel coast, from about 50 to about 110 fathoms, and 4 from off the Indus Delta, 16 to 44 fms.

In an average specimen the length of the carapace is 26 millim., and the extreme breadth 48 millim.

*Charybdis (Goniohellenus) hoplites*, var. *vadorum*.

Differs from the typical deep-sea form in the following particulars:—

(1) the carapace is depressed, therefore the granular convexities of the areolæ stand out in higher relief:

(2) the last spine of the antero-lateral borders is rather longer:

(3) the spine at the inner angle of the wrist is much longer:

(4) Egg-laden females are hardly half the size.

In the Indian Museum are 9 specimens from the Orissa coast,  $7\frac{1}{2}$  to 20 fms., 6 from the Persian Gulf, and 3 from the Arakan coast.

*Charybdis (Goniohellenus) hoplites* var. *pusilla*.

This is a dwarf variety, egg-laden females having a carapace only about 9 millim. long and about 16 millim. in extreme breadth.

The carapace is of a thin texture, the chelipeds and legs are slenderer, and the dorsal bulge of the branchial regions is stronger and sharper.

In the Indian Museum are 300 specimens from off the Konkan coast 56 to 58 fathoms.

*Gonioneptunus*, Ortmann.

*Gonioneptunus*, Ortmann, Zool. Jahrb. Syst. etc., VII. 1893-94, p. 79.

This "genus," as Ortmann remarks, is a link between *Charybdis* (= *Goniosoma*) and *Neptunus*. It has much the same bearing to *Goniosoma* that the "genus" *Cronius* has to *Neptunus*, and is one of those forms that would justify any general zoologist in uniting all the Lupine "genera" of systematists into one natural genus.

It differs from *Goniosoma* only in the fact that the broad lobular process of the external angle of the basal antenna-joint is not in contact with the front, so that the antennal flagellum is not excluded from the orbital hiatus.

42. *Charybdis (Gonioneptunus) truncata* (De Haan).

*Portunus truncatus*, Fabricius, Ent. Syst. Suppl. p. 365, and Latreille, Hist. Nat. Crust. VI. p. 16, (*vide* A. M. Edw.).

*Thalamita truncata*, Milne Edwards, Hist. Nat. Crust. I. 463 (*vide* A. M. Edw.).

*Portunus (Thalamita) truncatus*, De Haan, Faun. Japon. Crust. p. 43, pl. xii. fig. 3, ♀ only.

*Portunus (Charybdis) truncatus*, De Haan, Faun. Japon. Crust. p. 65, pl. xviii. fig. 2.

*Goniosoma truncatum*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 380, 385, pl. xxxiv. fig. 4.

*Gonioneptunus subornatus*, Ortmann, Zool. Jahrb. Syst. VII. 1893, p. 79, pl. iii. fig. 9.

The lobule of the basal antenna-joint does not touch the front, so that the flagellum stands in the upper part of the orbital hiatus.

The length of the carapace slightly exceeds two-thirds of the extreme breadth.

Carapace covered with a dense short tomentum, moderately convex, the regions ill-defined, crossed transversely by fine granular ridges which have the same disposition and are almost as faint as those of *C. crucifera*: in addition there are small patches of granules on the cardiac and inner part of the branchial regions.

The front is cut into eight teeth (*including* the inner orbital angles) of which the middle four are broadly triangular and almost acute, while the pair on either side are sub-confluent and form a sort of reduplicated inner supra-orbital angle, somewhat as in *Neptunus* (*Lupocycloporus*) *whitei*.

Antero-lateral borders cut into six teeth, of which the second is the smallest, and the 6th—though more spine-like—is hardly more prominent than those in front of it: all except the sixth are cut rather square, have the free edge serrate, and are anteriorly acuminate—much as in *C. hoplites*.

The posterior border of the dorsal surface of the carapace is practically straight and forms an obtuse angle of junction with either postero-lateral border.

Except that the inner angle of the lower edge of the orbit is denticiform and strongly prominent, and that the inner fissure of the roof is wider, the orbits, and the eyes, are as in *C. ornata*.

Chelipeds not much more than twice the length of the carapace, their upper surface more or less granular, their under surface with smooth-worn squamiform markings. Arm with two more enlarged and one or two less enlarged spines on the anterior border, and one at the far end of the posterior border. Wrist with 3 spinules on the outer angle and a large spine at the inner angle. Hands inflated, strongly 6 or 7-costate—the costæ granular, and with 3 small spines on the upper surface: very similar, in fact, to those of *C. callianassa*. The fingers in the smaller cheliped are as long as, but in the larger cheliped are shorter than, the palm.

The merus of the last pair of legs is nearly as long as broad and has the usual spine on the posterior border: the same border of the propodite is smooth.



In both sexes the 2nd and 3rd abdominal terga are carinate—the 2nd strongly and sharply so. The 6th tergum of the male is truncate-triangular, the sides being very slightly sinuous.

In life the dorsal surface of the carapace is terra-cotta red and there is a good-sized crimson spot towards the inner side of the middle of either branchial region: the exposed dorsal surface of the chelipeds is reddish with numerous darker red markings.

In the Indian Museum there are 6 specimens, including an egg-laden female, from the Gulf of Martaban 53–67 fathoms.

In the male the carapace is about 27 millim. long and about 39 millim. in extreme breadth: in the female it is a good deal smaller.

43. *Charybdis (Gonioneptunus) bimaculata*, Miers.

*Goniosoma variegatum* var. *bimaculatum*, Miers, Challenger Brachyura, p. 191, pl. xv. fig. 3.

As in *C. truncata* the lobule at the outer angle of the basal antenna-joint does not touch the front, so that the antennal flagellum stands in the orbital hiatus.

Length of carapace more than  $\frac{2}{3}$  but less than  $\frac{3}{4}$  the breadth.

Carapace flattish, covered with dense short tomentum, crossed transversely by salient granular ridges arranged exactly as in *C. ornata*.

Front almost similar to that of *C. ornata*, except that, as in *C. truncata*, the outer pair of teeth on either side are sub-confluent and form a sort of reduplicated inner supra-orbital angle.

Antero-lateral borders exactly as in *C. truncata*, except that the last (spine-like) tooth is at least half again as long as any of those in front of it.

Posterior border of dorsal surface of carapace exactly as in *C. truncata*.

Eyes and orbits as in *C. ornata*.

Chelipeds about  $2\frac{1}{4}$  times the length of the carapace. The lower border and the distal half of the upper surface of the arm are granular: there are 2 or 3 spines on the anterior border of this joint, and the posterior border ends in a spine. Upper surface of wrist granular, the inner angle of this joint strongly dentiform, and there are 2 or 3 spinules on the outer angle. Hand in the adult inflated and, except that the squamiform markings of the under surface are almost obliterated, exactly similar to that of *C. truncata*.

Abdomen as in *C. truncata*.

Except that the merus is only about  $\frac{2}{3}$  as long as broad, the last pair of legs are as in *C. truncata*.

In the Indian Museum are 2 small specimens, from Palk Straits

and the Orissa coast, as well as one of the "Challenger" duplicates from Japan.

In the Japanese specimen there is a small dark spot near the middle of either epibranchial region.

Though the sculpture of the carapace and the dorsal inclination of the orbits do certainly give this species a considerable resemblance to *C. variegata*, and though the hands strongly resemble those of *C. callianassa* (which has been confused with *C. variegata*), this species is absolutely different from those, and is very nearly allied to *C. truncata*.

#### 44. *Charybdis (Gonioneptunus) investigatoris*, n. sp.

The lobule of the basal antenna-joint does not touch the front, so that the flagellum stands in the upper part of the orbital hiatus.

Length of carapace nearly five-sixths the breadth.

Carapace little transverse, little convex, the regions indistinct, and the transverse markings extremely indistinct.

Front cut into eight teeth (*including* the inner orbital angles) of which (1) the middle two are rounded, rather narrow, and distinctly the most prominent (2) the submedian are broad and slant outwards, and (3) the outermost pair on either side are narrow and subacute, and form a sort of reduplicated supra-orbital angle. *The extent of the fronto-orbital border is almost equal to the greatest breadth of the carapace.*

Antero-lateral borders little oblique, cut into six acute teeth with sharp entire edges, of which the first 3 are much larger than the next 2, while the last is a spine only slightly more prominent than the tooth in front of it.

The posterior border of the dorsum of the carapace, though nearly straight forms a curve with the postero-lateral borders.

The eyes and orbits are large—the major diameter of the orbit being at least half the width of the inter-orbital space—but have no particular dorsal inclination: the inner angle of the lower border of the orbit is not dentiform.

Chelipeds slender, about twice the length of the carapace. Four acute spines, three of which are enlarged, on the anterior border, and none on the posterior border. Wrist with 3 spinules on the outer angle and a very long and acute spine at the inner angle. Hand slender with indistinct costæ on the outer surface, with a ridge along the middle of the inner surface, and with four spines on the upper surface—the two on the inner edge of the upper surface being singularly large and acute. Fingers acute, markedly longer than the hand (palm).

Legs long and slender. The merus of the last pair is more than

twice as long as broad and has the usual spine at the far end of the posterior border: there are 1 or 2 spinules on the same border of the propodite of this pair.

The 6th abdominal tergum of the male is truncate-triangular and its line of separation from the preceding segments is indistinct.

A single male specimen, with the carapace 10 millim. long and 12 millim. broad, from off the Ganjam coast, 35 fathoms.

THALAMONYX, A. Milne Edwards.

*Thalamonyx*, A. Milne Edwards, *Nouv. Archiv. du Mus.* IX. 1873, p. 168: Miers, *Challenger Brachyura*, p. 192.

Resembles *Charybdis* (= *Goniosoma*) in all essential characters but differs in the following particulars:—

(1) the front proper (not including the inner supra-orbital angles) is broader, being very much more than a third the greatest width of the carapace, and is cut into two broad lobes, not including the inner supra-orbital angles:

(2) the antero-lateral borders are very little oblique, and are cut into 5 teeth only.

Ortmann, whom I am inclined to follow, regards it as only a subgenus of *Charybdis* (= *Goniosoma*). de Man, on the other hand, is inclined to regard it as identical with *Thalamita*, and there is much to be said in favour of this view also. The fronto-orbital border, however, is not quite so broad and the antero-lateral borders are not, therefore, so nearly parallel, nor is the posterior part of the carapace so contracted nor the inner supra-orbital angle so broad as in most species of *Thalamita*. It is a form that excellently well illustrates the real generic unity of the two supposed genera.

45. *Thalamonyx gracilipes*, A. M. Edw.

*Thalamonyx gracilipes*, A. Milne Edwards, *Nouv. Archiv. du Mus.* IX. 1873, p. 169, pl. iv. fig. 3.

*Thalamonyx danæ* var. *gracilipes*, Miers, *Challenger Brachyura*, p. 192.

*Goniosoma* (*Thalamonyx*) *danæ*, Ortmann, *Zool. Jahrb., Syst.*, VII. 1893-94, p. 83 (part).

Carapace more than two-thirds as long as broad with the regions fairly well defined and the surface granular, some of the granules forming short transverse lines.

Front sublamellar and prominent, divided into two broad shallow lobes of which the inner angles are a little bit pronounced.

Antero-lateral borders little oblique and little arched, forming an obtuse angle little short of a right-angle with the anterior border, cut into five claw-like teeth of nearly equal size.

The posterior border of the dorsum of the carapace is straight but does not form an angle with the postero-lateral borders.

Orbits large, with no particular dorsal inclination, their major diameter about half the width of the inter-orbital space: the inner angle of the lower border is bluntly acuminate but hardly dentiform.

Chelipeds granular: arm with squamiform markings, with 2 spines on the anterior border and none on the posterior border: wrist costate, with 3 tiny spinules on the outer angle and a strong spine at the inner angle: hands not inflated (in the female at least), carinate, with 3 spines on the upper surface.

Merus of last pair of legs hardly half as long as broad, with the usual spine near the far end of the posterior border.

An egg-laden female in the Indian Museum, from the Andamans, has the carapace 7 millim. long and 9 millim. broad.

Miers and Ortmann regard this species as not distinct from *T. danæ*, A. M. Edw. (Nouv. Archiv. du Mus. V. 1869, p. 183, pl. vii. figs. 6, 7).

#### THALAMITA, Latreille, A. M. Edw.

*Thalamita*, Latreille in Cuvier Règne An., Crust. (ed. 2) Vol. IV. p. 33 (foot-note): A. Milne Edwards, Ann. Sci. Nat., Zool., (4) XIV. 1860, p. 228, and Archiv. du Mus. X. 1861, p. 354: Miers, Challenger Brachyura, p. 193.

*Thalamites quadrilatères*, Milne Edwards, Hist. Nat. Crust. I. 457.

Carapace hexagonal (but, owing to the straightness of the antero-lateral borders, with a quadrilateral cast), broad or very broad, depressed or little convex, usually with well marked transverse ridges.

The extent of the fronto-orbital border is usually little less than the greatest breadth of the carapace: the width of the inter-orbital space is from three-fifths to half the greatest breadth of the carapace: and the width of the true front (*i.e.* excluding the broad inner supra-orbital angles) is from two-fifths to a third the greatest breadth of the carapace.

Front well separated from the broad supra-orbital angles and cut into 2, 4, or 6 lobes or teeth, not including the supra-orbital angles.

Antero-lateral borders hardly oblique, forming almost a right angle with the frontal border, very little arched, cut into 5 teeth (including the outer orbital angle) of which the fourth is often rudimentary and sometimes absent.

Two sutures in the upper border of the orbit: a gap in the lower border, of which border the inner angle is seldom prominent. The antennules fold transversely.

Basal antennal joint having its outer angle enormously produced,

the process being in close contact with the whole length of the inner supra-orbital angle and completely filling the orbital hiatus, from which, therefore, the antennal flagellum is widely excluded.

Epistome sufficiently long: buccal cavern squarish, broader than long, the efferent branchial channels well defined.

Chelipeds and legs as in *Charybdis* (= *Goniosoma*). Abdomen as in *Neptunus*.

Obviously different as the extremes are, the forms included under *Charybdis* (= *Goniosoma*) and *Thalamita* yet constitute an unbroken series, and there is no one character, still less a combination of characters, by which the two groups can be sharply segregated.

Among Indian forms, however, even the most *Charybdis*-like *Thalamites* (e.g. *T. exetastica* and *imparimanus*) never have more than five distinct teeth on the antero-lateral border (though *T. exetastica* has a microscope accessory (6th) denticle on the first tooth), and always have a characteristic broadening of the inner supra-orbital angle; while the most *Thalamita*-like *Charybdes* (e.g. *C. investigatoris*) has the antero-lateral border cut into six distinct teeth and has a narrow inner supra-orbital angle.

*Key to the Indian species of the genus Thalamita.*

- I. The extreme extent of the basal antenna-joint is far greater than the major diameter of the orbit:—
  - A. Front cut into six lobes of nearly equal size—exclusive of the broad inner supra-orbital angles:—
    1. Antero-lateral borders of carapace cut into five teeth of nearly equal size:—
      - i. Transverse ridges of carapace faint: outer surface of palms nearly smooth ..... *T. crenata.*
      - ii. Transverse ridges of carapace very distinct: outer surface of palms costate ..... *T. danæ.*
    2. Antero-lateral borders cut into five teeth, of which the 4th is much the smallest:—
      - i. Fourth tooth rudimentary: crest of basal antenna-joint with some large spines ..... *T. prymna.*
      - ii. Fourth tooth rudimentary: crest of basal antenna-joint smooth ..... *T. picta.*
      - iii. Fourth tooth small: basal antenna-joint granular ..... *T. stimpsoni.*

- B. Front cut into two lobes—*exclusive* of the broad inner supra-orbital angles :—
1. Inner supra-orbital angles arched, much narrower than either of the frontal lobes :—
    - i. Frontal lobes distinct and independent : hand covered with squamiform markings, its outer surface costate ..... *T. sima* [*T. arcuata*?]
    - ii. Median frontal notch indistinct : only the upper part of hand granular, its outer surface smooth or very indistinctly costate :—
      - a. Teeth of antero-lateral border of carapace acute, the last more prominent than the others ..... *T. poissonii* [? *T. sima.*]
      - b. Lobes of antero-lateral border square-cut, the last not enlarged ..... *T. chaptali.*
  2. Inner supra-orbital angles straight or little arched, not much narrower than either of the frontal lobes :—
    - i. Crest of basal antenna-joint smooth : 4th tooth of antero-lateral borders of carapace rudimentary.. ..... *T. integra.*
    - ii. Crest of basal antenna-joint granular, denticulate, or spinose :—
      - a. Crest granular or dentate : 4th tooth of antero-lateral borders rudimentary : fingers rather stumpy ..... *T. admeta.*
      - b. Crest granular or dentate : 4th tooth small : fingers sharp and as long as the palm ..... *T. savignyi.*
      - c. Crest spinose : 4th tooth somewhat smaller than the others : frontal lobes prominent, with their angles though rounded strongly pronounced..... *T. quadrilobata.*
- II. The extreme extent of the basal antenna-joint is equal to, or less than, the major diameter of the orbit :—
- A. Front cut into six lobes—*exclusive* of the inner supra-orbital angles :—
    1. Antero-lateral borders of the carapace cut into five teeth, of which the fourth is rudimentary :—

- i. All the frontal teeth clearly cut and on the same level, the middle pair much narrower than the submedian pair ..... *T. investigatoris.*
      - ii. The middle frontal teeth are not very clearly defined from, are on a lower plane and are not much narrower than, and are somewhat overlapped by the submedian pair ..... *T. imparimanus.*
    - 2. Antero-lateral borders cut into five teeth, of which the last two are much smaller than the others: all the frontal teeth clearly cut, the median on a lower plane and hardly narrower than the submedian pair..... *T. ezetastica.*
  - B. Front cut into four lobes—*exclusive* of the inner supra-orbital angles :—
    - 1. Median lobes of the front narrower than the lateral lobes :—
      - i. Front sinuous, the median lobes more prominent than the others :—
        - a. Median frontal lobes moderately prominent: antero-lateral borders of carapace cut into five teeth, of which the 4th is the smallest ..... *T. sezlobata.*
        - b. Median frontal lobes conspicuously prominent: antero-lateral borders cut into four teeth, of which the 3rd is the smallest ..... *T. hanseni.*
      - ii. Front perfectly straight: antero-lateral borders cut into five teeth of which the 4th is the smallest ... *T. intermedia.*
    - 2. Median lobes of the front very much broader than the lateral lobes :—
      - i. Wrist with 3 sharp spinules on the outer surface, hand with granular costæ on outer surface, fingers about as long as the palm ..... *T. wood-masoni.*
      - ii. Outer surface of wrist and hand nearly smooth, fingers shorter than palm ..... *T. taprobatica.*
  - C. Front cut into two lobes—*exclusive* of the inner supra-orbital angles :—
    - 1. Front very slightly convex, hardly prominent beyond the supra-orbital angles: carapace markedly transverse, its antero-lateral borders cut into five teeth of

- which the last 2 are very much smaller than the first 3 ..... *T. oculea*.
- [2. Front convex and markedly prominent beyond the supra-orbital angles: carapace little transverse, its antero-lateral borders cut into five teeth of nearly equal size ..... *Thalamonyx gracilipes*].

*Thalamita prymna* (Herbst) Kossmann.

The following names are, in my opinion, all synonymous, namely:—*T. prymna*, *T. crenata*, *T. danæ*, *T. stimpsoni* and *T. picta*. But as it is only occasionally that one encounters specimens that show a combination or confusion of characters I prefer, for convenience, to consider the usually accepted species as distinct. I believe, however, that Kossman's view as to the specific identity of all the *Thalamitas* with an eight-lobed front combined with a very broad basal antenna-joint, untenable as that opinion appears at first sight, is the correct one.

46. *Thalamita crenata* (Latr.) Edw.

*Thalamita crenata*, Latr., Milne Edwards, Hist. Nat. Crust. I. 461: Guérin in Cuvier, Icon. Règne An. Crust. Texte p. 6 (cor. *Thalamita admete* Guérin, Icon. Règne An. Crust. pl. i. fig. 4): Rüppell, 24 Krabben roth. Meer. p. 6, pl. i. fig. 2: Kranss, Sudafr. Crust. p. 25: Stimpson, Proc. Ac. Nat. Sci. Philad. 1859, p. 39: A. Milne Edwards, Archiv. du Mus. X. 1861 pp. 365, 367; Nouv. Archiv. du Mus. IV. 1868, p. 70 and IX. 1873, p. 166: Heller, SB. AK. Wien, XLIII. 1861, p. 356 and Novara Crust. p. 29: Martens, Verh. zool.-bot. Ges. Wien XVI. 1866, p. 381: Hilgendorf, MB. AK. Berl. 1878, p. 800: Hoffmann in Pollen and van Dam, Faun. Madagasc., Crust. p. 9: Lenz and Richters, Abh. senck. Ges. Frankf. XII. 1881, p. 422: Miers, Zool. H. M. S. Alert, pp. 184, 232, 518, 540; and Challenger Brachyura p. 199: Muller, Verh. Ges. Nat. Basel, VIII. 1876, p. 475: de Man, Journ. Linn. Soc., Zool., XXII. 1887-88 p. 79; and in Weber's Zool. Ergebn. Niederl. Ost-Ind. II. 1892, p. 285; and Zool. Jahrb., Syst., &c., VIII. 1894-95 p. 569: Cano, Boll. Soc. Nat. Napol. III. 1889, p. 218: Thallwitz, Abh. Zool. Mus. Dresden 1890-91, No. 3, p. 47: G. Pfeffer, Mitt. Naturhist. Mus. Hamburg, VII. 1890, No. 8, p. 7: Ortman, Zool. Jahrb., Syst., VII. 1893-94, p. 86; and in Semon's Beschrngsr. (Jena. Denk. VIII.) Crust. p. 46.

*Thalamita prymna* var. *crenata*, Richters in Möbius, Meeresf. Maurit. p. 153.

Carapace, length two-thirds the breadth, slightly convex, nearly smooth, crossed transversely by fine faint granular ridges—one, broken only by the cervical groove, between the last spines of the antero-ateral borders, one across the middle of the gastric region, and a series of four crescentic ridges (of which however the middle two are usually obsolete) defining the gastric region anteriorly.

Front cut into six rounded lobes of nearly equal size, not including



the arched inner supra-orbital angles each of which is as broad as any two of the true frontal lobes.

Antero-lateral borders cut into five clawshaped teeth of nearly equal size, or slightly decreasing in size from before backwards.

Posterior border of dorsal surface of carapace forming a curve with the postero-lateral borders, its length about one-third the greatest breadth of the carapace.

Orbits without any dorsal inclination, their major diameter about one-fifth the width of the interorbital space: the inner angle of their lower border dentiform and fairly prominent.

The basal antenna-joint is about two-ninths the greatest breadth of the carapace in extent, its orbital prolongation is in nearly the same straight line with its stem, and is traversed by a granular ridge.

Chelipeds a little unequal, the larger one in the male being about  $2\frac{1}{4}$  times the length of the carapace, with a nearly smooth surface. Anterior border of arm with 3 enlarged spines and some granules, posterior border with a few squamiform granules only. Inner angle of wrist stoutly dentiform, outer surface with three teeth imperfectly united by costæ. Hand with five spines (most of which are blunt and sometimes become obsolescent), in two rows, on the upper surface—those of either row being more or less connected by a ridge which is in part granular: there are no other distinct ridges on the hand except a faintish one in the neighbourhood of the immobile finger. The fingers of the larger hand are not quite as long as the somewhat swollen palm, those of the smaller hand are as long as their palm.

Legs smooth, unarmed except for the usual spine at the far end of the posterior border of the merus of the last pair and for 2 or 3 denticles (which, however, are often absent) on the posterior border of the propodite of the last pair.

The 6th abdominal tergum of the male is broader than long and has gently curved sides.

Large males in the Indian Museum collection have the carapace about 40 millim. long and about 60 millim. broad.

In the Indian Museum are 34 specimens, from the Andamans, Mergui, Bombay, Karachi and the Persian Gulf (besides specimens from Peuang, Singapore, Australia, and Samoa).

#### 47. *Thalamita Danæ*, Stimpson.

*Thalamita crenata*, Dana, U. S. Expl. Exp. Crust. pt. I. p. 282, pl. xvii. figs.

7 a-b.

*Thalamita Danæ*, Stimpson, Proc. Ac. Nat. Sci. Philad. (1858) 1859, p. 39: A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 366, 367, pl. xxxvi. fig. 1: Miers, Cat. Crust. New Zealand, p. 29: Hilgendorf, MB. Ak. Berl. 1878, p. 800: Richters

in Möbius Meeresf. Maurit. p. 153 : Tenison Woods, P.L.S., N. S. Wales, V. 1880-81, p. 118 : Filhol, Crust. New Zealand, Miss. de l'île Campbell, p. 382 : (?) de Man, Archiv. f. Naturges. LIII. 1887, i. p. 334; and Journ. Linn. Soc., Zool., XXII. 1887-88, p. 78 pl. iv. figs 8, 9; and in Weber's Zool. Ergebn. Niederl. Ost-Ind. II. 1892, p. 285; and Notes Leyden Mus. XV. 1893, p. 285; and Zool. Jahrb., Syst., VIII. 1894-95, p. 569.

Differs from *T. crenata* in the following particulars:—

(1) the carapace is nearly three-fourths as long as broad, its posterior border is nearer two-fifths than a third its greatest breadth, its transverse ridges are very distinct, and the four crescentic ridges near the anterior limit of the gastric region are all prominent, especially the middle two:

(2) the front, though otherwise similar, is more prominent:

(3) a large part of the upper surface of the arm and wrist and at least the dorsal half of the surfaces of the hand are granular,—the granules being more or less squamiform; the ridges that connect the spines of the wrist are distinct; there are 6 or 7 costæ on the hand, and the spines of the hand are much sharper:

(4) the 6th abdominal tergum of the male is much broader than long, and its sides are divergent in two-thirds of their extent and then suddenly converge.

In the Indian Museum are 20 specimens from the Andamans and Mergui.

#### 48. *Thalamita prymna* (Herbst).

*Cancer prymna*, Herbst, Krabben, III. iii. 41, pl. lvii. fig. 2.

*Thalamita prymna*, Milne Edwards, Hist. Nat. Crust. I. 461 : Krauss, Sudaf. Crust. p. 25 : De Haan, Faun. Japon. Crust. p. 43, pl. xii. fig. 2 : A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 360, 367, and Nouv. Archiv. du Mus. IX. 1873, p. 163 : Hess, Archiv. f. Naturges. XXXI. 1865, i. pp. 140, 171 : Hoffmann, in Pollen and van Dam Faun. Madagasc. Crust. p. 9 : Kossmann, Crust. roth. Meer. p. 47 (part) : Streets, Bull. U. S. Nat. Mus. VII. 1877, p. 108 : Neumann, Cat. Pod. Crust. Heidelb. Mus. p. 24 : de Man, Notes Leyden Mus. II. 1880, p. 180; and Archiv. f. Naturges. LIII. 1887, i. p. 333; and Journ. Linn. Soc. Zool. XXII. 1887-88, p. 75, pl. iv. figs. 5, 6; and in Weber's Zool. Ergebn. Niederl. Ost-Ind. II. 1892, p. 285; and in Zool. Jahrb., Syst., VIII. 1894-95, p. 567 : Richters, in Möbius Meeresf. Maurit. p. 153 : Miers, Ann. Mag. Nat. Hist. (5) V, 1880, p. 238; and Challenger Brachyura, p. 197 : Sluiter, Tijds. Nederl. Ind. XL. 1881, p. 162 : Haswell, Cat. Austral. Crust. p. 80 : Ortmann, Zool. Jahrb., Syst., VII. 1893, p. 84; and in Semon's Forschungs. (Jena. Denk. VIII.) Crust. p. 46 : Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 372.

*Thalamita crassimana*, Dana, Proc. Ac. Nat. Sci. Philad. 1852, p. 85; and U. S. Expl. Exp. Crust. pt. I. p. 284, pl. xvii. figs. 9a-d : Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 39.

Differs from *T. crenata* in the following particulars:—

(1) the carapace is even less convex, and, as in *T. Danæ*, its trans-

verse ridges are very distinct, moreover the mid-gastric ridge is continued, following the curves of the orbits, to the notch between the 1st and 2nd spines of the antero-lateral borders :

(2) the front is somewhat more prominent, the teeth are closer set and the four middle ones are remarkably square-cut :

(3) the teeth of the antero-lateral border end in spines and the fourth tooth is quite rudimentary and may even be altogether absent :

(4) the basal antenna-joint is nearer a fourth than two-ninths the greatest breadth of the carapace in extent, and its orbital prolongation is traversed by a row of spines of which from 1 to 3 are large :

(5) except that they are free from hair and that all the spines are large and much more acute, the chelipeds are like those of *T. Danæ*, but the granules on the upper surface of the arm are less numerous, and the faint ridge that separates the lower and inner surfaces of the hand in *T. Danæ* is absent :

(6) the propodite of the last pair of legs has its posterior border serrated throughout :

(7) the 6th abdominal tergum of the male is about as long as broad, and has gently convergent sides.

In the Indian Museum are 35 specimens, from the Andamans, Nicobars, Mergui, and Madras coast (besides 1 from Samoa).

#### 49. *Thalamita picta*, Stimpson.

*Thalamita picta*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 39 : A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 362, 367, and Nouv. Archiv. du Mus. IX. 1873, p. 164, pl. iv. fig. 4 : Hilgendorf, MB. Ak. Berl. 1878, p. 800 : Miers, Zool. H. M. S. Alert, pp. 518, 540 : Cano, Boll. Soc. Nat. Napoli, III. 1889, p. 217.

Differs from *T. prymna* in the following slight particulars :—

(1) the basal antenna-joint is not so broad and its crest is tooth-like, having a smooth entire edge :

(2) the two middle frontal teeth project more than the others.

In the Indian Museum there is a single specimen from the Andamans.

#### 50. *Thalamita Stimpsoni*, A. M. Edw.

*Thalamita stimpsoni*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 362, 367, pl. xxxv. fig. 4, and Nouv. Archiv. du Mus. IX. 1873, p. 164 : ? Tozzetti, Magenta Crust. p. 71, pl. v. figs. 4 a-f : Miers, Ann. Mag. Nat. Hist. (5) V. 1880, p. 238 ; and Zool. H. M. S. Alert, pp. 184, 232 ; and Challenger Brachyura, p. 198 : Tenison Woods, P. L. S. N. S. Wales, V. 1880-81, p. 118 : Haswell, Cat. Austral. Crust. p. 80 : Müller, Verh. Nat. Ges. Basel VIII. 1886, p. 475 : Cano, Boll. Soc. Nat. Napol. III. 1889, p. 217 : Ortman, Zool. Jahrb., Syst., VII. 1893-94, p. 85, and in Semon's Forschungs. (Jena. Denk. VIII.) Crust. p. 46.

Differs from *T. prymna* in the following slight particulars :—

- (1) the basal antenna-joint has a row of granules, but no spines :
- (2) the inner supra-orbital angles are broader :
- (3) the 4th spine of the antero-lateral border is usually not so complete a rudiment.

In the Indian Museum is one specimen from the Andamans (besides others from Singapore, Hongkong and Australia.)

This, as Miers has remarked, is one of the forms that supports Kossmann's view as to the identity of all the preceding species of *Thalamita*.

#### 51. *Thalamita Chaptalii*, Aud. et Savign.

*Portunus Chaptalii* Audouin, Explic. p. 83 Savigny Descr. Egypte Crust. pl. iv. fig. 1.

*Thalamita chaptalii*, Milne Edwards, Hist. Nat. Crust. I. 460 : A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 360, 367 : Miers, Zool. H. M. S. Alert, p. 231 (foot-note) : Cano, Boll. Soc. Nat. Napol. III. 1889, p. 216.

? *Thalamita sima*, Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 373.

Carapace two-thirds as long as broad, pilose, considerably convex, the transverse ridges distinct and disposed as in the preceding species except that there is an additional one running across the cardiac region and on to the branchial region on either side, its endings on the branchial regions being the most distinct part of its course.

Front proper forming a broad shallow arch grooved but not deeply divided in the middle line : the inner supra-orbital angles, which have their anterior border curved, are very much less wide than the frontal lobes proper.

Antero-lateral borders cut into five teeth, of which the fourth, though considerably smaller, and the fifth, though somewhat smaller than the other three, are quite well developed : the first three teeth are somewhat square-cut, the first being very distinctly so.

The posterior border of the dorsum of the carapace is straight but forms a curve with the postero-lateral borders, its length is slightly more than a third the greatest breadth of the carapace.

Orbits without any particular dorsal inclination, their major diameter about one-fourth the width of the interorbital space : the inner angle of the lower border is not pronounced.

The basal antenna-joint is between a fifth and a sixth the greatest breadth of the carapace in extent, and is traversed by a low smooth crest.

Chelipeds about  $2\frac{1}{4}$  times the length of the carapace : usually only two enlarged teeth—and those blunt—on the anterior border of the

arm, the posterior border and part of the upper surface granular : upper surface of wrist granular and costate, inner angle strongly spiniform, the usual spinules on the outer angle obsolete. Hand rather full, upper surface granular, with the usual two parallel crests and five spines : the spines however are blunt and small, and the anterior two of the outer row are usually obsolete : except for a few indistinct costæ the other parts of the hand are smooth : the fingers are slightly longer than the hand, except in the larger cheliped of the adult male.

The merus of the last pair of legs is nearly twice as long as broad and has the usual spine on its posterior border : the same border of the propodite is smooth.

The sixth abdominal tergum of the male is a good deal broader than long and has the sides parallel or slightly divergent in at least two-thirds of their extent.

A small species: the largest male in the Indian Museum has the carapace 13 millim. long and a little less than 21 millim. in extreme breadth, and there are several egg-laden females a good deal smaller.

147 specimens from the Andamans (one take), besides several from Mauritius.

## 52. *Thalamita Poissonii*, Audouin et Savigny.

*Portunus Poissonii*, Audouin, Explic. p. 84 Savigny, Descr. Egypt. Crust. pl. iv. fig. 3.

*Thalamita Poissonii*, de Man, Notes Leyden Mus. II. 1880, p. 181 : Cano, Boll. Soc. Nat. Napoli, III. 1889, p. 216.

Differs from *T. chaptalii* in the following particulars:—

(1) the teeth of the antero-lateral borders are acute, and the last tooth is more spiniform and more prominent than the others :

(2) the posterior border of the propodite of the last pair of legs is armed with 2 or 3 small spinules :

(3) the teeth on the anterior border of the arm are acute.

In the Indian Museum are two specimens from the Persian Gulf. I much doubt that this is distinct from *T. chaptalii*.

## 53. *Thalamita sima*, Edw.

*Thalamita sima*, Milne Edwards, Hist. Nat. Crust. I. 460 : Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 39 : A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 359, 367 ; and Nouv. Archiv. du Mus. IV. 1868, p. 70, and IX. 1873, p. 163 : Miers, Cat. Crust. New Zealand, p. 28 ; and P.Z.S. 1879, pp. 20, 32 ; and Zool. H.M.S. Alert, pp. 184, 231, 518, 539 ; and Challenger Brachyura, p. 195 : Kossmann, Reise roth. Meer., Crust. p. 50 : Tozzetti, Magenta Crust. p. 78, pl. vi. figs. 1 a-e : Hilgendorf, MB. Ak. Berl. 1878, p. 800 : Tenison Woods, P.L.S. N.S. Wales, V. 1880-81, p. 118 : Haswell, Cat. Austral. Crust. p. 80 : Filhol, Crust. New Zealand, Miss. ile Campbell, p. 382 : Muller, Verh. Nat. Ges. Basel, VIII. 1886, p. 475 : ? de Man, Journ. Linn. Soc.,

Zool., 1887-88, p. 75, and Zool. Jahrb. Syst. VIII. 1894-95, p. 564: Cano, Boll. Soc. Nat. Napoli, III. 1889, p. 216: Walker, Journ. Linn. Soc., Zool., XX. p. 110: Ortmann, Zool. Jahrb. Syst. VII. 1893-94, p. 84, and in Semon's *Forschungsr.* (Jena. Denk. VIII) Crust. p. 46: ? J. R. Henderson, *Trans. Linn. Soc., Zool.*, (2) V. 1893, p. 373.

*Portunus (Thalamita) arcuatus*, De Haan, Faun. Japon. Crust. p. 43, pl. ii. fig. 2.

Differs from *T. Chaptalii* in the following particulars:—

(1) the front proper, though arched as a whole, is distinctly divided into two broad shallow lobes the rounded outer angles of which are very distinctly separated from the supra-orbital angles:

(2) the antero-lateral borders are cut into 5 acute teeth of which the last is decidedly the largest and most prominent:

(3) the inner angle of the lower border of the orbit is more prominent:

(4) the chelipeds are everywhere more granular, their under surface especially being covered with transverse squamiform markings: the small spines on the outer surface of the wrist are well marked: the hand is everywhere covered with transverse squamiform markings and is very distinctly 6 or 7-costate, and on its upper surface are 5 distinct spines, of which 4 are large and acute.

In the Indian Museum is a single specimen from the Persian Gulf (besides 12 from Hongkong and Nagasaki).

Our specimens are undoubtedly the *Thalamita arcuata* of De Haan, which, according to A. Milne Edwards is synonymous with *T. sima* of Milne Edwards.

#### 54. *Thalamita admeta* (Herbst) Edw.

*Cancer admete*, Herbst, *Krabben* III. iii. 40, pl. lvii. fig. 1.

*Portunus admete* Latr., Audouin *Explic.* p. 84, Savigny *Descr. Egypt. Crust.* pl. iv. fig. 4.

*Thalamita admete*, Cuvier *Règne Animal Crust.* pl. ix. fig. 2: Milne Edwards, *Hist. Nat. Crust.* I. 459: Krauss, *Sudafr. Crust.* p. 24: Dana, *U. S. Expl. Exp. Crust.* pt. I. p. 281, pl. xvii. figs. 5 a-c: Stimpson, *Proc. Ac. Nat. Sci. Philad.* 1853, p. 39: A. Milne Edwards, *Archiv. du Mus.* X. 1861, pp. 356, 367; and *Nouv. Archiv. du Mus.* IX. 1873, p. 162: Heller, *SB. Ak. Wien*, XLIII. 1861, i. p. 355: and *Crust. Sudl. Europ.* p. 79, pl. ii. fig. 17. (*vide* Guerin); and *Novara Crust.* p. 28; *Streets, Bull. U. S. Nat. Mus.* VII. 1877, p. 105: Hilgendorf, *MB. Ak. Berl.* 1878, p. 799: Richters in Möbius *Meeresf. Maurit.* p. 153: Miers, *Zool. H. M. S. Alert*, pp. 183, 230; and *Challenger Brachyura*, p. 194: Carus, *Prod. Faun. Medit.* p. 515, (*vide* Guerin): de Man, *Archiv. f. Naturges.* LIII. 1887, i. p. 332; and in *Weber's Zool. Ergebn. Niederl. Ost.—Ind.* II. 1892, p. 285: Thallwitz, *Abh. Zool. Mus. Dresden* 1890-91, No. 3, p. 46: Ortmann, *Zool. Jahrb., Syst.*, VII. 1893-94, p. 83; and in *Semon's Forschungsr.* (Jena. Denk. VIII) *Crust.* p. 46: J. R. Henderson, *Trans. Linn. Soc. Zool.* (2) V. 1893, p. 372: Whitelegge, *Mem. Austral. Mus.* III. 1897, p. 138.

*Thalamita savignyi*, A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 357 and 367, and Nouv. Archiv. du Mus. IX. 1873, p. 163: Kossmann, Reise roth. Meer. Crust. p. 49: de Man, Notes Leyden Mus. II. 1880, p. 180, and III. 1881, p. 99; and Journ. Linn. Soc. Zool. XXII. 1887-88, p. 73; and Zool. Jahrb., Syst. etc., VIII. 1894-95, p. 564: Cano, Boll. Soc. Nat. Nap. III. 1889, p. 215: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 372: Ortman in Semon's Forschungsr. (Jena. Denk. VIII). Crust. p. 46.

Carapace only about five-ninths to three-fifths as long as broad, pilose, flat, crossed transversely by granular ridges which have the same disposition as in *T. danæ*, *crenata*, etc., except that, as in *T. chapatalii*, *simu* etc., there is an additional one across the cardiac region and extending, with an interruption, on to either branchial region.

Inter-orbital space divided into four square-cut lobes of nearly equal width: the middle two, which form the front proper, are laminar and are considerably the more prominent: the outer two, which are the broad inner supra-orbital angles, have a straight, or inappreciably curved anterior border.

Antero-lateral borders cut into 5 acute claw-like teeth, of which the 4th is much smaller than the others and is often rudimentary.

The posterior border of the dorsum of the carapace forms a curve with the postero-lateral borders: its length is a little less than a third the greatest breadth of the carapace.

The orbits have no particular dorsal inclination, their major diameter is about a fifth the width of the inter-orbital space, the inner angle of their lower border is bluntly dentiform.

Basal antenna-joint nearly a fourth the greatest breadth of the carapace in extent: its orbital extension traversed by a serrated crest.

Chelipeds unequal in the adult male. Three enlarged teeth on the anterior border of the arm: the posterior border granular in its distal half. Upper and outer surface of wrist costate and slightly granular, 2 or 3 spinules at the outer angle, the inner angle strongly spiniform. Hand full and deep, with 5 costæ on the upper and outer surfaces: on the upper two costæ are altogether 6 spines, of which the distal two are the smallest: the other surfaces of the hand are generally smooth, but there may be a faint bulge or ridge along the inner surface and an incomplete line of granules along the lower border. Fingers a good deal shorter than the hand (especially in the larger cheliped) rather stumpy, and though sharp-pointed showing an inclination to be channelled along the inner surface: the dactylus is decidedly hook-like.

In some individuals the hand, except for the two spinose costæ on the upper surface and for traces of two costæ on the outer surface, is quite smooth. In others there are only four distinct spines on the hand,—the two small ones immediately behind the finger-joint being

obsolescent. In the variety *savignyi* the hand is not particularly full or deep, and the fingers, which are as long as the hand, are not channelled along the inner surface.

The merus of the last pair of legs is nearly twice as long as broad and has the usual spine near the far end of the posterior border; the posterior border of the propodite of this pair is serrated throughout.

The 6th abdominal tergum of the male is not much broader than long, its sides are slightly but gradually convergent.

The carapace of an average male in the Indian Museum is 15 millim. long and 26 millim. broad, but there is a specimen much larger than this from the "South Seas."

In the Indian Museum are 45 specimens from the Andamans, Mergui, Palk Straits and Persian Gulf.

Three varieties of this species are recognizable, but the differences between them are very inconstant and are not, in my opinion, of specific value:—

(1) *Thalamita admeta* (Herbst). "Der Hand ist gross, auf der aussern Wölbung gekornt."

(2) *Thalamita admeta* A. M. Edw. "Main portant.....sur la face externe deux crêtes peu marquées et lisses."

(3) *Thalamita savignyi* A. M. Edw., which differs in the following particulars:—

(a) the transverse ridges of the carapace are in sharper relief: (b) the division between the 2 true frontal lobes is not always broad and deep: (c) the fourth tooth of the antero-lateral borders, though smaller than the others, is not rudimentary: (d) the hand is not particularly full and deep, and its inner surface is sometimes granular, all the granular costæ of the outer surface being well-marked also: (e) the fingers are straighter, are as long as the palm, and have no particular channelling of the inner surface.

#### 55. *Thalamita quadrilobata*, Miers.

*Thalamita quadrilobata*, Miers, Zool. H. M. S. "Alert," pp. 518, 539, pl. xlviii. fig. B; and Challenger Brachyura, p. 194.

Differs from *T. admeta* in the following particulars:—

(1) the carapace is not quite so broad, its length being about three-fifths its breadth:

(2) the two lobes that form the front proper project very much more beyond the two lobes that form the supra-orbital angles and their free edges are so concave and their angles therefore are so pronounced that the front (not including the supra-orbital angles) appears four-lobed:



(3) the fifth tooth of the antero-lateral borders though smaller than the others is by no means a rudiment:

(4) the crest of the basal antenna-joint is armed with a row of 3 large spines like those of *T. prymna*.

(5) the hands and fingers are like those of the *var. savignyi*: i.e., the hand is distinctly costate, some of its inner surface is granular, and the fingers are as long as the hand and have no particular channelling of the inner surface.

In the Indian Museum there is a single specimen from the Andaman Islands: the length of the carapace is 22 millim., its breadth 35 millim.

This form is probably only a variety of *T. admeta*.

#### 56. *Thalamita integra*, Dana.

*Thalamita integra*, Dana, Proc. Ac. Nat. Sci. Philad. VI. 1852, p. 85 and U. S. Expl. Exp. Crust. pt. I. p. 281, pl. xvii. figs. 6 *a-d*: Stimpson, Proc. Ac. Nat. Sci. Philad., 1858, p. 39: A. Milne Edwards, Archiv. du Mus. X. 1861, pp. 358, 367, and in Maillard's Pile Réunion, Annexe F. p. 2: Streets, Bull. U. S. Nat. Mus. VII. 1877, p. 107: Hilgendorf, MB. Ak. Berl. 1878, p. 799: Richters in Möbius Meeresf. Maurit. p. 153: Miers, Zool. H. M. S. Alert, pp. 518, 540, and Challenger Brachyura, p. 195: de Man, Journ. Linn. Soc., Zool., XXII. 1887-88, p. 74: Cano, Boll. Soc. Nat. Nap. III. 1889, p. 215: Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 373: Whitelegge, Mem. Austral. Mus. III. 1897, p. 138.

Closely allied to *T. admeta* from which it can be recognized by the following characters:—

(1) the carapace is not quite so broad and is distinctly convex: it is bare of tomentum and the transverse ridges are much less distinct, the one that crosses the cardiac region being obsolescent or absent:

(2) the crest of the basal antenna-joint has a sharp entire edge:

(3) the surface of the chelipeds is smooth and polished: the costæ of the wrist are worn and in great part obliterated, and the usual 3 spines at the outer angle of this joint are indistinct blunt points: the hand is quite smooth; the inner border of its upper surface is crest-like and bears two teeth, there is a blunt tooth in the usual place in front of the apex of the wrist-joint, and in front of this are one or two blunt tubercles; there may also be a smooth ridge running along the distal two-thirds of the lower border of the hand:

(4) the 6th abdominal tergum of the male is much broader than long.

In the Indian Museum are two specimens—from Mergui and the Andamans (besides a "Challenger" duplicate from Honolulu).

#### 57. *Thalamita investigatoris*, n. sp.

Carapace about two-thirds as long as broad, covered with a velvet-

like pile, crossed by transverse ridges disposed as in *T. sima, admeta*, etc.—*i.e.*, there is an additional ridge extending across the cardiac and neighbouring parts of the branchial regions—but they are all faint.

Front cut into six lobes (*not* including the inner supra-orbital angles) very similar to those of *Charybdis* (= *Goniosoma*) *callianassa*, *i.e.*, the middle two are narrow rounded and more prominent than the others, the next on either side are broad, and the third on either side are very narrow and are subacute.

Antero-lateral borders straight, cut into 5 acute teeth (including, as usual, the outer orbital angles) of which the first 3 are large, the 5th very small, and the 4th a rudiment.

Posterior border straight, but forming a curve with the postero-lateral borders, its length hardly more than two-fifths the greatest width of the carapace.

Orbits large, their major diameter more than two-fifths the width of the interorbital space: the inner angle of the lower border not denticiform.

The basal antenna-joint is not equal to the major diameter of the orbit in its extreme extent: its crest is low and denticulated.

Chelipeds markedly unequal in the adult male, their upper surface with close-set vesicular granules: two or three enlarged spines on the anterior border of the arm, none on the posterior border: inner angle of wrist spiniform, two or three minute points on the outer angle: hand not costate, with only two distinct spines,—one being in front of the apex of the wrist-joint, the other, which is the larger, being some way behind the finger joint: [the other spines usually present in *Thalamita*, if present, are not distinguishable from the general granulation]. Fingers shorter than the hand, especially in the larger cheliped.

First 3 pair of legs long and slender, banded with brown. The merus of the last pair is more than twice as long as broad and has the usual spine on the posterior border: there are also a few spinules on the posterior border of the propodite of this pair.

Sixth abdominal tergum of male a good deal broader than long, its sides parallel in their proximal half and then suddenly converging.

A single male from off Ceylon, 34 fathoms.

A small species, the carapace being 8 millim. long, and 11·5 millim. broad.

#### 58. *Thalamita exetastica* n. sp.

Closely resembles *T. investigatoris*, from which it differs in the following particulars:—

(1) the median frontal teeth are on a lower plane than, and are almost as broad as, the submedian teeth:

(2) the teeth of the antero-lateral border gradually decrease in size from before backwards, the 4th and 5th being extremely small; moreover there is a tiny tooth cut in the base of the first, somewhat after the manner of *Goniosoma orientale*, but very much smaller:

(3) the carapace is three-quarters as long as broad, and the length of the posterior border is more than half the greatest breadth of the carapace:

(4) all surfaces of the chelipeds, except that part of the upper surface of the arm that is concealed by the carapace, are covered with transverse squamiform markings; the hand is costate and there are at least 4 distinct spines on its upper surface, two of which along the inner border are particularly large; the fingers are as long as the palm.

(5) the legs are not particularly long and slender; the merus of the last pair is about two-thirds as broad as long, and the posterior border of the propodite is smooth.

A mature female and a young male from off the Malabar coast, 26–31 fms.

A small species, the carapace being 9 millim. long and 12 millim. broad. It is more nearly related to *Oharybdis* (= *Goniosoma*) than is any other of these small Thalamites with reduced basal antenna-joint.

59. *Thalamita imparimanus*, n. sp.

Closely resembles *T. investigatoris*, from which it differs in the following particulars:—

(1) the transverse ridges of the carapace are prominent:

(2) the median frontal teeth are about as broad as, are on a lower plane than, and are to some extent overlapped by, the submedian teeth:

(3) the basal antenna-joint is quite *Goniosoma*-like, its greatest extent being less than half the major diameter of the orbit: its crest is almost indistinguishable:

(4) the chelipeds, though otherwise similar, have the inequality in the male even more marked and there are no points on the outer angle of the wrist that are distinct from the general granulation:

(5) the legs are even longer and slenderer, and the posterior border of the propodite of the last pair is smooth:

(6) the line of junction between the 6th and 7th abdominal terga of the male is concave instead of straight.

Three specimens from off the Ganjam coast, 35 fathoms.

The carapace of the largest is 7 millim. long and 10 millim. broad.

60. *Thalamita sexlobata*, Miers.

*Thalamita sexlobata*, Miers, Challenger Brachyura, p. 196, pl. xvi. fig. 2: Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 373.

Carapace nearly three-fourths as long as broad, flattish, closely pilose, the transverse ridges distinct and disposed as in *T. sima*, *admeta* and *investigatoris*.

Front cut into 4 lobes (*not* including the supra-orbital angles) of which the middle pair are the narrowest and slightly the most prominent and on a slightly lower plane, while the outer pair are the broadest, being also broader than the arched supra-orbital angles from which they are separated by a distinct notch.

Antero-lateral borders cut into 5 teeth, of which the first is the largest and the fourth is a mere rudiment, while the fifth is sometimes smaller and sometimes larger than the third.

Posterior border of the usual shape, its length is nearly half the greatest breadth of the carapace.

Orbits large, with a somewhat dorsal inclination, their major diameter is about a third the width of the inter-orbital space: the inner angle of the lower border not dentiform.

Basal antenna-joint about equal to the major diameter of the orbit in extreme extent: its crest is low and either entire or finely granular.

Chelipeds pilose, covered with transverse squamiform markings. Two enlarged spines on the anterior border of the arm, none on the posterior border. Inner angle of wrist strongly spiniform, three spinules on outer angle. Hand costate, with 4 or 5 (usually 4) spines, of which the most conspicuous are the 2 along the inner border of the upper surface. Fingers of the smaller cheliped rather longer, of the larger cheliped rather shorter, than the hand.

First 3 pair of legs with transverse squamiform markings on the upper surface. In the last pair the merus is nearly twice as long as broad and has the usual spine on the posterior border, and the same border of the propodite is smooth.

Sixth abdominal tergum of male with arched sides, the tergum being broader than long and much broader at its base than at its far end, though the base is not quite the broadest part.

In the Indian Museum are 15 specimens, from the Arakan coast, Andamans, and Persian Gulf. The carapace of an egg-laden female is 9 millim. long and 12.5 millim. broad.

61. *Thalamita Hanseni*, n. sp.

Carapace two-thirds as long as broad, slightly convex, somewhat pilose, crossed by transverse ridges which have the same disposition as in *T. admeta*, *sealobata* etc.

Front deeply cut into 4 lobes (*not* including the inner supra-orbital

angles) of which the middle two are narrow rounded and prominent beyond the outer two which are broad: the latter are well separated from the supra-orbital angles, which are arched and are about the same breadth as the middle frontal lobes.

Antero-lateral borders cut into 4 acute teeth (*including* the outer orbital angles) of which the first and last are the largest.

Posterior border of dorsum of carapace straight, but forming a curve with the postero-lateral borders, its length is half the greatest width of the carapace.

Orbits large, their major diameter about two-fifths the width of the inter-orbital space, the inner angle of their lower border is not dentiform, and they have no particular dorsal inclination.

Basal antenna-joint less than the major diameter of the orbit in extreme extent, its crest is smooth.

Chelipeds of usual form: three spines on the anterior border of the arm, none on the posterior border, the distal half of the upper surface with squamiform markings: inner angle of wrist strongly spiniform, three spinules on the outer angle: hand with 5 spines, in the usual position, the two behind the finger-joint the smallest, there are 2 or 3 obscure costæ and some indistinct squamiform markings on the outer surface: fingers shorter than the palm, especially in the larger cheliped.

Legs slender: the merus of the last pair is more than twice as long as broad and has the usual spine on the posterior border, the same border of the propodite of this pair has 2 or 3 spinules.

6th abdominal tergum of male much broader than long, with gradually convergent sides.

Three specimens were dredged by a Danish Expedition off Trincomalee in 2 fathoms, and have been very kindly lent to me for examination by Dr. H. J. Hansen. The carapace of the largest specimen is 6 millim. long and 9 millim. broad.

#### 62. ? *Thalamita intermedia*, Miers.

*Thalamita intermedia*, Miers, Challenger Brachyura, p. 196, pl. xvi. fig. 1: Ortmann, in Semon's Forschungsr. (Jena, Denk. VIII.) Crust. p. 46.

"The carapace is broadly transverse, and is covered with a close, whitish pubescence, the transverse ridges which cross its dorsal surface are not more distinct than in *Thalamita admete* to which species and to *Thalamita savignyi*, *Thalamita intermedia* is nearly allied.

"Of the six lobes of the front the median are smallest, and separated by a narrow and rather deep incision, the submedian and lateral are subequal, the latter slightly overlapping the former; the lateral lobes project somewhat less than the others.

“The five spines of the antero-lateral margin are all well developed, but the three anterior are very slightly larger than the fourth and fifth.

“The basal antennal joint is very distinctly granulated; the maxillipeds present nothing remarkable.

“The chelipeds in the male are subequal, the merus or arm with three spines on its anterior margin, of which the two nearest to the distal extremity are largest; wrist with a strong spine on its inner margin and three small spinules on its outer surface, palm with three or four spines disposed alternately in two series, on its upper surface, and with three granulated ridges on its outer surface, between which are other granules, as in *Thalamita savignyi*; the fingers are somewhat shorter than the palm, and irregularly denticulated on their inner margins.

“The ambulatory legs slender and slightly compressed; the fifth legs shaped much as in *Thalamita admeta* and *Thalamita savignyi*, with a spine near the distal end of the inferior margin of the merus-joint, and with the inferior margin of the penultimate joint armed with a very distinct series of small spinules.

Colour (in spirit) pinkish-brown; pubescence whitish.”

The above is Miers' description, which I have copied, as I am not perfectly sure of the identity of our specimen. It should be added that the basal antenna-joint is “*Goniosoma*”-like, its extreme extent being less than the major diameter of the orbit, and that the front is cut perfectly straight.

In the Indian Museum is a single egg-laden female from off Ceylon 34 fms. The carapace is 5.5 millim. long and 9 millim. in extreme breadth.

### 63. *Thalamita Wood-Masoni*, n. sp.

Carapace nearly three-fourths as long as broad, convex, crossed transversely by ridges, which have the same disposition as in *T. sima*, *T. admeta*, *T. investigatoris*, etc., and are all very distinct and straight.

Front cut into 4 rather obscurely marked lobes (*not* including the inner supra-orbital angles) of which the two middle ones are very broad and the two lateral ones very narrow: the inner supra-orbital angles, which are well arched, are broader than the lateral lobes of the front but much narrower than the median lobes.

Antero-lateral borders nearly straight, cut into 5 sharp teeth, of which the 4th is rudimentary and is visible only when the carapace is denuded of its close pile.

Posterior border of dorsum of carapace straight but forming a curve with the postero-lateral borders, its length is rather more than two-fifths the greatest breadth of the carapace.

Orbits without any particular dorsal inclination: their major diameter nearly a third the width of the inter-orbital space: the inner angle of the lower border not dentiform.

Basal antenna-joint about equal to the major diameter of the orbit in extreme extent, traversed by a low microscopically-granular crest.

Chelipeds rather pilose: the arm has 3 spines on the anterior border, none on the posterior border, the exposed part of its upper surface has some squamiform granules: wrist costate and granular, its inner angle spiniform, 3 sharp spinules on its outer angle: hand with numerous granular costæ, and with 5 sharp and very distinct spines in the usual position: fingers about as long as the hand in the smaller cheliped, shorter than the hand in the larger cheliped.

Merus of last pair of legs slender, more than twice as long as broad, with the usual spine on the posterior border: the posterior border of the propodite of the same pair has some spinules.

The 6th abdominal tergum of the male is a good deal broader than long, its sides are suddenly convergent near the distal end and its distal border is concave.

In the Indian Museum is a single specimen from the Andamans. Among the specimens kindly lent me for examination by Dr. H. J. Hansen of the Copenhagen Museum is a male from Paumban (Palk Str.).

A small species; carapace 9 millim. long, 12.5 millim. broad.

*Thalamita Wood-Masoni* var. *taprobanica*.

Differs from *T. Wood-Masoni*, type, much as *T. admeta* differs from var. *T. savignyi*:—

(1) the frontal lobes are deeper cut:

(2) the sculpture of the chelipeds is much less distinct: the squamiform markings on the arm wrist and hand, and the costæ of the wrist and hand are much worn; the spinules on the outer angle of the wrist are blunt and obsolescent; and the spines on the upper surface of the hand are small and blunt—the anterior two of the outer row being smaller and blunter than the others; the fingers are much shorter.

In the Indian Museum is a single specimen from Ceylon.

64. *Thalamita oculatea* n. sp.

Carapace rather more than two-thirds as long as broad, closely and densely pilose. When denuded, the transverse ridges are prominent and more numerous than in any other Indian species, because besides the ridges found in *T. danæ* etc., and besides the additional ridge across the cardiac and neighbouring part of the branchial regions found in

*T. sima, admeta* etc., there is—behind all—another short ridge or linear tubercle on either branchial region.

Front proper straight, obscurely divided into 2 lobes (*not* including the inner supra-orbital angles) by a notch that needs looking for with a lens. The inner supra-orbital angles are arched and their breadth is not half that of either of the true frontal lobes.

Antero-lateral borders nearly straight, cut into 5 teeth, of which the first is the largest and the last two (which are co-equal) are very much smaller than any of the others.

Posterior border of dorsum of carapace straight, but forming a curve with the postero-lateral borders; its length is rather more than half the greatest breadth of the carapace.

Orbits with a distinctly dorsal inclination, large—their major diameter being little less than half the width of the inter-orbital space—the fissures in the upper border obscure, the inner angle of the lower border not dentiform.

Basal antenna-joint Goniosoma-like, its extreme extent being much less than the major diameter of the orbit, its crest low and smooth.

Chelipeds pilose, covered with transverse squamiform markings: 2 enlarged teeth on the anterior border of the arm, none on the posterior border: inner angle of wrist strongly spiniform, 2 or 3 inconspicuous denticles on the outer angle: hand costate, with 4 or 5 (usually 4) spines, of which only three (namely, the one in front of the apex of the wrist-joint and the two along the inner border of the upper surface) are visible to ordinary observation, the other 1 or 2 being lost in the general squamiform granulation.

Legs pilose, the first 3 pair with squamiform sculpture on the upper surface: in the last pair the merus is nearly twice as long as broad, and has the usual spine on its posterior border, and the propodite has a smooth posterior border.

Sternum with numerous transverse grooves—a sort of scutiform sculpture—most conspicuous in the male.

6th abdominal tergum of male a good deal broader than long, with gradually convergent sides.

7 specimens from off Ceylon, 28–34 fms., 1 from off Malabar coast 26–31 fms., 3 from the Andaman Sea.

A small species: the carapace of the largest egg-laden female is 9 millim. long and 13 millim. broad.

### Alliance III. *Podophthalmoida.*

#### PODOPHTHALMUS, Lamk.

*Podophthalmus*, Lamarck, *Syst. Anim. sans. Vert.* V. p. 152, and *Hist. Nat.*



Anim. sans. Vertebr. V. p. 255 : Latreille, Hist. Nat. Crust. VI. p. 53 : Leach, Zool. Miscell. II. p. 147 : Desmarest, Consid. Gen. Crust. p. 99 : Milne Edwards, Hist. Nat. Crust. I. 465 : De Haan, Faun. Japon. Crust. p. 10 : A. Milne Edwards, Ann. Sci. Nat., Zool., (4) XIV, 1860, pp. 283, 228, and Archiv. du Mus. X. 1861, p. 419 : Miers, Challenger Brachyura, p. 207.

Carapace extremely broad. Its antero-lateral borders are almost transverse in the greater part of their extent and then turn obliquely backwards to end in a large spine ; they are deeply grooved along their whole extent to receive the enormously elongate eye-stalks. The groove is an extension of the true orbit, which also encroaches on the dorsal surface of the front, so that the true front comes to lie beneath the roots of the eye-stalks, cut off from the rest of the carapace except for a narrow isthmus left between the eye-stalks.

The true front, which thus lies below the eye-stalks but in its normal relation to the antennules and antennæ, is extremely narrow.

Close behind the spine that terminates the antero-lateral border is another, smaller, spine.

The eyes are borne on slender basal stalks of peculiar length : the orbits, as already explained, occupy the whole extent of the antero-lateral border, even extending on to the lateral epibranchial spine. The antennules are lodged in fossæ beneath the front, into which they are not completely retractile.

The antennæ are also in their normal position in the wide orbital hiatus : the basal joint is short, the flagellum long and slender.

The epistome though short, or even linear, and though encroached upon by the external maxillipeds, is well defined. Buccal cavern squarish broader than long : efferent branchial channels ill defined.

Chelipeds legs and abdomen as *Neptunus*.

As M. A. Milne Edwards has remarked *Podophthalmus* is merely an abnormal *Neptunus*.

#### 65. *Podophthalmus nacreus*, n. sp.

Carapace broadly hexagonal, approaching the oblong-quadrate, its length just over half its breadth (lateral spines included) its regions fairly well delimited, its surface finely granular.

Front proper (that is, the piece almost cut off from the rest of the carapace by the encroachment of the eye-stalks) horizontal, distinctly bilobed, its breadth about a sixth that of the carapace (spines included).

Antero-lateral borders distinctly arched, or angularly bent, the lower edge of the groove for the eye-stalks very prominent and forming almost a quadrant of a broad ellipse, the lateral epibranchial spine short—its length about half the width of the front.

Postero-lateral borders not at all strongly convergent, the spine at their anterior end sharply carinate. Posterior border straight, its length is half the greatest width of the carapace (spines included).

Eyes, with the eye-stalks, well over half the greatest breadth of the carapace (spines included).

The maxillipeds in repose almost close the mouth, a narrow space being left between them: the antero-external angle of the merus produced and lobe-like. Epistome almost linear.

Chelipeds in the male nearly three times the greatest length of the carapace: anterior border of arm with a row of spines the distal 2 of which are enlarged, posterior border with 2 enlarged spines in its distal half: inner angle of wrist strongly spiniform, a spine followed by a carina along the outer surface of wrist: hand very sharply carinated on the upper and outer surfaces, armed with 2 spines—one in front of the apex of the wrist-joint, the other behind the finger-joint: dactylus very little shorter than the palm.

First 3 pair of legs slender: a short spine on the posterior border of the merus of the 4th pair.

2nd and 3rd abdominal terga carinate in both sexes: 6th tergum in the male much broader than long, with converging sides.

Colours in spirit yellowish; the edges of the carapace, the crests and spines of the chelipeds, and the carinæ of the abdomen have much the same nacreous sheen as in *Neptunus argentatus*.

In the Indian Museum are 3 specimens from the Andamans, and one from the Gulf of Martaban 53 fms. The carapace of the largest specimen is 12 millim. long and 23 millim. broad.

This species in several respects approaches *Euphyllax*. It differs from *Podophthalmus vigil* in the following particulars:—

(1) the carapace is almost oblong-quadrated, its antero-lateral borders are curved or angularly bent, its surface is granular and its regions better defined:

(2) the buccal cavern is squarer and is more nearly closed by the external maxillipeds, the antero-external angle of the merus of which is produced to form a lobule: the epistome is linear:

(3) the front is horizontal and bilobed:

(4) the lateral epibranchial spine is much shorter:

(5) the hand is very sharply carinated and the fingers are nearly as long as the palm.

#### Family CANCRIDÆ.

*Canceriens arquês* (*Pseudocarcinus* and *Pirimela* only) Milne Edwards Hist. Nat. Crust. I. 371: and *Corystiens*(part) Milne Edwards, *op. cit.* II, 139.

*Cyclinea* and *Corystoidea* (part) Dana, U. S. Expl. Exp. Crust. pt. I. pp. 294 and 296: Miers, Challenger Brachyura, pp. 208 and 209.

*Cancrini* (exc. *Carcinus*) and *Xanthini* (*Thiidæ* only) Ortmann, Zool. Jahrb. Syst. VII. 1893-94, pp. 421 and 428.

Carapace moderately convex, either broadly transversely-oval (as in the *Cancrinæ*) or elongate-oval or subcircular or (rarely) somewhat hexagonal, the regions rarely strongly defined and rarely areolated.

Front not very broad, commonly cut into 3 teeth, which are sometimes prominent: [sometimes (*Thiinæ*) the front is subentire or bilobed; in *Acanthocyclus* it is triangular and pointed.]

The antennules always fold longitudinally.

Antennal flagella usually long, coarse, and setaceous [absent in *Acanthocyclus*, short and slender in *Kraussia*].

Epistome usually sunken, always more or less overlapped by the external maxillipeds which are often somewhat elongate.

Legs gressorial.

Sternum narrow.

I propose to divide the Cancridæ into the following five subfamilies:—

Subfamily I. *Cancrinæ*. Carapace broadly transverse, oval, the antero-lateral borders cut into many teeth or puckers, the regions either not defined or fairly well defined and areolated. Front cut into 3 teeth. Buccal orifice about square. Epistome but slightly sunken and slightly overlapped by the external maxillipeds, which completely close the mouth and have the merus not elongate. Basal antenna-joint fixed.

Constituent genera:—

1. \**Cancer*, Lamk., Leach, A. Milne Edwards Nouv. Archiv. du Mus. I. 1865, p. 185.

2. *Metacarcinus*, A. Milne Edwards, Nouv. Archiv. du Mus. I. 1865, p. 201.

3. *Trichocarcinus*, Miers, P.Z.S. 1879, p. 34 (= *Trichocera*, De Haan, Faun. Japon. Crust. p. 16).

Subfamily II. *Pirimelinæ*. Carapace somewhat hexagonal, not transverse, regions very well defined and areolated, antero-lateral borders cut into 5 teeth. Front cut into 3 teeth. Buccal orifice moderately elongate. Epistome a good deal sunken and much overlapped by the external maxillipeds which completely close the mouth. Basal antenna-joint fixed.

Includes a single genus, namely

\* *Pirimela*, Leach, Milne Edwards, Hist. Nat. Crust. I. 423.

Subfamily III. *Thiinæ*. Carapace subcircular the regions not defined, antero-lateral borders entire or denticulate. Front entire, or cut into two lobes which may again be subdivided into two lobules. Buccal orifice moderately elongate, the external maxillipeds, which completely cover the mouth, encroach somewhat on the very short epistome. Basal antenna-joint fixed.

Constituent genera :—

1. *Thia*, Leach : Milne Edwards, Hist. Nat. Crust. II. 143.
2. \**Kraussia*, Dana.

Subfamily IV. *Atelecyclinæ*. Carapace subcircular, often a little longer than broad, the regions usually fairly or well defined, not much areolated, antero-lateral borders usually with teeth. Front usually cut into 3 (sometimes 2 or 4) teeth which are often prominent. Buccal orifice elongate, not completely covered by the external maxillipeds which are elongate—especially as to their merus—and overlap or completely conceal the sunken epistome. Basal antenna-joint either fixed or slightly movable.

Constituent genera :—

1. \**Atelecyclus*, Milne Edwards, Hist. Nat. Crust. II. 141.
2. *Erimacrus*, Benedict Proc. U. S. Nat. Mus. XV. 1892, p. 229 (= *Podacanthus*, Brandt, Bull. Phys. Math. Acad. Petersb. VII. 1849, p. 180).
3. \**Hypopeltarium*, Miers, Challenger Brachyura, p. 210 (= *Peltarion*, Lucas in Jacquinot's Voy. Astrolabe au Pol. Sud., Zool. III. Crust. p. 80).
4. *Pliosoma*, Stimpson, Ann. Lyc. Nat. Hist. New York, VII. 1862, p. 227.
5. \**Telmessus*, White Ann. Mag. Nat. Hist. XVII. 1846, p. 497 and Samarang Crust. p. 14 (= *Platycorystes*, Brandt, Bull. Phys. Math. Acad. Petersb. VII. 1848, p. 179 : = *Cheiragonus*, Latr.).
6. \**Trachycarcinus*, Faxon.
7. \**Trichopeltarium*, A. Milne Edwards.

Subfamily V. *Acanthocyclinæ*, carapace subcircular. Front ending in a triangular point. Epistome short sunken, completely concealed by the external maxillipeds which also completely cover the buccal orifice. Antennal flagella absent. For the single genus

*Acanthocyclus*, Milne Edwards and Lucas, Voy. Amer. Merid. Crust. p. 29.

[? Subfamily *Trichiinæ* for *Trichia* De Haan, Faun. Japon. Crust. p. 109, which may however be the type of a distinct family.]

In the foregoing lists the genera known to me by autopsy are marked with an asterisk and Indian genera are printed in Roman type. I have made no attempt to split the Subfamilies into "alliances" as I have not sufficient material at my disposal for such a purpose.

### Subfamily THIINÆ.

#### KRAUSSIA, Dana.

*Kraussia*, Dana, Silliman's Amer. Journ. Sci. and Arts. XIII. 1852, p. 120, and U. S. Expl. Exp. Crust. pt. I. p. 300.

Carapace not much broader than long, not concealing the first three abdominal terga even in the male, subcircular but with the antero-lateral borders much longer than the postero-lateral, and the latter rather strongly convergent and slightly concave: the regions not defined.

Front well separated from and prominent beyond the inner supra-orbital angles, almost horizontal, cut into two lobes which may, or may not, be again divided into two lobules.

The antennules fold alongside their basal joint, much nearer the longitudinal than the transverse.

The basal antenna-joint touches the front and occupies all the space between the antennulary pits and the orbit: the flagellum, which is short and slender, stands in the orbital hiatus.

Buccal cavern squarish, a little elongate: the external maxillipeds—of which the merus is not elongate—slightly overlap the epistome, which though short and sunken is well enough defined. No ridges on the palate to define the efferent branchial channels.

Chelipeds massive, short and stumpy with particularly stumpy fingers.

Legs short and stout, ending in blade-like dactyli.

The abdomen of the male consists of 5 segments, the 3rd-5th terga being fused.

Sternum narrow.

#### *Key to the Indian species of Kraussia.*

- I. Carapace somewhat broad, its frontal and antero-lateral borders conspicuously dentate: front bilobed ..... *K. integra*.
- II. Carapace somewhat elongate, its frontal and antero-lateral borders minutely denticulate: front four lobed ..... *K. nitida*.

#### 1. *Kraussia integra* (De Haan).

*Cancer (Xantho) integer*, De Haan, Faun. Japon. Crust. p. 66, pl. xviii. fig. 6.

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? *Kraussia rastripes*, F. Müller, Verh. Ges. Basel. VIII. 1886, pp. 475, 480, pl. iv. fig. 5.

Carapace about four-fifths as long as broad, little convex, smooth to the naked eye, but with fine transverse subsquamiform pitting under the lens.

Frontal, orbital, and antero-lateral borders elegantly uniformly and conspicuously denticulate, and fringed (except the infra-orbital border) with long stiff silky hairs. Similar hairs fringe the legs, the arm and the inner angle of the wrist, and the anterior edge of the external maxillipeds.

Front cut into two broad lobes, each of which shows a very slight tendency to be divided into two lobules. Dorsal surface of roof of orbit without any marked grooves.

Chelipeds about as long as the carapace, the hand the most massive joint: the fingers are very short and stumpy, the dactylus closing very obliquely on a short straight immobile finger that is little better than a tubercle. On the outer surface of the hand is some fine subsquamiform sculpture: on the upper surface of the finger are some bluntly-dentiform granules in rows, and there are some granules near the inner angle of the wrist.

Legs stoutish, slightly shorter and much less massive than the chelipeds: the dorsad surfaces of the propodites and dactyli—as of the carpopodites also in their distal end—are abundantly and elegantly denticulate. All the dactyli are blade-like.

In the Indian Museum are two specimens from the Andamans.

## 2. *Kraussia nitida*, Stimpson.

*Kraussia nitida*, Stimpson. Proc. Ac. Nat. Sci. Philad. 1858, p. 40: Miers, Zool. H. M. S. Alert, pp. 184, 235: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 379, pl. xxxviii. fig. 9.

Differs from *K. integra* in the following particulars:—

(1) The length of the carapace is more than four-fifths the breadth, and the carapace is more convex from side to side:

(2) The frontal, orbital, and antero-lateral borders are minutely, instead of conspicuously, denticulate, and the hairs that fringe them are more scanty:

(3) The front is more prominent and is cut into 2 lobes each of which is deeply cut into 2 lobules:

(4) There are two distinct though fine grooves in the roof of the orbit, one of which passes far back on to the carapace and imitates a cervical groove:

(5) The chelipeds are quite smooth except for a few granules at the inner angle of the wrist:

(6) The dactyli of the legs are more broadly blade-like, and the last three joints of the legs are without any denticulations or have only a trace of them on the propodite.

In the Indian Museum are two specimens one from the Andamans, 20 fms., the other from off the Ganjam coast, 9 fms.

### Subfamily ATELECYCLINÆ.

#### TEICHOPELTARIUM, A. M. Edw.

*Trichopeltarium*, A. Milne Edwards, Bull. Mus. Comp. Zool. VIII. 1880, p. 19.

Carapace oval or subcircular, as long as or longer than broad, strongly convex, its borders spinate.

Front prominent, not very broad, cut into 3 sharp teeth or spines.

Orbits shallow, defined by spines with considerable gaps between them: inner suborbital angle spiniform. Eye-stalks slender.

The antennules fold longitudinally. The basal antenna-joint is short and subcylindrical; the flagellum coarse, stout, setaceous.

Epistome of fair length, fairly well defined, sunken, and overlapped by the external maxillipeds. Buccal orifice square-cut, longer than broad, not completely covered by the external maxillipeds, which are somewhat elongate and have the merus a little narrower than the ischium. Efferent branchial regions defined by ridges which do not reach up to the epistome.

Chelipeds massive and unequal in the male.

Legs stout, hairy, more or less spiny, ending in stout styliform dactyli: they are longer and are not much less massive than the female chelipeds.

#### 3. ? *Trichopeltarium ovale*, Anderson.

? *Trichopeltarium ovale*, Anderson, J.A.S.B. Vol. LXV. pt. 2. 1896, p. 103; Ill. Zool. Investigator, Crust. pl. xxv. figs. 4-4a: Alcock, Investigator Deep Sea Brachyura, p. 57.

Carapace egg-shaped, covered with spines which on its dorsal surface are bifid or multifid, and with short stiff but not very conspicuous hairs. The regions are well defined by coarse grooves: the gastric is divided into three sub-regions, and the cardiac into two, and on either side of the cardiac region a semilunar area is marked off on the branchial region.

The front, which is cut into three prongs, is about one-seventh the greatest breadth of the carapace, and is separated from the orbit by a deep notch.

The orbits are very incomplete: they are formed by a prominent

preocular tooth (parallel with, but less prominent than, the front), below which at the inner suborbital angle is an almost equally prominent coarse spine: there are also two other teeth—one at the external orbital angle, and the other between this and the preocular tooth—hardly distinguishable from the ordinary spines of the carapace. The eyestalks which are slender, tapering, and of good length, do not nearly fill the shallow orbital cavity.

The antennules fold longitudinally in fossæ, beneath the front: their basal joint is large. The antennæ arise almost in the same transverse line with the antennules: their basal joint forms a large part of the floor of the orbit.

The epistome is sunk below (*i.e.* is really arched much above) the plane of the external maxillipeds. The efferent branchial channels are defined by an incomplete ridge, and are patulous. The external maxillipeds are slender, and leave the mandibles exposed between them: the merus is obovate and narrower than the ischium, the palp is coarse.

The chelipeds and legs are spiny and bristly, the spines in the case of the legs being well pronounced only on the dorsal surface of the meropodites.

In the female the chelipeds are shorter and not much stouter than the legs and are about as long as the carapace.

The legs are little unequal in length, the first pair which are slightly the longest being hardly half as long again as the carapace: they all end in long, stout, cylindrical, sharply styliform dactyli.

The abdomen of the female is seven-jointed and covered with coarse hairs: the first two segments are broader, and on them the spines decrease in size to the seventh segment which is smooth.

The colour in life is recorded by Dr. A. R. Anderson as pale bluish yellow.

Length of carapace and rostrum 64 millim., breadth 55.5 millim., depth 35 millim.

A single female from off the west coast of Ceylon 180–217 fms., on a foul bottom of broken coral.

#### TRACHYCARCINUS, Faxon.

*Trachycarcinus*, Faxon, Bull. Mus. Comp. Zool. XXIV. 1893, p. 156, and Mem. Mus. Comp. Zool. XVIII. 1895, p. 25; Alcock, Investigator Deep Sea Brachyura, p. 58.

“Carapace pentagonal, moderately convex, lateral margins long, nearly straight, toothed. Front narrow, produced, three-toothed. Orbits large with forward aspect, imperfect, with two hiatuses above



one below, and one at the inner angle; lower wall formed chiefly by the carapace. Anterior margin of buccal cavity not distinctly defined, epistome short, ridges of the endostome developed. Sternum long and rather narrow. Abdomen of male narrow and five-jointed, the third, fourth, and fifth segments consolidated. Eye-stalks very small, retractile within the orbits. Antennules longitudinally folded. The antennæ lie in the inner hiatus of the orbit; their basal segment is but slightly enlarged, not filling the hiatus at the inner angle of the orbit nor attaining to the front, subcylindrical, unarmed, imperfectly fused with the carapace; the second segment is longer and slenderer than the first, the third segment about equal to the second in length, but slenderer; all these segments are furnished with long and coarse setæ; the whole antenna is less than one-half as long as the carapace. The ischium of the outer maxillipeds is produced at its antero-internal angle; the merus of the same appendages is rounded at the antero-external angle, obliquely truncated but not emarginated at the antero-internal angle, where it articulates with the following segment. Legs of moderate length. Right and left chelipeds very unequally developed in the male. Dactyli of ambulatory legs styliform, straight slender, longer than the penultimate segments."

#### 4. *Trachycarcinus glaucus*, Alcock and Anderson,

*Trachycarcinus glaucus*, Alcock and Anderson, Ann. Mag. Nat. Hist. Jan. 1899, p. 8: Alcock, Investigator Deep Sea Brachyura, p. 59, pl. ii. fig. 2.

Carapace irregularly pentagonal, its surface coated with short stiff club-shaped hairs; the regions well defined, rather tumid, much subdivided into tumid lobules, of which the convexities are capped by clusters of large conical granules and the general surface also is studded especially in the young with similar granules.

Front narrow, horizontal, prominent, deeply cleft into three prongs of nearly equal size.

Antero-lateral borders half as long again as the postero-lateral, armed with three stout pinnulate spines not including the outer orbital angle: postero-lateral borders entire, posterior border finely beaded.

Upper orbital wall deeply cleft into three pinnulate teeth, lower orbital border deeply concave, its inner angle strongly spiniform. Eye-stalks slender, rather long: the eyes, which are more ventral than terminal, are dull and faintly pigmented (as in many species of *Munidopsis*), and are non-faceted.

Antennal flagella short, extremely slender, not hairy.

Chelipeds remarkably unequal in the male, equal in the female.

The smaller cheliped of the male and both chelipeds of the female

are about as long as the carapace, and are coated, almost to the finger-tips, with stiff club-shaped hairs, which are short except along the upper border of the wrist and hand and of the basal part of the finger, where they are long: beneath the hairs are some scattered granules, and along the upper border of the arm, wrist and hand are some denticles: the inner angle of the wrist is strongly spiniform, and the far end of the upper border of the hand is dentiform.

The larger cheliped of the male is about twice the length of the carapace, about half its length being formed by the hand and fingers: the greatest breadth of the hand is about half the length of the carapace. It is almost smooth, the upper border of the arm and hand, and the inner border and upper and outer surfaces of the wrist, alone being furnished with denticles and hairs: the inner angle of the wrist is spiniform.

The legs are covered with short stiff club-shaped hairs which are rather more thick-set on the anterior borders and on the dactyli than elsewhere. The second and third pair, which are rather longer than the first and last pair are somewhat less than  $1\frac{2}{3}$  times the length of the carapace. All the dactyli end in a little claw.

The abdomen of the male consists of seven distinct segments, but the 3rd, 4th and 5th move together.

In life the animal is covered with a coat of mud held together by the hairs above described, the only bare parts being the hand and fingers and part of the arm of the larger cheliped of the male.

The colours in life are described by Dr. A. R. Anderson, as "white with a bluish tinge, eyes with a slight reddish opalescence." In spirit the bluish tinge is fainter, the eyes are a pale milky yellow-ochre, and the large hand is ivory-white.

The dimensions of the largest male are as follows:—

Length of carapace ...	...	...	...	18.5 millim.
Breadth of carapace ...	...	...	...	14.5 "
Combined length of hand and fingers, along lower border...				14.75 "
Combined length of basal joints, arm and wrist, along upper border	...	...	...	15 "

Fifteen specimens were dredged off the Travancore coast at a depth of 430 fms. The bottom consisted chiefly of coral (living and dead).

Several of the specimens were egg-laden females. The eggs are comparatively few in number and are large, their diameter being about 1.3 millim.

This species is very like *Trachycarcinus corallinus*, Faxon, which was dredged by the "Albatross" off Panama and the Pacific coast of Mexico, at depths of 546–695 fathoms.

It differs from that species in the following particulars :—

The carapace is more granular, and its lobules are capped by blunt conical spinules, *not* smooth tubercles ; and its posterior border is finely and irregularly beaded, *not* dentate.

The front is deeply cut into 3 spines or prongs of almost equal size, *not* into 3 teeth of which the middle one is larger than the others.

The eyes, though very pale, are distinctly pigmented, *not* devoid of pigment.

The inner angle of the wrist of the smaller cheliped is very strongly spiniform, *not* unarmed.

As Mr. Faxon says, *Trachycarcinus* is very closely related to *Trichopeltarium* ; in fact, the relation is so close as to make the separation of the two forms almost doubtful.

### Family CORYSTIDÆ.

*Corystiens* (part) Milne Edwards, Hist. Nat. Crust. II. 139.

*Corystoidea-Corystidæ* (part) Dana, U. S. Expl. Exp. Crust. pt. I, p. 296.

*Corystoidea* (part) Miers, Challenger Brachyura, p. 210.

*Majoidea-Corystoidea*, Ortmann, Zool. Jahrb., Syst., VII. 1893, pp. 26, 28.

*Oxyrhyncha-Corystidæ*, Ortmann, in Bronn's Thier Reich. V. ii. (Arthropoda), p. 1166.

Carapace much longer than broad, oval, convex from side to side, the regions sometimes fairly well defined, sometimes not, never areolated.

Front fairly prominent, cut into 2 or 3 teeth.

The antennules are small and fold longitudinally.

The antennæ, when present and perfect, usually have the flagellum long coarse and setaceous.

There is no epistome, and the external maxillipeds, which are elongate and sometimes have a slight pediform cast, extend almost up to the antennules. The buccal orifice is elongate and is square cut with the anterior angles rounded and slightly convergent.

Legs either all gressorial or the last pair modified for swimming.

The following genera compose this family :—

I. *Genera in which the legs are not natatory* :—

1. *Bellia*, Milne Edwards, Ann. Sci. Nat. (3) IX. 1848, p. 192.

2. \**Corystes*, Latr., Milne Edwards, Hist. Nat. Crust. II. 146.

3. *Corystoides*, Edwards and Lucas, Voy. Amer. Merid., Crust. p. 31.

4. *Gomezia*, Gray, Zool. Miscell. p. 39, Miers, Challenger Brachyura, p. 212 (= *Oeidia*, De Haan, Faun. Japon. Crust. p. 15).

5. *Podocatactes*, Ortmann, Zool. Jahrb., Syst., VII. 1893, p. 29.

II. *Genera in which the legs are more or less natatory* :—

6. \* *Nautilocorystes*, Milne Edwards, Hist. Nat. Crust. II. 149 (= *Dicera*, De Haan, Faun. Japon. Crust. p. 14).

7. *Pseudocorystes*, Milne Edwards, Hist. Nat. Crust. II. 149.

## NAUTILOCORYSTES, Edw.

*Nautilocorystes*, Milne Edwards, Hist. Nat. Crust. II. 149.

*Dicera*, De Haan, Faun. Japon. Crust. p. 14.

Carapace elongate-obovate, slightly convex from side to side, smooth without distinction of regions, the antero-lateral borders longer than the postero-lateral and armed with five teeth.

Front moderately broad, horizontal, moderately prominent, cut into 2 or 3 teeth.

The antennules fold longitudinally. Antennæ coarse, setaceous, the basal joint occupying the orbital hiatus, the flagellum about half as long as the carapace.

Buccal orifice elongate subquadrate, not defined anteriorly: external maxillipeds elongate, the merus narrower than the ischium and bearing the flagellum at its summit. Even in repose the external maxillipeds partly conceal the antennules.

Chelipeds short, much more massive than the legs.

Legs compressed, the first 3 pair end in a lanceolate dactylus the last pair end in a blade-like swimming dactylus.

1. *Nautilocorystes investigatoris*, n. sp.

Carapace elongate-obovate covered with a multitude of fine brown longitudinal lines, smooth.

Front about a third the greatest breadth of the carapace, slightly prominent beyond the orbits, cut into 3 teeth.

Antero-lateral borders cut into 5 irregularly disposed teeth including the outer orbital angle.

Inner angle of lower border of orbit acutely dentiform, prominent beyond the level of the front.

Chelipeds equal, about as long as the carapace: a spine at the inner angle of the wrist and two spines on the upper surface of the hand—one being in front of the apex of the wrist-joint the other behind the finger-joint.

Legs compressed, much slenderer but not much shorter than the chelipeds, hairy: the dactylus of the last pair is broadly blade-shaped as in *N. ocellatus*.

In the Indian Museum are 2 females—one with eggs—from the Vizagapatam coast 15–17 fms. The carapace is 6.25 millim. long and 5.5 millim. broad.

This species differs from *N. ocellatus* in the following particulars:—the front is 3-spined, the inner suborbital angle is extremely prominent and spiniform, there are two spines on the hand, and the colour-markings are fine longitudinal lines.

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# JOURNAL

OF THE

## ASIATIC SOCIETY OF BENGAL.



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No. II.—1899.  
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*Notes on the Fauna of the Gilgit District.*—By CAPT. A. H. McMAHON,  
F.Z.S., F.G.S., F.R.G.S., C.S.I., C.I.E.

[Recd. 20th Feb. ; Read March 1st, 1899.]

By the term Gilgit I mean the country included within the geographical limits of the present Gilgit Political agency. It comprises besides Gilgit proper the states of Hunza, Nagar and Yasin; the Astor and tributary valleys; Chilas; and the Upper Indus valley with its tributary valleys from Haramosh as far south as Hodur. Briefly, I refer to the country bounded on the North by Wakhan and the Pamirs; on the East by the Mustagh range and Baltistan; on the South by the Burzil, Kamri and Bahusar Passes leading into Kashmir and Hazara; on the West by the Shandur Pass and the independent territory of Tanjir and Darel. Comprising as this tract does a mountainous country of lofty ranges with several peaks over 25,000 feet and countless others between 20,000 and 25,000 feet in height, it may justly lay claim to being one of the most lofty tracts of country on the surface of our globe.

Any information therefore which we may obtain and collect regarding the fauna of this country cannot fail to be of interest to the zoological world. It is on this account that I venture to place on record the results of such observations as I have been able to make during my stay (in 1897-98) in the Gilgit Agency. Such as they are they may help to corroborate the results of the zoological researches of Biddulph, Scully, and Alcock in portions of the same tract, and perhaps in a few instances also to add to them.

With but few exceptions the fauna of the country may be termed nomadic. The reptiles, and a few mammals only such as the marmots, the rats, the hamsters and voles can be said to have any permanent residence throughout the year. Even the rat leaves his summer country house in the fields for his winter one in the shelter of the roofs and walls of houses on the approach of the cold season. The other mammals are purely nomadic. As the heat in the lower valleys increases they betake themselves higher and higher into the upper valleys, either following the lower fringe of snow line, as in the case of markhor, (*Capra falconeri*), Shapu (*Ovis vignei*), hares, lynxes, wolves, foxes, wild dogs, bears and martens; or keeping above the snow line nearly all the year round as in the case of ibex (*Capra Sibirica*) and snow leopards. The fishes too range widely throughout the year, ascending in the summer to the very feet of the glaciers and retreating in the winter down to the warmer waters of the Indus Valley.

The birds, as in most other countries, travel widely; the majority are only winter visitors; some pause merely for a short rest on their journeys to and from India from Central Asia and other northern climes; others stay the whole winter. Even those which one might perhaps call permanent Gilgit residents, such as the Lämmergeier (*Gypaetus barbatus*) and certain eagles and hawks, abandon the lower valleys and resort to the upper ones for the summer.

One cannot fail to be struck by the absence of animal life in the lower valleys in the summer. The carcasses of animals which in most other countries, summer or winter, would soon be picked clean by beasts and birds, lie untouched throughout the entire summer. With the first approach of cold, down come the wolves, foxes, dogs, vultures and all the world of nature's scavengers, and the carcase which has lain so long untouched disappears as if by magic; even the bare bones disappear, carried off by the majestic Lämmergeier, which swoops down on them the moment the more vulgar crowd have left them. Unlike the summer, no sooner does a beast die or fall a victim to the sportman's bullet in the winter than down come the vultures on to it, and if of small size it may be carried off before his very eyes before the sportsmen can get up to it. Many a dispute one sees between the first arrivals. I once saw a lordly Griffon Vulture (*Gyps himalayanus*) alight on the carcase of a cow, followed by some crows, the common Jungle Crow (*Corvus macrorhynchus*). One would have thought the meal sufficient for all, but the crows evidently did not think so, for they at once set upon the luckless vulture and turned him out. It only took three crows to eject him, and not content with removing him, they followed him in the air taking pecks at him from behind to accelerate his move-



ments. Two returned, but the third remained in attendance, and whenever the Griffon showed signs of turning the crow renewed his attacks, and this went on until the strange couple were lost to sight.

#### *Mammalia.*

Regarding mammals I can give little information not already collected by former observers; I can however add to the fauna already recorded two more animals hitherto unknown to be in the Gilgit District, *i.e.* (1) the Bharal (*Ovis nahura*). I first heard of a pair of horns being picked up on the Mintaka Pass leading into the Pamirs. Subsequently I obtained two more horns and one good specimen of the entire animal. They are to be found in small numbers only in Gughal (the upper Hunza valley) near Passu. I am told they are in large numbers in Raskam on the north of the Mustagh range. (2) The ermine (*Putorius Erminea*) not hitherto reported within the Gilgit district. I obtained specimens which came from the forest regions in the upper valleys of Chilas.

While in the Hunza and Nagar countries I was much struck with the large numbers of the Beech Marten (*Mustela foina*) which descend in winter into the Hunza Nagar valley, to altitudes of 6,000 ft. or so and take up their abode in the walls of the villages and houses. I found that a small reward would obtain me any quantity in these villages, and in fact I soon had to prohibit any more being brought to me.

Before leaving the mammals, I would invite the attention of zoologists to the question whether the Tibet Marmot (*Arctomys himalayanus*), the smaller Himalayan Marmot (*Arctomys hodgsoni*), and Longtailed Marmot (*Arctomys caudatus*) are not all one and the same species, the tail differing in length according to age. I cannot help thinking that they are one species. I have just sent home to the Zoological Society of London a live specimen of a young Marmot caught in the Burzil Pass, the habitat of the *Arctomys caudatus*. At present by tail measurement he is an *Arctomys himalayanus*; I fully expect he will grow into an *Arctomys caudatus*, or failing that by reason of confinement, remain at the intermediate stage of *Arctomys hodgsoni*.

#### *Reptilia and Batrachia.*

These are represented by but few kinds in this country. Those that exist there have to put up with a long period of hibernation amounting in the case of some to about eight months out of the twelve.

The Himalayan Viper (*Halys himalayanus*) is very common in wooded tracts. I was struck with the number of cobras (*Naia tripu-*

dians) which exist in Gilgit itself and the Indus Valley. I obtained many specimens and heard of others. These are all of the black variety. I have never heard however of any one ever having been bitten by cobras in the Gilgit District.

From what I could hear the *Echis carinata* is common in the Indus Valley in the neighbourhood of Chilas, but I never obtained a specimen.

The following lizards abound in the lower portion of the Astor and in the Indus Valleys, but are only to be seen in the summer months. (1) *Agama tuberculata*—noticeable for its deep jet black colouring on the head and back. (2) *Agama himalayana*. This in life has a pretty pale pink colouring over the throat.

The little *Mabuia* is very common in the upper Astor and other neighbouring valleys. I noticed no other lizards in the district.

#### *Birds.*

The winter visitors are very numerous, and as mentioned before the majority merely pass through the country on their way to and from India; others remain throughout the winter. I have naturally been unable to make anything that would in the least approach to being an exhaustive list of the birds to be found in the district. I will content myself with giving, with a few remarks when necessary, a list of those birds only of which I have brought specimens for the Indian Museum.

*Gypaetus barbatus*. Very common in the winter.

*Gyps himalayensis*.

*Hieraetus fasciatus*. Differs slightly from type by having 3rd quill slightly the longest.

*Buteo ferox*.

*Circus aeruginosus*.

*Buteo desertorum*. This has been seen to catch uninjured mallard; one also seized and carried off a woodcock which had been shot.

*Circus cyaneus*.

*Falco barbarus*. I only obtained two specimens, and I do not think they are common in the Gilgit district. One of the above was shot after seizing a pigeon and biting off its head in mid air.

*Accipiter nisus*.

*Falco subbuteo*. One specimen was caught by the hand sitting in a bush.

*Tinnunculus alaudarius*. Very common.

*Gecinus squamatus*. Very numerous. On one occasion when out hare shooting through low scrub, I put up large numbers. They seem to feed in the patches of highish grass growing at the foot of small trees, and their habits in this particular seem greatly to resemble the woodcock's.

*Erismatura leucocephala*.

*Merganser castor*.

*Aegialitis dubia*.

*Porzana parva*.

*Corvus macrorhynchus*. Very common.

*Corvus cornix*. Fairly common.

*Graculus eremita*. This and the yellow-billed chough (*Pyrrhocorax alpinus*), are very common.

*Pica rustica*. Very common; to be seen in large flocks everywhere in the district.

*Merula maxima*. This specimen appears to agree closely with the so-called species *Merula maxima*, but the Indian Museum specimens show so much gradation between this and the European variety *M. merula* that there would seem good grounds for supposing both to be one and the same species, especially as exactly the same difference in size exists between the European and Himalayan varieties of Missel Thrush. (*Turdus viscivorus*).

*Trochalopteryx lineatum*. Very common.

*Chimarrornis leucocephalus*. Generally seen making short flights from boulder to boulder in the beds of mountain streams. It constantly moves its tail vertically upwards in sharp jerks, but does so somewhat slower than a water-wagtail.

*Ruticilla erythrogaster*.

*Carduelis caniceps*. Very common in winter.

*Tichodroma muraria*.

*Galerita cristata*. Very common.

*Emberiza stracheyi*.

Among rare visitors I should note that two specimens of the Mute swan (*Cygnus olor*) were obtained in the winter of 1897 at Chilas.

I am much indebted to Major A. Alcock, I.M.S. and Mr. F. Finn, of the Indian Museum for the kind assistance given me in verifying and correcting the classification of my specimens.

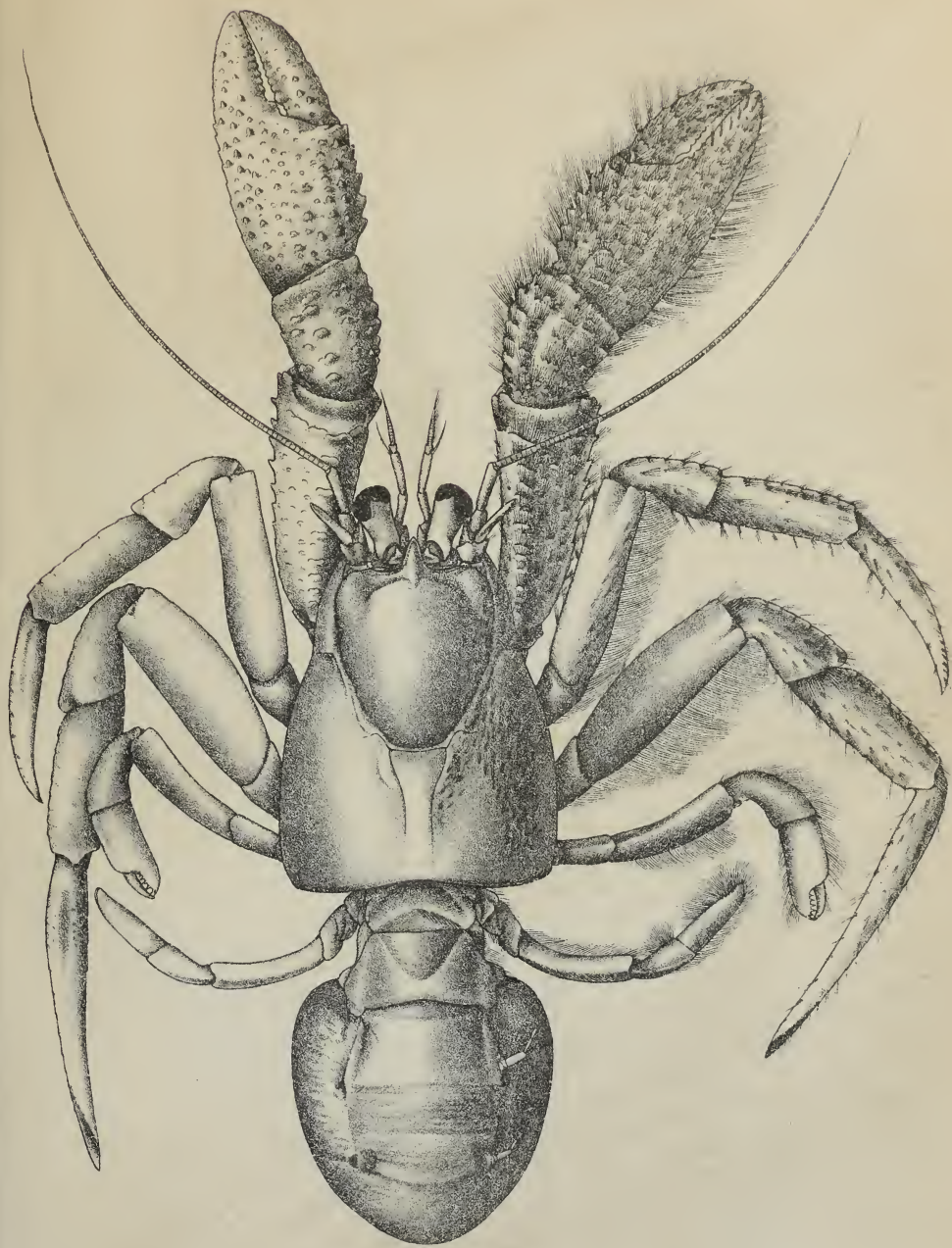
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*Note on Hume's Bush-quail (Microperdix manipurensis).*—By CAPTAIN  
H. S. WOOD, I.M.S. *Communicated by the Natural History Secretary.*

[Received May 26th; Read June 7th, 1899.]

During my seven years of residence in Manipur I must have shot over 80 birds of this species there. It is by no means such a rare bird as Hume thinks. For my part I thought it was one of the ordinary quails until I saw a description of the bird in Mr. Oates' last book, and I sent a skin to the Indian Museum. I also gave Mr. Turner of Cooper's Hill a few specimens which he had stuffed by a trained taxidermist. I was surprised to find that there were so few specimens in the Museums and regret that I did not keep the skins of a few more. The Manipuri name for the bird is *Lanz-Soibol*, literally, the Trap Quail, as the Nagas snare this bird in nooses after the jungle fires. These birds breed in Manipur; the egg as in all the quail tribe is very large in proportion to the size of the bird, and is of a greenish colour blotched with patches of brown and black. The nest is merely a hole scraped in the ground and there is no particular nest formation. The eggs in my possession unfortunately got broken in transit or else they would have been valuable. I have only seen these birds at certain times of the year, during the rains and before the jungle fires. They keep to very dense jungle composed entirely of sun and elephant grass, and as they are great runners they are very hard to see. It is only after the jungle fires from February to April that one sees these birds in any quantity. They are always in coveys varying in number from 6 to 8. They are great runners and at first look like black rats running along the ground and are hard to see in the burnt grass the colour of which they so resemble. They will rise readily to dogs and after a short flight drop again into any patch of unburnt grass. I found them in greatest abundance in jungles adjoining nullahs in which there was a certain amount of water,—in fact they are always found close to water. Their call is a low whistle, soft in character, and this is heard chiefly in the evening after one has been firing the jungle, apparently a call for the assembly. This is a very handsome quail when closely examined, the breast markings being particularly handsome. I have never seen these birds in the low Hills. They are associates of the common francolin and where one is found the other is also in the locality. When running they keep very close to each other; in this way I have bagged as many as four in a single shot. Hume's description as to details of colouring is so accurate that I have nothing to add.

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S. C. Mondul, del. et. lith.

CHLAENOPAGURUS ANDERSONI 3. x 14.



*Natural History Notes from the Royal Indian Marine Survey Ship 'Investigator,' Commander T. H. Heming, R. N., commanding.—* Series III. No. 3. *On some Notable New and Rare Species of Crustacea.* By A. ALCOCK, M.B., C.M.Z.S., Superintendent of the Indian Museum.

(Plate I.)

[Received July 28th; Read August 2nd, 1899.]

CONTENTS :—

- § 1. On a new Hermit-crab exhibiting perfect commensalism with a Sea-anemone.
- § 2. On a new species of Crab of the genus *Domecia*.
- § 3. On a new species of *Latreillia*, and on the occurrence of *Latreilopsis* in the Andaman Sea.

Among the collections recently sent to the Indian Museum by Captain A. R. Anderson, I. M. S., lately Surgeon-Naturalist to the Marine Survey, are a large number of specimens of a new form of Hermit-crab, a single specimen of a new species of the curious little Coral-crab *Domecia*, a new species of *Latreillia*, and specimens of *Latreilopsis bispinosa*.

§ 1. *On a new Hermit-crab exhibiting adaptive commensalism with a Sea-anemone.*

The Hermit-crab is noteworthy (1) in having for its refuge, not the usual mollusk-shell, but a sheet or blanket formed by the coenosarc of a colony of Sea-anemones, (2) in being—as far as the male is concerned—symmetrical, and (3) in having the appendages of the 3rd–5th somites of the male and of the 2nd–5th segments of the female present on the right or left side indifferently.

Symmetry in Hermit-crabs is, of course, nothing new: *Pomatocheles* is perfectly symmetrical, as also are *Chiroplatæa* and *Pylocheles* (if these two genera are really distinct from *Pomatocheles*): also symmetrical are *Glaucothoe*, *Mixtopagurus*, *Xylopagurus*, the male of *Gryllopagurus*, some species of *Cancellus*, and lastly, though in a different way, *Ostraconotus*, *Tylaspis*, and *Porcellanopagurus*.

[In our new form the male is symmetrical somewhat in the same way as in the three genera last named; that is to say, the abdomen is a soft bag without any lateral twist.]

Nor is there anything unusual in the fact that the protective covering of the abdomen is not a mollusk shell; for in these seas alone there are several well-known instances of Hermit-crabs making use of other convenient receptacles. For instance, *Pylocheles Miersi* is found impacted in hollow twigs of sunken drift wood; *Troglopagurus*, according to Messrs. Thurston and Henderson, lives in small cavities

in coral; and I have myself seen a large *Coenobita*, on the island of Minnikoy, holding the empty shell of a small coco-nut over its abdomen. Again, in other parts of the world, *Gryllopagurus* lives in burrows of its own construction; *Pylocheles Agassizii* was found concealed in a cavity in a piece of sandstone, and another specimen was taken from the gastral chamber of a siliceous sponge; *Xylopagurus rectus*, like our *Pylocheles Miersi*, was discovered in a lodging in drift wood; *Ostraconotus* and *Tylaspis* are both believed to have some special protective shield, other than a shell: and *Porcellanopagurus* lives free among sea-weed.

Again, the association of our new form of Hermit-crab with a sea-anemone is nothing strange: indeed, commensalism between crustacea and sea-anemones is one of the most familiar facts of zoology, and a large number of instances of it have been described. In most cases, however, the facts seem to be that an individual of a definite species of crab and an individual of a definite species of sea-anemone have both at once taken possession of the same mollusk-shell, which they continue to inhabit for their mutual advantage,—the crab acting as locomotive to the sea-anemone, and the sea-anemone in return acting as a defence and warning-post, and possibly also as a decoy, for the benefit of the crab.

But though the mutual advantage of the association is plain enough, the absolute and essential necessity of it is not so plainly seen, and it is reasonable to imagine that when in the course of growth the Hermit-crab has to seek a new and larger shell, the partnership with the sea-anemone can be dissolved by simple withdrawal, without dangerously affecting the life of either individual—at any rate until such time as each can find a new partner of suitable size. In other words, there is no adaptation of either animal to the other, and each seems capable of existing apart from the other.

In the present case there is no shell to act as introduction to and bond between the two animals; and the sea-anemone, which is a colonial form with a spreading coenosarc, merely forms a sheet, which the crab simply tucks under its telson by one end and pulls over its back by the other end—the polyps seeming to have no power of adhesion and to depend on the crab for a fast hold.

The nearest approach to this state of affairs is found in *Parapagurus pilosimanus*, which, when full-grown, lives in a cavity hollowed out of the coenosarc of a colony of a large species of *Epizoanthus*. But in this case the individual hermit-crab and sea-anemone start their partnership with an empty mollusk-shell, which in course of time, as the occupants increase in size, becomes absorbed, so that, at last, the crab is entirely dependent on the polyp-colony for the protection of its soft abdomen.



But even here, though the association seems to have become much more intimate and permanent, there seems to be no essential adaptation of either animal to the other, nor does it appear to be beyond the bounds of possibility that each might exist—though its existence might not be so complete and secure—apart from the other.

In the case of the new form of Hermit-crab, now to be described, there is no evidence of the intervention of a shell, or other adventitious support, at any stage. Captain Anderson dredged 205 specimens, of both sexes and all ages, and in every observable instance the parent polyp of the protective colony appears to have settled on the hinder end of the abdomen of the crab and to have gradually spread by budding as the latter increased in size; so that the intimate and immediate connexion between the two animals appears to be, from the first, a necessary one.

In other words, the peculiar interest of the case is that the two animals seem to have become directly adapted to one another, and to be incapable of a separate and independent existence.

For the Hermit-crab I propose the generic name *Chlænopagurus*, from *χλᾶνα* a large square mantle worn over the chiton, in Homeric times, as a defence against the weather. According to Liddell and Scott the chlæna was of a purple colour, which also corresponds with the colour of the polypts that form the Hermit-crab's mantle.

For the polypts I am not at present in a position to propose a name. They belong to the family *Zoanthidæ*, but not, as far as I can make out, to any known genus. The colony consists of a copious lamellar coenosarc in which the polypts, which are small and have not very numerous tentacles, are deeply embedded: the coenosarc is perfectly soft, fleshy, and flexible, without any incrustation or deposit.

*CHLÆNOPAGURUS, gen. nov.*

Carapace membranous, except in the cardiac region and the region enclosed by the cervical groove, which are perfectly calcified. Rostrum prominent.

Abdomen a soft membranous obscurely-segmented bag; symmetrical in the male, although the appendages of the 3rd, 4th and 5th somites are developed on one side only; asymmetrical in the female, owing to the presence, on one side, of a large fleshy leaf-like appendage that forms a brood-pouch.

Telson and the appendages on either side of it quite symmetrical.

Eye-stalks stout, of good length: eyes large, reniform: ophthalmic scales acute.

Antennules of moderate length. Antennal acicle long and slender antennal flagellum long.

Mandibles with a two-jointed palp. Exopodite of first maxillæ with a small curved non-segmented flagellum. External maxillipeds of the usual pediform shape.

Chelipeds equal; massive in both sexes, but more so in the male.

Legs stout, compressed: the first two pairs are about as long as or a little longer than the chelipeds, and end in long stout dactyli: the last two pairs are reduced in length and are chelate, the chelæ of the penultimate pair being particularly perfect.

In the male the first two pairs of abdominal appendages are present and are quite symmetrical: they are uniramous appendages modified for purposes of reproduction. The appendages of the next three somites (3rd-5th) are present on one side only—right or left: they are minute, or rudimentary and, uniramous.

In the female the appendages of the first abdominal somite form a small symmetrical uniramous pair. Those of the next four somites (2nd-5th) are present on one side only—right or left: the first three of them are slender biramous appendages, of good size, for carrying the eggs, and are contained within a capacious cup-like brood-pouch formed by a membranous lobe that springs from one side of the fifth somite: the fourth of them is a tiny biramous appendage and is not enclosed in the brood-pouch.

In both sexes the appendages of the sixth somite are symmetrical biramous swimmerets, placed symmetrically on either side of the telson: their rami are slender and falciform.

The branchial formula is as follows:—

Somites and their appendages.	Podo-branchiæ.	Arthrobranchiæ.		Pleuro-branchiæ.	Total.
		Anterior.	Posterior.		
IX. ...	1r. ...	1	1	0	= 2 + 1r.
X. ...	0 ...	1	1	0	= 2
XI. ...	0 ...	1	1	1	= 3
XII. ...	0 ...	1	1	1	= 3
XIII. ...	0 ...	1	1	1	= 3
XIV. ...	0 ...	0	0	0	= 0
	—	—	—	—	—
	1r.	5	5	3	13 + 1r.

[N.B.—The rudimentary podobranch (?) of the external maxillipeds is a small lobe of the anterior arthrobranch of the same appendages.]

Each gill consists of two series of broad leaflets. The leaflets, however, are not quite simple, since each one carries, near the tip, a pair of slender filaments large enough to be seen with the naked eye.

The single species known does not inhabit a shell, but lives

under a blanket formed by the perfectly soft coenosarc of a colony of Actiniarian polyps of a genus near *Zoanthus* or, more probably, *Mamilifera*.

*Chlaenopagurus Andersoni*, n. sp. (Plate I.)

The cervical groove is deep-cut, and the portion of the carapace that is included within it is strongly calcified. The triangular cardiac region is also fairly well calcified, especially in its anterior part. But all the rest of the carapace, except here and there along the outer edge of the cervical groove, is quite soft and membranous. The hepatic region is marked off from the branchial region by a transverse furrow, and a longitudinal furrow separates the hepatic from the pterygostomian region.

The front, which is carinated dorsally and deflexed at tip, projects well between the eye-stalks.

The eyes are large and reniform and are borne on stout stalks, which are about quarter the length of the carapace measured in the middle line.

The first two joints of the antennular peduncle are together slightly longer than the eyestalk, the first joint being flattened and somewhat dilated dorsally: the third joint and the flagellum combined are not half again as long as the first two joints.

The antennal peduncle is about the same length as that of the antennules: the acicle is about as long as the eye-stalk: the flagellum is about twice the length of the carapace.

The chelipeds are massive, quite equal, and about as long as the entire body with the abdomen in the natural position: not much more than a third of their length is formed by the arm. They are more or less covered with long, stiff, golden yellow bristles, which are specially thick-set on the under surface of the arm and the outer surface of the wrist and hand: these bristles do not hide the rather coarse squamiform tubercles from which they spring. There are some coarsish spines along the inner border of the ischium, both the lower borders of the arm, and on a good part of the outer surface of the wrist and hand.

The legs are stout and compressed, and their borders—and in the case of the last three joints of the first two pairs, a considerable part of the surface also—are more or less covered with the same stiff yellow bristles that grow on the chelipeds. The first pair of legs are of equal length with the chelipeds. The second pair are a little longer, and a third of their length is formed by the long sabre-shaped dactylus. The third pair do not reach to the far end of the carpus of the second

pair: they terminate in a very perfect chela of comparatively large size, with the dactylus anterior (or dorsal). The fourth pair reach just beyond the far end of the merus of the third pair: they end in a very much smaller and less perfect chela, with the dactylus posterior (or ventral).

The abdomen is a perfectly soft membranous bag, of which the segmentation is quite recognizably, but far from conspicuously, defined. In the male it is symmetrical, though the minute or rudimentary appendages, that are present on one side (*right or left*) of the 3rd 4th and 5th segments, are represented on the other side only by small tufts of small bristles. In the female its symmetry is lost by the presence, on one side or other, of a large membranous leaf-like lobe that forms a capacious cup-like brood-pouch.

The first two pairs of abdominal appendages of the male end in convoluted plates, the second pair working in the grooves formed by the first pair.

The telson is quite symmetrical, and lies in the middle line, tucked up against the ventral surface of the abdomen. On either side of it are the quite symmetrical swimmerets of the sixth pair: the basipodite of these has a spine at its posterior angle: both the exopodite and endopodite are narrow slender and falciform, with the anterior edge serrated and the tip spiniform: the exopodite is many times larger than the endopodite.

The animal does not inhabit a shell, but is protected by the soft fleshy coenosarc of a colony of Actiniarian polyps. This forms a sort of sheet or blanket, one end of which is tucked round the telson of the crab and is firmly held by the hook-like swimmerets of the 6th abdominal somite and by the folded-in telson, while the corners of the other end are firmly grasped by the chelæ of the penultimate thoracic appendages in such a way that the sheet can be drawn right over the back of the crab as far as the eyes.

The colour of the crab is red: the coenosarc of the polyp-colony is bluish, the polyps themselves are dark purple.

A large male, lying in the natural position with the telson bent under, measures, from the tip of the rostrum, 63 millim.; and the chelipeds of the same individual, measured along their convex curve, are 68 millim. in length.

An egg-laden female measured in the same way, is 37 millim. long and has chelipeds 35 millim. long.

205 specimens, representing both sexes in all stages, were dredged by the Investigator off Cape Comorin, in 102 fathoms.

I have much pleasure in dedicating this species to Captain A. R. S.

Anderson, I. M. S., who was Surgeon-Naturalist on the "Investigator" from 1893 to 1899, and who discovered the species and first noticed the peculiar nature of its protective covering.

It will be figured in full detail in the *Illustrations of the Zoology of the Investigator*.

§ 2. *On a new species of Crab of the genus Domecia of the sub-family Eriphiinæ, of the family Xanthidæ.*

So far as I know, the genus *Domecia* has hitherto been represented in collections by a single species, *D. hispida* Eydoux and Souleyet, which was first discovered off the Sandwich Islands and has since been found to have a very remarkable distribution in shallow water, having been taken on the reefs of the Gulf of Mexico and Caribbean Sea, in the Andaman Sea, and in several parts of the tropical Indo-Pacific, from Java and the Liu Kiu Islands on the west to Tahiti on the east.

In my *Materials for a Carcinological Fauna of India*, pt. 3, p. 465 (Journ. As. Soc. Bengal, Vol. LXVIII. pt. 2, 1898, p. 230) four specimens of *Domecia hispida* are recorded from the Andaman Islands (Little Andaman and the Coco islets), and I have now to record the recent capture, again by the "Investigator," of three more very fine specimens from the same locality, as well as of an entirely new species of the same genus.

This new species differs from its sole congener *D. hispida* in the following characters:—

- (1) the carapace, chelipeds, and legs are much less hairy and spiny:
- (2) the orbital margin is smooth or only finely and obscurely crenulate:
- (3) the exposed surface of the curious merus of the external maxillipeds is perfectly smooth:
- (4) the coloration is different:
- (5) the size is considerably less.

*Domecia glabra*, n. sp.

Carapace about three-quarters as long as broad, contracted posteriorly, flat, with no trace of regions and with only four distinct spines on its surface,—namely two, one behind the other, on either branchial region, near the antero-lateral border. [There is also a row of tiny spinules, visible only with a strong lens, immediately behind the frontal margin]. The surface of the carapace is free from hairs.

Frontal margin sinuous, denticulate and spinate: orbital margin smooth, or finely and faintly puckered: antero-lateral borders armed with four spines (including the outer orbital angle) of which the last but one has a tiny secondary spinule at its base. Two spines, side by side, at the inner suborbital angle.

External maxillipeds shaped like those of *D. hispida*, the merus being a very short broad joint, but having a perfectly smooth surface. Anterior edge of buccal cavern smooth.

Chelipeds, in the female, equal, hardly longer than the carapace: a spine at the far end of the inner (anterior) border of the arm, and some spinules at the far end of the outer (posterior) surface: upper surface of wrist, hand, and base of dactylus spiny.

Legs stout, not much shorter than the chelipeds: the anterior (dorsal) border of their merus, carpus, and propodite, and the posterior border of their dactylus, finely serrated: there are a few fine stiff hairs between the serrations.

Colours, orange or yellow; most of the spines of the carapace, but not of the appendages, are black.

A single egg-laden female from the Andamans, 16 fathoms: its carapace is only 4 millim. long.

The species has been figured for a future issue of the *Illustrations of the Zoology of the Investigator*.

### § 3. *On a new species of Latreillia and on Latreillopsis bispinosa.*

A new species of *Latreillia* was dredged in the Gulf of Martaban, in 53 and 67 fathoms. Its nearest relative is the Atlantic and Mediterranean *L. elegans*; which it resembles in form and colouration but from which it differs in the structure of the last pair of legs. These have a long propodite plumed exactly like the vane of a feather, and a very short dactylus. The species, which has been named *L. pennifera*, will be described in the forthcoming fifth part of my *Materials for a Carcinological Fauna of India*, and will be figured in a future issue of the *Illustrations of the Zoology of the Investigator*.

*Latreillopsis bispinosa*, described and figured by Dr. Henderson in the Report on the "Challenger" Anomura, has hitherto been known by a single imperfect female specimen, which was dredged off Zebu in the Philippine Islands.

Dr. Anderson has lately sent 3 specimens, namely, an adult male and female and a young male, which were dredged off the east coast of the Andamans at a depth of 53 fathoms (not the Gulf of Martaban, 53



Wing - covert

A. C. Chowdhary, Del. et. lith.

DISSEMURUS ALCOCKI.





fathoms' station). The male differs from the female in the form of the chelipeds, which in the male have a club-shaped palm. The branchial formula is exactly the same as that of *Latreillia pennifera*: there are 8 branchiæ on either side, namely 3 pleurobranchiæ (somites xi. xii. and xiii.), 2 pairs of arthrobranchiæ (appendages ix. and x.), and a small podobranchia on the second maxillipeds.

*On a new species of Bhimraj (Dissemurus), with some observations on the so-called family Dicruridæ.—By F. FINN, B.A., F.Z.S., Deputy Superintendent of the Indian Museum.*

(Plate II.)

[Received July 28th; Read August 2nd, 1899].

About three years ago I saw at the establishment of Mr. W. Rutledge, of Entally, a living specimen of a Bhimraj or Racket-tailed Drongo, which at once attracted my attention by its pied plumage, and I purchased it for the Museum. Unfortunately the bird did not long survive, being in poor condition when received, and its skin was transferred to the Museum collection. At the time I regarded it merely as a curious variety, but, taking into consideration the extreme rarity of symmetrical albinism (except in the case of albinoid or pallid varieties), and the fact that the appearance of this specimen is not suggestive of ordinary albinism, but rather of specific difference, I venture to characterize it as new, and shall name it after Major Alcock, I.M.S., Superintendent of the Indian Museum, in recognition of the kind encouragement he has always extended to my ornithological studies.

*Dissemurus alcocki*, sp. nov. (Plate II).

Habit and size of an ordinary example of *Dissemurus paradiseus* with a moderate crest; colour also as in that species; black glossed with steel-blue, with the following exceptions: the upper and lower wing-coverts except the primary-coverts, inner scapulars, axillaries, upper tail-coverts and the lower plumage from the breast downwards, which are white edged with black, and the rump and under tail-coverts, which are entirely white. There are also some white streaks on the lower breast, and a shading of white on the inner webs of the tail-feathers and innermost secondaries, and on the outer webs of the outer secondaries. The black edging of the white feathers is best developed on the greater wing-coverts, where it extends right round the tip of the feather. Soft parts as in *D. paradiseus* of the same age. Bill from gape  $1\frac{1}{2}$  inches; wing 6; shank 1.1.

The tail is unfortunately broken, so that its length, and that of the whole bird, is not worth giving. The resemblance of this individual in all essential structural characters to the ordinary Bhimraj is, however, so great, that I do not doubt that the tail will prove to have a similar form with long racket-tipped outermost feathers.

The bird was a young hand-reared one, like all Bhimrajs I have seen for sale. Whether it would have lost any of the white on its first moult is of course doubtful, but *D. paradiseus*, unlike many other Drongos, is not much marked with white below in its youth, so that it is quite possible that the white lower parts are permanent in this form.

Mr. Rutledge tells me that he has had three similar specimens to that described, and that they all came from Segowli in the Gorakhpur district. The natives, he says, consider the form distinct, and call it the "King Bhimraj." Even should it, however, prove to be only a very marked aberration or sport, like the black-winged Pea-fowl (*Pavo nigripennis*) or the Ringed Guillemot (*Uria ringvia*), it is well worthy of note and of the attention of ornithologists, to say nothing of its remarkable beauty of marking, which should recommend it to fanciers, with whom in India the common Bhimraj is so popular.\*

I take this opportunity of raising the question as to whether the so-called family *Dicruridæ* deserves its rank, and ought not rather to be retained in the *Laniidæ*, as Mr. Oates has very rightly, in my opinion, done with the Swallow-shrikes "*Artamidæ*" and Cuckoo-shrikes "*Camppephagidæ*." That gentleman says, it is true, in the "Fauna of British India" (Birds, Vol. I., p. 308), that the Drongos "form one of the best-defined families of the Passeres, their generally black plumage and forked tail of ten feathers sufficing to distinguish them readily." This

\* This popularity is well deserved, for the Bhimraj is probably the most accomplished mimic known. Its powers in this respect have been alluded to by Jerdon (Birds of India, Vol. I., p. 49) and I myself have heard a very fine specimen once in Mr. Rutledge's possession imitate the mewling of a cat and the song of a canary to perfection. Mr. R. D. Oldham, of the Geological Survey, told me of one which he heard *talk* with a perfectly human voice; and the bird used by myself in bionomical experiments (see J. A. S. B., 1897), after a sojourn of a year or two at the Zoo learnt to imitate, in addition to other sounds, the babbling of a Cockatoo, in which one word at least "Baba" was quite distinctly audible. When I kept several together, before I began experimenting, they displayed a marked partiality for the leaves of *Bougainvillea*, and as the identical bird alluded to above, which was one of them, ate plantain readily, I am inclined to think that the corvine bill of this form is connected with a corvine omnivorousness of habits. The Bhimraj is also very affectionate and fond of notice, and, were it not that it needs (though too generally it does not get it) a very large cage and a good supply of living food, would make an ideal cage-bird.

is quite true, but I submit that all these characters taken together are not of family value even for Passeres. Colour of plumage cannot be allowed to go for much, and besides, we have the blue-grey *Dicrurus leucogenys*—showing one of the most characteristic of the Laniine hues. A forked tail recurs among the Cuckoo-shrikes in *Campochæra* and *Pteropodocys*, and the number of feathers in it cannot be considered of much import, when we allow the Thrushes of the genus *Oreocinclæ* to have twelve or fourteen, and yet remain together.

An anatomical distinction, which Mr. Oates has not noticed, is that the *Dicruridæ*, alone among Passeres, lack the accessory semitendinosus muscle, as recorded by Garrod. But I fail to see that an isolated anatomical character like this, especially in the case of these Drongos to family rank, any more than the possession of powder-down patches (likewise not mentioned by Mr. Oates) does the Swallow-shrikes, which alone among their order exhibit them. The Drongos, I may mention, so far as I have been able to observe, all use their feet like other arboreal shrikes, which they resemble in build, hopping when on the ground, and grasping their food in one foot—even sometimes carrying it thus. (See J. A. S. B., May 1898).

It may be objected that on the score of convenience it would be better to have all the so nearly-related genera of *Dicruridæ* bracketed together: but it seems to me that it would be more convenient and natural still to regard them all as constituting one natural but somewhat polymorphic genus. The degree of furcation of the tail and the style of crest are hardly to be considered as of generic importance, taken against the general similarity of build; and the differing forms of bill can be largely explained by reference to the habits of the species. From what Dr. Sharpe states in the British Museum Catalogue of Birds, Vol. III. pp. 230, 235, it may be seen that a distinct gradation exists between two such extreme forms as the shrike-like, purely zoophagous *Dicrurus ater* and the slender-billed, partially melliphagous *Chibia hottentotta*: and if these can be united, I see no reason why the genus should not be made to embrace the entire family.

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*Materials for a Carcinological Fauna of India. No. 5. The Brachyura Primigenia, or Dromiacea. By A. ALCOCK, M.B., C.M.Z.S., Superintendent of the Indian Museum.*

[Received 1st September; Read 1st November, 1899.]

The opinions adopted in this paper are those of BOAS, that the *Dromiacea* are *Brachyura*; and of BOUVIER, that they connect the higher *Brachyura* with the Homarid family of *Maerura*.

I have endeavoured to show that the *Dromiacea*, or *Brachyura Primigenia*, include two natural groups—*Dromiidea* and *Homolidea*—each of which is a collection of families equivalent to the collections of families recognized as *Catometopa*, *Cyclometopa*, etc.; but, as is only to be expected in dealing with primitive groups, the families are small.

After raising a family to the rank of a tribe, and splitting it up into several independent families, it may seem inconsistent to unite the recognized genera of other authors, as is done in this paper with the genera *Dromia*, *Dromidia*, *Cryptodromia*, and *Petalomera*, all of which are treated as sub-genera of *Dromia*. But the reason for this treatment is that these are all linked together by intermediate forms.

The Indian species of *Dromiacea* number 28 and belong to the following genera and families:—

- |           |   |  |
|-----------|---|--|
| DROMIIDEA | { | <b>Homolodromidæ</b> :— <i>Arachnodromia</i> (?= <i>Homolodromia</i> ).  |
|           |   | <b>Dynomenidæ</b> :— <i>Dynomene</i> , <i>Acanthodromia</i> .  |
|           |   | <b>Dromiidæ</b> :— <i>Dromia</i> ( <i>Dromidia</i> , <i>Cryptodromia</i> , <i>Petalomera</i> ),<br><i>Pseudodromia</i> , <i>Couchoectes</i> , <i>Sphaerodromia</i> . |

HOMOLIDEA { **Homolidæ** :—*Homola* (*Paromola*, *Homolax*) *Paromolopsis*,  
*Hypsophrys*.  
**Latreillidæ** :—*Latreillopsis*, *Latreillia*.

### DROMIACEA or BRACHYURA PRIMIGENIA.

*Anomoures Dromiens* and *Homoliens*, (part) Milne Edwards, Hist Nat. Crust. II., pp. 168, 180.

*Dromiacea*, De Haan, Faun. Japon. Crust. p. 102.

*Dromidea vel Anomoura Maïidica Superiora*, Dana, U.S. Expl. Exp. Crust. pt. 1, p. 400.

*Anomoura Dromidea*, Miers, Cat. Crust. New Zealand, p. 57.

*Dromiacea*, J. E. V. Boas, Recherches sur les affinités des Crustacés décapodes, p. 202.

*Anomoura Dromidea*, Haswell, Cat. Austral. Crust. p. 138.

*Anomura Dromidea*, Henderson, Challenger Reports, Zoology, Vol. XXVI., p. 2.

*Dromiacés* (Études Comparatives des), Bouvier, Bull. Soc. Philomath. Paris, (8) VIII., 1896, pp. 34–108.

*Dromiidea*, Ortmann in Bronn's Thier Reich, V. ii., Arthropoda, p. 1153.

Carapace seldom broader than long, subquadrilateral or subovoid (sometimes sub-circular, or urn-shaped, or sub-pentagonal), often (as also the appendages) pilose. Front narrow.

Orbits and antennular fossæ may either be altogether wanting, or there may be common orbito-antennular fossæ into which the eyes and antennules are both retractile.

The antennal peduncle consists of four separate joints, and the antennal flagellum is long.

The epistome is triangular or truncate-triangular, and is well delimited from the palate.

The buccal cavern is quadrilateral, but is usually broader in front than behind. The external maxillipeds may be pediform, or sub-pediform, or completely opercular.

The last pair of legs are dorsal in position, and, with few exceptions, are prehensile slender and reduced in size, or even sometimes rudimentary. The penultimate pair sometimes resemble the last pair.

The abdomen in both sexes is large, and usually consists of seven separate segments: in the male it has the usual anterior two pairs of modified copulatory appendages: in the female it has the usual four pairs of ovigerous appendages and, in addition, a pair of smaller uniramous appendages situated on the first segment.

The genital ducts of the female open upon the bases of the 2nd pair of legs (third pereopods): those of the male open on the bases of the fourth pair of legs (5th pereopods).

The gills are usually phyllobranchiæ, but may be trichobranchiæ,

or may be intermediate in character. The gill-plumes vary in number from 20 to 8 on either side.

I follow Professor Boas, without hesitation, in placing the *Dromiacea* at the base of the *Brachyura*; and I further think that no one who has access to a good spirit-collection of the two groups in question can read M. E.-L. Bouvier's clever paper, cited above, *Sur l'origine Homarienne des Crabes*, without accepting the opinion of the latter author—an opinion previously suggested, as the author states, by Huxley—that the *Dromiacea* are the directly-connecting link between the Crabs (*Brachyura vera*) and the *Homaridæ*.

The *Dromiacea* may be divided into two groups, which seem to me to have something more than family value, namely, the *Dromiidea* and the *Homolidea*, each of which has retained certain primitive characters while following its own line of evolution.

#### Tribe I. DROMIDEA.

*Dromiens*, Milne Edwards, *Hist. Nat. Crust.* II. 168.

*Dromidæ*, Henderson, *Challenger Anomura*, p. 2.

*Dromidæ et Dynomenidæ*, Ortmann, in Bronn's *Thier Reich*, V. ii. *Arthropoda*, p. 1155.

Carapace sometimes longer than broad, often broader than long, without *linea anomurica*.

Eyes and antennules almost always (*Homolodromia* is the only exception) retractile into common orbito-antennular pits, the lower wall of which is formed about equally (1) by the basal joint of the antennule itself, (2) by the basal joint of the antenna, and (3) by a sub-orbital spine or dentiform lobe.

These orbito-antennular pits very often show traces of a subdivision into two fossæ, one for the antennule the other for the eye—the boundary between the two fossæ often being a tooth or a sort of fold in the upper margin of the "orbit."

Eye of the ordinary form, situated at the end of a short stout eye-stalk, the basal joint of the eye-stalk being inconspicuous.

Epistome triangular, its apex usually being in close contact with the deflexed tip of the front. Vault of the palate of good depth.

External maxillipeds usually opercular, sometimes subpediform.

Fingers of the chelipeds generally short, stout, channelled along their opposed surfaces, and strongly calcified in their distal half.

Sternum of the female traversed longitudinally, in part or in almost all of its extent, by a pair of special grooves that sometimes end in special tubercles.

The abdomen of both sexes consists of seven separate segments. Very often a pair of small lateral plates—the rudiments, probably, of

the 6th pair of abdominal appendages—is intercalated between the 6th and 7th somites.

The gill-plumes vary in number from 20 to 14 on either side, and are either trichobranchiæ or phyllobranchiæ.

Many of the species are protected by a commensal Sponge or Ascidian, or by an empty valve of a Lamellibranch shell, carried over the back.

#### Tribe II. HOMOLIDEA.

*Homoliens* (part), Milne Edwards, Hist. Nat. Crust. II. 180.

*Homolidæ*, Henderson, Challenger Anomura, p. 18: Ortmann in Bronn's Thier Reich, V. ii., Arthropoda, p. 1155.

Carapace longer than broad: *linea anomurica*, usually present.\* The eyes are not retractile into orbits, nor the antennules into pits. Basal antennular joint subglobular.

The eye-stalks each consist of two movable joints, a slender conspicuous basal joint which is sometimes of great length, and a stout terminal joint that carries the eye. The antennal flagella are, except in the *Latreillidæ*, much longer than the carapace.

The interantennular septum is a distinct vertical process, and is not formed merely by the close apposition of the apex of the epistome to the front.

The front forms a slender triangular prominent rostrum which may be bifid at tip, and often has a spine on either side of its base.

The division between the epistome and palate is distinct, but the vault of the palate is shallow.

External maxillipeds pediform or sub-operculiform.

The chelipeds and legs are long and slender: the fingers are not channelled *en cuillère*. Only the last pair of legs is dorsal and reduced in size.

Sternum of the female broad, without any special longitudinal grooves.

The abdomen of the male, and usually but not always of the female also, consists of seven separate segments. There are no lateral platelets intercalated between the 6th and 7th segments.

The gills are phyllobranchiæ, and the gill-plumes vary in number from 14 to 8 on either side.

\* The *linea anomurica* is a curious suture-line running fore and aft on either side from the posterior border of the carapace to the inner side of the antennal spine. For its homologue among the nearer relatives of the Homolidea we have to go to certain species of *Peneus*.



In comparing the above synopses of characters it will be seen that the *Dromidea* as a whole have developed along Brachyurous lines in respect of the antennal flagella, orbits, external maxillipeds, and shape of the carapace, but have kept near to the primitive (Homarid) branchial arrangements. Whereas the *Homolidea* as a whole show a tendency to approach the higher Brachyura in the reduction of the branchiæ, but have not departed much from the primitive (Homarid) type in the form of the antennal flagella, external maxillipeds and very imperfect orbits.

### Tribe I. DROMIIDEA.

The *Dromiidea* which, notwithstanding the more Brachyurous form of the carapace of their best known representatives, are as a whole more primitive than the *Homolidea* may be divided into three families—*Homolodromidæ*, *Dynomenidæ* and *Dromidæ*—characterized as follows:—

#### Family I. HOMOLODROMIDÆ.

Carapace longer than broad, convex in both directions, the true cervical and the branchial grooves both present.

Front cut into two prominent teeth, between which, but on a much lower plane, a third small tooth is *sometimes* present.

Antennal flagella longer than the carapace.

External maxillipeds with a marked pediform cast.

Chelipeds equal, slender, though stouter than the legs.

First two pair of legs much longer than the chelipeds: last two pair much shorter than the first two pair, subdorsal, prehensile.

The abdomen in both sexes consists of 7 separate segments: there are no lateral platelets intercalated between the 6th and 7th segments.

The gills are trichobranchiæ, or are intermediate between trichobranchiæ and phyllobranchiæ: the gill-plumes are very numerous—there may be as many as 20 on either side.

Epipodites are present on the chelipeds and first two or three pairs of legs.

The sternal grooves of the female are short, ending at the level of the genital openings.

To this family belong the following genera:—

1. *Homolodromia*, A. Milne Edwards, Bull. Mus. Comp. Zool., VIII. 1880, p. 33: Recueil de Fig. de Crustacés Nouveaux, pl. 39, fig. 2.
2. *Dicranodromia*, A. Milne Edwards, Bull. Mus. Comp. Zool., VIII. 1880, p. 31: Recueil de Fig. de Crust. Nouv. pl. 10.
3. \**Arachnodromia*, Alcock, *seq.*

#### Family II. DYNOMENIDÆ, Ortmann.

*Dynomenidæ*, Ortmann in Bronn's Thier Reich, V. ii., Arthropoda, p. 1155.

Carapace variable, either longer than broad and convex, or broader

than long and flattish. Branchial groove usually present, cervical groove sometimes present.

Front broadly triangular, sometimes notched at tip. Antennal flagella not so long as the carapace.

External maxillipeds typically opercular, completely closing the buccal cavern.

Chelipeds equal or slightly unequal, generally much stouter than the legs.

First three pair of legs stout, about as long as the chelipeds. Fourth (last) pair of legs dorsal and rudimentary.

The abdomen in both sexes consists of 7 segments, and there is a pair of lateral platelets intercalated between the last two segments.

The gills are phyllobranchiæ but sometimes show the transition from tricho- to phyllobranchiæ. The gill-plumes are 16 (?) on either side.

Epipodites are present on the chelipeds and first three pair of legs.

Sternal grooves of the female ending at the level of the genital openings.

To this family belong (1) *Dynomene* and (2) *Acanthodromia*, both of which are represented in Indian Seas.

### Family III. DROMIIDE, *restr.*

Carapace variable, sometimes as long as or even a little longer than broad, sometimes slightly broader than long; generally strongly convex in both directions, sometimes flat; commonly ovoid or subcircular, occasionally pentagonal.

\* Branchial groove almost always conspicuous, the true cervical groove present or absent on the dorsum of the carapace.

Front usually cut into 3 teeth, the middle one of which is always on a much lower plane than the others and is often of insignificant size or even absent: the front is rarely triangular, without lateral teeth. Antennal flagella shorter than the carapace.

External maxillipeds typically opercular, completely closing the buccal cavern.

Chelipeds equal, generally much stouter than the legs.

First two pair of legs generally stout, not much shorter than the chelipeds.

Last two pair of legs generally much reduced in length and slender, subdorsal and prehensile. There is a tendency for the fourth (last)

\* The branchial groove of Bouvier, which by most authors is called the "cervical" groove.

pair to be a little longer than the third pair, and occasionally the fourth pair are as long as either of the first two pair.

The abdomen in both sexes consists of 7 segments, and there is a pair of lateral platelets intercalated between the last two segments.

The gills are phyllobranchiæ and are 14 in number on either side.†

An epipodite of small size is present on the chelipeds but not on any of the legs.†

The sternal grooves of the female are variable: they may end at the level of the genital openings, or at the bases of the first pair of legs, or at the bases of the chelipeds.

To this Family the following genera belong:—

1. \**Dromia*, Fabr.: *seq.*
2. \**Dromidia*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 225 (subgenus of *Dromia*).
3. \**Cryptodromia*, Stimpson: *seq.* (subgenus of *Dromia*).
4. \**Petalomera*, Stimpson: *seq.* (subgenus of *Dromia*).
5. \**Pseudodromia*, Stimpson: *seq.* (? subgenus of *Dromia*).
6. *Eudromia*, Henderson, Challenger Anomura, p. 13.
7. ???*Ascidiophilus*, Richters, in Mobius, Meeresf. Maurit. p. 158 (it is very doubtful whether this form really belongs to the Dromiacea).
8. \**Conchoecetes*, Stimpson: *seq.*
9. *Hypochoncha*, Guérin, Rev. et Magasin de Zool. (2) VI. 1854, p. 333.
10. \**Sphærodromia*, Alcock, *seq.*

## Tribe II. HOMOLIDEA.

The *Homolidea* may be divided into two families *Homolidæ* and *Latreillidæ*.

To the Homolidæ belong (1) *Homola* (with subgenera *Homolax* and *Paramola*), (2) *Paramolopsis* and (3) *Hypsophrys*, all of which are represented in Indian Seas.

To the Latreillidæ belong (1) *Latreilliu* and (2) *Latreillopsis*, both of which are found in Indian Seas.

I am uncertain of the position of *Homologenus* A. Milne Edwards, which, but for its singular branchial formula, would be placed with the *Homolidæ*. It may perhaps have to be separated as a distinct subfamily of the *Homolidæ*. The references to the literature of this genus are: Bull. Mus. Comp. Zool. VIII., 1880, p. 34, (*Homolopsis* name pre-occupied): Challenger Anomura, p. 20: Bull. Soc. Philom., Paris, (8) VIII., 1896, p. 63: Bronn's Thier Reich V. ii., Arthropoda, p. 1156.

† Huxley (P. Z. S. 1878, p. 785) gave, as the sum of the branchial formula of *Dromia*, gills 16+1 epipodite. Milne Edwards (Hist. Nat. Crust. II. 172) stated that the gills are 14 in number on either side. I have examined *Dromia Rumphii* and *D. ciliata*, *Cryptodromia lateralis*, *Petalomera granulata* and *Conchoecetes artificiofus*, in all of which I find 14 branchiæ and 4 epipodites on either side: of the epipodites, 3 belong to the maxillipeds, and one—a small one—to the chelipeds.

Family I. HOMOLIDÆ *restr.*

Carapace elongate-quadrangular, or ovoid, or urn-shaped.

Terminal joint of the eyestalk (with the eye) either longer or shorter than the slender basal joint. Antennal flagella much longer than the carapace.

External maxillipeds pediform or subpediform.

The gill-plumes are 14 in number on either side, and there are epipodites to the chelipeds and first two pair of legs.

*Homola*, *Paromolopsis* and *Hypsophrys*, *vid. seq.*

## Family II. LATREILLIDÆ.

Carapace elongate-quadrangular, or piriform.

Basal joint of eye-stalk very much longer than the terminal joint.

Antennal flagella not so long as the carapace.

External maxillipeds sub-operculiform.

The gill-plumes are 8 in number on either side and there are no epipodites to the chelipeds or legs.

*Latreillia* and *Latreillopsis*, *vid. seq.*

## Tribe DROMIIDEA.

## Family HOMOLODROMIDÆ.

## ARACHNODROMIA, Alcock.

*Arachnodromia*, Alcock, Investigator Deep Sea Brachyura, p. 17.

Carapace elongate-oblong but somewhat broader behind than in front, deep, inflated, tomentose, its texture thin but well calcified: two creases break either lateral border, the posterior one being the more distinct and being continued to the cardiac region (=branchial groove), the anterior one, or true cervical groove, not proceeding far on to the dorsum of the carapace.

The front is horizontal, prominent, and deeply bifid.

The antennule and eye of either side are completely retractile into a common deep fossa (just as in *Dromia*) which affords them complete protection. As in *Dromia*, the floor of this common antennular-orbital fossa is formed by a subocular ("antennal") tooth in contact with the basal joint of the antenna, and, as in *Dromia*, the outer wall of the orbit is breached by a wide gap. The orbital portion of the fossa, which is loosely filled by the eyes, has the hollow for the eyes much deeper than the hollow for the eyestalk. The eyestalks are long and slender, the eyes small but perfectly formed and well pigmented.

The two basal joints of the antennæ, which are quite freely movable, largely fill the gap in the lower wall of the orbit, and lie in the

same plane with the antennules; the second joint has its antero-external angle produced to form a coarsish spine: the antennal flagella are longer than the carapace.

The palate is particularly well demarcated from the epistome and is rather broader in front than behind: the ridges that define the expiratory canals are very distinct. The epistome is in the closest possible contact with the front, but without complete fusion. The external maxillipeds are distinctly operculiform, but owing to the moderate expansion of the merus and to the coarseness of the palp, they have a slight pediform cast: they close the buccal cavern, but not so tightly as in *Dromia*.

The chelipeds are equal and are rather slender, though considerably stouter than the legs: the fingers are well calcified and are hollowed *en cuillère*, the tip of the dactylus shuts into a notch in the tip of the opposed finger.

The legs are cylindrical: the first two pairs are very long, the last two are short, subdorsal in position, and cheliform rather than subcheliform.

The sternal grooves of the female end opposite the openings of the oviducts, without tubercles.

The abdomen of both sexes consists of seven distinct segments. In both sexes the pleuræ of the 3rd–6th abdominal somites are remarkably free and independent (*i.e.* not in contact with those in front and behind) and the last abdominal tergum is nearly as long as the preceding five combined. In the male this last tergum is marked in a way that suggests its formation out of a segment fused with a pair of appendages.

This crustacean, as I have previously remarked, so closely resembles the *Homolodromia* described and figured by Milne Edwards\* and referred to by Bouvier,† that at first sight it might be supposed to be the same form.

In *Homolodromia*, however, it is distinctly stated that the antennules are not retractile, and that there are no special orbits.

In *Arachnodromia*, on the other hand, there are orbits formed on exactly the same plan as, and hardly less perfect than, those of *Dromia*, and they afford complete protection to the retracted eyes and antennules, the antennular flagella folding, as in *Dromia*, behind the eyes.

\* A. Milne Edwards, Bull. Mus. Comp. Zool. Vol. VIII. 1880, p. 32, and Recueil de figures de Crustacés Nouveaux etc. pl. 39, fig. 2. Not the *Homalodromia* of Miers, which ought to be placed with *Pseudodromia*.

† E. L. Bouvier, Bull. Soc. Philom. Paris (8) VIII. 1895–96, p. 37, *et seq.*

The branchial formula is as follows:—

Somites and their appendages.	Podobranchiæ.	Arthrobranchiæ.	Pleurobranchiæ.
VII. ...	0 ep.	0	0 = ep.
VIII. ...	1+ep.	1	0 = 2+ep.
IX. ...	1+ep.	2	0 = 3+ep.
X. ...	1+ep.	2	0 = 3+ep.
XI. ...	1+ep.	2	1 = 4+ep.
XII. ...	1+ep.	2	1 = 4+ep.
XIII. ...	0	2	1 = 3
XIV. ...	0	0	1 = 1
	5+6 ep.	11	4      20+6 ep.

The formula is thus the same as that given by Bouvier for *Homolodromia*.

### 1. *Arachnodromia Baffini*, Alcock and Anderson.

*Arachnodromia Baffini*, Alcock and Anderson, Ann. Mag. Nat. Hist., Jan. 1899, p. 7: Alcock, Investigator Deep Sea Brachyura, p. 19, pl. ii. fig. 1.

Carapace square-cut, dorsally convex, very distinctly (from a fourth to a fifth) longer than broad, its greatest breadth being just in front of the posterior border, its greatest depth approximating its greatest breadth, its surface—like that of the appendages and other parts of the body—tomentose. Except for a few small sharp granules anteriorly and laterally and along the lateral border, the carapace is unarmed.

The front is deeply cleft to its base, and has the form of two acutely triangular teeth.

Upper margin of orbit notched near its outer angle which is dentiform, the outer angle of the lower margin of the orbit is much more strongly dentiform, and the (outer) orbital wall between the two spines is deficient.

Antennal flagella longer than the carapace.

Chelipeds rather slender, unarmed except for a few granules seen on denudation, about  $1\frac{2}{3}$  times the length of the carapace: fingers strongly hollowed '*en cuillère*,' especially the immovable one, which alone has teeth: wrist not elongate.

First two pairs of legs more than twice the length of the carapace: their dactyli are about two-thirds the length of the preceding joint, are stout, are sharply spinate along the posterior edge, and end in a claw. The last two pairs of legs are about the same length as the carapace: their small claw-like dactyli shut down on a ring of spines at the end of the preceding joint.

Colours : dirty whitish, with a bluish tinge on the carapace and a faint reddish tinge elsewhere ; eyes chocolate.

Two males and a female, from off the Travancore coast, 430 fms. : a small male from the Andamans, 238–290 fms.

The carapace of the largest male is 20 millim. long and 15 millim. broad, that of the female is 30 millim. long and 24 millim. broad.

Named in memory of the great Arctic explorer William Baffin, who, according to Sir Clements Markham, was the first Englishman to actually plot charts in these Seas.

#### Family DYNOMENIDÆ.

This family includes two genera which may be thus diagnosed :—

- I. Carapace flattish, broader than long,  
covered with hairs ..... DYNOMENE.
- II. Carapace convex, longer than broad,  
covered with spines or spinules..... ACANTHODROMIA.

#### DYNOMENE, Latreille.

*Dynomene*, Latreille in Cuvier's Règne An. (nouv. ed. 1829) p. 69 : Desmarest, Consid. Gen. Crust. p. 133 : Milne Edwards, Hist. Nat. Crust. II., 179 : Lamarck, Hist. Nat. Anim. sans Vert. (2nd ed.) p. 482 : De Haan, Faun. Japon. Crust. p. 104 : Dana, U. S. Expl. Exp. Crust. pt. I. p. 402 : A. Milne Edwards, Ann. Sci. Nat. Zool., (6) VIII. 1879, Art. 3 : Ortmann in Bronn's Thier Reich, V. ii., Arthropoda, p. 1155.

All parts usually tomentose.

Carapace subcircular, flattish, broader than long.

Front broadly triangular, dorsally grooved, more or less distinctly notched or divided at tip.

Palate well delimited from epistome : efferent branchial channels well defined.

The chelipeds usually do not differ greatly in size from the first 3 pair of legs : these are stout and of about equal length.

The 4th (last) pair of legs are quite rudimentary and alone are dorsal in position.

As regards the branchial formula, according to Bouvier it follows the *Dicranodromia* and *Homolodromia* type.\*

*Distribution* : Tropical Indo-Pacific, from Madagascar to California.

#### 2. *Dynomene pilumnoides*, n. sp.

The carapace and appendages are covered with an exceedingly thick tomentum of club-shaped hairs, the chelipeds and legs are also

\* The material at my disposal, at present, does not permit me to indulge in dissection ; but I have been able to make out that the branchial plumes and epipodites are more numerous than they are in *Dromia*, *Cryptodromia*, &c.

thickly fringed with additional longer hairs. The hairs completely conceal all the texture and sculpture beneath them.

Carapace subcircular, slightly broader than long, flattish. The true cervical groove is well defined, but the branchial groove is hardly distinguishable.

There are a few very inconspicuous symmetrically-disposed elevations on the gastric and on the anterior part of the branchial regions.

Front broadly-triangular, deeply grooved in the middle line. Upper border of orbit oblique, with a fold or notch (best visible from inside the orbit) marking the equivalent of the inner supra-orbital angle of the higher Brachyura. Outer orbital angle not dentiform. Suborbital lobe neither dentiform nor prominent.

Lateral borders of carapace with 5 spine-like teeth, the last of which is much the smallest and stands at the branchial groove.

Chelipeds in the male a little unequal, the smaller one not stouter and not quite so long as, the larger one a little stouter and about as long as, the first 3 pair of legs.

When the chelipeds and legs are denuded their surface is smooth and unsculptured, except that the posterior border of the dactyli of the legs is serrated.

The fourth (last) pair of legs are small slender rudiments, not a fourth the length of the 3rd pair.

A single male from off the Laccadives, 50 to 30 fathoms. Its carapace is 10 millim. long and a little over 11 millim. broad.

The smoothness of the carapace, chelipeds, and legs, and the inequality of the chelipeds distinguish this species from *D. hispida*, of which, however, it may prove to be only a variety.

#### ACANTHODROMIA, A. Milne Edwards.

*Acanthodromia*, A. Milne Edwards, Bull. Mus. Comp. Zool., VIII. 1880, p. 31 : E. L. Bouvier, Bull. Soc. Philomath. Paris, (8) VIII. 1895-96, pp. 56, 57 : Ortmann in Bronn's Thier Reich, V. ii., Arthropoda, p. 1155.

Differs from *Dynomene* in having the carapace longer than broad, convex, and closely covered with spines instead of hairs.

*Distribution*: Caribbean Sea, Andaman Sea.

#### 3. *Acanthodromia margarita*, Alcock.

*Dynomene margarita*, Alcock, Investigator Deep-Sea Brachyura, p. 19, pl. ii. fig. 3.

The whole carapace and dorsal surfaces of the chelipeds and legs are as closely as possible covered with spines and spinules: the under surfaces of the body and legs, the eye-stalks, antennæ, and external maxillipeds are closely and crisply granular.



On the middle of the fourth abdominal tergum is a pair of large smooth tubercles, exactly like pearls, in the closest contact with one another.

Carapace sub-cylindrical, longer than broad; the regions hardly indicated, though the branchial groove is fairly plain.

Front triangular, deflexed, dorsally concave; its apex is in close contact with that of the epistome, and is surmounted by a horizontal spine similar to the larger spines of the surface of the carapace. Supra-orbital borders tumid.

Antennal flagellum nearly as long as the carapace.

Chelipeds equal, a little longer and stouter than the first three pair of legs, and not much longer than the carapace. The fingers are short and stout, and meet throughout their extent.

The last pair of legs are slender rudiments, hardly longer than the basal joints of the other legs.

Colours in spirit, milk-white; eyes deeply pigmented.

A single small male from the Andaman Sea, 75 fathoms. The length of its carapace is 5 millim.

### Family III. DROMIIDÆ.

#### *Key to the Indian Genera and Sub-genera of Dromiida.*

- I. Front much as in *Dynomene*, broadly triangular, dorsally grooved, notched at tip. The sternal grooves of the female do not quite reach to the level of the genital openings on the 2nd pair of legs (third pereopods) ... SPHERODROMIA.
- II. Front usually cut into 3, sometimes into 2, teeth, rarely entire and triangular. The sternal grooves of the female reach at least as far as the level of the bases of the 1st pair of legs (2nd pereopods):—
  1. Third pair of legs, though shorter, not less stout than the first two pair; ending in a huge talon-like dactylus: fourth (last) pair of legs short and very slender. Carapace flat and pentagonal ... CONCHOECETES.
  2. Third pair of legs similar to, though sometimes shorter than, the fourth (last) pair. Carapace usually convex:—
    - i. Fourth (last) pair of legs shorter than the first two pair:—
      - a. Legs smooth, the meropodites not specially dilated ... DROMIA & DROMIDIA.
      - b. Legs nodular, the meropodites not specially dilated ... CRYPTODROMIA.
      - c. Legs nodular; the meropodites of the chelipeds and first or first two pair of legs dilated, petal-like ... PETALOMERA.

- ii. Fourth (last) pair of legs at least as long as  
either of the first two pair ... .. PSEUDODROMIA.

*Sphærodromia* and *Conchoecetes*, and doubtfully also *Pseudodromia*, are to be looked upon as distinct genera. But there are undoubtedly forms that are transitional between *Dromia* and *Dromidia*, *Dromia* and *Cryptodromia*, and *Cryptodromia* and *Petalomera*, and even between *Dromia* and *Pseudodromia*, so that these ought not, in a natural system, to be separated, though for convenience they may stand as subgenera.

#### DROMIA, Fabr.

*Dromia*, Fabricius, Ent. Syst. Suppl. p. 359: Latreille, Hist. Nat. Crust. &c., V. p. 383, and Nonv. Dict. Hist. Nat. IX. p. 583: Leach, Malac. Pod. Britt. Text of pl. xxiv A: Risso, Hist. Nat. Crust. Nice, p. 15, and Hist. Nat. Europ. Mérid. V. p. 32: Desmarest, Consid. Gen. Crust. p. 136: Milne Edwards, Hist. Nat. Crust. II. p. 170: Lamarck, Hist. Nat. Anim. sans Verteb. (2nd ed. 1838) V. p. 480: De Haan, Faun. Japon. Crust. p. 104: Dana, U. S. Expl. Expd. Crust. pt. I. p. 402: Stimpson, Proc. Acad. Nat. Sci. Philad. 1858, p. 226: Henderson, Challenger Anomura, p. 3: Ortman in Bronn's Thier-Reich, V. ii. Arthropoda, p. 1155.

All parts except the tips of the fingers and of the dactyli are, generally, tomentose.

Carapace not elongate in the adult, strongly convex or subglobose.

Front cut into three teeth, of which the middle one is on a lower plane than the others and is often so much smaller than them and so much deflexed as to be hardly visible from a dorsal view.

Palate well delimited from the epistome: efferent branchial channels well defined, but not always bounded by distinct and unbroken ridges.

The chelipeds may have some of the joints nodose, but the legs are smooth.

None of the legs have the merus dilated. The last two pair of legs are distinctly subcheliform, the spine at the end of the propodite against which the dactylus closes being well developed.

The sternal grooves of the female do not meet, and they end on the 2nd segment of the sternum, between the 2nd pereopods.

The branchial formula is as follows:—

Somites and their appendages.	Podo- branchiæ.	Arthrobranchiæ.		Pleuro- branchiæ.	
		Anterior.	Posterior.		
VII. ...	ep.	0	0	0	= 0 ep.
VIII. ...	1+ep.	0	0	0	= 1+ep.
IX. ...	0 ep.	1	1	0	= 2+ep.
X. ...	0 ep.	1	1	0	= 2+ep.
XI. ...	0	1	1 (small)	1	= 3
XII. ...	0	1	1 (small)	1	= 3
XIII. ...	0	1	0	1	= 2
XIV. ...	0	0	0	1	= 1
Total ...	1+4 ep.	5	4	4	14+4 ep.

*Key to the Indian species of the genus Dromia.*

- I. Carapace, in the adult, broader than long: front cut into 3 teeth of nearly equal size, of which the middle one is slightly the most prominent: third (penultimate) pair of legs hardly shorter than the fourth (last); no large spine at the far end of the posterior border of the propodite of the fourth (last) pair *D. rumphii.*
- II. Carapace, in the adult, at least as long as broad: front cut into 3 teeth, of which the middle one is so small and so much deflexed as to be almost invisible in a dorsal view: third pair of legs very markedly shorter than the fourth; a spine at the far end of the posterior border of the propodite of the fourth (last) pair quite as long as that at the same end of the anterior border:—
1. True antero-lateral border of the carapace with 3 or 4 spines ... .. *D. cranioides.*
  2. True antero-lateral border of the carapace entire ... *D. unidentata.*

4. *Dromia Rumphii*, Fabr.

*Cancer lanosus*, Rumph, Amboin. Rariteitk. p. 19. pl. xi. fig. 1: Seba, Thesaurus, III. pl. xviii. fig. 1.

*Dromia Rumphii*, Fabricius, Ent. Syst. Suppl. p. 360: Milne Edwards, Hist. Nat. Crust. II. 174: De Haan, Faun. Japon. Crust. p. 107, pl. xxxii: Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 240: Tozzetti, "Magenta" Crust., p. 207: Hilgendorf MB. Ak. Berl. 1878, p. 812: Miers, Ann. Mag. Nat. Hist. (5) V. 1880, p. 370: Walker, Journ. Linn. Soc. Zool., XX. 1886-1890, p. 111: Ortmann, Zool. Jahrb. Syst. &c., VI. 1892, p. 548: J. R. Henderson, Trans. Linn. Soc., Zool. (2) V. 1893, p. 406.

All parts, except the tips of the fingers and dactyli thickly covered with a harsh tomentum, with sometimes scattered tufts of longer hair on the carapace.

Carapace in adults broader than long, strongly convex, smooth; the cardiac region and the branchial or "cervical" groove on either side of it plainly marked, the gastric region faintly indicated.

Front cut into 3 nearly horizontal teeth of nearly equal size, the middle one on a lower plane and slightly the most prominent.

In young specimens a projection of the upper edge of the "orbit" marks the position of the true inner supra-orbital angle of the higher Brachyura, but in large specimens this is obsolete.

The true antero-lateral borders of the carapace are cut into 3 sharp but coarsish spines, the 2nd of which often has a small secondary denticle at its base. In addition there is a spine on the summit of the infra-orbital lobule, and another at the outer angle of the buccal cavern.

The postero-lateral borders are convergent and have one large coarse spine, placed immediately behind the cervical groove.

The borders of the arm are dentate, especially the upper border, and there are 2 or 3 teeth at the distal end of the upper border of the

wrist and also along the upper border of the hand: all these dentations tend to disappear with age, but two tubercles at the distal end of the outer surface of the wrist are persistent.

The last two pair of legs are about equal in length, being hardly half as long as either of the first two pair: their propodites are much shortened and their dactyli are claw-like, forming chelæ with the opposing spines at the end of the propodites.

Abdomen of male with a broad convex ridge down the middle line.

Sternal tubercles of female very prominent.

In the Indian Museum are specimens from the Persian Gulf, Malabar coast (28 to 49 fms.), Ceylon, Coromandel coast, Orissa coast (25 fms.) and Gulf of Martaban (67 fms.)—also 2 from Mauritius.

The largest specimen, from Mauritius, is  $5\frac{3}{4}$  inches across the carapace.

*Distribution*: Indo-Pacific Seas from the Red Sea, Mozambique, and Mauritius, to Japan.

##### 5. *Dromia cranioides*, de Man.

*Dromidia cranioides*, de Man, Journ. Linn. Soc. Zool., XXII., 1887-88, p. 208, pl. xiv. figs. 6-8.

Carapace etc. tomentose. Carapace globose, a little longer than broad, perfectly smooth except for the "cervical" groove and for two small faint elevations side by side just behind the front.

Front cut into 3 teeth, the middle one of which is so small and on a plane so much lower than the others that it is hardly seen in a dorsal view.

A strongly marked acuminate tooth near the middle of the upper border of the orbit is equivalent to the inner supra-orbital angle of higher Brachyura. Sub-orbital lobe dentiform, very prominent. Outer orbital angle well defined, dentiform.

True antero-lateral borders of the carapace cut into 3 or 4 teeth; when 4, it is by intercalation of a little tooth close to the base of the 1st. A tooth, but not a strongly pronounced one, at the outer angle of the buccal cavern.

Postero-lateral borders slightly convergent, with one tooth placed immediately behind the branchial or "cervical" groove.

Borders of arm granular or obtusely denticulate, as also are the upper border of the wrist and of the hand: two tubercles at the distal end of the outer surface of the wrist.

The last two pair of legs have a claw-like dactylus which meets, in a cheliform manner, a spine at the end of the corresponding propodite.

The last pair are much longer than the last pair but one, being, in fact, very little shorter than either of the first two pair.

Abdomen as in *D. Rumphii*.

The sternal grooves of the female approach one another closely, but do not actually meet, on the 2nd segment of the sternum, near the anterior end of which they terminate, without tubercles.

In the Indian Museum are 5 females and 2 males, from the Andamans and Mergui.

The length of the carapace of the largest specimen is 28 millim.

This species may perhaps turn out to be identical with *Dromia indica* Gray (Zool. Miscell., p. 40).

#### 6. *Dromia unidentata*, Rüppell.

*Dromia unidentata*, Rüppell, 24 Krabben roth. Meer., p. 16, pl. iv. fig. 2, pl. vi. fig. 9: Milne Edwards, Hist. Nat. Crust. II. 178: A Milne Edwards, Nouv. Archiv. du Mus. IV. 1868, p. 72: Hilgendorf, MB. Ak. Berl. 1878, p. 813: Müller, Verh. Nat. Ges. Basel. VIII. 1886, p. 472.

*Dromidia unidentata*, Kossmann, Reise roth. Meer. Crust. p. 67: de Man, Journ. Linn. Soc. Zool. XXII. 1887-88, p. 207, pl. xiv. figs. 4-5: Cano, Boll. Soc. Nat. Napol. III. 1889, p. 255: Henderson, Trans. Linn. Soc. Zool., (2) V. 1893, p. 405: Ortman, in Semon's Zool. Forschungr. (Jena. Denkschr. VIII) Crust. p. 34.

Carapace etc. densely tomentose. Carapace about as long as broad, strongly convex, with some dimples when denuded, two of which, separating the post-gastric from the branchial regions, are specially conspicuous. "Cervical" groove well marked.

Front cut into two broadish but sharp teeth, between which, but on a very much lower plane, is an extremely inconspicuous denticle.

A broad tooth ("internal supra-orbital angle") near the middle of the upper border of the orbit. Outer orbital angle prominent but not dentiform. Suborbital lobe bluntly dentiform, but not prominent.

Antero-lateral borders entire, rather sharp. A slight projection, hardly amounting to a tooth, on the postero-lateral border, immediately behind the branchial or "cervical" groove.

Chelipeds smooth, except for two tubercles at the far end of the outer surface of the wrist.

The fourth (last) pair of legs are not so very much shorter than either of the first two pair and are very much longer than the 3rd pair. The propodites of the last two pair are much broader than long and are very spiny, one of the spines in the case of the last pair being as least as long as the spine against which the claw-like dactylus closes—so much so, that the last pair of legs appear to end in 3 claw-like spines the middle one being the dactylus.

The abdomen of the male, when denuded, has a broad convex ridge down the middle line; but when not denuded, the terminal segments of the male abdomen form with the basal joints of the chelipeds and first two pair of legs a remarkably flat surface, owing to the abrupt angular bending up of the last three abdominal segments.

The sternal grooves of the female approach one another closely, but do not actually meet, on the second segment of the sternum, near the anterior end of which they terminate, but without tubercles.

In the Indian Museum are 4 males and an egg-laden female, from Mergui, Port Blair, and the Persian Gulf.

The carapace of the largest specimen is 24 millim. long.

In one of the male specimens, in which the vasa deferentia are, as usual, wonderfully prominent, there are also openings in the basal joints of the 2nd pair of legs (3rd pereopods) corresponding with the genital openings of the female.

*Distribution*: Red Sea and East coast of Africa, Persian Gulf, Ceylon, Coromandel coast, Andaman Sea, Malay Archipelago.

#### Subgenus DROMIDIA, Stimpson.

*Dromidia*, Stimpson, Proc. Ac. Nat. Sci. Philad., 1858, p. 225: Henderson, Challenger Anomura, p. 12: Ortmann in Bronn's Thier Reich, V. ii. Arthropoda, p. 1155.

*Dromidia* is stated to differ from *Dromia* in having (1) the efferent branchial channels defined each by a distinct ridge, and (2) the sternal grooves of the female produced to, and approximated together on, the segment bearing the chelipeds.

Neither of these characters is sufficiently definite to be of generic value, and I do not think that they are enough to justify even sub-generic recognition.

Henderson (Trans. Linn. Soc., Zool. (2) V. 1893, p. 406) includes *Dromia (Dromidia) australiensis* Haswell in the Indian Fauna, basing his identification on de Man's figure (Archiv. für Naturges. LIII. 1887, i. pl. xvii. fig. 6.) But as that figure does not seem to me to correspond unequivocally with Haswell's description (Proc. Linn. Soc., N. S. Wales, VI. 1882, p. 755, and Cat. Austral. Crust. p. 139), it is sufficient for present proposes to quote these references.

#### Subgenus CRYPTODROMIA, Stimpson.

*Cryptodromia*, Stimpson, Proc. Ac. Nat. Sci. Philad., 1858, p. 225: Miers, Cat. Crust. New Zealand, p. 57: Haswell, Cat. Austral. Crust., p. 138: Henderson, Challenger Anomura, p. 5: Ortmann in Bronn's Thier Reich, V. ii. Arthropoda, p. 1155.

*Epidromia*, Kossmann, Reise roth-Meer., Crust., p. 69.

Differs from *Dromia* only in the following particulars:—

The tomentum when present is much shorter and more velvet-like. The legs, or at least the first two pairs of them, are nodular, as well as the chelipeds. According to Bouvier and Ortmann the chelipeds are without an epipodite; but in *C. lateralis* this is not the case, and a small epipodite is present. The ridges that define the efferent branchial channels are distinct and unbroken.

The species are all small.

*Key to the Indian species of Cryptodromia.*

I. Carapace smooth (non-granular):—

1. No spines on dorsal surface of carapace:—

i. Front cut into 3 teeth, all of which are plainly visible in a dorsal view: antero-lateral borders of carapace with more than one tooth: legs nodular:—

a. Antero-lateral borders with 3 teeth (not including the outer orbital angle and some teeth on the subhepatic region) ... .. *C. tuberculata.*

b. Antero-lateral borders with 2 teeth (not including the outer orbital angle, etc.):—

a. Regions of carapace well defined: no tubercle on the surface of the maxillipeds... .. *C. canaliculata.*

β. A pearl-like tubercle in the middle of the exposed surface of the merus of the external maxillipeds ... .. *C. bullifera.*

ii. Front cut into 3 teeth, the middle one of which is hardly seen in a dorsal view: antero-lateral borders of carapace with a single tooth, at their anterior end: legs hardly nodular ... .. *C. hilgendorfi.*

2. A dorsal spine on the hepatic region of the carapace, just behind the outer orbital angle ... .. *C. de Manii*

II. Carapace (and appendages also) profusely granular: the regions of the carapace well defined and areolated:—

1. Carapace subcircular in outline, its antero-lateral borders entire ... .. *C. ebalioides.*

2. Carapace pentagonal in outline, its antero-lateral borders dentate ... .. *C. Gilesii.*

7. *Dromia (Cryptodromia) tuberculata*, Stimpson.

*Cryptodromia tuberculata*, Stimpson, Proc. Ac. Nat. Sci., Philad. 1858, p. 239: de Man, Archiv. f. Naturges. LIII. 1887, i. p. 401.

Var. *pilifera*, nov.

Carapace etc. covered with a short scurfy tomentum which does not conceal the underlying texture.

Carapace broader than long, convex, smooth, without distinction of regions: the cervical groove broad, shallow.

Front cut into 3 broad triangular teeth of about equal size, the middle one of which is on a lower plane than the others and is deflexed.

A sharp tooth near the middle of the upper border of the orbit marks the true inner supra-orbital angle. Outer orbital angle dentiform. Suborbital lobe dentiform and very prominent.

True antero-lateral border cut into 3 or 4 blunt teeth: in the gap between the 1st tooth and the outer orbital angle two subhepatic teeth—one of which is large—show up and, from a dorsal view, look as if they belonged to the antero-lateral border: there are two similar teeth, one alone of which is conspicuous, at the outer angle of the buccal cavern.

On the postero-lateral border, at the branchial or "cervical" groove, is a denticle.

Wrist and palm, and corresponding joints of first two pair of legs, sharply and profusely nodular or tubercular on the outer surface: fingers compressed.

The third pair of legs, though much slenderer and less nodular than the first two pair and only about half their length, are fashioned on much the same plan, except that the propodite is much shortened: the spinule at the end of the propodite of this pair is not big enough to form a chela with the claw-like dactylus.

Last (4th) pair of legs slender and smooth, hardly a dactylus length shorter than the 2nd pair: their propodite has spines at the end of both borders, the spine at the end of the anterior border being large enough to form a chela with the dactylus.

Abdomen of the male slightly convex along the middle line, the 4th and 5th terga with some little nodules: in the female the 3rd-5th terga have the surface a little uneven, but not distinctly nodular.

Every specimen has a commensal sponge which covers it completely like a cap.

In the Indian Museum are 70 specimens from the Andaman reefs.

The carapace of a large egg-laden female is 9 millim. long and 11 millim. broad.

#### 8. ? *Dromia* (*Cryptodromia*) *canaliculata*, Stimpson.

? *Cryptodromia canaliculata*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 240: de Man, Archiv. f. Naturges. LIII. 1887, i. p. 402 (*et synon.*): Ortman, Zool. Jahrb., Syst. etc. VI. 1892, p. 545.

*Dromia tomentosa*, Heller, SB. Ak. Wien, XLIV. 1861, p. 241: *Cryptodromia tomentosa*, Hilgendorf, MB. Ak. Berl. 1878, p. 813, pl. ii. figs. 3-5: Kossmann, Reise roth. Meer. Crust. p. 68.



? *Cryptodromia pentagonalis*, Hilgendorf, MB. Ak. Berl., p. 814, pl. ii. figs. 1-2 : Henderson, Trans. Linn. Soc. Zool. (2) V. 1893, p. 406.

Carapace etc. with a short velvet-like tomentum.

Carapace not quite as long as broad, only moderately convex, its surface smooth, its regions very fairly indicated: the "cervical" groove is distinct, the fronto-orbital region is marked off by a shallow transverse groove that runs from one antero-lateral angle of the carapace to the other, and the front itself is longitudinally grooved.

Front cut into 3 broad triangular teeth of nearly equal size, the middle one nearly horizontal, but on a much lower plane than the others, which are somewhat upcurved.

A tooth near the middle of the upper border of the orbit marks the position of the true inner supra-orbital angle. Outer orbital angle dentiform. Infra-orbital lobe dentiform and prominent.

True antero-lateral borders with 2 teeth: in the concave space between the 1st (large) tooth and the outer orbital angle a stout sub-hepatic tooth shows up: below this again is a tooth at the outer angle of the buccal cavern.

On the postero-lateral border, immediately behind the branchial or "cervical" groove, is a tooth.

Outer surface of wrist nodular: a few nodules on upper border of palm: fingers short and stout.

The carpus and propodite of the first 2 pair of legs are nodular.

Last 2 pair of legs short and slender, not nodular, not much more than half the length of the first 2 pair: the 4th (last) pair very little longer than the 3rd. Both end in a strong claw-like dactylus, but are hardly cheliform, although there is a small spine at the end of the propodite of each.

Abdomen of male with a convex ridge down the middle line.

In the Indian Museum are 2 males and a female, from the Audamans and the Persian Gulf.

The carapace of the largest specimen is 14 millim. long.

*Distribution*: Indo-Pacific Seas from the Red Sea and east coast of Africa to Japan.

#### 9. *Dromia* (*Cryptodromia*) *bullifera*, n. sp.

Carapace etc. covered with a short tomentum.

Carapace about as long as broad, convex, smooth, "cervical" groove shallow but distinct.

Front cut into 3 acute rather slender teeth, the middle one of which is on a lower plane and is slenderer than the others.

An acute *spine* near the middle of the upper border of the orbit

marks the position of the true inner supra-orbital angle. Outer orbital angle spiniform. Suborbital lobe dentiform, fairly prominent.

True antero-lateral borders of the carapace cut into 2 teeth, the anterior being much the larger and spine-like. In the gap between the 1st tooth and the outer orbital angle two small smooth subhepatic tubercles are visible, one below the other.

*An elegant pearl-like tubercle below the sub-orbital lobe, a similar but smaller tubercle in the middle of the exposed surface of the merus of the external maxillipeds and another in the middle of the exposed surface of the second joint of the antennal peduncle, are characteristic.*

An extremely inconspicuous denticle on the postero-lateral border, behind the branchial or "cervical" groove.

Outer surface of wrist and upper surface of hand nodular, two of the nodules on the wrist being particularly acute.

Outer surface of carpus and propodite of first 2 pair of legs broken but not nodular.

Last 2 pair of legs slender and very short, ending in claw-like dactyli, but not cheliform.

Abdomen of male convex along the middle line.

One specimen from the Andaman Sea, 490 fathoms, another from off Ceylon, 34 fathoms.

The carapace is between 5 and 6 millim. long.

#### 10. *Dromia (Cryptodromia) de Manii*, n. sp.

*Cryptodromia* sp. de Man, Journ. Linn. Soc. Zool., XXII., 1888, p. 211.

Carapace etc. tomentose.

Carapace as long as broad, convex, smooth, the "cervical" groove rather indistinct.

Front cut into 3 teeth, the middle one of which is the smallest and is much deflexed.

A tooth near the middle of the upper border of the orbit (true inner supra-orbital angle). Outer orbital angle dentiform.

Suborbital lobe dentiform, but not very prominent.

True antero-lateral border with two blunt teeth: two more blunt teeth on the subhepatic border and one at the angle of the buccal cavern are continued on from the antero-lateral border.

*A tooth on the hepatic region, dorsal of the antero-lateral border, and just behind the outer orbital angle, is characteristic.*

A tiny denticle on the postero-lateral border, just behind the branchial or "cervical" groove.

Outer surface of wrist and upper surface of hand nodular; outer surface of hand granular.

Outer surface of carpus and propodite of first two pair of legs uneven but not distinctly nodular.

Last 2 pair of legs short, ending in claw-like dactyli, not cheliform; the 3rd pair shorter than the 4th.

A single small specimen from Mergui (Anderson collection).

### 11. *Dromia* (*Cryptodromia*) *Hilgendorfi*, de Man.

*Cryptodromia Hilgendorfi*, de Man, Archiv. f. Naturges. LIII. 1887, i. 404, pl. xviii. fig. 3.

Carapace etc. with a short velvet-like tomentum.

Carapace longer than broad, convex, smooth, without distinction of regions. "Cervical" groove broad and shallow.

Front cut into 3 teeth, the lateral ones broad and triangular, the middle one so small and deflexed as to be hardly visible in a dorsal view.

There is no distinct tooth in the upper border of the orbit, but only an angular bulge, to mark the position of the inner supra-orbital angle. Outer orbital angle and sub-orbital lobe not dentiform.

The antero-lateral borders of the carapace are smooth and entire, but as they bend sharply inwards towards the orbits their anterior angle forms a forwardly-directed tooth, the space between which and the outer-orbital angle is concave.

A very small prominence on the postero-lateral border, just behind the branchial or "cervical" groove.

The chelipeds and legs have an uneven surface, but are not really nodular, though both the inner and outer angles of the wrist are strongly pronounced.

The last 2 pair of legs are short and slender, the 4th (last) pair being very little longer than the 3rd; both end in stout claw-like dactyli but are not at all cheliform.

The abdomen bends in very sharply from the 4th segment, making the under surface of the body very flat.

In the Indian Museum are a male and a female from the Persian Gulf.

The carapace of the larger of the two is 12 millim. long.

*Distribution*: Indo-Malayan coasts.

### 12. *Dromia* (*Cryptodromia*) *ebalioides*, n. sp.

Carapace hardly at all tomentose: a few hairs on the borders of some of the leg-joints.

Carapace subcircular with projecting front, convex, *its surface closely and crisply granular*: not only are all its regions very distinct

but they are also areolated, *the individual areolæ being convex, subcircular, and particularly well defined.* The true cervical groove is present, as well as the branchial groove that generally goes by this name.

Front longitudinally grooved, cut into 3 serrulated teeth of which the lateral ones are broadly triangular, while the middle one is narrow and is more prominent than the others.

Upper border of the orbit very oblique, serrulate, devoid of any tooth to mark the inner supra-orbital angle of the higher Brachyura. Outer orbital angle and suborbital lobe not prominent.

Lateral borders of carapace serrulate, not toothed, though there may be a small granular bulge in front of, and another behind, the branchial groove.

Legs and chelipeds crisply granular, the chelipeds and first two pair of legs being also nodular.

Last 2 pair of legs very slender, hardly half the length of the first 2 pair, ending in hook-like dactyli, not cheliform.

First four abdominal terga with some symmetrical granular sculpture, the other three granular but not sculptured.

Three specimens, a male and 2 females, from Karáchi: the carapace of the largest is 7 millim. long and 8 millim. broad.

This species, and the one following, show the transition to *Petalomera*, having a granular carapace, on the dorsal surface of which the true cervical groove is as plain as the branchial groove that is commonly called "cervical."

### 13. *Dromia (Cryptodromia) Gilesii*, n. sp.

Closely related to *D. sculpta*, Haswell.

Carapace etc. without tomentum: a few hairs on some of the leg-joints.

Carapace pentagonal, convex, its greatest length about equal to its greatest breadth, the greater part of its surface covered with vesiculous granules: not only are all the regions very distinct, but they are also areolated—the areolæ however not being so individually convex as they are in *D. ebaloides*. The true cervical groove is present as well as the branchial groove.

Front cut into 3 triangular teeth, of which the middle one is the smallest and is on a lower plane and obliquely deflexed.

Upper orbital border very oblique: a hardly noticeable angulation—not a distinct tooth—marks the true inner supra-orbital angle. Outer orbital angle not pronounced. Suborbital lobe dentiform but inconspicuous.

Antero-lateral borders of the carapace cut into 5 small granular

lobules or tubercles, of which only 2 belong to the true antero-lateral border, the other 3 being on the subhepatic border and at the outer angle of the buccal cavern.

A granular tubercle on the postero-lateral border, just behind the "cervical" groove.

Legs and chelipeds crisply granular, the chelipeds and first 3 pair of legs being also nodular: the nodules on the carpal joints being prominent and acute.

Last 2 pair of legs very slender, hardly half the length of the first 2 pair, ending in hook-like dactyli, not cheliform.

All the abdominal terga are symmetrically sculptured and granular.

In the Indian Museum are 12 specimens, from off the Malabar coast, 29 fathoms.

The carapace of an egg-laden female is 8 millim. long and  $8\frac{1}{2}$  millim. broad.

This species is easily distinguished from *D. ebalioides* (1) by the sharply pentagonal carapace and less-completely isolated areolæ, (2) by the much more prominent front, (3) by the antero-lateral borders being broken by irregular tubercle-like lobules, and (4) by the more abundant sculpture of the abdominal terga: in everything but the form of the meropodites of the chelipeds and first pair of legs it strongly resembles *Petalomera*.

#### Subgenus PETALOMERA, Stimpson.

*Petalomera*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 226: Ortmann in Bronn's Thier Reich (*loc. cit.*) p. 1155 (name only).

*Petalomera* closely resembles *Cryptodromia*, especially those species (e.g. *Cryptodromia ebalioides* and *Gilesii*) in which the carapace is granular and has the cervical and branchial grooves both well developed; and, indeed, only differs from *Cryptodromia* in having the upper border of the meropodites of the chelipeds and first, or first two, pair of legs produced to form a crest so high and thin as to give the joint a petaloid shape.

As in *Cryptodromia* the sternal grooves of the female are widely separated, and end on the second segment of the sternum. As in *Cryptodromia lateralis*, there is a small epipodite to the chelipeds.

There can be little doubt that, as Bouvier (Bull. Soc. Philomath. Paris, 1895-96, p. 52) has remarked, *Petalomera* is a form slightly more primitive than *Dromia*.

#### 14. *Dromia* (*Petalomera*) *granulata*, Stimpson.

*Petalomera granulata*, Stimpson, Proc. Acad. Nat. Sci. Philad., 1858, p. 240.

*Petalomera granulata* var. *indica*, nov.

Carapace etc. hardly at all hairy: edges of the legs with some hairs.

Carapace a little longer than broad, convex in both directions, with numerous unevenly distributed vesiculous granules: all the regions are distinct, but are not all equally well defined. The cervical and branchial grooves are both present.

Front dorsally grooved in the middle line, cut into 3 serrulate teeth, of which the lateral ones are large and triangular, while the middle one is small and is on a much lower plane.

Upper border of orbit serrulate: a tooth near its middle marks the true inner supra-orbital angle. Outer orbital angle pronounced but not dentiform. The suborbital lobe forms a granular tubercle or denticle.

Antero-lateral borders of the carapace cut into 3 granular teeth, the first being subhepatic.

Chelipeds very much more massive than the legs: they and the first pair of legs have the merus petaloid, owing chiefly to the thin expanded crest-like upper border of that joint. The merus of the next pair of legs is not petaloid, though its upper border is sharp. In the chelipeds the inner border of the wrist and the upper border of the palm are prominent and, like the upper and outer surfaces of those joints, are granular: there are also two sharp tubercles at the distal end of the outer surface of the wrist.

The first two pair of legs have a few small granules on some of the joints.

The last two pair of legs are slender and end in small claw-like dactyli, which are opposed to a very small spine at the end of the corresponding propodites: the last pair of legs is very slightly longer than the penultimate pair.

In both sexes the abdomen has a convex ridge down the middle line and the 2nd-5th terga have a few scattered granules on their surface.

The largest specimen is slightly over 15 millim. long, and is 15 millim. broad, but in young specimens the carapace is more elongate.

Colours of fresh spirit specimens: yellow with some reddish markings.

In the Indian Museum are 22 specimens, from the Andamans and from off Ceylon 28 and 34 fathoms.

This variety is to be distinguished from *P. granulata* only in not having the merus of the second pair of legs (3rd pereopods) petaloid.

From *P. pulchra* Miers (Zool. H. M. S. "Alert" p. 260, pl. xxvii. fig. A), it differs only in having a tooth on the supra-orbital border,

which border is serrulate not entire; in having small spines opposed to the dactyli—at the end of the propodites of the last two pair of legs; and in being more granular.

PSEUDODROMIA, Stimpson.

*Pseudodromia*, Stimpson, Proc. Acad. Nat. Sci. Philad. 1853, p. 226: Henderson, Challenger Anomura, p. 15: Ortmann in Bronn's Thier Reich V. ii., Arthropoda, p. 1155.

*Homalodromia*, Miers (*nee* Homolodromia A. M. Edw.), Zool. H. M. S. Alert, p. 553.

Differs from *Dromia* in the following particulars:—

The carapace is more elongate: the efferent branchial channels are defined by ridges.

The fourth (last) pair of legs are as long as, or even longer than, the first two pair.

The sternal grooves of the female end in two tubercles placed close together near the bases of the chelipeds.

The front is variable: it may be cut into 3 teeth as in most species of *Dromia*, or may be bilobed, or may consist of a single triangular tooth.

*Distribution*: Cape of Good Hope, Seychelles, Indian Seas.

N. B.—In *Dromia cranioides*, *Dromia unidentata* and *Cryptodromia tuberculata* the last pair of legs are very little shorter than either of the first two pair.

*Key to the Indian species of Pseudodromia.*

- I. Front cut into 2 teeth, each of which is fused at base with the tooth of the prominent supra-orbital margin; so that the front appears to be formed of two divergent lobes each of which has both its angles acutely produced ... *P. quadricornis.*
- II. Front in the form of a single triangular tooth ... *P. integrifrons.*

15. *Pseudodromia quadricornis*, n. sp. ?

Perhaps identical with "*Homalodromia*" *Coppingeri*, Miers, *loc. cit.* pl. L. fig. B.

Carapace etc. tomentose: a line of peculiarly long silky hairs forms a fringe or false anterior border to the carapace, behind the deflexed front.

Front deflexed, dorsally grooved in the middle line, cut into two broad teeth, each of which is fused at base with a broad supra-orbital tooth; so that the front appears to consist of two large lobes, each of which has its anterior edge concave and its antero-lateral angles acutely produced.

Carapace in the adult longer than broad, slightly convex from side

to side, almost flat fore and aft behind the line of long hairs that marks the frontal declivity: its surface, when denuded, is quite smooth: only the branchial or "cervical" groove and the cardiac region are distinctly marked.

Lateral borders of carapace entire, except that there may be a tiny denticle behind the branchial groove.

Outer orbital angle dentiform. Sub-orbital lobe dentiform, deflexed.

Chelipeds and legs comparatively slender, the chelipeds shorter and hardly stouter than the legs. Two acute tubercles on the outer surface of the wrist.

Fourth (last) pair of legs little slenderer and about as long as either of the first two pair, ending in a slender claw-like dactylus to which a spinule at the end of the propodite is opposed.

Third pair of legs not less stout than, but only about half the length of, the first two pair; ending in a claw-like dactylus.

Length of carapace of an adult female 7 millim., greatest breadth—in front of the branchial groove—6 millim.

Five specimens, representing adults of both sexes, from off Ceylon 34 fathoms, and from the Pedro Shoal (off Malabar coast) 20 fathoms.

#### 16. *Pseudodromia integrifrons*, Henderson.

*Pseudodromia integrifrons*, Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 406, pl. xxxviii, figs. 7-9.

The front is entire and subacute, without any trace of lateral teeth. No supra-orbital tooth. Outer orbital angle poorly marked. The lower orbital margin is formed simply by the antennal peduncle. Chelipeds without any teeth or tubercles. The carpus of the third pair of legs has a prominent lobe at its distal end, anteriorly. Dactylus of fourth (last) pair of legs straight: its propodite with 3 spinules at its far end.

*Loc.* Tuticorin.

No specimens in the Indian Museum.

#### CONCHÆCETES, Stimpson.

*Conchæcetes*, Stimpson, Proc. Acad. Nat. Sci. Philad. 1858, p. 226: Ortman in Bronn's Thier Reich, *loc. cit.* (name only).

All parts, except the dactyli and tips of the fingers covered with a close velvet-like tomentum.

Carapace not elongate in the adult, dorsally quite flat, sub-pentagonal in outline.

Front cut into 3 teeth, of which the middle one is on a very much lower plane (and is much smaller) than the others.



Palate well delimited from the epistome. Efferent branchial channels well defined.

Chelipeds in the male much more massive and much longer than any of the legs.

The third pair of legs though shorter are not less massive than the first 2 pair, and end in a powerful talon like dactylus. The fourth (last) pair of legs are short and slender.

The sternal grooves of the female do not meet; they end in tubercles on the second segment of the sternum, between the bases of the 2nd pereopods.

The branchial formula and the number and disposition of the epipodites are exactly the same as in *Dromia Rumphii*.

#### 17. *Conchæcetes artificiosus* (Fabr.).

*Dromia artificiosa*, Fabricius, Ent. Syst. Suppl. p. 360.

*Cancer artificiosus*, Herbst, Krabben, III. iii. 54, pl. lviii. fig. 7.

*Conchæcetes artificiosus*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 240: Henderson, Trans. Linn. Soc. Zool. (2) V. 1893, p. 407.

*Dromia conchifera*, Haswell, P. L. S., N. S. Wales, VI. 1881-2, p. 757, and Cat. Austral. Crust. p. 141, pl. iii. fig. 4.

Carapace etc. with a dense short velvety tomentum.

Carapace pentagonal, with the posterior border of the pentagon curved, its dorsal surface quite flat, its greatest length (in the adult) about equal to its greatest breadth, its regions all well defined by grooves, the cervical and branchial furrows both equally well cut. There are sometimes a few granules near the borders of the carapace.

Front cut into 3 teeth with granular edges, the middle tooth being smaller and on a much lower plane than the others.

Upper border of orbit very oblique: a granular spine or tooth marks the true inner supra-orbital angle of higher *Brachyura*. Outer border of orbit apparently wanting, but on denudation a concave row of granules is found there. Sub-orbital lobe granular and dentiform.

On the lateral borders of the carapace are usually two teeth, one immediately behind the cervical groove, the other immediately behind the branchial groove: one (the posterior) or both of these teeth may be nearly worn away, but usually they are both very distinct. Between the first spine and the orbital tooth is a (sometimes broken) row of granules, and between the same spine and the outer angle of the buccal cavern is a row of granular tubercles: the surface of the subhepatic region between these two rows of granules may, when denuded, be granular or not.

The chelipeds of the adult male are, as in *Petalomera*, much more

massive, compared with the legs, than is usual among the *Dromiidæ*: they are also much longer than any of the legs. The outer (exposed) surfaces of all the joints are more or less granular, some of the granules on the palm being very large and visible without denudation: in addition, the upper border of the arm is denticulate, there are 2 coarse tubercles at the far end of the outer surface of the wrist, and 2 on the palm just behind the finger-joint.

The first 3 pair of legs are short, and some of their joints are granular and have a tendency to be nodular, a nodule on the carpus being very constant. Of these legs the 3rd pair ends in a characteristic stout talon-like dactylus the tip of which bends towards a stout lobe at the proximal end of the posterior border of the propodite.

The 4th (last) pair of legs are very slender: they reach to the far end of the carpus of the 3rd pair, and end in a tiny claw-like dactylus.

In both sexes the abdomen has a convexity along the middle line.

This species protects itself with the valve of a Lamellibranch shell, which is held, as in a frame, by the strong hook-like dactyli of the third pair of legs.

In the Indian Museum are 24 specimens, representing both sexes, from the Andamans, from various parts of the Coromandel coast between Tuticorin and the Hooghly Delta, and from off the Indus Delta up to a depth of 62 fathoms. It appears to prefer a muddy bottom. There are also 2 specimens from Hongkong.

Distribution: coasts of India, China, and Australia.

#### 18. *Conchoecetes andamanicus* n. sp. ?

Three small specimens from the Andamans differ from adults in the following particulars:—

The carapace, though not flatter dorsally, is more depressed and therefore much shallower.

The front is cut into 2 triangular teeth, between which is a tiny denticle not visible in a dorsal view.

There is no spine or tooth on the upper border of the orbit.

The antero-lateral borders though granular are thin and overhanging, and are without any traces of spines or teeth behind the cervical and branchial grooves. The subhepatic regions are granular but are not bounded by distinct rows of granules.

Instead of two blunt tubercles behind the finger-joint, there is one large subacute tubercle.

#### SPHERODROMIA, Alcock.

*Sphærodromia*, Alcock, Investigator Deep-Sea Brachyura, p. 16.

All parts except the tips of the fingers and of the dactyli are tomentose.

Carapace not elongate, subglobose. Front broadly triangular, somewhat deflexed, dorsally grooved, rather deeply notched at tip (of the *Dynomene*-type).

Palate well delimited from the epistome: efferent branchial channels defined by ridges.

The chelipeds and legs are as in typical *Dromia*, except that the chelipeds are not at all nodose.

The sternal grooves of the female are wide apart and do not reach to the level of the genital openings, exactly resembling those of *Dynomene*.

Though the gills are phyllobranchiæ the individual gill-plates are narrow and thick and are undoubtedly transitional.

#### 19. *Sphærodromia Kendalli*, Alcock & Anderson.

*Dromidia Kendalli*, Alcock & Anderson, J. A. S. B. Vol. LXIII. pt. 2, 1894, p. 175: Illustrations of the Zoology of the Investigator, Crustacea, pl. xxiv. figs. 1, 1a.

*Dromia (Sphærodromia) Kendalli*, Alcock, Investigator Deep-Sea Brachyura, p. 16.

Carapace etc. covered with a dense, yellowish, velvet-like tomentum.

Carapace sub-circular, globose, smooth except for a few vesiculous granules on the pterygostomial regions and on the posterior part of the sidewall, only the cardiac region and the branchial, or "cervical" groove are marked. [The true cervical groove is not distinguishable on the dorsum of the carapace].

The front consists of two triangular teeth. The upper border of the orbit is oblique, but there is no tooth—only a break, or fold, better visible from below than from above—to mark the true inner supra-orbital angle. The outer angle of the orbit is not defined. The sub-orbital lobe is broadly and bluntly triangular.

Lateral borders of the carapace entire, the antero-lateral borders subcrisiform and ending at the sub-orbital lobe.

The external maxillipeds when closed leave a gap between their anterior border and the edge of the epistome.

Vesiculous granules are present on the edges of the arms, on the upper and outer surfaces of the wrists, and everywhere on the hands except on the lower part of the inner surface.

The last two pairs of legs are about equal and are about half as long as the other legs: each ends in a small claw-like dactylus which is opposed to two or three tiny spinules at the end of its propodite.

A single female, with the carapace 18 millim. in diameter from the Bay of Bengal, off Nellore coast, 112 fathoms.

20. *Sphærodromia nux*, n. sp.

Differs from *Sphærodromia Kendallii* only in the following particulars:—

The carapace though of the same subglobular shape is a little broader than long; and the antero-lateral border, instead of running to the orbital angle, runs down without interruption to the outer angle of the buccal cavern. The surface of the carapace, especially in its antero-lateral parts, is finely granular under a lens. The sub-orbital lobe is neither dentiform nor prominent.

A male and a female from the Gulf of Martaban, 70 fathoms.

The carapace of the female is nearly 10 millim. long and nearly 11 millim. broad.

Tribe HOMOLIDÆ.

Family I. HOMOLIDÆ.

*Key to the Indian genera of the Family Homolidæ.*

- I. Carapace ovoid. External maxillipeds quite pediform: terminal joint of the eye-stalk very much longer than the basal joint, which is obsolescent: dactylus of last pair of legs very small, and shutting down on the slightly expanded *distal* border of the propodite ... .. HYP SOPH RYS.
- II. External maxillipeds subpediform, the merus, though not a broad joint, having its outer angle distinctly dilated: terminal joint of the last pair of legs shutting against the *posterior* border of the propodite:—
  1. Carapace subquadrilateral, or urn-shaped, not depressed; its hepatic spine some distance behind the level of the supra-orbital spine: the terminal joint of the eye-stalk is not always quite as long as the basal joint ... .. HOMOLA.
  2. Carapace urn-shaped, depressed; its hepatic spine almost on the same level as the supra-orbital spine: the terminal joint of the eye-stalk is a little longer than the basal joint ... .. PAROMOLOPSIS.

HOMOLA, Leach.

*Homola*, Leach, Trans. Linn. Soc., Vol. XI, 1815, p. 324, and Zool. Miscell. Vol. II. p. 82, pl. lxxxviii: Latreille, Nouv. Dict. d'Hist. Nat. XV. 1817, p. 277, and in Cuvier's Regne Animal, ed. 1829, p. 67: Desmarest, Consid. Gen. Crust. p. 133: Risso, Hist. Nat. Europ. Merid. Vol. V. pp. 34-35: Roux, Crust. de la Méditerranée text of pl. vii: Milne Edwards, Hist. Nat. Crust. II. 181: deHaan, Faun. Japon. Crust. p. 105: Dana U. S. Expl. Exp. Crust. pt. I, p. 403: Heller, Crust. Sudl.

Europ. p. 148: Henderson, "Challenger" Anomura, p. 18: Ortmann, Zool. Jahrb. Syst. etc. VI. 1892, pp. 540 and 542 and in Bronn's Thier Reich, V. ii. Arthropoda, p. 1156: A. Milne Edwards and Bouvier, "Hirondelle" Brachyures et Anomures (Monaco 1894) p. 60: Alcock, Investigator Deep-Sea Brachyura, p. 6.

Carapace deep, longer than broad, quadrilateral or urn-shaped, with deep vertical sides, the gastric region well demarcated and occupying the anterior half of the carapace, the linea anomurica distinct and dorsal.

Front narrow, forming a rostrum, which is either entire or bifid at tip and has a spine, often of large size, on either side of its base.

The orbits are quite incomplete and do not even conceal the eye-stalks, and the eyes, which project far outside them, are retractile against the sides of the carapace. The eye-stalks are long and are composed of two joints, a slender basal joint, and a swollen terminal joint that carries the eye, the terminal joint (with the eye) being nearly as long as the basal joint.

The epistome is fairly or very distinctly marked off from the palate. The expiratory canals are very well defined. The external maxillipeds are subpediform.

The chelipeds are rather slender and generally somewhat spiny. The legs are long and more or less compressed and spiny, the last pair are subcheliform, but have the propodite dilated near the basal end and never twice the length of the dactylus.

The abdomen of both sexes consists of seven separate segments and is rather broad.

The branchial formula is as follows:—

Somites and their appendages.	Podo-branchiæ.	Arthrobranchiæ.		Pleuro-branchiæ.	
		Anterior.	Posterior.		
VII. ...	0 ep.	0	0	0 =	ep.
VIII. ...	1+ep.	0	1	0 =	2+ep.
IX. ...	0 ep.	1	1	0 =	2+ep.
X. ...	0 ep.	1	1	0 =	2+ep.
XI. ...	0 ep.	1	1	1 =	3+ep.
XII. ...	0 ep.	1	1	1 =	3+ep.
XIII. ...	0	1	0	1 =	2
XIV. ...	0	0	0	0 =	0
	1+6 ep.	5	5	3 =	14+6 ep.

*Distribution*: West Indies and Atlantic coasts of N. America, Azores and coast of Portugal: Mediterranean: East Indian Seas from Cape Comorin to the Philippines.

In my *Account of the Investigator Deep Sea Brachyura*, I have proposed the following subdivision of the genus *Homola*:—

1. *HOMOLA*. Carapace square-cut, its broadest part being in front, across the middle of the gastric region: the *linea anomurica* rather

inconspicuous, keeping close to the lateral border. Rostrum a non-cylindrical bifid tooth, with a smaller spine on either side of its base. 2nd joint of antenna-peduncle having its antero-external angle produced to form a spine. Palate distinctly delimited from the epistome everywhere except in the middle line. The last pair of legs reach to the end of the carpus of the preceding pair.

TYPES *H. barbata* (Herbst) and *H. andamanica*, Alcock.

HOMOLAX. Carapace urn-shaped, its greatest breadth being behind, across the middle of the branchial regions: the *linea anomurica* conspicuous, running well inside the lateral border. Rostrum as in *Homola*. 2nd joint of antenna-peduncle having its antero-external angle acute, but not spiniform. Palate as well demarcated from the epistome in the middle line as it is elsewhere. The last pair of legs reach beyond the end of the carpus of the preceding pair.

TYPE *H. megalops*, Alcock.

PAROMOLA Wood-Mason. "Carapace decidedly macrurous in form," its greatest breadth being behind: the *linea anomurica* very conspicuous and well inside the lateral border. Rostrum a simple cylindrical spine of large size, flanked on either side by a single spine of equal or greater size. 2nd joint of antenna-peduncle not produced or specially acute at the antero-external angle. Palate everywhere well demarcated from the epistome. The last pair of legs not reaching beyond the end of the merus of the preceding pair.

TYPES *H. cuvieri*, Roux and *H. profundorum*, Alcock.

#### Subgenus *Homola*.

#### 21. *Homola andamanica*, Alcock.

*Homola andamanica*, Alcock, Investigator Deep-Sea Brachyura, p. 7: and Illustrations of the Zoology of the Investigator, Crustacea, pl. xl. fig. 1.

This may, very possibly, prove the same as *Homola orientalis* Henderson, though it cannot be quite reconciled with the description, still less with the figure, of that species.

In any case it is probably only a variety of *Homola barbata*, with 3 good specimens of which—representing both sexes—it has been compared. The only differences between it and *H. barbata* are the following:—

The eyes are more reniform. The second spine of the lateral border is just behind the hepatic region. There are spines on the posterior border of the meropodites of all four pairs of walking legs.

Carapace elongate-subquadrilateral, its greatest breadth is across the middle of the gastric region, behind which point its sides are quite straight and vertical: it is well calcified, and, like all other parts except the antennary flagella, is covered with short soft but stiff hairs that are not thick set enough to form a coat of concealment.

Rostrum a depressed grooved tooth, bifid at tip. Four spines on the anterior border of the carapace, namely, one on either side of the rostrum, one at either supra-orbital angle.

Lateral borders of dorsum of carapace straight, very slightly convergent, spinate; the first spine, which stands alone on the hepatic region, is of pre-eminent size, the second though much smaller than the first is much larger than any of the others.

Gastric region very well demarcated, armed with nine large spines—three in a triangle on either median area, one on either lateral area, and one on the hinder part of the central area.

Some spines on the subocular, subhepatic, and pterygostomian regions—largest on the subocular region, where they are definitely arranged in two crescentic rows. Two spines, one *beside* the other, on the carapace outside the antenna-peduncle, in addition to the spinuliform suborbital angle.

Eyes somewhat reniform.

Chelipeds slender, but distinctly stouter than the legs, more hairy than the carapace, especially along the edges of the joints. Upper and lower borders of arm spiny; wrist with rows of spines on the outer surface and a spine or two at the inner angle; lower border of hand spiny, upper border of hand denticulate, cutting edges of fingers sharp, entire.

Legs compressed, their edges plumed with short bristles, with long bristles interspersed. The second and third pair, which are a dactyl-length longer than the first, are not quite  $2\frac{1}{2}$  times the length of the carapace: in all three pairs both edges of the merus are armed with stout spines—at least in the distal half, and the posterior border of the propus and dactylus with compressed articulated spines which are distant and acicular on the propus but stout very regular and close-set on the dactylus.

The subcheliform fourth pair of legs reach very slightly beyond the end of the carpus of the preceding pair: the merus has 3 or 4 spines on the lower border and a terminal spine on the upper border, the claw-like dactylus closes against a bunch of spines on the near end of the propus.

In the Indian Museum are a male and female from the Andaman Sea, 79–90 fathoms; the carapace of the female is about 27 millim. long, and about 21 millim. wide.

Subgenus *Homolax*.22. *Homola megalops*, Alcock.

*Homola megalops*, Alcock, Ann. Mag. Nat. Hist., May 1894, p. 408: Illustrations of the Zoology of the R. I. M. S. 'Investigator,' Crustacea pl. xiv. figs. 1, 1a: Investigator Deep-Sea Brachyura, p. 9.

Carapace urn-shaped, its greatest breadth is across the middle of the branchial region; its sides, and still more the spinulate lateral borders of its dorsum, are elegantly curved; the hairs that cover it are so inconspicuous as to be recognizable only with a lens.

Rostrum a depressed grooved tooth, entire, or emarginate at tip. Four spines on the anterior border of the carapace arranged as in *H. barbata*.

The only enlarged spine of the lateral border stands alone on the hepatic region.

Nine spines on the gastric region—two immediately behind the spines at the base of the rostrum, the other seven in an open S-shaped curve across the middle of the region.

A single row of spines on the subocular region, which region is remarkably hollowed for the reception of the retracted eye. Two spines, one above the other, on the carapace beside the antenna-peduncle, in addition to the bluntly-dentiform suborbital angle.

Eyes reniform, very large, their major diameter being one-sixth the breadth of the carapace.

Chelipeds slender, their arms and wrists distinctly slenderer than the meropodites of the legs: in the adult male they do not reach half-way along the merus of the first pair of legs: they are covered with a short inconspicuous velvet, with hardly any long bristles on the edges of the joints: they are armed much as in *H. barbata*, but the upper border of the hand is spiny and the lower border faintly denticulate. The fingers, which have a sharp entire cutting-edge, are as long as the rest of the hand.

The legs have the surface—especially the dorsal surface—of most of the joints covered with a close short velvet, but have few or no bristles along their edges. The 2nd and 3rd pair, which are nearly a dactylus longer than the first, are nearly three times as long as the carapace: the subcheliform 4th pair reach beyond the end of the carpus of the preceding pair. The first three pair have the anterior edge of their greatly compressed meropodite closely spinate, and the posterior edges of that joint and the ischium closely spinulate; their last three joints have the edges smooth, except for a few small jointed spinules at the base of the posterior border of the dactylus. The last pair of legs have



the posterior edge of their subcylindrical meropodite closely spinate and have only a single terminal spine on the upper edge, the carpus has a strong terminal spine on its posterior border, and the propus has a salient group of spines behind the middle of its posterior border forming a subcheliform stump for the serrated posterior edge of the claw-like dactylus.

Colour in life salmon-pink.

Andaman Sea, 188–220 fathoms, a male and a female; 370–419 fathoms, 3 males and 3 females. Bay of Bengal, off Coromandel Coast, 145–250 fathoms, a male and a female. Gulf of Manár, off Colombo, 142–400 fathoms, 2 young males.

Dimensions of carapace of a full-grown specimen 41 millim. long, 36 millim. broad.

The gills are fourteen in number on either side, arranged as in *Homola barbata*, exclusive of a quite rudimentary posterior arthrobranch to the penultimate pair of legs.

#### Subgenus *Paromola*.

#### 23. *Homola profundorum*, Alcock and Anderson.

*Homola profundorum*, Alcock and Anderson, Ann. Mag. Nat. Hist. Jan. 1899, p. 5: Alcock, Investigator Deep-Sea Brachyura, p. 10, pl. i. fig. 2.

Carapace very decidedly macruriform, deep, ovoid-triangular, broadest abaft the middle of the branchial region, tapering to an acutely-spiniform rostrum of which the length is about a third that of the rest of the carapace. Diverging from either side of the base of the rostrum is a spine of similar form and size. The only other elevations on the carapace are a hepatic spine just behind the hollow for the retracted eye, an antennal spine just outside the antennal base, and a blunt denticle near the middle of the ill-defined lateral border.

The gastric region is well delimited, and the *linea anomurica* is broad conspicuous and dorsal.

The stout cylindrical terminal joint of the eye-stalks is longer than the slender basal joint, the eyes are of good size, well pigmented, and hemispherical.

The chelipeds are slender but are stouter than the legs; the arm has the outer lower border spinate and, on the upper border, a few spinules and a strong terminal spine; both the inner and the outer angles of the wrist are armed with a strong spine, the fingers are much shorter than the hand and have the cutting-edge entire.

The legs are slender and subcylindrical, the 2nd and 3rd pair, which are slightly longer than the first, are at least three times the length of the carapace. In the first 3 pair there are a few distant

spines and a strong terminal spine on the anterior border of the merus, a few articulating spinules at the far end of the posterior border of the propodite, and a comb of articulating spines along the posterior border of the dactylus—the last joint being but half the length of the last but one. The dorsal fourth pair of legs are far slenderer than the others and do not reach the end of the merus of the preceding pair: their propodite is triangular, owing to the expansion of its posterior border, and opposes a sharply-serrated edge to the less strongly toothed posterior border of the short dactylus—the parts being cheliform rather than subcheliform.

The body and appendages are coated with very short distant bristles which do not conceal the surface: there are some longer and thicker bristles along the edges of the chelipeds, and a very few scattered hairs along the edges of the legs.

Three young females from off the Travancore coast, 430 fathoms.

The carapace of these is about 13 millim. long, and about 9 millim. in greatest breadth.

#### PAROMOLOPSIS, Wood-Mason.

*Paromolopsis boasi*, Wood-Mason, Ann. Mag. Nat. Hist., March, 1891, p. 268.

*Paromolopsis*, Alcock, Investigator Deep-Sea Brachyura, p. 11.

Resembles *Homola* but differs in the following important particulars:—

The carapace is “more brachyurous:” it is urn-shaped and *depressed*, its sides being far from vertical and being overhung by the sharply defined lateral borders. The hepatic region is elongate and advanced, so that the hepatic spine is on a level with the spines of the anterior border, and helps to form a very decided false-orbit. The buccal cavern is scarcely broader in front than behind.

In other respects it agrees with *Homola* and more particularly with the subgenus *Homolax*.

The branchial formula is the same as that of *Homola*.

#### 24. *Paromolopsis boasi*, Wood-Mason.

*Paromolopsis boasi*, Wood-Mason, Ann. Mag. Nat. Hist., March 1891, p. 268 and fig. 5: Alcock, Investigator Deep-Sea Brachyura, p. 11.

Every exposed surface of the body and appendages, excepting only the flagella of the antennæ, is covered with an even, velvet-like, tomentum.

Carapace ending in a short triangular rostrum with an upturned tip, its greatest breadth, which is across the middle of the branchial regions, is equal to its length without the rostrum. Unlike the species

of *Homola*, the lateral border is well-defined throughout, is carinated, is co-extensive with the length of the carapace, and ends in a large triangular hepatic spine the tip of which is on a level with the tips of the spines of the anterior border: these are four in number, one on either side of the rostrum and one at either outer orbital angle.

There is an antennal spine and spinule, there are some definitely-placed nodular swellings on the well defined gastric region, and the surface of the denuded carapace is granular, but there are no spines other than those mentioned.

The swollen terminal joint of the eyestalk is rather longer than the slender basal joint: eyes of good size, well pigmented, hemispherical, retractile into a very decided hollow in the front wall of the hepatic region.

The 2nd joint of the antenna-peduncle is not produced or acute at the antero-external angle; the antennal flagellum is much longer than the carapace.

Chelipeds (in the adult female and young male) short, just reaching beyond the end of the carpus of the first pair of legs: the arm is slenderer than the corresponding joint of the first three pair of legs: the fingers are longer than the hands: none of the joints are spinate.

The second and third legs, which are longer than the first by their dactylus, and longer than the fourth by their merus and dactylus, are 3 times the length of the carapace. In the first three pair of legs the anterior border of the meropodite is armed with large spines, but the other joints are unarmed: the dactylus is slender, curved, and of great length, being hardly shorter than the preceding joint.

In the subcheliform, dorsal, fourth pair the anterior border of the merus ends in a spine and the posterior border of the merus is spiny throughout, the propus is much dilated and toothed at its basal angle posteriorly, so as to be *l*-shaped and has one or two spines on the undilated portion of its posterior border, and the dactylus is short and is toothed along the posterior border.

The abdomen of the male consists of seven segments.

The carapace of an adult female is 45 millim. long and 43.5 millim. broad.

The colours in life vary from red to bluish-pink.

In the Indian Museum are a large female and three young females from off the Andamans, 480–500 fathoms, 498 fathoms and 561 fathoms; a young male, a large adult female and four young females from off the Travancore coast, 406 and 430 fathoms; a large female with eggs from off the Laccadives, 360 fathoms; and a young female from off Colombo, 597 fathoms.

## HYP SOPHRYS, Wood-Mason.

*Hypsophrys superciliosa*, Wood-Mason, Ann. Mag. Nat. Hist., March, 1891, p. 269.

*Hypsophrys*, Alcock, Investigator Deep Sea Brachyura, p. 12.

Carapace deep, longer than broad, quadrilateral or ovate-oblong, with deep vertical parallel sides, the gastric region well delimited and occupying its anterior half, the *linea anomurica* dorsal, distinct or indistinct.

Front narrow, forming a simple or bifid rostrum which has a spine on either side of its base.

The orbits do not afford any concealment to the eyes, but form, on either side of the rostrum, a broad concave facet sharply marked off from the rest of the carapace by a ridge that arches round dorsally from the rostrum to the antennal spine: at the upper and inner angle of this facet is a well defined hollow that catches the knee of the 2nd and 3rd joints of the antennular peduncle when fixed. The eyes are well formed: the terminal joint of the eyestalk is barrel-shaped much as in *Homola*, but the slender basal joint is short or obsolescent, so that the eyes do not appreciably project beyond the edge of the orbital facet.

The antennules and antennæ are identical with those of *Homola*.

The mouth-parts also are very like those of *Homola*, but as the outer border of the merus of the external maxillipeds is hardly at all expanded these appendages are even more pediform than in *Homola*.

Chelipeds slender, spiny, equal. Legs of the first three pair long, with broad compressed meropodites. Fourth pair of legs short, very slender, cheliform, their dactylus, which is many times shorter than their propus, shutting down against and co-terminous with the slightly expanded distal end of the propus.

The abdomen of both sexes consists of seven separate segments.

In general form *Hypsophrys* resembles *Homola barbata*, but it differs from *Homola* in the following particulars:—

1. The eyestalks are like those of *Dromia*, the long slender basal joint of *Homola* being reduced to next to nothing.

2. Though there are no true orbits there are distinct orbital facets, and the homologies of these with the orbits of *Dromia*—in respect both of conformation and of common use for eyes and antennules—are unmistakable.

3. The external maxillipeds are unequivocally pediform, the merus being hardly broader than the ischium.

4. The fourth (last) pair of legs have the subchelæ or chelæ quite different in form: the propodite is long and is slightly expanded at its distal end, and the dactylus is a minute joint, ever so much smaller

than the propodite, that shuts down against the *distal border* of the latter like the blade of a knife.

The branchial formula of *Hypsophrys* is exactly the same as that of *Homola*.

25. *Hypsophrys superciliosa*, Wood-Mason.

*Hypsophrys superciliosa*, Wood-Mason, Ann. Mag. Nat. Hist., March 1891, p. 269 : Illustrations of the Zoology of the "Investigator," Crust. pl. xiv. figs. 4, 4a, 1895 : Alcock, Investigator Deep Sea Brachyura, p. 14.

Rostrum simply pointed. Linea anomurica rather indistinct.

Four small spines or teeth on the anterior (orbital) border of the carapace, two being far apart at the base of the rostrum and one at either outer orbital angle. Two, or all four, of these teeth may be obsolescent or obsolete.

Lateral borders of dorsum of carapace not defined, except by a single isolated spine on the hepatic region. Gastric region sharply subdivided into three subregions, of which the lateral are somewhat nodular. Two or three spines on the subhepatic and suborbital region, the innermost of which is "antennal," also sometimes a few spinules.

Eyes well formed and faceted, but pale. Antennal flagella about half again as long as the carapace.

The pediform external maxillipeds have their surfaces and edges devoid of spines.

Chelipeds slender, but much more massive than the legs, about half a hand-length shorter than the first pair of legs in the adult male : spines and spinules in rows on edges and on both inner and outer surfaces of arms, wrists and hands : fingers about three-fourths the length of the palm.

The second pair of legs, which are slightly longer than the first and third and considerably more than twice the length of the fourth, are slightly more than three times the length of the carapace.

In the first three pair the meropodites are compressed, with the anterior border spiny and the posterior border much less strongly and profusely spiny ; the other joints are slender and unarmed, except for a few articulating spinelets at the far end of the posterior border of the propodite and in the basal half of the posterior border of the dactylus ; the dactylus is slightly shorter than the propodite.

The fourth (dorsal) pair are very slender and are unarmed except at their cheliform ending : their propodite is many times longer than the dactylus.

The terminal joint of the male abdomen is bluntly triangular.

There are some soft bristles on the chelipeds, and a few on the legs, and some very short and inconspicuous hairs on the carapace.

Colours in life, pink.

The carapace of a large egg-laden female is 19 millim. long and 15 millim. broad.

This species has frequently been taken in the Laccadive Sea and in the sea to the north of the Laccadives at depths ranging from 740 to 931 fathoms, on soft bottoms.

In the Indian Museum are more than 30 specimens representing both sexes, both adult and in young stages.

### 26. *Hypsophrys longipes*, Alcock and Anderson.

*Hypsophrys longipes*, Alcock and Anderson, Ann. Mag. Nat. Hist., Jan. 1899, p. 6: Alcock, Investigator, Deep-Sea Brachyura, p. 15, pl. i. fig. 1.

Rostrum deeply bifid. Linea anomurica distinct.

Four large spines on the anterior border of the carapace—two close together at the base of the rostrum, one at either orbital angle.

Lateral borders of dorsum of carapace well defined, spinulate; the ridge on the side-wall of the carapace that defines the branchial regions anteriorly is also spinulate. A row of spines on the hepatic region, the largest of which is on the lateral border of the carapace and has a spine dorsad of it.

Gastric region obscurely subdivided, each lateral subregion is armed with 5 or 6 large spines, while on the median region there is a central spine sometimes followed by a row of spinules. Subhepatic and sub-orbital region with numerous large spines, one of which is "antennal."

Eyes well pigmented. Antennal flagella more than twice the length of the carapace.

Rows of spinules on the exposed surface of the ischium merus and exognath of the external maxillipeds, and a row on the basal joint of the antennules.

Chelipeds slender, reaching not far beyond the end of the carpus of the first pair of legs, the arm and wrist not stouter than the meropodites of the first three pair of legs; spinate and spinulate as in the preceding species; fingers as long as the hand.

The second and third pair of legs, which are slightly longer than the first and three times as long as the fourth, are four times the length of the carapace. In the first three pair of legs the merus is compressed and has its anterior border spinate and its posterior borders spinulate, the posterior border of the propodite carries a few distant articulating spinelets, and the dactylus—which is about two-thirds the length of the

preceding joint—has a close comb of articulating spines along its posterior border.

The fourth (dorsal) pair, which are extremely slender, have the posterior border of the merus strongly spinate: the propodite is several times longer than the minute dactylus.

The terminal joint of the male abdomen ends acutely.

Hairs and bristles are sparsely present just as in the preceding species.

The carapace of a large egg-laden female is 38 millim. long and 30 millim. broad.

In the Indian Museum are eleven specimens, representing adults and young of both sexes, dredged off the coast of Travancore at 430 fathoms, on a bottom which, though muddy, was abundantly covered with coral.

## Family II. LATREILLIDÆ.

*Key to the genera of the Family Latreillidæ.*

- |     |   |                |
|-----|---|----------------|
| I.  | Carapace subquadrilateral. Antennæ long. All seven abdominal segments distinct in both sexes ... ..   | LATREILLOPSIS. |
| II. | Carapace pyriform, its anterior portion forming a long subcylindrical "neck." Antennæ short. The 4th, 5th, and 6th abdominal segments of the female are fused together ... .. | LATREILLIA.    |

### LATREILLOPSIS, Henderson.

*Latreillopsis*, Henderson, Challenger Anomura, p. 21: Ortmann in Bronn's Thier-Reich, v. ii. Arthropoda, p. 1156.

Carapace subquadrilateral, deepish, with vertical side-walls, not entirely concealing the basal joints of the legs: the regions fairly well indicated. Front of moderate width, ending in a spiniform rostrum on either side of which is a long slender divergent "supra-ocular" spine. Linea anomurica present, most distinct posteriorly.

Eyes as in *Latreillia*, large and borne free at the end of slender eyestalks of remarkable length. Antennæ long, freely movable from their base; the peduncle slender, cylindrical, and consisting of four joints, as usual.

Epistome well demarcated from the palate. Buccal cavern much broader in front than behind, the efferent branchial channels very well defined. Though the external maxillipeds do not quite meet across the buccal cavern they are distinctly operculiform, owing to the expansion of their merus.

Chelipeds long and slender but much shorter than the first three pair of legs: their joints, like those of the legs, are cylindrical, and the palm in the male is enlarged and club-shaped.

Legs slender, the first three pair very long; the fourth pair reduced in length, and subchelate.

The abdomen in both sexes consists of 7 separate segments.

The branchial formula is exactly the same as that of *Latreillia pen-nifera*, and is as follows:—

Somites and their appendages.	Podo- branchiæ.	Arthrobranchiæ.				Pleuro- branchiæ.	=	
		Anterior.		Posterior.				
VII.	... 0 ep.	... 0	... 0	... 0	... 0	=	ep.	
VIII.	... 1+ ep.	... 0	... 0	... 0	... 0	=	1+ ep.	
IX.	... 0+ ep.	... 1	... 1	... 1	... 0	=	2+ ep.	
X.	... 0	... 1	... 1	... 1	... 0	=	2	
XI.	... 0	... 0	... 0	... 0	... 1	=	1	
XII.	... 0	... 0	... 0	... 0	... 1	=	1	
XIII.	... 0	... 0	... 0	... 0	... 1	=	1	
XIV.	... 0	... 0	... 0	... 0	... 0	=	0	
	—	—	—	—	—	—	—	
	1	2	2	2	3	=	8+3 ep.	

*Distribution* : Oriental Seas (Andaman S. and Philippine S.).

### 27. *Latreillopsis bispinosa*, Henderson.

*Latreillopsis bispinosa*, Henderson, Challenger Anomura, p. 22, pl. ii. fig. 3. ♀.

Carapace longer than broad, shaped much as in *Homola*: frontal region with three sharp slender spines, the middle one—which is the shortest and is slightly deflexed—being the rostrum, the other two—which are about a third the length of the carapace and are slightly up-tilted—being placed above the bases of the eye-stalks.

Gastric region tumid, with a tubercle posteriorly and a curved transverse row of tiny tubercles anteriorly. Cardiac region small, tumid, culminating in two tubercles placed side by side or confluent. Branchial regions with an irregular surface, and with one or two tiny spinules on the side wall.

Hepatic regions standing out like a pair of little wings, with two spines—the foremost of which is nearly as long as the rostrum—projecting obliquely forwards from their prominent outer angle, and with one or two small spinules on their under surface.

Eyestalks nearly as long as the supra-ocular spines. Antennal peduncle about as long as the eyes and eye-stalks combined, the flagellum more than three-fourths the length of the carapace.

Chelipeds and legs slender, cylindrical, practically smooth, except for a spine at the far end of the anterior (extensor) border of the merus.

The chelipeds in the male are just over twice, in the female less than twice, the length of the carapace without the rostrum. In the



female they are hardly stouter than the legs; but in the male they are distinctly stouter, especially as regards the palm, which is club-shaped: the palm is much longer than the fingers.

The first three pair of legs increase in length, gradually but slightly, from before backwards, the 3rd pair being between 4 and  $4\frac{1}{2}$  times the length of the carapace: the dactyli are long and curved.

The fourth pair of legs are a little longer than the male chelipeds: their last two joints are short, and the dactylus folds down, like a knife-blade, on a double row of spines along the posterior border of the propodite.

In both sexes the last abdominal tergum is shaped like a spear-head, and the 2nd, 3rd, 4th and 6th terga have an acute tubercle in the middle line.

The carapace of an egg-laden female is 8 millim. long, the same length as that of an apparently adult male.

Colours in spirit yellow, the fingers and eyes dark brown.

In the Indian Museum are two males and a female from the Andaman Sea, 53 fathoms (*not* the same station as that where *Latreillia* was dredged).

*Distribution*: Off the Andamans and off the Philippines.

#### LATREILLIA, ROUX.

*Latreillia*, Roux, Crust. Medit. pl. xxii. and text: Milne Edwards, Hist. Nat. Crust. I. p. 277: DeHaan, Faun. Japon., Crust., p. 105: Heller, Crust. Sudl. Europ. p. 146: Henderson, Challenger Anomura, p. 23: A. Milne Edwards and Bouvier, Crust. Decap. Hirondelle, Brach. et Anom. (Monaco 1894) p. 59: Bouvier, Bull. Soc. Philom. 1896, p. 64: Ortmann in Bronn's Thier-Reich, V. ii., Arthropoda, p. 1156.

Carapace elongate-piriform, not covering the basal joints of the legs, its anterior part prolonged to form a subcylindrical "neck" at the end of which are the spiniform rostrum, lying deflexed between two long slender divergent "supra-ocular" spines, the eyes, the antennules, and the antennæ. The regions are fairly well indicated, and there is no *linea anomurica*.

Eyes much as in *Homola*, large and borne free at the end of very long and slender basal stalks. Antennæ short, of filiform slenderness, freely movable from their base.

Epistome of great length fore and aft, corresponding with the "neck" of the carapace. Buccal cavern well demarcated from the epistome, the efferent branchial channels well defined. External maxillipeds not completely closing the buccal orifice: they have a pediform cast, the ischium and merus being rather narrow and the flagellum coarse.

Chelipeds long and slender, but always much shorter than the first three pair of legs: all the joints are slender, except the palm, which in one or both sexes is club-shaped. Fingers shorter than the palm.

First three pair of legs very long and slender; some of their joints are spiny.

Fourth pair of legs more or less reduced in length, subdorsal in position.

The abdomen of the male consists of seven separate segments; that of the female consists of five segments—the 4th, 5th and 6th being fused together.

The branchial formula given by Bouvier for *Latreillia elegans*, and verified by myself for *Latreillia pennifera*, is as follows:—

Somites and their appendages.	Podo-branchiæ.	Arthrobranchiæ.				Pleuro-branchiæ.		
		Anterior.		Posterior.				
VII. ...	0 ep. ...	0	...	0	...	0	=	0 ep.
VIII. ...	1+ep. ...	0	...	0	...	0	=	1+ep.
IX. ...	0+ep. ...	1	...	1	...	0	=	2+ep.
X. ...	0 ...	1	...	1	...	0	=	2
XI. ...	0 ...	0	...	0	...	1	=	1
XII. ...	0 ...	0	...	0	...	1	=	1
XIII. ...	0 ...	0	...	0	...	1	=	1
XIV. ...	0 ...	0	...	0	...	0	=	0
	—	—	—	—	—	—	—	—
	1+3 ep.	2		2		3	=	8+3 ep.

*Distribution*: Atlantic coasts of North America between 38° and 40° N.: off the Canaries and Azores: Mediterranean Sea: Bay of Bengal and Andaman Sea: Japanese Seas: New South Wales coast.

### 28. *Latreillia pennifera*, n. sp.

Very closely related to *L. elegans*, Roux.

Carapace smooth, without spines, though the hepatic regions have a strong bulge: the “neck” is rather slender (equally so in both sexes) and is nearly as long as the rest of the carapace measured in the middle line.

Rostral spine short, acute, strongly deflexed. Supraocular spines as long as the eyestalks, about half the total length of the carapace (“neck” included) measured in the middle line; occasionally bearing some tiny secondary spinules.

Antennules slightly longer than the eyestalks: the outer flagellum longer and very much coarser than the inner.

The chelipeds, which are slightly longer in the male than in the female, are between  $3\frac{1}{2}$  and 4 times the total length of the carapace:

their joints are long, slender, and cylindrical, except the palm of the male, which is club-shaped: there are a few spines on the arm, but the other joints are smooth: the fingers are not half the length of the hand (palm).

The first three pair of legs, though they increase slightly in length from before backwards, are not very dissimilar in length, the first pair being nearly 8 times the total length of the carapace. All their joints are slender: the merus is spinate, the carpus sparsely spinate, and the propodite is slightly dilated at the far end of the posterior border where there are a few spines.

The last pair of legs are between  $4\frac{1}{2}$  and 5 times the total length of the carapace and reach almost to—in the female even beyond—the end of the carpus of the last pair but one: the merus is rather sparsely spinate, chiefly on the posterior border, and the propodite is plumed on both sides so as to exactly resemble the vane of a feather: the dactylus is extremely short.

In both sexes the last abdominal segment is shaped like a spear-head: in the female the 2nd and 3rd abdominal terga have a median spine and the 4th has a spine at the proximal end of either lateral border.

Colours in spirit yellow. In life the carapace is reddish with longitudinal stripes of dark red, the eyestalks chelipeds and legs are closely cross-banded with red, and the eyes are purplish black.

The carapace of an adult female, with eggs, is 11 millim. long.

14 specimens from the Gulf of Martaban, 53 and 67 fathoms, and from off the northern end of Ceylon, 28 fathoms.



*A List of the Butterflies of Ceylon, with Notes on the various Species.*—  
By LIONEL DE NICÉVILLE, F.E.S., C.M.Z.S., &c., and MAJOR N.  
MANDERS, R.A.M.C., F.E.S.

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The Island of Ceylon is so well known that a lengthened description of its peculiarities is unnecessary. It may roughly be divided into two regions, the low and hill country. The latter comprises the south-west and central portions of the Island exclusive of the south-west coast line, and receives the greater portion of the annual rainfall. The hills rise to 8,000 ft., the highest, Pedro Point close to Nuwara Eliya, being 8,200 ft. The vegetation from 6,000 ft. upwards gradually becomes of a more temperate character. At Nuwara Eliya, 6,000 ft., both tropical and sub-tropical vegetation occurs, the latter preponderating.

The higher forests are very thick, almost impenetrable, always soaking with moisture, and consequently butterfly life is almost absent. In fact, very few butterflies occur from 7,000 ft. upwards, the seasons seem to be too cold and damp for them, and even those found at 6,000 ft. appear to be passengers from the low country. A few, but very few, are found only in what may be called the upper hill district. The middle and low hill districts from 6,000 ft. to 400 ft. are very largely under tea cultivation, but in those few localities where the jungle has been left butterflies abound, and it is remarkable what a number of different species survive in a very limited patch of forest. This part of the Island has, perhaps, been better worked than any other, as it is the home of the planter, many of whom take an interest in entomology. The low country, from 400 ft. to the seaboard, is of course entirely tropical. The Northern, Eastern, North-Western and North-Central areas are either covered with dense forest or are open and park-like. They are in most places unhealthy from malaria, and are very hot and dry. The Hambantota district on the south coast is of a similar character. Large portions of this low jungle country is practically uninhabited, very difficult to get about in, and consequently its entomological peculiarities are not well known. There is such a sameness in the vegetation, rainfall, and characteristics of this part of the country generally, that we doubt there being many more species remaining to be discovered, and these are likely to be either South Indian species or local forms. Many and various attempts have been made by collectors to obtain specimens from these out-of-the-way places by employing natives; but experience has shewn that it is a pure waste of money, ending only in vexation of spirit. A more idle, worthless lot than the

native butterfly-hunters of Ceylon does not exist; the reason being that living is so cheap, clothes almost unnecessary, and labour so dear, that there is little or no incentive to work. The best plan for those who have sufficient leisure is to adopt Messrs. Mackwood and Fairlie's method, and fit out one or two bullock carts and camp out, travelling slowly from place to place. This can be made very enjoyable, more especially if the entomologist is a sportsman as well, as game, large and small, abounds in many places, and he can combine the two very satisfactorily; but on the other hand July, one of the best months in the Northern Province, is the worst for shooting; so that unless more than butterflies are studied, the entomologist will find time hang heavily on his hands, as the number of species is undoubtedly few, the whole number of Ceylon butterflies only amounting to some 228 species. The following extract from the *Ceylon Independent* will give a very good idea of the rainfall of the various districts in the Island:—

“The Surveyor-General has published with his Meteorological Report for last year a map of the Island, shewing the Average Annual Rainfall. We find from a comparison of this map with that supplied for the previous year that there is hardly any change in the amount of rainfall recorded in the different districts in 1896 and 1897. The district roughly included between Nawalapitiya and Watawala is the rainiest district of the Island, having the large annual rainfall of 200 inches and more. Taking this as the centre, the districts of the Island may be arranged round it roughly in concentric circles according to rainfall. The district next in point of rainfall to the Nawalapitiya-Watawala district is that portion of the country in which are included Awissawella, Labugama and the Ratnapura districts with a rainfall of 150 inches and more. Next comes a large tract with a rainfall of 100 inches and more. In this tract are included the sea-board districts of the Western Province excluding Colombo, and of the Southern from Galle to Ambalangoda. A large part of the Central Province except the Nuwara Eliya district is also included in this tract. Next in order comes an area with 75 inches and more of rainfall in which are included Colombo and Kandy, the route of the Railway between those two towns, the district of Galle, and the rest of the Central Province not included in the area mentioned before. The driest parts of the Island come next. These dry districts can be divided into two areas, one with a rainfall of 50 inches and more, and the other with a rainfall of under 50 inches. In the former are included the N.-W.P. except the Puttalam district, the whole of the N.-C.P., half of the Jaffna Peninsula, Mullaittivu, Trincomali, Batticaloa, the Matara district, and strange to say Dumbara though surrounded by very rainy districts. The last place

is occupied by Puttalam, Mannar, Jaffna, Tangalle and Hambantota. We should like to make a remark with reference to the two dry zones of the Island mentioned above, which represent the largest portion of the Island. At one time they were the most populous and prosperous, but now the most sparsely populated and most unhealthy districts of the Island. The ruin of these districts is due entirely to the fact that the rainfall is not now stored for the purposes of cultivation as was done in ancient time."

The seasons are very well marked, and consequently those genera such as *Terias* which are subject to seasonal variation show these modifications very distinctly. The dry-season begins about the end of January, and lasts with an occasional shower until the burst of the South-West monsoon in the beginning of June. As soon as this is established butterfly life becomes abundant, but gradually diminishes as the monsoon dies away. In September there is usually a spasmodic revival just before the setting in of the North-East monsoon in the middle of October. After the initial heavy rains, butterflies start afresh in November, December and January, and it is in these months more especially, though to a slighter extent at the beginning of the South-West monsoon, that the extraordinary migratory flights of butterflies take place. These flights are perfectly amazing and scarcely credible. At Colombo, where Manders has more particularly noticed them, the direction of the flight is always northerly and principally along the seashore, possibly the more readily to avoid obstacles. The species which comprise these sensational flights are the following to the exclusion of almost any other:—*Euploea asela*, Moore (and *E. montana*, Felder, at Nuwara Eliya in May), *Appias albina*, Boisduval, and *Appias paulina*, Cramer, the two *Catopsilias*, *Papilio demoleus*, Linnæus, and *Belenois mesentina*, Cramer, irregularly. He calculated the number passing two fixed points 20 yards apart close to the edge of the sea, and concluded that not less than 14,000 passed between these points during the hours the flight lasted from 10 A.M. to 2 or 3 P.M. There is no doubt that other species migrate also at uncertain intervals. Mr. Green informs us that *Jamides bochus*, Cramer, does, and so also does *Polyommatus boeticus*, Linnæus. We are not prepared to put forth any hypothesis to account for this phenomenon, though it is a subject of great interest and well worth study, but it requires a large number of skilled observers over a considerable area and for several years, and unfortunately it is difficult to secure these. The central mass of hills checks the spread of the south-west rain from reaching the northern and north-eastern parts of the island, and consequently this climate is very hot and dry. Except for an occasional heavy downpour they are practically waterless, except

in the North-East monsoon when very heavy rain falls for a very limited period. Butterfly life in this region seems to be dependent very largely on the rainfall, a certain amount of moisture being required to bring the pupæ to emergence. On studying the list of butterflies it will be observed—which indeed would naturally be expected—that the very great majority of Ceylonese butterflies occur also in South India, or are very closely related forms, and no doubt the butterfly fauna of Ceylon has been almost entirely derived from Southern India. There is very little evidence of any connection, with the Malayan region; indeed, this evidence is confined, as far as we know, to three species only, viz., *Danais exprompta*, Butler, *Euploea corus*, Fabricius, and *Elymnias singhala*, Moore. *D. exprompta* is no doubt a local race of *D. similis*, Linnæus, a Chinese species, and *E. corus* is related to *E. castlenavi*, Felder, a Nicobarese and Malayan species. It is noteworthy that these two species belong to a highly protected group and are very tenacious of life. One might hazard the conjecture that the ancestors of these species were carried hither by favourable winds from the Malayan coast, succeeded in establishing themselves, and formed local races. *E. singhala* is very closely akin to *E. panthera*, Fabricius, (= *E. lutescens*, Butler,) also a Malayan species, and it is remarkable that its one locality almost is the Peradeniya Botanical Gardens, which contains numerous Malayan *Palmacæ* (on which the larva feeds) received from that part of the world. The butterflies found only in Ceylon otherwise than local forms are very few indeed. *Danais taprobana*, Felder, is undoubtedly the most striking as it is a common and handsome insect. The most interesting butterfly in Ceylon is, probably, *Lethe dynsate*, Hewitson, as it has no allies and has a distinct subgenus to itself. It is the link in the genus *Lethe* between those species having no sexual characters on either wing and those having sexual characters on both wings. In Ceylon it is a widely distributed but apparently local insect, and may yet be found in Southern India when that country has been more fully explored. *Prioneris sita*, Felder, is a wonderful mimic of *Delias eucharis*, Drury, though its manner of flight is quite different. The mimicry cannot be accepted on the usual grounds as it is a fast-flying insect and seemingly well able to take care of itself; though manifestly it must be an immense advantage to the insect to be mistaken when at rest (when butterflies are most liable to danger from their natural foes) for an inedible species, such as *D. eucharis*, and the mimicry is shown by the coloration and markings of the underside only, which is the surface exposed, all *Pierinæ* resting with closed wings.

A perusal of this paper will show that we have endeavoured indirectly to bring to notice the very incomplete knowledge we yet

possess of this well-worked group. Among the more interesting questions to which local entomologists might well direct attention is the study of the various local forms with the allied South Indian species. The genus *Cirrhochroa*, for instance, is in an unsatisfactory state. The limits of the genus *Terias* will remain undefined indefinitely unless some entomologist will devote himself to a series of breeding experiments, which should not be difficult as the species are easily observed and reared. Our conclusions regarding the few species found in Ceylon even with Mr. Green's and Mr. Ormiston's help are yet far from complete. The genus *Aphnæus* requires much close observation before it can be definitely stated how many species occur in the Island. Mimicry does not occur to any marked degree, to nothing like the same extent as it does for instance in the Sikhim forests, where butterfly life is far more abundant and the struggle for existence all the more keen. The best examples of one species mimicing another is the female of *Hypolimnias misippus*, Linnæus, mimicing *Danaïis chrysippus*, Linnæus, and of the *Prioneris* mentioned above; and that of mimicing a natural object, *Kallima philarchus*, Westwood, a member of the well-known "oakleaf" genus, resembling an oak or perhaps better a chestnut leaf.

The list is largely founded on Moore's "Lepidoptera of Ceylon," vols. I and III, which is likely to be the standard work on Ceylon butterflies for some years yet to come. We have therefore noticed where the nomenclature now differs from the time, nearly twenty years ago, when Moore's work was published, and have also intimated where we have differed from Moore's determinations, so that local entomologists may bring their "Lepidoptera of Ceylon" up to date. That work enumerates 252 species; of these we have removed several as being synonyms of other species or from errors in record. We have, on the other hand, added 12, bringing the total number up to 228, and we do not think this is likely to be greatly exceeded. We have to thank many local entomologists for help most readily accorded. To Mr. F. M. Mackwood, our Nestor in the science, we are greatly indebted, as he has ungrudgingly given us the result of his many years' experience. Mr. Green of Punduloya and Mr. Ormiston of Haldummulle have given us valuable notes and a large number of specimens, and Mr. Pole of Chilaw has been most obliging in sending us notes and presenting us with considerable numbers of specimens from the more inaccessible and arid portion of the island.

Mr. de Nicéville would especially desire to bring prominently to the notice of lepidopterists in Ceylon the importance of carrying out a series of experiments in breeding butterflies of several genera occurring in the island, notably *Mycælesis*, *Cirrhochroa*, *Aphnæus*, *Terias* and *Appias*.



The food-plants of the larvæ of all these genera are well-known, without this knowledge it would be impossible to do anything in this direction. Growing examples of these plants should be enclosed in a cage of gauze or perforated zinc, the leaves having first been carefully examined to see if they bear any eggs or larvæ; if they do, these should be removed. A female of the species to be experimented with should be let loose in the cage, and it is probable that she will lay eggs. No more than one female should be put into any one cage. On her death, she should be preserved for future reference, as it is important that her identification should be certain, and also for comparison with her offspring. All the resultant butterflies from the eggs laid by one mother should be set and compared with her. It will not improbably be found that these specimens will exhibit very great variation, the variations (especially if the experiments are carried out at the change of the seasons from wet to dry or from dry to wet) including distinct seasonal forms and probably intermediate forms between the wet and dry, and very possibly one or more forms which have been considered distinct species. Cabinet naturalists from analogy may make possibly correct guesses as to what are seasonal forms and what are distinct species, but these guesses require confirmation, and certainty can only be arrived at by careful breeding.

In this paper Major N. Manders is responsible for the notes on occurrence, etc., while Mr. L. de Nicéville has revised the nomenclature, bringing it as far as possible up to date. He has followed Dr. F. Moore's "Lepidoptera Indica" as far as published (part x1), the *Lycænidæ* in vol. iii of de Nicéville's "Butterflies of India, Burmah and Ceylon," the *Papilioninæ* in the Hon. Walter Rothschild's "Novitates Zoologicæ," vol. ii, pp. 167-463 (1895), and the *Hesperidæ* in Messrs. Elwes and Edward's paper in Trans. Zool. Soc. Lond., vol. xiv, pp. 101-324 (1897).

## Family NYMPHALIDÆ.

### Subfamily DANAINÆ.\*

#### 1. HESTIA JASONIA, Westwood.

Moore as *Nectaria jasonia*. Species of the genus have received many trivial names, such as the Sylph, the Widow, the Floater, the Spectre, and the Silver-paper-fly. It is peculiar to Ceylon, and is found in the low country, as at Labugama, 200 ft., and up to about 5,000 ft.; always in forests and in the neighbourhood of streams. It has a slow

\* The subfamily name should be more correctly *Danaididæ*, as it ought to be based on the genus *Danaida*, Latreille first using that name in 1805, *Danaus* in 1809, and *Danais* in 1819 (*Anrivillius*, Kongl. Sv. Vet. Akad. Hand., vol. xxxi, p. 30 (1898)).

sailing flight within a few feet only of the ground, and is consequently easily captured, in this being unlike many of its allied species, which have a lofty flight over dense jungle or mangrove swamps, and are consequently rare in collections. The females are larger and usually paler than the males, but both sexes exhibit great variation in depth of colouring and extent of markings, these characters having been taken by some authors in allied species occurring elsewhere to constitute distinct species, very erroneously in our opinion. The larva still remains to be described. It will probably be found to feed on a creeper with a milky juice, the larva of the allied South Indian species, *H. lynceus*, Drury, feeding on *Aganosma cymosa*, Nat. Order *Apocynaceæ*. Mr. E. Ernest Green has sent de Nicéville a beautiful coloured drawing of the side view of a larva made by him from a specimen discovered by Mr. F. B. Armstrong, who found it in the district of Deltola feeding upon a climbing asclepidaceous plant allied to *Hoya*. It is deep velvety black, with four pairs of long filamentous tentacles from the third, fourth, sixth and twelfth segments, each pair springing from close to the dorsal line; each segment is marked with a rather broad pale yellow band, and the sixth to the twelfth segments bear laterally a large oval crimson spot; the head and legs are black. The larva is a very handsome one and is evidently warningly coloured. It probably feeds openly and must be very conspicuous.

## 2. DANAIS (*Radena*) EXPROMPTA, Butler.

Confined to Ceylon, and there found on the South-West littoral, no species of the subgenus occurring in peninsular or continental India. It is abundant at Galle in June and July and again in November and December; also in the jungly country between Galle and Colombo, and sparingly in the botanical gardens at Heneratgoda, but not further north than Negombo, where it is common. It used to occur in the immediate neighbourhood of Colombo, but of recent years appears to have disappeared. It is easily distinguished from the next species when on the wing by its much bluer coloration, which colour, however, rapidly fades after the death of the insect. The larva has still to be discovered.

## 3. DANAIS (*Tirumala*) LIMNIACE, Cramer.

Moore as *limniacæ*. Common and found almost everywhere in Ceylon; elsewhere it occurs nearly all over India, in Burma, Indo-China, and Southern China and in the islands of Formosa and Hainan. The larva feeds on *Asclepias*, *Calotropis* and *Hoya* (Moore), and in the Western Himalayas on *Marsdenia*.

4. DANAIIS (*Tirumala*) SEPTENTRIONIS, Butler.

Occurs commonly everywhere. The larva in Ceylon does not appear to have been discovered; in the Western Himalayas it feeds on *Vallisneria*. It occurs in many parts of India, Burma, the Malay Peninsula, Indo-China, and many of the Malayan Islands. Mr. H. Fruhstorfer has recently named this species from South India and Ceylon *Tirumala melissa dravidarum* (Berl. Ent. Zeitsch., vol. xlv, pp. 113, 1191—899). We do not think that this southern race of *D. septentrionis* can be separated from the northern one.

5. DANAIIS (*Limnas*) CHRYSIPPUS, Linnæus.

Moore as *Salatura chrysippus*. Very common all over the island. The larva feeds on *Calotropis* and *Asclepias*. Found also in S.-E. Europe, nearly all Africa and its satellite islands, all southern continental Asia, the Loochoo Islands, and many of the western islands of the Malay Archipelago.

6. DANAIIS (*Salatura*) PLEXIPPUS, Linnæus.

Moore as *Salatura genutia*, Cramer. Very common indeed everywhere. In Calcutta, de Nicéville has seen the eggs of this species laid on *Cynanchum corymbosum*, Wight, in the Western Himalayas it feeds on an allied species of the same genus, and Dr. Moore gives *Raphis*, *Ceropegea* and *Raphanus* as its food-plants in Ceylon. It is found in most parts of India, Burma, the Malay Peninsula, Indo-China, Southern China, and Hainan and Formosa Isles.

7. DANAIIS (*Parantica*) AGLEA, Cramer.

Moore as *Parantica ceylonica* (recte *ceylanica*), Felder. A local race of this species is the North and Eastern Indian *D. melanoides*, Moore. In Ceylon it is an abundant and widely distributed butterfly flying nearly all the year round. The larva in South India and Ceylon feeds on *Tylophora* and *Calotropis*. Dr. Moore says that *D. grammica* of Boisduval from Java is a synonym of *D. aglea*, and that he has a single female of it from Java. *D. ceylanica*, Felder, is another synonym.

8. DANAIIS (*Chittira*) TAPROBANA, Felder.

Moore as *Chittira fumata*, Butler. One of the most distinctive butterflies of Ceylon, and peculiar to the Island. It is abundant nearly all the year round in the hill country, but not below 5,000 feet, especially common in the neighbourhood of Nuwara Eliya. It has been recorded from as low as 3,000 feet. Its transformations still await discovery.

9. *EUPLOEA* (*Crastia*) *ASELA*, Moore.

This species is an insular form of the continental Indian *E. core*, Cramer. It is one of the commonest of our butterflies at all elevations, especially so in November and December when it joins in the annual flights in thousands. As it is a fairly well-marked species, and has never been recorded from any locality outside Ceylon, it would seem that the annual migrations so-called of the Ceylonese butterflies are purely local, and that the flights do not even reach to the mainland of South India by Adam's Bridge across the narrow Palk Strait. The larva feeds on *Nerium*, and probably also on species of *Ficus*.

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We have removed *E. (Crastia) frauenfeldii*, Felder, and *E. (Crastia) scherzeri*, Felder, from the list of Ceylonese butterflies. Felder's original descriptions of these species are to be found in a list of the butterflies captured at the various ports at which the frigate "Novara" touched, written in 1862. *E. frauenfeldii* was said by Dr. Felder to have come from "Ceylon," and by Dr. Moore from "Trincomalee, on the N.-E. side of the island," there being a single male from thence in the British Museum. *E. scherzeri* is also said by Felder to have come from "Ceylon," and is so recorded by Moore on Felder's authority. It is de Nicéville's opinion that Felder's type specimens of both these species were wrongly located, and that they both came from the Nicobar Isles, which the "Novara" visited. If this be so, *E. camorta*, Moore, is a synonym of *E. scherzeri*. He has examined the type specimens of both *E. frauenfeldii* and *E. scherzeri* in the Natural History Museum of Vienna. As regards the specimen from Trincomalee mentioned above which has been described and figured by Dr. Moore as *E. frauenfeldii*, the identification is certainly incorrect, it being nothing less than *E. lorquini*, Felder, originally described from South China, and very common at Hong-Kong and on the opposite mainland of Southern China. *E. (Crastia) felderi*, Butler, is a synonym of it as stated by Butler himself, though the type is said to have come from Sumatra, but it is recorded also by Butler from Hong-Kong. Felder himself in 1865 united *E. frauenfeldii* to *E. esperi*, Felder, originally described from "Kar Nicobar," saying that the type specimens are opposite sexes of one species, and the species will stand under the former name from the Nicobars, with *E. (Tronga) biseriata*, Moore, as a second synonym. As neither *E. frauenfeldii* nor *E. scherzeri* have (with the exception of the British Museum specimen of the former mentioned above) for nearly forty years been found in Ceylon, and that *Euploeas* are large, conspicuous, and very easily caught butterflies which (where they occur) are nearly

always common, it is hardly possible that they can have been overlooked during all these years in a small island that has been thoroughly well worked for *Lepidoptera*. Neither is it probable that they have been exterminated, and still less probable that single immigrant specimens should have been captured on the occasion of the "Novara's" visit. The Trincomalee specimen is almost certainly wrongly ticketed.

#### 10. EUPLŒA CORUS, Fabricius.

Moore as *Macrop læa elisa*, Butler. It is peculiar to Ceylon, on species of the subgenus being found in peninsular or continental India, though an allied species, *E. castelnavi*, Felder, occurs in the Malay Peninsula, Sumatra and the Nicobars. The Burmese form of *E. castelnavi* has recently been named *Macrop læa corus vitrina* by Fruhstorfer. In Ceylon *E. corus* is common at Galle, Labugama, and doubtless also in the intervening districts in June and July and again in November and December. Formerly it was found on Crow Island and other places in the immediate neighbourhood of Colombo. It is one of the largest butterflies of Ceylon, and from its dull brown colour, its slow flapping flight, and its love of deep shady jungle, might easily when flying be mistaken for a bat. Dr. Moore has figured the larva and pupa, but the food-plant of the former appears to be unknown.

#### 11. EUPLŒA (*Pademma*) SINHALA, Moore.

Moore as *Isamia sinhala*. It is an insular race of the peninsular and continental *E. kollari*, Felder. Found in the low country and up to about 3,000 feet but not commonly. Manders took it once at Colombo on ground now built over. From its superficial resemblance to the common *E. asela*, Moore, it may very easily be overlooked. Its transformations are unknown.

#### 12. EUPLŒA (*Narmada*) MONTANA, Felder.

Peculiar to Ceylon, but it has a near ally in the South Indian *E. coreoides*, Moore, which on the east coast occurs as far north as Orissa, and is a synonym of the much older *E. coreta* of Godart. *E. montana* is not uncommon at certain seasons, and occasionally migrates in great numbers with *E. asela*, Moore, of which it is a mimic in the müllerian sense, but may be distinguished from *E. asela* even in flight by its more rounded wings. It is found at all elevations, and has been taken rarely in the outskirts of Colombo, more commonly at Kandy, and abundantly at Nuwara Eliya in May. Its larva and pupa are still undiscovered.

## Subfamily SATYRINÆ.

13. MYCALESIS (*Orsotriæna*) MANDATA, Moore.

A very common species in the Western and Central Provinces of Ceylon up to about 3,000 feet, in open spaces in forests and jungle. It occurs also in Southern India. *M. mandata* is the wet-season and *M. mandosa*, Butler, is the dry-season form of this species. Its transformations have been recorded, and like all the Indian *Satyrinæ* its larva feeds on rice and grasses.

14. MYCALESIS (*Calysisme*) PERSEUS, Fabricius.

Like the last, this appears under two seasonal forms, a wet and a dry, *M. perseus* being the latter, and *M. blasius*, Fabricius, the former, Moore giving them as separate species in Lep. Cey., his pl. xi, figs. 2, 2a, male, representing the wet-season form. It is a very common species up to moderate elevations, and occurs almost throughout India, Burma, the Malay Peninsula, Southern China, Hainan and Formosa Isles, and many of the islands of the Malay Archipelago, extending to the Solomon group in the Pacific Ocean. Moore describes it as having in the male on the underside of the forewing a glandular patch of scales on the middle of the submedian nervure small and black, and the hindwing having on the upperside a tuft of radiating yellowish hairs arising within the discoidal cell from behind the base of the subcostal nervure and overlapping a glandular patch of black scales at the base of the first subcostal nervule. The larva feeds on grass as usual.

15. MYCALESIS (*Calysisme*) POLYDECTA, Cramer.

This also has two distinct seasonal forms, *M. polydecta* being found in the dry-season, *M. justina*, Cramer, in the wet. It is omitted by Moore from his "Lepidoptera of Ceylon," but finds a place in his "Lepidoptera Indica." He describes the male as having on the underside of the forewing a small glandular patch of blackish scales on the middle of the submedian nervure, and on the upperside of the hindwing having a subbasal tuft of yellow hairs overlapping a glandular patch of blackish scales. In so far there appears to be but little difference between *M. perseus*, Fabricius, and *M. polydecta*, black and blackish, yellow and yellowish. But he goes on to say that "Individuals of the dry-season brood [it should be broods, as more than one brood of each seasonal form occurs in the year] of *C. polydecta* are distinguishable from those of the dry-season brood of *C. perseus* by the large pale-bordered ocellus on the upperside of the forewing, and in the hindwing of both sexes having a scalloped exterior margin, which latter is very prominent in most of the

females." He notes that the wet-season brood of *M. polydecta* has "a moderately large distinctly-formed median ocellus with a yellowish outer ring (much larger than in the males of the wet and dry-season brood of *M. perseus*), the surrounding area being slightly tinged with ochreous" on the upperside of the forewing. His figures of both sexes of both species bear out this distinction between them. But we have grave doubts that this solitary and unimportant character really denotes two distinct species. Breeding alone can solve the question, though a critical examination of the prehensores of the male might go to prove the matter one way or the other. *M. polydecta* appears to occur almost everywhere in India with *M. perseus*, which is another disquieting feature. It is quite common in Ceylon. The wet-season form is figured in Lep. Cey., pl. xi, figs. 3, 3a, male, as *Calysisme drusia*, and again the same form on the same plate, figs. 4, 4b, male; 4a, female, as *C. mineus*: the dry-season form is given on pl. xii, figs. 1, 1a, male, as *C. perseus*. The true *M. mineus*, Linnæus, given originally by Moore from Ceylon, is now restricted by him to Northern and Eastern India, Burma, Siam and S.-E. China. Dr. Moore confines the occurrence of *M. polydecta* to India. It has not been bred.

16. MYCALESIS (*Calysisme*) SUBDITA, Moore.

This species has recently been described by Dr. Moore from South India and Ceylon. The male has on the underside of the forewing a [large] elongated glandular patch of ochreous-yellow scales upon the submedian nervure extending from its middle to the discal pale band; and on the upperside of the hindwing a subbasal tuft of pale hairs exerted or overlapping a glandular patch of ochreous-yellow scales. In the dry-season form Moore describes the scales as yellow instead of ochreous-yellow. The large size as well as the colour of the patch of scales described above on the forewing will readily distinguish the males of this species from the two which have preceded it. Dr. Moore records it from Trincomali in August, October and November, but it is doubtless quite common throughout Ceylon all the year round and only awaits recognition. Its transformations have not been recorded.

17. MYCALESIS (*Calysisme*) RAMA, Moore.

*Calysisme rama*, Moore, Lep. Ind., vol. i, p. 196, pl. lvii, figs. 3, 3a, male, wet-season form (1892).

"MALE. UPPERSIDE, both wings olivaceous ochreous-brown, marginal lines indistinct. Forewing with a distinct transverse medial discal line, and a large prominent median black ocellus with a white pupil and narrow ochreous-yellow outer ring, above which is a very minute

subapical ocellus between the discoidal nervules. *Hindwing* with a less distinct small ocellus between the second and first median nervules, a subbasal tuft of *yellow* hairs overlapping a small glandular patch of dark brown scales extending below the first subcostal nervule and surrounded by the ordinary nacreous costal area. *UNDERSIDE, both wings* pale ochreous-brown, palest externally; marginal lines distinct; with a moderately broad pale ochreous-yellow transverse discal fascia, the inner border of which is sharply defined by a dark brown line, the outer border being diffused. *Forewing* with a small prominent subapical and a large median ocellus; and with a small glandular patch of *dull brown* scales on the middle of the submedian nacreous area. *Hindwing* with seven ocelli, the upper second and third, and the seventh minute and almost obsolete, the other four prominent. *Body* beneath, *legs*, and sides of *palpi* pale ochreous; club of *antennæ* blackish and tip with ochreous. *EXPANSE*: 1.87 inches."

"A single specimen of the male of this species (presumably of the wet-season brood) taken at Udagama, in the West Central District of Ceylon by Mr. Reginald Poole, and now in the collection of Mr. E. E. Green, is all that is yet known to the author." (*Moore, l.c.*).

Mr. John Poole has sent a single male of this species to de Nicéville to see, taken at Udagama. Before anything definite can be said about this supposed new species, much more must be known about it than can be ascertained from a couple of specimens.

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With regard to the *Calysisme* group of the genus *Mycalesis*, Manders writes:—"I have through the kindness of Mr. Ormiston and others been able to examine a large series of specimens from Ceylon, and I find as a result that though it is easy to separate typical examples of each it is impossible to draw any hard and fast line between the seasonal forms; and further I am in some instances unable satisfactorily to discriminate the species; there are certain specimens which are intermediate between *M. perseus* and *M. polydecta*." Further, Manders has compiled the following note on the appendages of the males of the subgenus:—"The yellow hair-like processes on the upperside of the hindwing of *M. perseus* and *M. polydecta* are situated immediately behind the subcostal nervure at its origin. They arise almost in a bunch between the scales of the wing, and pass forwards and outwards in a fan-shaped manner to the oval depressions about to be described. They are structureless and solid throughout (as examined under  $\frac{1}{12}$  oil immersion lens magnifying 950 diameters), they gradually taper to a point, and are probably chitinous in composition. The oval depressions alluded to above are two in number, one situated on the submedian



nervure of the forewing on its underside, the other partly below but more largely above the subcostal nervure of the hindwing on its upper-side. In *M. perseus* and *M. polydecta* these depressions are black, and are due to very closely imbricated scales with *evenly* rounded ends. That these spoon-shaped structures are depressions of the wing-surface is evident from the fact that all the scales are not in focus at the same time. In some specimens of *M. perseus* and *M. polydecta* these depressions are darkly iridescent, and under the microscope are seen to be composed not only of black scales, but also many of a deep steel, and others again of a lighter blue colour, changing their depth of colouring according to the direction of the light thrown on them. The scales under 950 diameters shew very minute striation, but in all cases the ends are *evenly* rounded. These rounded scales resist the action of solvents such as *eau de juvallé* much more strenuously than the scales on other parts of the wing. There is no true glandular structure whatever; but it is noteworthy that only the ends of the yellow "hairs" rest in the oval depressions. There is nothing in the structure of these appendages to indicate their function, nor do I think that they are used for stridulating purposes, as in that case I should have expected to find that the scales and hair-like processes would be toothed in some way so as to produce sounds, but this is not the case."

18. MYCALESIS (*Nissanga*) PATNIA, Moore.

Peculiar to Ceylon; but a closely-allied species, *M. junonia*, Butler, occurs in South India. It is in Ceylon a widely distributed and common insect, ascending to considerable elevations, being particularly common about Kandy. It is strongly seasonally dimorphic; the rains form being very dark, especially on the under surface. It has never been bred.

19. LETHE (*Hanipha*) DYNSTATE, Hewitson.

Moore as *H. sihala*, Moore, and *H. dynstate*, of the former he described both sexes in the Lep. Cey., of the latter the female only, but united them under one species in Lep. Ind. It is not only rare but is one of the most interesting of Ceylonese butterflies, and is confined to the island. The sexual patch of hairs on the forewing of the male on the upperside is unique, the subgenus *Hanipha* being confined to a single species. The white subapical band on the forewing of the female is variable in width, specimens from the hills having it narrower than specimens from the low country. It is found in the South-West portion of Ceylon at Awisawella and Udugama in the low country in July, and at Haputale, 5,000 feet, and Ohiya, 6,000 feet, in the hill country. It has also been taken in the Maskeliya district by

Mr. E. E. Green. Dr. Moore records it from near Nuwara Eliya in March and April, and at Punduloya in July. Its transformations are unknown. Like all *Lethes*, the larva probably feeds on bamboo or grasses.

20. *LETHE DRYPETIS*, Hewitson.

Moore as *L. drypetes* [sic] in Lep. Cey. and Lep. Ind. Occurs also in South India (as *L. todara*, Moore). In Ceylon it is not uncommon amongst bamboos, on which the larva feeds, at 3,000 feet and upwards. It is common in Punduloya in suitable localities, and Manders has taken it in May in the Hakgala Gardens below Nuwara Eliya.

21. *LETHE NEELGHERRIENSIS*, Guérin.

Moore as *neelgheriensis* in Lep. Ind. Common in the middle hill districts of Ceylon, more particularly perhaps along roads leading through tea estates. It is found also in Southern and Central India, and is closely allied to the North Indian *L. rohria*, Fabricius = *L. dyrta*, Felder. Dr. Aurivillius has named the *L. dyrta* of authors *L. confusa* (Ent. Tids., vol. xviii, p. 142, n. 15—1897). Mr. E. E. Green says that the larva feeds on grasses.

22. *LETHE DARETIS*, Hewitson.

Peculiar to Ceylon, and very common at high elevations. It is one of the few butterflies found on the Horton Plains, 7,000 feet. It is abundant nearly all the year round at Nuwara Eliya, the females being more frequently noticed than the males from their habit of flying closer to the ground. The males, unlike the majority of the genus, are fond of settling on the upper branches of low jungle trees, and flying rapidly in the sun round the topmost branches. Its transformations are unknown.

23. *YPTHEMA SINGALA*, Felder.

Moore as *Y. singala* and *Y. thora*, Moore. Through the kindness of Mr. Ormiston, Manders has examined thirty specimens of this insect from the Haldummulle district, 1,500-3,500 feet, and from the Bandara-wella district, 5,000 feet, and finds very great variety amongst them. The males are more frequently spotless on both wings on the upperside; but sometimes have a more or less conspicuous ocellus at the anal angle of the hindwing, and a more conspicuous, larger external ocellus is not infrequent; very rarely there is a third small ocellus external to this. In two specimens the forewing has a small subapical bipupilled ocellus, this being the *Y. thora* of Moore. The females are more constant on the

upperside. The underside of both sexes is very variable, the upper ocellus of the hindwing is the one usually wanting. In one specimen there are four ocelli on one wing and five on the other. The species is widely distributed, and is not uncommon on grassy slopes in the middle hill districts. Dr. Moore restricts it to Ceylon, but it certainly occurs in many parts of India also. It is strongly seasonally dimorphic. Its transformations are unknown.

24. *YPTHEMA CEYLONICA*, Hewitson.

The pure white patch on the upperside of the hindwing of this insect renders it one of the most conspicuous and easily distinguishable species in the genus. It is very common in the low country, particularly so in the Cinnamon Gardens at Colombo, fluttering about amongst the grass on the roadsides nearly all the year round. It is found in South India, and on the east coast as far north as Orissa. It has never been bred.

25. *MELANITIS ISMENE*, Cramer.

Moore as *M. ismene*, and *M. leda*, Linnæus. The wet-season form of this species is *M. determinata*, Butler; the dry-season form is true *M. ismene*. The true *M. leda*, Linnæus, usually understood to be the wet-season form of *M. ismene*, is now said by Drs. Butler and Moore to be a distinct species from Amboina. *M. ismene* is very common in Ceylon and is widely distributed. Its range in Africa, Asia, Malaya, Australasia and the South Seas is very great. It has been frequently bred on rice and grasses.

26. *MELANITIS TAMBRA*, Moore.

Dr. Moore in *Lep. Indica* describes and figures dry and wet-season forms of this species, and restricts it to Ceylon. He also describes the larva and pupa but does not give its food-plant, though that is almost certain to be the same as for *M. ismene*, Cramer. It is very close indeed to *M. bela*, Moore, restricted by the describer to the Himalayas, Assam, the Naga and Khasi Hills and Burma. If really distinct, which we doubt, size alone would appear to distinguish between them, *M. tambra* being the smaller. *M. tambra* probably occurs all the year round, and has been recorded from the Western and Central Provinces, in the plains and up to 3,000 feet elevation; from Punduloya, Ramboda and Kandy (Moore), Manders records it from the Hambantota district. Dr. Moore gives *M. varaha*, Moore, from South India, which is also doubtfully distinct from *M. bela*. *M. suyudana*, Moore, the describer restricts to the Malay Peninsula, Sumatra, Nias and Java; *M. abdullæ*,

Distant, Dr. Moore gives from the Malay Peninsula; and there are doubtless other named forms of *M. bela* which have been described from more distant localities. As *M. ismene*, Cramer, is admitted to have a wide range, it is more than probable, we think, that *M. bela* is also widely spread.

#### Subfamily ELYMNIINÆ.

##### 27. ELYMNIAS FRATERNA, Butler.

This is the Ceylonese form of the continental Indian *E. undularis*, Drury, the females of the two species being indistinguishable. It is common in Ceylon in the low country, and is found usually in jungle in the neighbourhood of water. The males are fond of settling on the stems of *Caladium*, which make them somewhat conspicuous in spite of their dull-coloured under-surface. The female is totally unlike the male, and bears a strong superficial resemblance to *Danais plexippus*, Linnæus, which it doubtless mimics. The larva is well known and feeds on *Palmacææ*.

##### 28. ELYMNIAS (*Melyniás*) SINGHALA, Moore.

Moore as *Melyniás singala* in Lep. Ind. It is somewhat close to, though quite distinct from, *E. lutescens*, Butler, from the Malay Peninsula, Sumatra and Borneo, which is probably a synonym of *E. panthera*, Fabricius, though the latter is kept by Moore as a distinct species from Java. Moore places *panthera* in the genus *Elymniás* and *singala* in the genus *Melyniás*. Mr. F. M. Mackwood informs us that up to quite recently the Peradeniya Botanical Gardens near Kandy was the only locality for *E. singala*, and it is abundant there, but it is apparently gradually extending its range. It appears to be quite constant, and is confined to Ceylon. Moore suggests that it mimics *Euploea sinhala*, Moore. The transformations are unknown, but Mackwood says that the larva feeds on the leaves of a species of palm tree.

#### Subfamily AMATHUSIINÆ.

##### 29. DISCOPHORA LEPIDA, Moore.

Restricted to South India and Ceylon, and apparently always rare. In South India it is strongly seasonally dimorphic. In Ceylon it is found in the low country jungles on the east and west of the island; we have specimens from Awissawella and the forests near Galle; Mackwood obtained a single specimen in Ambegamoa. The transformations have been described, and, as usual in the genus, the larva feeds on bamboo.

## Subfamily NYMPHALINÆ.

Dr. Moore divides the subfamily into eight groups, *Charaxina*, *Potamina* (*Apaturidæ*, auctorum), *Euthaliina*, *Limnivitina*, *Nymphalina*, *Argynnina*, *Melitæina*, and *Eurytelina*. As far as we can we have followed him, but up to date several of his groups have not been reached in Lep. Ind.

Group *Charaxina*.

## 30. CHARAXES PSAPHON, Westwood.

The Hon. Walter Rothschild in *Novitates Zoologicae*, vol. v, p. 545 (1898) has commenced a paper entitled "A Monograph of *Charaxes* and the allied prionopterous genera," but as two parts, which have alone been published up to the present date, only include one species from Ceylon, we are only able to follow him so far. He says the type of *Charaxes* is *jason*, Linnæus, and of *Eulepis* is *samatha*, Moore. He admits three other genera, *Euxanthe*, *Palla*, and a new genus, the types of these being *eurinome*, Cramer, *decius*, Cramer, and *trojanus*, ? author. The two first would appear to contain our Ceylonese species.

In Lep. Cey. Moore gives *Haridra psaphon*, Westwood, male only, and *Haridra serendiba*, Moore, female only, these two names representing opposite sexes of one and the same species. It is confined to Ceylon, but has a close ally in the South Indian *C. imna*, Butler. It is not very rare near Kandy, and Moore records it from Trincomali, Kottawa, Awissawella and Kanthalla. It may be useful to collectors to note that toddy or rum and sugar spread upon tree trunks in the haunt of *Charaxes* and *Euthalias* often proves a very successful bait. The female is very rarely met with. The transformations of *C. psaphon* are unknown.

## 31. CHARAXES FABIVS, Fabricius.

Abundant on the North Central Road and low forest land generally in that Province, but not reaching the middle hill district. It is found in many parts of India and in Burma. Its transformations are well known, and the larva feeds on the tamarind tree, *Tamarindus indica*.

## 32. EULEPIS ATHAMAS, Drury.

Moore as *Eulepis samatha*, Moore, and sunk by him in Lep. Ind. as a synonym of *E. athamas*. Rothschild in *Nov. Zool.*, vol. vi, p. 249 (1899) records it from Ceylon as "*Eulepis athamas agrarius* f. (temp. ?) *madeus*, Rothschild." Not at all rare in jungle in the lower hill district. It is very common in the neighbourhood of Kandy at the beginning of

the South-West Monsoon and at the end of the year. Rothschild restricts this particular form of *E. athamas* to the Central Provinces of India, South India and Ceylon. The parent form, true *E. athamas*, he gives from N.-W. India to Southern China, Burma, the Malay Peninsula, and Indo-China. Its transformations have been frequently recorded.

Group *Potamina*.

33. POTAMIS (*Rohana*) CAMIBA, Moore.

This species is confined to Ceylon and Southern India, to the northwards being replaced by *P. parysatis*, Westwood, that species being found in the Himalayas, Assam, Burma, Indo-China and Southern China. It is widely distributed in Ceylon from the low hill country upwards, and the males are not uncommon; the female, as in the genus generally, is much less commonly seen, and is a good mimic of species of *Ergolis*. The larva and pupa have been described and figured.

Group *Euthaliina*.

34. PARTHENOS CYANEUS, Moore.

Confined to Ceylon, replaced in South India by *P. virens*, Moore. *P. cyaneus* is found at all elevations, is not rare, but is difficult to catch. It has a remarkably distinctive mode of flight, which makes it recognizable at once on the wing. It flies in May, June and July, and again in November and December. Moore describes and figures its early stages.

35. SYMPHÆDRA NAIS, Forster.

Found on the eastern side of the island near Trincomali, and in the grassy country near Haldummule from 500 to 2,000 feet elevation, commonly in November and December. In India it is widely distributed. Its larva feeds on *Diospyros*, Nat. Order *Ebenaceæ*, and on *Sâl* (*Shorea robusta*).

36. EUTHALIA (*Dophla*) EVELINA, Stoll.

Restricted to Ceylon, replaced in South India by the closely-allied *E. laudabilis*, Swinhoe. Common in the jungles in the low country in the North Central Province, probably throughout the year in greater or less abundance. On one occasion Manders counted thirty of these butterflies sucking up the sap flowing from a tree in the jungle near Mahintale in August. It occurs also in the forests near Galle and Labugama. Its transformations are unknown. The larva will probably be found on *Diospyros*.

## 37. EUTHALIA LUBENTINA, Cramer.

Found in Ceylon not commonly in the thick forests between Dambool and Anaradhapura, and Dambool and Trincomali. It occurs in many parts of India, in Burma, the Malay Peninsula, Indo-China and Sumatra. The females are more frequently met with than the males. Its transformations are known, the larva feeding on *Loranthus*.

## 38. EUTHALIA GARUDA, Moore.

Not so common as the next, but found in the same localities. Mackwood got it at 3,000 feet elevation, and Yerbury at Peripanachera-kullam on the Kandy Road; Manders at Heneratgoda. It occurs nearly all over India, in Burma, the Malay Peninsula, Indo-China, Sumatra, Java, and Borneo, the form from the three last-named islands being probably the *E. sandakana* of Moore. The larva and pupa are well known, the former feeding on plants of many orders, but more especially on the mangoe.

## 39. EUTHALIA VASANTA, Moore.

Found only in Ceylon, and very common in the low country, especially so about gardens in Colombo in June and July, and again from October to December. The transformations are known, the larva, like that of *E. garuda*, Moore, feeding on mangoe leaves.

Dr. Moore in *Lep. Cey.*, vol. iii, p. 529 (1887) records *E. puseda*, Moore, from Ceylon from specimens in the British Museum. In *Lep. Ind.*, vol. iii, p. 99 (1897) he records *Cynitia puseda* from the Malay Peninsula only. It can hardly occur in Ceylon.

Group *Limenitina*.40. LIMENITIS (*Moduza*) CALIDOSA, Moore.

Moore as *M. calidasa*. Confined to the Inland, and a local race of *L. procris*, Cramer, from India and Burma. In Ceylon it is not rare in the jungles of the lower hills. The transformations have been described and figured.

## 41. NEPTIS JUMBAH, Moore.

Moore or *N. jumba* in *Lep. Cey.*, and *Andrapana jumba* in *Lep. Ind.* Common in the jungles in the North Central Province, but not extending into the lower hill district. Manders has taken it at Anaradhapura, Mahintale and Dambool in August; it also occurs in many parts of India, Burma, in the South Andaman and Maldivé Isles. It is a well-marked and easily-recognized seasonally dimorphic species; and its transformations have been recorded.

## 42. NEPTIS VARMONA, Moore.

Moore as *N. varmona* and *N. disrupta*, Moore. A common low country insect which is seasonally dimorphic; occasionally the melanic aberration *N. disrupta* is met with. Dr. Moore says that the dry-season forms have been named *N. kamarupa*, Moore, and *N. eurymene*, Butler, and the wet-season forms are typical *N. varmona*, and *N. swinhoei*, Butler. It is widely spread in India, and its transformations are well known.

43. NEPTIS (*Rahinda*) SINUATA, Moore.

A common species at low elevations, but found in the hills up to an elevation of 300 feet. It has a near ally in *N. hordonia*, Stoll, from India, Burma, the Malay Peninsula, Indo-China, Sumatra, Java, Borneo, Banka, Bali, Lombok, Sumba and Sambawa. Its larva and pupa are unknown.

Group *Nymphalina*.

## 44. JUNONIA IPHITA, Cramer.

Moore as *Precis iphita*. Abundant everywhere in Ceylon, and occurring nearly all over India, and in Burma, the Maldive Isles, the Malay Peninsula, and many of the islands in the Malay Archipelago as far as New Guinea and in New Ireland in the Pacific, also in China and Hainan Island, and wherever found varies considerably in the depth of its colouring owing to seasonal causes. Its larva and pupa have been described.

## 45. JUNONIA ATLITES, Linnæus.

Moore as *Precis laomedia*, Linnæus. A common low country insect in Ceylon, found also in India, Burma, the Malay Peninsula, the Nicobar Isles, Indo-China, probably Southern China, Hainan Isle, and nearly throughout the Malay Archipelago. It has often been bred.

## 46. JUNONIA ORITHYIA, Linnæus.

Moore as *J. orithya*. This name was first spelt *oritya* by Linnæus, but *orithya* is classically correct. Abundant, more especially in the low country, but not uncommon at Nuwara Eliya. Occurs almost all over India, Burma, Southern China, Formosa, and probably in Indo-China. Its larva and pupa have long been known.

## 47. JUNONIA HIERTA, Fabricius.

Moore as *J. ænone*, Linnæus. Scarce in Ceylon, and only found in the hottest and driest parts of the island. It occurs all over India, in



Burma, in the Andamans and Nicobars, Southern China and Hainan Island. In India it has often been bred.

48. JUNONIA LEMONIAS, Linnæus.

Not so abundant in Ceylon as *J. atlites*, Linnæus, and found in the same regions. Occurs also throughout India, Burma, the Malay Peninsula, Indo-China, Southern China, Formosa, Hainan, the Philippines, and has been recorded from Japan. Transformations known.

49. JUNONIA ALMANA, Linnæus.

Moore as *J. asterie*, Linnæus, which is the wet-season form, while true *J. almana* occurs in the dry-season. It is abundant in the low country. Found all over India, Burma, the Malay Peninsula, in the Andamans and Nicobars, China, Formosa, Hainan, Japan, Sumatra, Java, Borneo, Bali, and the Philippines. Its transformations are well known.

50. CUPHA PLACIDA, Moore.

The Ceylon insect is a good local race of the Indian *C. erymanthis*, Drury, in South India the two species gradually merge into one another. Mr. Fruhstorfer in Berl. Ent. Zeitsch., vol. xliii, p. 198 (1898) has described the form from South India intermediate between true *C. erymanthis* and *C. placida* as *C. erymanthis maja*. This form cannot in our opinion rank even as a subspecies, as it is not constant to locality. In Ceylon *C. placida* is widely distributed but not abundant, more common in the low country, found rarely at Nuwara Eliya, in jungle near water, and is not easy to capture in good condition. Its transformations have been described, the larva feeds on *Flacourtia*.

51. CETHOSIA NIETNERI, Felder.

Peculiar to Ceylon, replaced in Southern India by the allied *C. mahratta*, Moore. Very common in the low hill country round Kandy, rarely met with at Colombo in June and July. Its handsome larva and pupa are well known.

52. CYNTHIA ASELA, Moore.

Peculiar to Ceylon, replaced in South India by the closely-allied *C. saloma*, de Nicéville. In Ceylon it is locally common in the low country and the middle hill districts. As usual in the genus, the female is much less commonly seen than the male, and on the wing may be mistaken for *C. nietneri*, Felder. It is generally found in thick jungle near water. Its transformations have been recorded.

53. *CIRRHOCHROA THAIS*, Fabricius.  
 54. *CIRRHOCHROA LANKA*, Moore.  
 55. *CIRRHOCHROA COGNATA*, Moore.  
 56. *CIRRHOCHROA SWINHOEI*, Butler.

It is impossible in the present state of our knowledge to be at all certain, much less dogmatic, as to how many species of *Cirrhochroa* exist in South India and Ceylon. From the other species of *Cirrhochroa* found in North-East India all of them can be at once distinguished by their smaller size and deep ferruginous colour, except *C. swinhoei*, Butler, which is more ochreous. According to Moore, *C. thais* occurs in Ceylon, but de Nicéville states in Butt. Ind. that the description given by Fabricius applies best to *C. thais* from Southern India, and that the Ceylonese *C. cognata* is a local race of it. In a similar way *C. lanka* is a local race of the South Indian *C. relata*, de Nicéville. *C. swinhoei* is not given by Moore as occurring in Ceylon, but de Nicéville states that he has specimens from thence. This is a problem to which local entomologists should turn their attention and endeavour to solve by breeding the various species, and by examining a large number of specimens from as many localities in Ceylon and Southern India as possible. They occur all over Ceylon, from sea-level to 6,000 feet elevation. The imagines are probably seasonally dimorphic, which will account for their vagaries in coloration and markings. The transformations of *C. cognata* have been described, but no food-plant is recorded. In South India *C. thais* has been bred on *Hydrocarpus wightiana*.

57. *HYPOLIMNAS BOLINA*, Linnæus.

We omit *Apatura jacintha*, Drury, recorded as a distinct species by Moore from Ceylon, as it is in our opinion not distinct from the parent form. *H. bolina* is common everywhere in Ceylon and almost throughout Southern Asia, Malaya, Australia to the Pacific. Its transformations are well known.

58. *HYPOLIMNAS MISIPPUS*, Linnæus.

The female of this species is totally unlike the male and exists in two forms, the first being the *Papilio diocippus* of Cramer, a perfect mimic of *Danaïs chrysippus*, Linnæus, and is by far the more common of the two; the second is the *Papilio inaria* of Cramer, a mimic of *Danaïs dorippus*, Klug, and is distinctly rare. It is curious that it should occur in Ceylon at all, as *D. dorippus* is not found in the Island, being confined in India to the western littoral (Bombay, Kutch and Sind).

*H. misippus* is found in Ceylon in the low country in September, but is not abundant. It is very widely spread, occurring even in North America, nearly all over Africa, in Southern Asia, Malayana, and Australia, also in many oceanic islands. Its transformations are well known.

59. PYRAMEIS CARDUI, Linnæus.

This cosmopolitan butterfly is found everywhere in Ceylon commonly. Its earlier stages have been recorded for centuries.

60. PYRAMEIS INDICA, Herbst.

The Ceylon form of this species, which also is found in Southern India, has, quite unnecessarily we think, been named by Mr. Fruhstorfer in Ent. Nach., vol. xxiv, p. 61 (1898), *P. indica nubicola*. In Ceylon it is found only at high elevations such as Nuwara Eliya and the Horton Plains, where it is not uncommon. It is more plentiful in some seasons than in others, and flies throughout the year. It occurs in Madeira, the Canary Isles, Southern Europe, the Himalayas, Assam, Northern Burma, China, Corea, Japan, Formosa, the Philippines, and M. Oberthür has recorded it from Australia. Its transformations have been recorded.

61. VANESSA HARONICA, Moore.

A local race of the Indian *V. canace*, Linnæus; found also in Burma, the Malay Peninsula, China, Corea, Japan and Hainan Island. Not uncommon in the upper and middle hill districts of Ceylon, occasionally found at much lower elevations, and nearly all the year round. Its larva and pupa are known.

62. KALLIMA PHILARCHUS, Westwood.

Found only in Ceylon. It occurs locally common at Kandy, Kurunegalla, Haldummulle, and Ratigalla amongst other places in July and again in November and December. It is strongly attracted by old beer casks, toddy, decaying fruit, and "sugaring" the tree trunks with sugar and rum or with toddy, all of these are a sure bait if used where the butterfly is found. *K. mackwoodi*, Moore, from Ceylon, is not distinct from *K. philarchus*, that species varying much in the depth of colouring and the number and position of the hyaline spots on the forewing. On the underside it is extremely variable, some specimens having a pale grey ground-colour, others a deep red, and so on. It is almost a perfect mimic of a dead leaf when at rest with its wings folded. It has not been bred in Ceylon, but the larva of the allied *K. wardi*, Moore, in South India feeds on *Strobilanthes*.

## 63. DOLESCHALIA POLIBETE, Cramer.

Moore as *D. bisaltide*, Cramer. Not uncommon in the jungles at the foot of the hills, occurring also in South India; found again in the Eastern Himalayas, Assam, Burma, the Andaman and Nicobar Isles, and in several of the islands of the Malay Archipelago. It varies greatly on the under surface. Two or three specimens have been taken at Nuwara Eliya, they were probably non-resident. Its transformations are well known.

Group *Argynnina*.

## 64. ARGYNNIS HYPERBIUS, Linnæus.

Moore as *Acidalia niphe*, Linnæus. Very common in the upper and middle hill districts wherever the genus *Viola* is found, on which plants the larva feeds; particularly numerous about Nuwara Eliya and on the Horton Plains, stragglers being occasionally found in the low country. It flies nearly all the year round. In India it is very widely spread, occurring also in Abyssinia, the Maldive Isles, Northern Burma, China, Formosa, Japan, Sumatra, and the Philippine Isles. Dr. C. Aurivillius has recently pointed out that *Papilio hyperbius*, Linnæus (1763) is an older name than *P. niphe*, Linnæus (1767).

## 65. ATELLA PHALANTHA, Drury.

Moore as *A. phalanta*. Common everywhere in Ceylon but not abundant. It occurs also commonly nearly throughout India, where its early stages have frequently been studied. Found also throughout Africa and its satellite islands, in Burma, the Malay Peninsula, Indo-China, China, Hainan, Sumatra, Nias, Java, Bali, Lombok, Celebes, Sumba, Sambawa, Flores, Letti and Kisser.

Group *Eurytelina*.

## 66. ERGOLIS TAPROBANA, Westwood.

Confined to South India and Ceylon. Common all the year round in the low country and up to 6,000 feet. Its transformations have been recorded from Southern India. The larva feeds on the leaves of *Tragia involucrata*, and the castor-oil plant.

## 67. ERGOLIS ARIADNE, Linnæus.

Moore as *E. minorata*, Moore. Common in the low country and up to 2,000 feet; above this elevation it is rare. It occurs all over India and has been often bred, the larva feeding on *Tragia*. *E. ariadne* occurs also in Burma, the Malay Peninsula, Indo-China, Formosa, Hainan,

Sumatra, Java, Borneo, Bali, Banka, Lombok, Billiton, Celebes, Sambawa, Sumba, Flores, Alor, and Kalao.

68. *BYBLIA ILITHYIA*, Drury.

Common in the low jungles in the north of the island in July and December. It is found also in South and Western India as well as in Africa and Arabia, and is everywhere strongly seasonally dimorphic. The larva feeds on the leaves of *Tragia*.

Subfamily ACRÆINÆ.

69. *TELCHINIA VIOLE*, Fabricius.

An abundant species in the low country all the year round. Common also in India. Its transformations are well known, the larva feeding on *Modecca*.

Family LEMONIIDÆ.

Subfamily LIBYTHÆINÆ.

70. *LIBYTHEA MYRRHA*, Godart.

Not hitherto recognized from Ceylon, but there are one or two specimens from thence in Mr. Mackwood's collection, and one in that of Manders. These came probably from the neighbourhood of Kandy, where doubtless it is not rare though generally overlooked. It occurs almost throughout India, the larva feeding on *Celtis*. Mr. Fruhstorfer in Berl. Ent. Zeitsch., vol. xliii, p. 169 (1898) records true *L. myrrha* from Sumatra, Java, Bali, Lombok, Borneo, and Sambawa, and *L. myrrha sanguinalis*, Fruhstorfer, from the Himalayas and Malay Peninsula. Besides the localities for *L. myrrha* given above, it is found in Indo-China, Western China, and Sumba.

71. *LIBYTHEA RAMA*, Moore.

Very common at the higher elevations. Manders notes that he is inclined to think from the small material at his disposal that typical *L. rama* is found from about 5,000 feet upwards and gradually merges into *L. myrrha*, Godart, in the lower country; in this de Nicéville concurs. It is found also in South India, and Watson has recorded it from the Chin Hills of Upper Burma, 5,000 feet. It has never been bred.

72. *LIBYTHEA LEPITA*, Moore.

Not before recorded from Ceylon and apparently hitherto overlooked by collectors, though it is a well-marked and easily-recognised

species owing to the ferruginous tentpeg-shaped marking in the discoidal cell of the forewing. Mr. Mackwood has three or four specimens in his collection, and Manders several, all taken in the low country. It is found in India, very rarely in the south, more commonly in the north. It occurs also in Upper Burma, China and Japan. Its transformations are unknown.

#### Subfamily NEMEOBIINÆ.

##### 73. ABISARA PRUNOSA, Moore.

A local race of *A. echerius*, Stoll, from South China, differing only therefrom in its deeper coloration. Individuals vary greatly in size. In Ceylon it is common in the low country in June and July and again in November and December. It occurs also in South India, and has been bred there on *Embellia*; in Ceylon the larva feeds on *Ardisia*.

#### Family LYCÆNIDÆ.

##### 74. NEOPITHECOPS ZALMORA, Butler.

Moore as *Pithecopis dharmā*, Moore. There is a great difference between the rains and dry-season forms of this species, the former is almost white on the underside, the latter numerously speckled with fuscous spots. It is a common low country insect in Ceylon, and is very widely spread in Southern Asia. In South India the larva feeds on the leaves of *Glycosmis*.

##### 75. SPALGIS EPIUS, Westwood.

Not uncommon in Ceylon but local, and found in the low country. Manders has taken it once at Colombo, but it is common a few miles out at Rambukhan. The difference in the outline of the apices of the forewing of the two sexes is noteworthy, that of the male being very acute, that of the female rounded. The transformations of this species as given by Moore in Lep. Cey. are incorrect, the larvæ and pupæ figured being that of some other lycænid, probably that of *Rathinda amor*, Fabricius (No. 132). The larva is carnivorous; the pupa is very remarkable, as it presents the appearance of a minute monkey's head. It is found in many parts of India, in Burma, Java, Bali, Borneo, Sumba, Sambawa, and Damma Islands.

##### 76. MEGISBA MALAYA, Horsfield.

Moore as *M. thwaitesi*, Moore. This is an interesting species as it occurs in a tailed and a tailless form, the former not being found in Ceylon, though the commoner of the two forms elsewhere in Asia. Like

*Neopitheops zalmora*, Butler, it is variable as regards the extent of the white central area of the forewing. In Ceylon it is a common low country insect, and is often found in company with the two preceding species. It has a wide range in Southern Asia, occurring in Malaya as far east as New Guinea, and in the islands of the Pacific. It has been bred in Ceylon, the larva feeding on *Sapindaceæ*.

77. CHILADES LAIUS, Cramer.

Moore as *C. varunana*, Moore. Seasonally dimorphic, Moore's name applies to the wet-season form. It is a widely distributed insect in Ceylon, India, China, and in Hainan and Formosa Islands, in the former island being found at all elevations, and is usually abundant at Nuwara Eliya in November, the specimens then being of the rains' form. Manders notes that he has not yet met with the dry-season form in Ceylon, though no doubt it occurs there. The larva feeds on *Citrus*.

78. CHILADES TROCHILUS, Freyer.

Moore as *C. putli*, Kollar. Dr. Moore gives as localities Kandy and Trincomali, and states that it is rare. It occurs not uncommonly at Colombo in June, August and November, but from its very small size and dull coloration may easily be overlooked. Found also at Labugama in November and December. It is found from Europe to Australia and in Africa. The larva feeds on *Heliotropium strigosum*, Willd.

79. CYANIRIS AKASA, Horsfield.

Not uncommon in the neighbourhood of Nuwara Eliya in May and November, always near water; also in the Punduloya district, and doubtless elsewhere in the hill country. It is found also in the hills of South India and in many of the islands of the Malay Archipelago (Sumatra, Java, Bali, Lombok, Celebes and Sambawa). It has never been bred.

80. CYANIRIS PUSPA, Horsfield.

Moore as *C. lavendularis*, Moore. A species widely distributed over India and Malaya, and much subject to seasonal variation. Rare at Colombo, more common in the middle hill districts of Ceylon. The larva feeds on *Xylia* and *Cylista* in South India.

81. CYANIRIS SINGALENSIS, Felder.

Originally described from Ceylon from specimens taken at "Kallupahane, about 3,000 ft., on 15th December." Rare at Kandy, not uncommon in the hill districts, particularly so near Nuwara Eliya in May

and November. Usually flies over the tops of bushes overhanging hill streams, and is consequently difficult to capture. The females are much scarcer than the males and keep more to the jungle. It is found also in the Nilgiri Hills of South India, but has never been bred.

82. *CYANIRIS LANKA*, Moore.

Peculiar to Ceylon. Very common in the upper hill districts nearly all the year round, and the males may be seen in numbers settled on damp spots on the roads. The females are more usually met with fluttering about tea bushes and low-growing jungle bushes. Its transformations are unknown.

83. *CYANIRIS LIMBATUS*, Moore.

This species is not given by Moore in his *Lep. Ceylon*. "It is very near to *C. lanka*, Moore, the latter, however, in the male being still darker on the upperside, the narrow black border still narrower, and the discal series of spots on the underside of the forewing arranged almost in a connected line, not well-separated and irregularly-placed as in *C. limbatus*, [this is very distinctive]. It differs from *C. singalensis*, Felder, only in the colour of the upperside in the male being of a deeper shade; the markings of the underside in that species are perhaps placed rather more in echelon." (*de Nicéville*, *Butt. Ind.*, vol. iii, p. 109). It is found in the hill districts but not at the same elevation as *C. singalensis*, Felder, or *C. lanka*, Moore, Manders notes that he has not met with it in Nuwara Eliya or on the Horton Plains where the latter swarms. It is found in South India, Bengal, the Khasi Hills, and N.-E. Sumatra. Its transformations are unknown.

84. *ZIZERA LYSIMON*, Hübner.

Moore as *Z. karsandra*, Moore. Abundant nearly all the year round in the low country. Very widely spread, found in Europe, Africa, Teneriffe, Bourbon, Johanna, the Canary Islands, Mauritius, Madagascar, Arabia, almost throughout Southern Asia, and Malaya to Australia. It is seasonally dimorphic, the form flying in the rains being usually larger and much darker than that found in the dry-season. The larva feeds on *Amarantus*.

85. *ZIZERA GAIKA*, Trimen.

Moore as *Z. pygmaea*, Snellen, but Trimen's name has 14 years priority. Found in Ceylon in the same localities as the last, but is not so abundant. Found almost throughout Africa, Arabia, India and from Malaya to the Pacific. It has been bred on *Nelsonia* in South India.



## 86. ZIZERA OTIS, Fabricius.

Moore as *Z. indica*, Murray. A common low country insect in Ceylon, and flies nearly all the year round. The three species of *Zizera* usually occur together, and may be at once recognized by their habit of fluttering about amongst low herbage and grass within a few inches of the surface of the ground. Amongst other places they occur commonly on the Galle Face at Colombo. *Z. otis* inhabits all India and across Southern Asia to Hong-Kong, Burma, the Malay Peninsula, the Philippine Islands, and probably most of the islands of the Malay Archipelago and the South Sea Isles. The larva feeds on *Alysicarpus vaginalis*.

## 87. AZANUS UBALDUS, Cramer.

Not given by Moore, but Mr. Francis A. Fairlie has taken it at Jaffna in July, and on the North Central Road. It is found in Arabia and almost throughout India. It has frequently been recorded from Africa as *A. zena*, Moore. Dr. Butler in 1897 wrote that the male of *A. ubaldus* has no belt of thickened lilac scales across the upperside of the forewing, these scales being present in *A. zena*, but if the females got mixed as to locality it would be no easy matter to sort them. Its transformations have not been recorded, but the larva is said to feed on the leaves of *Acacia leucophlœa*.

## 88. AZANUS JESOUS, Guérin.

Moore as *A. crameri*, Moore. *Polyommatus jesous* was described in 1847; *Lycæna gamra*, Lederer, in 1855; *Lampides agave*, Walker, in 1870; and *Azanus crameri* in 1881, these four names representing one species. In Ceylon it is rare, and is found more especially in the hotter and drier parts of the island, though occasionally met with at Colombo. Wade got it at Hambantota, and Fairlie in the northern part of the Island rather commonly. It occurs in Africa, Syria, Arabia, and many localities in India. Its transformations are unknown.

## 89. LYCENESTHES LYCENINA, Felder.

Originally described from a specimen taken at "Avisavelle, Ceylon," on December 7th. Not uncommon in Ceylon on the lower hills. It is found almost throughout India, and in the Malay Peninsula, Sumatra, Borneo and Lombok. Its early stages have still to be discovered.

## 90. TALICADA NYSEUS, Guérin.

Occurs commonly but locally in the low country and up to nearly 4,000 feet. It is found in South India, Sind, Orissa, Assam and Burma. Larva feeds internally on the fleshy leaves of *Bryophyllum*.

## 91. EVERES ARGIADES, Pallas.

Moore as *E. parrhusius*, Fabricius. Abundant everywhere in Ceylon. It does not appear to be found in Africa, but occurs in Europe, almost throughout Asia, Malayana, in Australia, and the isles of the Pacific, also in North America under a slightly modified form. The larva in Europe and America feeds on *Leguminosæ*, but it does not appear to have been bred elsewhere.

## 92. NACADUBA MACROPHALMA, Felder.

Not uncommon in the middle hill districts of Ceylon, and fairly common in the lower hills and in the neighbourhood of Colombo. It is found in many parts of India, the Malay Islands, and in Australia. Its transformations are unknown.

## 93. NACADUBA HERMUS, Felder.

Moore as *N. viola*, Moore. It is a rare insect in Ceylon, but is probably overlooked from its resemblance to other species of the genus, "It can, however, be easily distinguished by the very acute apex and straight outer margin of the forewing, and posteriorly attenuated hindwing, with the outer margin very straight." (*de Nicéville*, Butt. Ind., vol. iii, p 147). Manders has taken a single specimen close to Colombo in November, and has notes of its occurrence at Haldummulle. It is widely spread in India, Malayana, Australia, and the South Sea Islands. It has never been bred.

## 94. NACADUBA ATRATA, Horsfield.

Dr. Moore in Lep. Cey. records *N. atrata* and *N. prominens*, Moore, as distinct species, but they cannot be satisfactorily separated. It is common in the middle hill districts and also in the low country of Ceylon. Like the last it has a wide range in India, the Malay Peninsula and Archipelago. Moore describes the transformations of *N. prominens*, the larva feeding on *Vateria*. In Southern India the larva of *N. atrata* feeds on *Embelia*.

## 95. NACADUBA NOREIA, Felder.

Described by Felder in 1868 from "Ninera Ellia," at about 6,000 feet, taken on 24th December, 1864. Mr. de Nicéville has examined the female type example in the Natural History Museum at Vienna, and finds that it is the tailless form of *Nacaduba ardates*, Moore, which also has a tailed form recorded by Moore from Ceylon, and described by him in 1874. Manders finds that both forms occur together at Nuwara Eliya and Kandy at the same season, in May and June, and again in

November and December. In Colombo he has only taken the tailless form, which flies in November and December. Dr. Moore in *Lep. Cey.*, vol. iii, p. 350, gives a note by Mr. E. E. Green regarding the two forms of *N. noreia*, from which one gathers that Mr. Green believes them to represent distinct species. Breeding alone can satisfactorily settle the point one way or the other. Mr. Thomas B. Butt writing from Deussworth, Awissawella, Ceylon, under date the 3rd December, 1890, says: "*N. ardates*, tailed and tailless, is quite promiscuous here. The last fine day almost that we had I took nine on or near some buffalo droppings, four were tailless, five were tailed." *N. noreia* has a wide range in India and Malayana, and occurs also in Northern Australia. Its larva has been bred on *Acacia cæsia* in South India.

96. JAMIDES BOCHUS, Cramer.

A very abundant species everywhere in Ceylon, from whence it was originally described, and occasionally migratory, at any rate in the hills. It occurs generally in India, in Burma, and Malayana. The larva feeds on *Xylia* and *Butea* in South India.

97. LAMPIDES ELPIS, Godart.

A common seasonally dimorphic species in the middle and lower hills. The larva feeds on cardamoms, and at times causes considerable damage to the crop. It also eats the flowers and seeds of *Kæmpfæria pandurata* in South India. *L. elpis* has a very wide range in India and Malayana.

98. LAMPIDES CORUSCANS, Moore.

Strictly confined to Ceylon, where it is much less common than the last-named species, and found chiefly in the Kandy and Awissawella districts flying in the jungle. Its transformations are unknown.

99. LAMPIDES LACTEATA, de Nicéville.

*L. lacteata*, de Nicéville, *Journ. Bomb. Nat. Hist. Soc.*, vol. x, p. 36, n. 17, pl. S, figs. 25, male; 26, female (1895); *L. pseudelpis*, Moore (*nec* Butler), *Lep. Cey.*, vol. i, p. 95 (1881); *id.*, de Nicéville, *Batt. Ind.*, vol. iii, p. 165, n. 736 (1890).

Apparently confined to and rare in Ceylon, Moore gives no localities for it; Manders has taken it at Kandy and Labugama in May; and de Nicéville has two pairs only from Ceylon with no precise locality recorded. It is probably frequently confounded with *L. elpis*, Godart, and has not been bred.

100. LAMPIDES CELENO, Cramer.

Moore as *L. ælianus*, Fabricius. Abundant everywhere, and highly

seasonally dimorphic; specimens taken at a considerable elevation in the dry cold weather (such as Nuwara Eliya in January) have the underside somewhat deep fuscous. It has a wide range in India, Indo-China, China, and Malayana, extending even to the islands of the Pacific. It has frequently been bred.

101. *CATOCHRYSOPS STRABO*, Fabricius.

A common species everywhere in Ceylon. It is found from India to Australia. It has frequently been bred; the larva feeds on *Ougeinia*, *Schleichera* and *Dolichos*.

102. *CATOCHRYSOPS LITHARGYRIA*, Moore.

Not common in Ceylon, from whence it was originally described, but occurs both in the low (Colombo) and hill (Nuwara Eliya) country. It is very closely allied to *C. strabo*, Fabricius, the females been indistinguishable. The males, however, are readily differentiated, the male of *C. strabo* being lilac, of *C. lithargyria* a pale silvery blue. It has been recorded from many localities between India and Australia where *C. strabo* is found, but never without that species. Its transformations are unknown.

103. *CATOCHRYSOPS CNEJUS*, Fabricius.

Very common everywhere in Ceylon, particularly so in the Northern Province. Its range is immense, being found from India through China, Malaya and Australasia to the South Sea Islands. It has frequently been bred on various plants of the Natural Order *Leguminosæ*.

104. *CATOCHRYSOPS PANDAVA*, Horsfield.

Local and not common, found towards the north of the island and along the North Central Road, also at Hambantota. It is not nearly as widely spread as the other species of the genus given above, but occurs all over India and in many of the Malayan islands as far east as Bali and Sumba at all events. It is highly seasonally dimorphic, and the larva feeds on the young fronds of Cycads.

105. *TARUCUS THEOPHRASTUS*, Fabricius.

Prefers the hottest and driest parts of the Island, such as Hambantota in the south and the Jaffna district in the north, flying in July. It is found in Northern Africa, Sacotra, Arabia, in many parts of India, and in the Malayan island of Sumba. Dr. Holland has described a *Tarucus clathratus* from Celebes, which probably is the same species. The transformations of *T. theophrastus* are well known, the larva feeding in *Zizyphus*.

## 106. TARUCUS TELICANUS, Lang.

Moore as *T. plinius*, Fabricius. An uncommon but widely distributed insect in the low country of Ceylon. It has a wide range, being found in Africa, Arabia, India, Burma, the Malay Archipelago, Formosa, Australia, and the islands of the South Sea. Its transformations are well known, the larva feeding on the leaves of *Sesbania*.

## 107. CASTALIUS ROSIMON, Fabricius.

Common in the low country jungles and on waste land in Ceylon. It has a wide range in India, Burma, the Malay Peninsula and onwards through the Malay Archipelago to Flores. It has frequently been bred on *Zizyphus*.

## 108. CASTALIUS ETHION, Doubleday and Hewitson.

Found in Ceylon in the same localities as the last but is not so common. It appears throughout the year except in the very dry weather. In India its range is more restricted than the last, but extends to the east as far as Flores at any rate. The larva feeds on *Zizyphus*.

## 109. CASTALIUS DECIDIA, Hewitson.

Moore as *C. decidia* and *C. hamatus*, Moore. It is seasonally dimorphic, the rains form is *C. hamatus*, an intermediate form is true *C. decidia*, while the dry-season form is *C. interruptus*, de Nicéville. It is found in Ceylon in the same localities as the other two species of the genus, as for instance at Heneratgoda in August, and at Labugama in November and December. This species is confined to India, Burma and Ceylon, not even occurring in the Malay Peninsula. Its transformations are known, the larva feeds on *Gonania* and *Zizyphus*.

## 110. POLYOMMATUS BÆTICUS, Linnæus.

Moore as *P. bæticus*. An abundant species in Ceylon, found everywhere and at all elevations. Occurs almost everywhere in the Old World. Its transformations are well known.

## 111. AMBLYPODIA ANITA, Hewitson.

Moore as *A. naradoides*, Moore, and *A. darana*, Moore, which are synonyms of *A. anita*. Common in the low country of Ceylon. The female is dimorphic, being smalt-blue in one form on the upperside, uniform pale violet-brown in the other. It is found in South India, North-East India, Assam, Burma, the Andaman Isles, Siam and Borneo. The larva feeds on *Ola*. In Moore's plate (Lep. Cey., pl. xliii) of this

species, figs. 1, 1a refer to *A. naradoides*, fig. 2 to *A. darana*, the numbering being reversed.

112. *IRAOTA TIMOLEON*, Stoll.

Moore as *I. mæcenas*, Fabricius, which is a synonym of *I. timoleon*. Found in August and probably other months in the Northern, Eastern and Southern districts. It occurs also in India, China and several of the Malayan islands. The larva feeds on *Ficus*.

113. *SURENDRA QUERCETORUM*, Moore.

Moore as *S. discalis*, Moore, which differs only from the typical form in being somewhat smaller. In Ceylon it is abundant in the low country, and up to about 2,400 feet. It is found in many parts of India and Burma, in Java and Sambawa. The larva feeds on *Acacia*,

114. *ARRHOPALA PIRAMA*, Moore.

Moore as *Nilasera pirama*. A local Ceylonese and South Indian form of the widely distributed *A. centaurus*, Fabricius, but easily discriminated in both sexes by the brilliant blue (not dull purple) colour on the upperside of both wings. It is very common in the neighbourhood of Colombo, and may often be seen flying about the mangoe trees in the Victoria Park just before sunset. Moore records it from Galle and Kandy. The parent form, from which many local races have been derived, has a wide range in India, Burma, Indo-China, and Malaya. The larva appears to feed on a great variety of plants.

115. *ARRHOPALA AMANTES*, Hewitson.

Moore as *Nilasera amantes*. Found in the same localities as the last, and is perhaps even more abundant. From *A. pirama*, Moore, it may be easily distinguished by the presence of a well-formed lobe at the anal angle of the hindwing. It has a wide range in India, and occurs also in Burma, the Andaman Isles, Bali, Celebes and Sumba. Its transformations are known, the larva feeding on a variety of plants.

116. *ARRHOPALA ABSEUS*, Hewitson.

Not hitherto recorded from Ceylon, but Mr. F. M. Mackwood informs us that it occurs in the Ratnapura district, and there is a single example in the Colombo Museum. It is found very rarely in Southern India, but is common in the North-East, in Burma, the Malay Peninsula, and many of the Malayan islands. Mr. G. C. Dudgeon has bred it in Sikkim, but its transformations have not been described. The larva probably feeds on Sâl (*Shorea robusta*).

## 117. CURETIS THETIS, Drury.

Moore as *C. thetyis*. Not uncommon at Kandy, Trincomali, and in the low country generally. It is common in many parts of India and has been recorded from Indo-China and several of the Malayan islands. Its transformations are well known.

## 118. ZESIUS CHRYSOMALLUS, Hübner.

Very abundant in the low country about cashew trees nearly all the year round, but more especially in November. It is a very constant species, showing no variation. It occurs locally in India at Barrackpore near Calcutta, the Malda district in Bengal, Chota Nagpur, the Central Provinces, Bombay, Ganjam, the Nilgiri Hills and in Travancore. It has been frequently bred.

## 119. CAMENA DEVA, Moore.

Moore as *Pratapa deva*. If *Camena* is held to be too near to *Camena* (the latter name having priority), then *Pratapa* must be used for the genus. Not uncommon in the low country and up to about 4,500 feet. It is found also in many parts of India and Burma, and in Nias Island, Java, and the Philippines. Its transformations are known, the larva feeding on *Loranthus*.

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We are unable to state definitely, or even perhaps approximately, the number of species of the genus *Aphnæus* which are found in Ceylon. It is without doubt a most puzzling genus, and in many cases it is obviously difficult to say where one species ends and another begins, and until some one undertakes breeding experiments on an extensive scale and records them carefully, it must be a matter of individual opinion as to how many there are. The following species have been recorded from Ceylon.

## 120. APHNÆUS VULCANUS, Fabricius.

Not recorded by Dr. Moore in Lep. Cey. from Ceylon, where, however, it is a very common low country insect. It is a common species also in India, and occurs in N.-E. Sumatra and Java. Its transformations are known, the larva feeding on the leaves of *Clerodendron*.

## 121. APHNÆUS FUSCA, Moore.

This is probably identical with *A. vulcanus*, Fabricius, and is always found with that species. Hitherto it has only been recorded from Ceylon. It has not been bred.

122. *APHNÆUS SCHISTACEA*, Moore.

Occurs commonly in August in the Dambool district, and also in the immediate neighbourhood of Colombo. It has been recorded from Sattara in the Bombay Presidency, from the Nilgiri Hills, and from Myingyan in Upper Burma. It has not been bred.

123. *APHNÆUS LOHITA*, Horsfield.

Moore as *A. lazularia*, Moore. Found in the same districts and at the same seasons as the last. It has a wide range in India, Indo-China, China, Hainan Island, and Malaya. Its transformations are known, Dr. Moore says the larva feeds on *Convolvulacææ*.

124. *APHNÆUS ZEBRINUS*, Moore.

Described by Dr. Moore in 1884 from Ceylon only, but omitted by him from *Lep. Cey.*, vol. iii, published in 1887. We have failed to recognise the species. Mr. J. J. Walker records it from Hongkong in Southern China.

125. *APHNÆUS ICTIS*, Hewitson.

Very common in the Dambool and Anaradhapura districts of Ceylon in August. It is widely spread in India, but has never been bred. The *A. vulcanus*, var. *maximus* of Elwes, from Burma, is a form of *A. ictis*, and may be kept distinct on account of its very large size.

126. *APHNÆUS NUBILUS*, Moore.

Described from Ceylon only by Dr. Moore, taken by Mackwood at Wattegama in May. It is very doubtfully distinct from the last, though Mr. Frank A. Fairlie, who has a very extensive acquaintance with the imagines of the genus in life as they occur in Ceylon, brings forward arguments to show that it is a distinct species. It can only be satisfactorily settled if it be so or not by breeding, though a critical examination of the prehensores of the male would doubtless shed some light on the subject.

127. *APHNÆUS GREENI*, Heron.

*Spindasis greeni*, Heron, *Ann. and Mag. of Nat. Hist.*, sixth series, vol. xviii, p. 190 (1896).

Described from a single male captured near Punduloya, on the summit of the Great Western range of hills in Ceylon, at this point attaining a height of about 6,000 feet. Mr. de Nicéville has examined this specimen in the British Museum, but would prefer to express no opinion regarding its validity as a distinct species.



128. *TAJURIA CIPPUS*, Fabricius.

This species is usually known and is described by Moore in Lep. Cey. as *T. longinus*, Fabricius (see Aurivillius, Ent. Tids., vol. xviii, p. 146, nn. 48, 49 (1897)). It is not uncommon in the lower and middle hill districts of that island, and has a wide range in India and Malaya. It has often been bred, the larva feeding on *Loranthaceæ*.

129. *TAJURIA JEHANA*, Moore.

Not recorded by the describer from Ceylon. It has been taken in the Jaffna district of Ceylon in July by Mr. F. A. Fairlie. It is closely related to *T. cippus*, Fabricius, but may be easily distinguished by its slatey-blue coloration on the upperside of both wings in the male. The females of the two species are difficult to discriminate. It is somewhat widely spread in India, but has not been bred.

130. *HYPOLYCÆNA NILGIRICA*, Moore.

Known only from the Nilgiri Hills and from Ceylon, where Mr. Fairlie has taken it near Jaffna in the North Central Province in July, Mr. Mackwood at Matale and at Dolosbage in March, and Manders at Heneratgoda in June. Its transformations are unknown.

131. *CHERITRA JAFFRA*, Butler.

Moore as *C. pseudojaffra*, Moore. Confined to South India and Ceylon, replaced in Northern India, Burma, Indo-China and Malaya by *C. freja*, Fabricius. In Ceylon *C. jaffra* is not uncommon in low country jungle, extending up to 2,500 feet elevation. Its larva feeds on *Xylia*.

132. *RATHINDA AMOR*, Fabricius.

Not rare about Kandy and in the low country jungles, found also near the rock fortress of Sigiri in August. It is found in many parts of India, even in the city of Calcutta. Its larva feeds on many plants, and is probably the one figured by Moore in Lep. Cey., vol. i, pl. xxxiv, fig. 1b, *larvæ* and *pupæ* as that of *Spalgis epius*, Westwood. It is also figured in Horsfield and Moore's Cat. Lep. E. I. C., vol. i, pl. xii, figs. 7, *larva*; 7a, *pupa* (1857).

133. *HORAGA CINGALENSIS*, Moore.

Moore as *H. ciniata*, Hewitson. A very rare insect, recorded by Moore from Kandy, where a few specimens have been taken; possibly also to be found in the lower hills. If really distinct from the Indian *H. onyx*, Moore, it is confined to Ceylon, and its transformations are unknown.

134. *CATAEPICILMA ELEGANS*, Druce.

Moore as *Catæpicilma elegans*. This beautiful insect is common in the lower hills of Ceylon, and hardly differs from Indian and Malayan specimens. If the Indian is distinct from the Malayan form, Mr. H. H. Druce suggests the name *major* for the former. The larva feeds on *Terminalia*.

135. *LOXURA ARCUATA*, Moore.

Very common in the low country of Ceylon up to about 2,500 feet, and is closely allied to *L. atymnus*, Cramer, of India and Malaya. Its transformations are known, the larva feeding on *Smilax*.

136. *DEUDORIX EPIJARBAS*, Moore.

A common low country insect in Ceylon, and widely spread in India, China and Malaya. Its larva is an internal feeder, eating the fruit of the pomegranate, horse-chestnut, and *Cinnarus*. It pupates inside the fruit.

137. *RAPALA SCHISTACEA*, Moore.

Not given by Moore in Lep. Cey. It is a species of wide distribution in India and Malaya, and is probably frequently overlooked from its close resemblance to *R. lazulina*, Moore, from which the male is distinguished by having a brilliant metallic blue gloss in certain lights on the upperside of both wings; the females of the two species are very similar. In Ceylon it has been taken by Mr. Fairlie in the Northern Province, and occurs also in the Haldummulle district. It has been bred often, the larva feeding on a great variety of plants.

138. *RAPALA LANKANA*, Moore.

The type, a female, was described by Moore in Lep. Cey. as *Deudorix lankana* from a specimen taken by Capt. Wade in the Kottawa forest near Galle. Manders has only seen three specimens of this rare insect, two males in the Colombo Museum and one in his own taken in October, all from the low country. The males have even a more brilliant and extensive iridescent purple gloss than has *R. schistacea*, Moore, and may also be readily distinguished by the ferruginous (not grey) under surface; also by its larger size. Elsewhere it has been recorded only from North Kanara, the Nilgiri Hills, and in Travancore. It has never been bred.

139. *RAPALA LAZULINA*, Moore.

Occurs in Ceylon at Kandy, Kaduganawa and the Haldummulle district, and has been recorded from the Nilgiri Hills of South India.

Is it really distinct from *R. varuna*, Horsfield (= *R. orseis*, Hewitson)? It has never been bred.

140. *RAPALA MELAMPUS*, Cramer.

Not given by Moore in Lep. Cey. Mr. F. Fairlie writes "I have taken only males of this species at Manipai near Jaffna, about half a dozen, on a windy day on the sheltered side of some tree, tamarind for choice, which is in full flower in July, and attracts a great number of butterflies." The northern parts of the Island have by no means been so thoroughly explored for butterflies as the other portions, and Mr. Fairlie has added several species to the Ceylon list from thence. A more extended and prolonged tour would probably result in further additions, most of which would probably be closely allied to or identical with South Indian species. *R. melampus* may at once be distinguished from the other species of the genus found in Ceylon by the wings of the male on the upperside being scarlet instead of blue; those of the female are dull brick red. It has a wide range in India, and occurs also in Burma, Sumatra, Nias, and Java. The larva feeds on *Ougeinea* and *Zizyphus*.

141. *BINDAHARA SUGRIVA*, Horsfield.

Moore as *B. phocides*, Fabricius. Uncommon in the low country, particularly about Kandy, where Capt. Wade states, however, that he found the male plentiful in the Botanical Gardens. It is found occasionally as high as 4,000 feet elevation, and is rare at Haldummulle. Mr. W. H. Miskin in "A Syn. Cat. of the Lep. Rhop. of Australia," p. 69 (1891), placed under *B. sugriva*, Horsfield, the *Myrina isabella* of Felder, the *B. phocides* of Moore *nec* Fabricius, and the *M. jolcus* of Felder as synonyms, and makes the following remarks:—"With great regard for the opinions of Messrs. Distant and de Nicéville, I have little doubt this, with *B. phocides*, Fabricius, and *B. areca*, Felder, all represent one rather variable species. In one specimen I have, from Ceylon, the blue colour in the apical region of the hindwing is restricted to a mere marginal line, only just perceptible; in a Cape York [North Australia] example the blue patch is as broad as long, and nearly touches the apical angle, the underside of both being exactly alike, and nearly as dark as in Horsfield's figure. The development of the white area in the hindwing of the female, and the lighter or darker shading of the underside, is so variable as to be quite unreliable for specific distinction." It would be interesting to know if the males of *B. sugriva* in Ceylon are often as variable as Mr. Miskin would appear to consider the species to be throughout

the wide range of the genus. The many specimens we have seen from Ceylon are quite constant. We have specimens from South India, Sumatra and Java. The larva feeds on the inside of the fruit of a creeper in South India.

142. *VIRACHOLA ISOCRATES*, Fabricius.

Common in the driest parts of the Island and along the North Central Road, in July. Wade records it from Hambantota in July. It occurs also in many parts of India, the larva feeding on the fruit of the pomegranate, tamarind, *Diospyros* and *Randia*.

143. *VIRACHOLA PERSE*, Hewitson.

All the remarks given above for *V. isocrates* apply equally well to this species, except that the larva has been bred from the fruit of the pomegranate and *Randia* only.

Family PAPILIONIDÆ.

Subfamily PIERINÆ.

144. *LEPTOSIA XIPHIA*, Fabricius.

Moore as *Nychitona xiphia*. Widely distributed over Ceylon and not uncommon in low country jungles. It is very constant, hardly varying at all in coloration and markings. It is found almost throughout India and Malaya. The larva feeds on various capers (*Capparis*).

145. *DELIAS EUCHARIS*, Drury.

Abundant everywhere in Ceylon, more particularly in the low country. Common also in India; Dr. Butler has recorded it from Burma and Penang! The larva feeds on *Loranthus* as usual in this genus.

146. *PRIONERIS SITA*, Felder.

Fairly common at moderate elevations in Ceylon, Manders has taken it in Punduloya in January, and has noted its occurrence amongst other places at Haputale, 5,000 feet, Koslande, 2,500 feet, Behilul Oya, 2,200 feet, and Wellaway, 500 feet. Mackwood records it from the hills from 2,000 to 6,000 feet. It is a splendid mimic in both sexes of the highly protected *Delias eucharis*, Drury, but its more rapid and somewhat darting flight makes it easily distinguishable when on the wing. The acutely-pointed apex of the forewing is also a noticeable feature even in flight. The female is extremely rare. It occurs rarely in South India, and has been bred by Mr. E. E. Green in Ceylon on *Capparis*.

## 147. CATOPSILIA CROCALE, Cramer.

Moore as *C. crocale* and *C. catilla*, Cramer, but the former is the older name. It is a very variable species, which does not appear to be dependant on the seasons for its various forms. It is very widely distributed in India, Malaya and Australasia, and seems to be variable wherever it is found. It is largely given to migrating in Ceylon and Southern India, and again in Java. Its larva feeds on *Cassia*.

## 148. CATOPSILIA PYRANTHE, Linnæus.

Moore in Lep. Cey. gives four forms of this species as separate species, *C. gnoma*, Fabricius, *C. ilea*, Fabricius, *C. chryseis*, Drury, as well as typical *C. pyranthe*. Mauders notes that as far as his observations go these four forms are not dependent on season, but appear indiscriminately nearly throughout the year, those flying in the dry-season from February to April being a little smaller than those found during the rest of the year. *C. chryseis* is perhaps not as common a form as the others. It takes part in the low country flights. It occurs everywhere in India and Malaya, the larva feeding on *Cassia*.

## 149. TERIAS LIBYTHEA, Fabricius.

Moore as *T. drona*, Horsfield. Dr. Butler considers that *T. senna* and *T. lerna*, both of Felder, represent the wet-season form of this species, *T. drona* is a form intermediate between the dry and wet-season forms, and the dry-season form is true *T. libythea*, with *T. rubella*, Wallace, and *T. hainana*, Moore, as synonyms. In Ceylon it is common in open country between 2,000 and 5,000 feet. It has a very wide range in the East. Like all the rest of the genus, the larva feeds on the *Leguminosæ*.

## 150. TERIAS VENATA, Moore.

Moore as *T. cingala*, Moore, and *T. rama*, Moore. Dr. Butler omits the former species from his "A Revision of the Picrine Butterflies of the genus *Terias* from the Old World." (Ann. and Mag. of Nat. Hist., seventh series, vol. i, p. 64, n. 21 (1898). He gives the range of *T. venata* "From the Himalayas southwards to Ceylon, and probably eastwards through North China, for we have it from Chusan Island and from the Philippines." He also notes that "The seasonal (?) forms differ less than usual: *T. rama* [and also *T. cingala*] is probably the best-marked wet type, *T. santana*, Felder, intermediate, and *T. venata* (of which *T. pallitana*, Moore, is the female) the dry; but, on the other hand, it is possible that, as seems to be the case in the closely allied *T. betheseba*, Janson, from Japan and Hainan Island, no differing dry form may exist, and the slight

discrepancies in the pattern of the upper surface or the definition of the markings on the under surface may be partly local and have a subspecific value. The fact that we have the extremes from the Anamully Hills in South India proves that they are not permanently separated as distinct species." Without seeing the type specimens of *T. cingala* it is difficult to say exactly what it is, it may be that it is a form of *T. libythea*, Fabricius, rather than of *T. venata*. In Ceylon *T. venata* is distinctly variable, and is found there at the same elevations as the last and throughout the year. It has not been bred as far as we are aware.

#### 151. *TERIAS HECABE*, Linnæus.

Dr. Butler has recently stated in his paper on *Terias* above referred to that *T. hecabe* does not occur in India or Ceylon but is found in Southern China, while what we have been accustomed to call *T. hecabe* is the *T. suava* of Boisduval, which Butler restricts to India and Ceylon, and Burma southwards to Malacca including the Mergui Archipelago. The only difference Butler gives between *T. hecabe* and *T. suava* is that the former is "broader-winged." According to the late Capt. E. Y. Watson, *T. hecabe* may be known "By never having more than two streaks or spots in the discoidal cell on the underside of the forewing in addition to the reniform spot on the disco-cellular nervules." Again "The dry-season form at the apex of the forewing on the underside has a more or less strongly pronounced brown patch." Manders notes that the larva feeds in his compound in Colombo on the leaves of the Madras Thorn, and that he has considerable experience of the insect as it is so common. The spots in the cell of the forewing on the underside are sometimes reduced to one or even absent altogether. The brown patch mentioned above is not absolutely indicative of the dry-season form; it varies considerably in size, and is found in the females at the commencement at any rate of the wet-season. True *T. hecabe* is a wet-season form, besides which Moore records from Ceylon *T. hecabeoides*, Ménétrières, also a wet-season form, and *T. simulata*, Moore, a dry-season form. *T. hecabe* is abundant everywhere in Ceylon and occurs at all seasons. The larva feeds in *Leguminosæ*.

Dr. Butler records *T. nicobariensis* (recte *nikobariensis*), Felder, from the Andamans, Nicobars, Java, Sumatra, Flores, Borneo, and the Philippines, and notes that the British Museum has "A female apparently referable to the intermediate form of this species, but said to have been taken in Ceylon." He gives *T. phanospila*, Felder, as a synonym, and says it is the dry-season form. Mr. de Nicéville has examined the type of *T. nikobariensis* at Vienna, and considers it to represent a variety of *T. hecabe* only.

## 152. TERIAS SILHETANA, Wallace.

Dr. Moore does not record *T. silhetana* from Ceylon, but gives *T. citrina*, Moore, which is a dry-season form, *T. rotundularis*, Moore, a wet-season form, *T. uniformis*, Moore, also a dry-season form, and *T. templetonii*, Butler, also a wet-season form. The butterfly is common in the middle and lower hill districts, but is only found rarely at the sea-level. It varies much in size, markings and in the form of the wings. *T. citrina* has always (?) three spots in the discoidal cell of the forewing on the underside exclusive of the reniform markings on the disco-cellular nervules, and sometimes has and at other times lacks an ochreous apical marking. A larger dry-season form 1.75 inches in expanse has a well-developed and almost square ochreous patch at the apex of the forewing on the underside, with the usual three spots in the cell. In one specimen in Manders' collection one of these spots (the basal one) is almost obsolete. The form *T. rotundularis* may be known by the more rounded shape of all the wings, which gives it a peculiar facies, so much so that Mr. Mackwood is strongly biased in favour of its being a distinct species. Mr. Ormiston of Kalupahani recently informed us that from one batch of eggs (whether laid by the same parent or not is unknown) he has bred all the above forms. In Ceylon the larva feeds on *Albizia Moluccana* and is gregarious.

## 153. TERIAS SARI, Horsfield.

Recorded by Dr. Butler from Ceylon, the Nilghiris, Burma, the Mergui Archipelago, Malacca, Sumatra, Java, Borneo, the Sulu Archipelago, and Palawan. We have specimens only from Sumatra, Java, Banka and Borneo. Dr. Moore also omits it from Ceylon. Watson says "*T. sari* is a very constant and easily recognisable species: it has on the underside only a single wavy line in the discoidal cell of the forewing, in addition to the usual disco-cellular markings, and the whole of the apex widely and evenly chocolate-brown, and also has a more or less diffused dark spot towards the outer angle."

## 154. IXIAS CINGALENSIS, Moore.

Moore as *I. cingalensis* and *I. pirenassa*, Wallace. In describing the latter Wallace wrote "Male, costa much curved, hindwing subtriangular. Upperside, both wings like '*Thestias*' *pyrene*, Linnæus [which he restricts to N. India, Bengal, China], but the transverse black band always touches the discoidal spot of the forewing." Its habitat he gives as Bombay and Madras. Moore appears to have kept the two species separate chiefly because *I. cingalensis* has the underside uniformly yellow without markings, while *I. pirenassa* is considerably

marked with purple-brown spots. These characters are due to season, the first occurring in the wet, the second in the dry-season. Watson keeps *I. cingalensis* and *I. pirenassa* distinct, the former having the yellow ground-colour of the forewing on the upperside of the male entering the second median interspace and filling the angle at the origin of the second median nervule, while in the second the yellow ground-colour does not enter the second median interspace, and he says that *I. pirenassa* is not found in Ceylon. Certainly Ceylon has only one species of the group of *I. pyrene*, Linnæus, but whether or no the Ceylon form can be always separated from the parent form is in our opinion extremely doubtful. Butler in his Revision of the Butterflies of the Genus *Ixias* (1898) has given *I. cingalensis* as the sole species of the *pyrene* group from Ceylon. He notes "*I. cingalensis* can be picked out at sight from a crowd of nearly allied forms, but the distinction given above [by Watson] is useless as a guide; its chief peculiarity is the narrowness and angularity of the orange belt across the forewing on the upperside in the male combined with the sharply defined and perfectly straight inner edge of this belt from the subcostal nervure to the first median nervule." He restricts *I. pyrene* to China, giving *I. sesia*, Fabricius, from Burma. *I. pirenassa* he records from Western India southwards to Depalpur. Watson restricts *I. pyrene* in India to Burma not extending west of Assam. In Ceylon *I. cingalensis* is found commonly all over the low country, and is peculiar to the island. It has not been bred.

155. *IXIAS MARIANNE*, Cramer.

Common in the hot dry country, not found above sea-level, and flies in June and October. It is found also in peninsular and continental India, and has been bred. The rainy season form is much larger and darker than the dry-season form.

156. *TERACOLUS AMATA*, Fabricius.

Moore as *Idmais modesta*, Butler. Moore records it from the low country, found abundantly in the Dambool District and north of it, also at Hambantota and in the Mullaitivu District. Manders got it commonly but worn in August at Anaradhapura. The female is dimorphic, Form I being salmon-coloured like the male, Form II being very pale primrose-coloured or almost pure white. It occurs in Africa, Arabia, Syria, Persia and many parts of India. Its transformations are known, the larva feeding on *Salvadora*.

157. *TERACOLUS EUCHARIS*, Fabricius.

Moore as *Callosune eucharis*. Dr. Moore gives no exact record of



the occurrence of this species in Ceylon. Mr. Pole says that it is not found south of Puttalam, nor along the east coast as far as Trincomali as far as he is aware. It flies in June and December, has apparently two broods, is a very local species, and is a lover of the sun even on wind-blown and arid sea-shores. It occurs also in South India. Its transformations are unknown.

158. TERACOLUS LIMBATUS, Butler.

Moore as *Callosune limbata*. Moore records it from Hambantota, from the Trincomali side of the island, and from Vavuniya Vilankulam. Mr. Pole notes that it is found as far south as ten miles north of Negombo on the west coast, from Tangalle to Trincomali along the south and east coast, rejoicing in tall grass away from the wind, and used to be common in Fort Frederick, Trincomali, all the year round. It is confined to Ceylon, but is very close indeed to the Persian and Indian *T. etrila*, Boisduval, differing therefrom only in the usually broader black outer margin to the hindwing on the upperside in the male. It has never been bred.

159. TERACOLUS DANAË, Fabricius.

Moore as *Callosune danæ* and *C. sanguinalis*, Butler. Our only record from Ceylon of this species is North Province, March, Dr. Moore gives no locality for it, but Mr. Pole says it is found in the same seasons and in the same localities as *T. eucharis*, Fabricius. Dr. Butler says that *T. danaë* is the wet-season form, *T. sanguinalis*, Butler, is an intermediate form, and *T. taplini*, Swinhoe, described from Bombay and Poona, is the dry-season form. It is found in Persia, and in Western and Southern India. Its transformations have not been recorded.

160. TERACOLUS TRIPUNCTA, Butler.

Moore as *Idmais tripuncta*. Recorded by Moore from Puttalam, rare in January. Mr. Pole says that it is not found south of the Batticaloa river, twenty miles south of Puttalam, and loves the glades along the edges of the forest, flying in June and October. Mr. Fairlie notes its occurrence along the North Central Road in July, the females flying in the morning between seven and eight o'clock, the males during the hottest part of the day at a very rapid rate and going right away without settling when once disturbed. It is found also at Manaar in January. It has a near ally in *T. fausta*, Olivier, which is found in Syria, Asia Minor, Persia, Baluchistan, Afghanistan, Sind, the Punjab and the Bombay Presidency; *T. tripuncta* being found also in the Bombay Presidency, the Central Provinces, South India, and along the east coast of India as far north as Orissa. It has never been bred.

## 161. BELENOIS MESENTINA, Cramer.

Moore as *B. taprobana*, Moore. Mr. H. Fruhstorfer in Berl. Ent. Zeitsch., vol. xlii, p. 326 (1897) has described the Ceylonese form of *B. mesentina* as *B. mesentina fervidior*, which in any case must fall as a synonym to *B. taprobana*. The lightest marked examples from Ceylon can be exactly matched with the darkest examples from India, so, although Ceylonese specimens average darker than Indian ones, we do not consider that the Ceylonese race can be justifiably kept distinct, even as a local form. Dr. Butler in Trans. Ent. Soc. Lond., 1898, p. 435, notes:—"We have a very extensive series of this species [in the British Museum], *B. angusta* = *agrippina* = *lordaca* being the wet phase, *B. mesentina* = *syrinx* intermediate, *B. auriginea* dry, and *B. taprobana* being an insular dry phase differing in the blacker outer border to the forewing of the male, on which the subapical spots are less prominent." In Ceylon *B. mesentina* is uncertain in its appearance, but is abundant in the low country when it does occur, and then joins in the migratory flights, June and July, and again in November and December. It is found in Madagascar, Africa, Arabia, Persia, Syria, Afghanistan, Baluchistan, and throughout India. It has often been bred, the larva feeding on *Capparis*, and A. Grote says on *Zizyphus* also.

## 162. APPIAS NARENDRA, Moore.

Moore as *Hiposcritia narendra*. Rare in Ceylon, recorded by Mackwood from the hills 2,000 to 4,000 feet. It is much more common in Southern India, being replaced in North-Eastern India, Burma, and Indo-China by the allied *A. indra*, Moore. It has never been bred.

## 163. APPIAS NEOMBO, Boisduval.

Originally described from Brazil, neighbourhood of Bahia and Fernambouc, but Boisduval evidently doubted the correctness of this locality as he wrote "Should not this species be rather from the East Indies?" We include it here solely on Dr. Moore's identification, in Lep. Cey. he records it as *Catophaga neombo*, and figures the male and Form I of the female, also describing the female Form III as a variety, this form he had previously figured in 1857. As regards his figure of the male, de Nicéville has none from Ceylon which match it, but he possess two males from North Kanara and one from Ootacamund which agree with it fairly well. Moore's figure of the white female Form I in Lep. Cey. is probably only a pale form of the female of *A. albina*, Boisduval, while his female variety is the yellow female Form III of the same species. Boisduval's description evidently applies to a female, as no male *Appias* has a figure-of-3 black band on the underside of the

forewing. What is wanted to clear up the uncertainty regarding this species is a figure of Boisduval's type specimen, this being probably in M. Charles Oberthür's possession. We know nothing of the occurrence of *A. neombo* in Ceylon, and do not quote Dr. Moore's localities for it, as his specimens were based on incorrect identification. It has not been bred.

164. *APPIAS ALBINA*, Boisduval.

Moore as *Catophaga venusta*, Moore. In this species the female is trimorphic (in *A. paulina*, Cramer, it is dimorphic), Form I having the the ground-colour of the underside wholly white except a small patch of yellow at the costal base of the forewing; Form II having the ground-colour of the underside of the forewing at the apex and the entire hindwing chrome-yellow; and Form III having the underside of both wings as in Form II, but the upperside of both wings is also yellow. The male differs from that sex of *A. paulina* in having the forewing apparently less broad and the apex more produced and not slightly truncated, the outer margin is straighter, not so concave, and the discoidal cell appears to be longer and narrower; the black markings on the upperside are extremely variable in both species. It is particularly common in Ceylon, occurring wherever *A. paulina* is found and at the same seasons. It occurs all over India, in Burma, the Andaman Isles, the Malay Peninsula, Indo-China, China, the Malay Archipelago and Australia. It has never been bred.

165. *APPIAS PAULINA*, Cramer.

Moore as *Catophaga galene*, Felder, and *C. lankapura*, Moore. This species was originally described from Tranquebar on the Coromandel Coast of South India, and from Batavia in Java. As far as Dr. Moore's descriptions of *C. galene* and *C. lankapura* go they are fairly accurate but he does not realize that *A. paulina* is dimorphic in the female, as he gives the Form I only for *C. galene*, and Form II only for *C. lankapura*, nor that the extent of the black markings on the upperside of the male on which he lays stress to distinguish that sex of the two species is unimportant, being very variable, this variability apparently not being due to seasonal causes, as the lightest and heaviest marked specimens occur in the same month. The female is dimorphic, there being no Form III as in *A. albina*, Boisduval. For two reasons there is a slight doubt in de Nicéville's mind as to whether the name *paulina* should be applied to this species. The first is that Cramer described it from Tranquebar and Java. As far as de Nicéville is aware, the species does not occur in South India, only in Ceylon, but it is more than probable that many

Ceylonese butterflies were considered by the old authors to have come from Tranquebar, the port of shipment, which were really not caught there, but close by in Ceylon. Java is probably altogether an incorrect locality. Secondly, in one particular (though otherwise it is excellent and unmistakable), Cramer's figure (that of a female) differs from our specimens in that the upperside of the forewing shews four white spots on the apical white area while there should only be three, and moreover these spots instead of forming a curved line as they do in our specimens are shewn in pairs in echelon. As, however, this discrepancy is probably due to incorrect drawing, and there is no other species known which fits the figure better than the present one, de Nicéville has no doubt that the figure was taken from our species, especially as it is immensely common in Ceylon, is given to migrating, and is the most likely one to have been obtained by the old authors. L. de Nicéville's identification of this species does not coincide with that of Dr. Butler's as set forth by him in *Ann and Mag. of Nat. Hist.*, seventh series, vol. ii, p. 397, n. 10 (1898), de Nicéville believing that *A. paulina* is strictly confined to Ceylon, Butler recording it from India, Indo-China and Malaya. Dr. Butler also gives *Catophaga leis*, Hübner, as a synonym of *Catophaga paulina*, de Nicéville believing that species to be quite distinct. *A. paulina* is found all over Ceylon, but is more common at the commencement of the monsoons than as any other times, when it migrates in immense swarms. Strangely enough it has never been bred.

166. *APPIAS LIBYTHEA*, Fabricius.

Not common in Ceylon and mostly confined to the low country in the north and extreme south. The extent of the black markings on the upperside of the forewing in both sexes is variable. Two females in Manders' collection from the hill country, 4,500 to 5,000 feet, are much more heavily marked than those from the Hambyamma Tank, 500 feet. It is found nearly all over India. The larva as usual in the genus feeds on *Capparis*, but it also eats the leaves of *Cratveva*.

167. *APPIAS TAPROBANA*, Moore.

Moore as *A. taprobana*, and *A. aperta*, Butler (= *A. vacans*, Butler). This species is the South Indian and Ceylonese local race of the widely-spread *A. hippo*, Cramer, of Northern India, Burma, Malay Peninsula, Indo-China, China, and the Malay Archipelago. In Ceylon *A. taprobana* is an abundant insect in the low country. The larva feeds on capers (*Capparis*) as usual.

168. *HEBOMOIA AUSTRALIS*, Butler.

Moore as *H. glaucippe*, Linnæus. Dr. Butler in Ann. and Mag. of Nat. Hist., seventh series, vol. i, p. 290, n. 2 (1898) has separated off the South Indian and Ceylonese *H. australis* from the North-Eastern India, Burma, Malay Peninsula, and China *H. glaucippe*. The male is almost identical with *H. javanensis*, Wallace, from Java, but is smaller than *H. glaucippe*; the female differs from *H. javanensis*, and both sexes from *H. glaucippe* by the great reduction, and in some cases almost complete absence, of the black line separating the apical orange patch from the basal half of the forewing on the upperside. *H. australis* is abundant in the low hills of Ceylon, occurring very occasionally at Colombo; it is very common at Kandy. The female is much scarcer than the male. The larva feeds on *Capparis* and in South India also on *Cratæva*.

169. *HUPHINA NERISSA*, Fabricius.

Moore as *H. phryne*, Fabricius, and *H. zeuxippe*, Cramer. Dr. Butler in Ann. and Mag. of Nat. Hist., seventh series, vol. iii, p. 211, n. 46 (1899), gives *H. phryne* with *Papilio evagete*, Cramer, *P. zeuxippe*, Cramer, *P. cassida*, Fabricius, and *H. pallida*, Swinhoe, as synonyms, from India, Ceylon and Java. On page 211, n. 47, under *H. hira*, Moore, he gives *Pieris copia*, Wallace, and *Appias dapha*, Moore, as synonyms, from Burma. On page 212, n. 53, he gives *H. nerissa*, with *Papilio amasene*, Cramer, and *P. coronis*, Cramer, as synonyms, from Nepal, Darjeeling, Tonkin and China. Mr. de Nicéville arranges the names quite differently. Under *H. nerissa* from Ceylon, India, Burma, Indo-China, China and Hainan Island he gives *P. phryne*, *P. amasene*, *P. coronis*, *P. evagete*, *P. zeuxippe*, *P. cassida*, *P. hira*, *P. copia*, *A. dapha*, and *H. pallida*, as synonyms, thus uniting under one the three species kept distinct by Dr. Butler. The conclusions de Nicéville arrives at are these:—*H. nerissa*, the parent form (as being the first described) of this group of the genus, has the ground-colour of the underside of the hindwing white, and is found in Nepal, Sikkim, Bhutan, Assam, Burma, Indo-China, South China, Hong-Kong and Hainan. Absolute synonyms are *P. amasene* and *A. dapha*. In Nepal (probably), Sikkim, Assam, and Aracan where it meets typical *H. phryne*, with the hindwing on the underside some shade of yellow or sandy buff, the two races intermingle, this connecting link being *P. copia*, and it is impossible, especially in the female sex, to say to which race certain specimens should be apportioned. Were it not so, the two races might be kept as distinct species, as east of the Eastern Himalayas to Hainan Island the race is constantly *H. nerissa* (except at Shillong in Assam and at Chittagong in Aracan, North Burma, where very typical specimens of *H. phryne* are found), while

south of the Himalayas to Ceylon the race is constantly *H. phryne*. In Burma there is a very interesting sub-local-race (if it may be so termed) which in both sexes on the underside of the forewing along the costa and at the apex, and in the hindwing at the base, is streaked with yellow, while the ground-colour remains white. It has not been named. Absolute synonyms of *H. phryne* are *P. coronis*, *P. evagete*, *P. zeuxippe*, *P. cassida*, *P. hira* and *H. pallida*. It is quite out of the question to allow two distinct species of this group of *Huphina* in Ceylon as Dr. Moore has done. *H. nerissu* is very common in the Island, though scarcer in some seasons than in others, and occurs at all elevations. It is highly seasonally dimorphic, and the larva feeds on *Capparis*.

170. HUPHINA REMBA, Moore.

An uncommon insect in Ceylon and of speedy flight, consequently is difficult to catch. It is found in the hill country between 2,000 and 4,000 feet, and is common at Pundaloya. It has been bred in South India, where outside of Ceylon it is alone found, and feeds on capers as usual. Dr. Butler records it from Mussoorie, which is certainly incorrect. Its coloration and markings vary greatly in accordance with the season, whether wet or dry.

171. NEPHERONIA CEYLANICA, Felder.

Originally described from "Rambodde and Trincomali." Dr. Moore in Lep. Cey. gives three species of *Nepheronia* as occurring in the Island, *N. ceylonica* (*sic*), Felder, *N. fraterna*, Moore, and *N. spiculifera*, Moore. With the best will in the world we are unable to distinguish between these three species. It is obviously somewhat variable, but whether this variability is due to seasonal changes or to the elevation of its breeding places we are uncertain. It is extremely common all over the island and occurs in the low country as well as in the hills. It has a near ally in the South Indian *N. pingasa*, Moore. It has not been bred, but the larva almost certainly will be found to feed on capers.

Subfamily PAPILIONINÆ.

172. TROIDES DARSIVS, Gray.

Moore as *Ornithoptera darsivus*. Common in the low country nearly all the year round; abundant also in the low hills, and occasionally seen at the highest elevations. The female is somewhat variable with regard to the amount of grey coloration on the veins of the forewing on the upperside; the male is very constant. *T. darsivus* is peculiar to Ceylon. The larva feeds on *Aristolochia*.

## 173. PAPILO HECTOR, Linnæus.

Moore as *Menelaides hector*. Common in the low country at certain seasons of the year, generally after the first outbreak of the two monsoons; abundant at Colombo. It is a common species in many parts of peninsular and continental India. The larva feeds on *Aristolochia*.

## 174. PAPILO JOPHON, Gray.

Moore as *Menelaides jophon*. Peculiar to Ceylon, and confined locally to the middle hill district. It is not rare at Punduloya and Gampola in June, and is easily captured in the early morning; after the sun is up it flies fast and soars over the tops of the forest trees quite out of reach. Wade records it from Ambogamna and the Kottawa forest; Mackwood from the hills from 2,000 to 4,000 feet, very local, taken only in the Navalpatha and Pusilawa country in a tract of about twenty miles in extent in June. *P. jophon* has a near ally in the South India *P. pandiyana*, Moore. The latter species has not been bred, but Moore figures the larva of *P. jophon*, though he does not record its food-plant.

## 175. PAPILO ARISTOLOCHIÆ, Fabricius.

Moore as *Menelaides ceylonica*, Moore. An abundant species in Ceylon, especially so in the low country. In its typical form *P. aristolochiæ* occurs almost throughout India, in Burma, Siam, the Malay Peninsula, China, the Loo Choo Islands, Natuna Islands, Java and Celebes. The larva feeds on *Aristolochia*.

## 176. PAPILO DEMOLEUS, Linnæus.

Moore as *Orpheides erithonius*, Cramer. A common low country insect in Ceylon, and takes a large share in the annual migratory flights. It is found also in Arabia, Persia, throughout India, Burma, in China, and in Formosa Island. The larva feeds on plants of the Natural Order *Rutaceæ*, which contains the oranges, limes, pomelos, etc., and the evil-smelling Garden Rue.

## 177. PAPILO MOOREANUS, Rothschild.

Moore as *Charus helenus*, Linnæus. This is a local race of *P. helenus*, confined to Ceylon, the South Indian local race being *P. daksha*, Hampson, typical *P. helenus* being found in North-East India, Burma, the Malay Peninsula, China and Southern Japan. Rothschild remarks in describing *P. mooreanus* that "It is very curious that Mr. F. Moore does not either describe or figure [in Lep. Cey.] the underside which exhibits the distinguishing characters," these being on the hindwing

“A complete series of seven subdiscal blue lunules, of which the three anterior stand at the outer edge of the white discal marks, and of which the two posterior are situated within the anal and subanal rufous spots.” It is a very common insect at all elevations, but especially so in the low country. It is difficult to capture in good condition from its habit of flying in and out of the jungle which soon tatters it. Dr. Moore describes the transformations of this species, but does not give the food-plant of the larva, which, however, is almost certain to be plants of the Natural Order *Rutaceæ*.

178. *PAPILIO PARINDA*, Moore.

Moore as *Iliades parinda*. An abundant species in the low country and lower hill districts of Ceylon, to which island it is confined. The females are much rarer than the males. A very conspicuous insect on the wing and invariably figures in the boxes of insects sold to confiding passengers at exorbitant prices by rascally natives. In South India and northwards to Bengal it is replaced by the parent form, *P. polymnestor*, Cramer. The larva feeds on *Rutaceæ*, especially on plants of the genus *Citrus*.

179. *PAPILIO POLYTES*, Linnæus.

Moore as *Laertias romulus*, Cramer. Abundant everywhere in Ceylon, and found throughout India, Burma, the Malay Peninsula, Indo-China, the Andaman and Nicobar Islands and Sumatra. Dr. Moore describes its transformations but does not mention the pabulum of the larva, which is plants of the Natural Order *Rutaceæ*.

180. *PAPILIO LANKESWARA*, Moore.

Dr. F. Moore as *Chilasa dissimilis*, Linnæus, *C. clytioides*, Moore, and *C. lankeswara*. The Hon. Walter Rothschild in Nov. Zool., vol. ii, p. 368 (1895) gives *P. lankeswara* sub-specific rank, with *clytioides* and *dissimilis* as aberrations, all three restricted to Ceylon, the parent form being *P. clytia*, Linnæus, from Northern India. He notes that “The local races of *P. clytia* are all variable, but we have here a very curious example of incongruous variation: *P. clytia*, *P. clytia lankeswara*, and *P. clytia panope* are pronouncedly dimorphic. To each of these three geographical races belong a *clytia* and a *dissimilis* form; while, however, the *clytia*-form develops in the respective localities into a subspecies, its aberration *dissimilis*, though very variable in every locality, remains the same. The *dissimilis* from Ceylon, Assam, Tenasserim, etc., are indistinguishable; the *clytia* from there exhibits certain obvious differences. In Palawan and the Philippines the *clytia* form alone occurs, the



*dissimilis*-form is absent. On the contrary, the Andamans are inhabited by a *dissimilis*-form, whereas specimens corresponding to *clytia* are absent; and further east, in the lesser Sunda Islands, we find a species with the pattern of *dissimilis* and no *clytia*-like form. From Borneo, Sumatra, and Java no representative species of *P. clytia*, Linnaeus, has been recorded." In Ceylon *P. lankeswara* is a common species in the lower hills. It is in all its forms an admirable mimic of species of *Danais* and *Euplœa*. In Ceylon the light form mimics *D. limniace*, Cramer, the dark form *E. asela*, Moore, and *E. montana*, Felder. Dr. Moore gives the food-plant of the larva as *Tetranthera*.

181. PAPILIO CRINO, Fabricius.

Moore as *Harimala montanus*, Felder, originally described from "Rambodde, Ceylon." In Ceylon it is common and widely distributed; the females are rare. It is less common in the higher hills, where it is probably a passenger only; it is abundant at Kandy, and common in the Northern Province as far north as Anaradhapura, in June, July and December. Rothschild says that the aberration *montanus* without woolly stripes on the forewing on the upperside along the veins of the male occurs all over the area of *P. crino*, which is throughout Southern India, the Central Provinces, Orissa and Bengal. The larva feeds on the leaves of the satin-wood tea in Ceylon.

182. PAPILIO ALCIBIADES, Fabricius.

Moore as *Pathysa antiphates*, Cramer. Rare and local in Ceylon, it seems to be more partial to the eastern and drier parts of the island. The parent form *P. antiphates* is from Eastern China, while *P. alcibiades* is found in India, Burma, the Malay Peninsula, and in many of the Malayan Islands. Rothschild describes the aberration *ceylonicus*, Eimer, as having "Two basal black bands on the upperside of the forewing extending beyond the median nervure; the fourth band broad and reaching the median nervure (not triangular). In these two characters *ab. ceylonicus* agrees with typical *P. antiphates*, from which it is distinguished by the greyish-black caudal area of the upperside of the hindwing being very much restricted." The larva feeds on *Unona*.

183. PAPILIO NOMIUS, Esper.

Moore as *Pathysa nomius*. Common and frequently abundant in the North Central Province and on the Trincomali side of the Island. It is found settling in large numbers together on damp patches of sand. It flies in July and August, and again at the end of the year. It

is found also in many parts of India, with a local race, *P. nomius swinhoei*, Moore, from Burma, Indo-China and Hainan Island. The larva feeds on plants of the Natural Order *Anonaceæ*.

184. *PAPILIO JASON*, Esper.

Moore as *Zetides telephus*, Felder, and *Z. doson*, Felder. *P. jason* is confined to South India and Ceylon; in the latter island it is very abundant in July, August, and at the end of the year in the north and eastern portions in the low country. On November 16th, 1898, the first day of the annual flight, Manders noted that it was migrating in large numbers at Colombo; nearly all the numerous specimens he captured were in a more or less tattered condition though freshly emerged, showing that they had flown a considerable distance; they probably came from the dry district of Hambantota on the south-eastern side of the island. In Northern India *P. jason* is replaced by *P. axion*, Felder, which is found also in Burma, the Malay Peninsula, South-Eastern China, the Andaman Isles, and in the Malay Archipelago. The larva feeds on plants of the Natural Order *Anonaceæ*.

185. *PAPILIO TEREDON*, Felder.

Moore as *Dalchini teredon*. Abundant in the hills, and in the north and eastern portions of the Island in the low country; but is not found in the damp south-eastern district. It is replaced in Northern India and Burma by the parent form, *P. sarpedon*, Linnæus, which is found also in the Malay Peninsula, many of the Malayan Islands, the Loo Choo Islands and in South Japan. The larva feeds on *Cinnamomeum* and many other plants.

186. *PAPILIO AGAMEMNON*, Linnæus.

Moore as *Zetides agamemnon*. Usually common and frequently very abundant, especially in the low country and lower hill district of Ceylon, and given to migrating. It has a wide range, being found almost throughout India, in Burma, the Malay Peninsula, Indo-China, and many islands of the Malay Archipelago. The larva feeds on *Magnoliaceæ* and *Anonaceæ*.

Family HESPERIIDÆ.

187. *HANTANA INFERNUS*, Felder.

Apparently confined to Ceylon, where it is not uncommon in the middle hill district in jungle. Its transformations are unknown.

188. *CELÉNORRHINUS SPILOTHYRUS*, Felder.

Moore as *Plesioneura spilothyrus*. A low hill district insect, common in the neighbourhood of Kandy. Messrs. Elwes and Edwards record it from South India and Java as well as from Ceylon. The larva feeds on *Acanthus*.

189. *SARANGESA ALBICILIA*, Moore.

Occurs at Trincomali in March and June, at Kandy and at Lagalla, and is widely distributed in the lower hill districts of Ceylon. Mr. Mackwood gives May and June as its months of emergence. It is confined to Ceylon and has not been bred. The late Herr Carl Plötz has described *Antigonus sezendis* from Ceylon in Berl. Ent. Zeitsch., vol. xxix, p. 230, n. 27 (1885); idem, id., Stet. Ent. Zeit., vol. xlvii, p. 112, n. 49b (1886). From a coloured drawing kindly made for de Nicéville by Herr G. Weymer from the type specimen in Herr Carl Ribbe's collection, it is quite evident that this species is the same as *S. albicilia*. *A. sezendis* is omitted by Messrs. Elwes and Edwards from their monograph of the oriental *Hesperiidæ*.

190. *COLADENIA INDRANI*, Moore.

Moore as *C. tissa*, Moore. Messrs. Elwes and Edwards restrict *C. tissa* to Ceylon, whence it was originally described, noting that "Though otherwise closely resembling the preceding [*C. indrani*], and probably just as variable in colour, may be known in both sexes by the distinct displacement inwards of the middle one of the three pale spots which form the subapical series [of the forewing]. The difference of the male genitalia of the two species are merely those of degree." In a large series of this species in de Nicéville's collection from many parts of India and Burma it is obvious that this character is as inconstant as the other markings, and is quite insufficient to discriminate the two species. *C. indrani* is seasonally dimorphic, true *C. indrani* being the wet, *C. tissa* the dry-season form. In Ceylon it is not uncommon in the lower hill district about Kandy; Mackwood recording it also from Badulla and Kadganawa. The larva feeds on *Xylia dolabriformis*, Benth., *Grewia microcos*, Linn., and many other plants of different orders, in South India. Herr Carl Plötz has in Berl. Ent. Zeitsch., vol. xxix, p. 225, n. 1 (1885), described this species from Ceylon as *Proteides lankæ*, redescribing it in Stet. Ent. Zeit., vol. xlvii, p. 85, n. 8 (1886). From a coloured drawing of the type in Herr Carl Ribbe's collection made for de Nicéville by Herr G. Weymer, it is evident that this species is the same as *C. indrani*. *P. lankæ* is not mentioned by Messrs. Elwes and Edwards.

## 191. TAGIADES OBSCURUS, Mabille.

Moore as *T. distans*, Moore. Originally described by Mabille from "Malay Archipelago, Java?" and by Moore from Ceylon. Mabille's description applies very well to our Ceylon specimens. Moore notes "The Javan *T. obscurus*, Mabille, is nearly allied, but differs in the absence of the discal semi-transparent spots on the forewing." Elwes and Edwards note "Though we have not been able to compare Malayan with Ceylon specimens, yet the absence of the discal spots relied on by Moore for distinguishing his species is a character of no value, the two spots being sometimes absent in Ceylon specimens." In this we concur. In Ceylon *T. obscurus* is common in the low country generally. The larva in South India feeds on *Dioscorea pentaphylla*.

## 192. TAGIADES ATTICUS, Fabricius.

Not rare in the lower hills, generally in the neighbourhood of water. It has a wide range in India, Burma, the Malay Peninsula and Malay Archipelago. Dr. Christopher Aurivillius in Ent. Tids., vol. xviii, p. 150, n. 71 (1897) points out that there is some doubt about the correct identification of this species. The larva feeds on *Smilax* and *Dioscorea*.

## 193. TAPENA THWAITESI, Moore.

Originally described from Galle in Ceylon, not met with by Manders, so it must be very rare. Elwes and Edwards record it from Burma, the Malay Peninsula, Sumatra and Borneo, and describe an allied species from the Nilgiris and North Kanara in South India as *T. hampsoni*, the larva of which feeds on *Doris* and *Dalbergia*. *T. thwaitesi* has not been bred.

## 194. CAPRONA RANSONNETII, Felder.

Moore as *Abaratha ransonneti*. Elwes and Edwards as *C. ransonnetii*. Not uncommon in the low country and about Colombo. It occurs also in South India, the Maldah district of Bengal, Orissa, the Central Provinces, Dehra Dun and Assam. In South India the larva feeds on *Helicteres isora*, Linnæus.

## 195. GOMALIA ALBOFASCIATA, Moore.

Rare in Ceylon, recorded by Wade in dense jungle between Kirinde and Werewille beyond Hambantota. Hampson records it from the foot of the Nilgiri Hills, Moore from the Kangra District, Swinhoe from Karachi, and Elwes and Edwards from Quetta. It has never been bred.

196. *HESPERIA GALBA*, Fabricius.

Not uncommon in Ceylon in the region of heavy rainfall away from the coast. It is probably often overlooked from its small size, obscure coloration and quick flight, on the wing it looks more like a fly than a butterfly. It is found nearly all over India and Burma, and occurs at Aden. The larva in Calcutta feeds on *Sida rhombifolia*, Linnæus, and in South India on *Waltheria indica*.

197. *BARACUS VITTATUS*, Felder.

Confined to Ceylon, where it is very common in the upper and middle hill districts in grassy open ground, and on the Horton Plains in March. It has never been bred.

198. *SUASTUS GREMIUS*, Fabricius.

Moore as *S. gremius* and *S. subgrisea*, Moore. The *Hesperia disu* of Kollar (Hügel's Kaschmir, vol. iv, p. 456, n. 6 (1844) described from the "Himalaya" is almost certainly a synonym of this species, but is omitted by Elwes and Edwards. A common low country insect in Ceylon. It is found almost all over India and Burma, also in Hong-Kong, Formosa and Hainan. Staudinger records it from Sumatra. The larva feeds on palms.

199. *SUASTUS MINUTA*, Moore.

Moore as *Tagiades minuta*. It is common at Kandy, and is found only in Ceylon. The *Pterygospidea everyx*, Mabille, Bull. Soc. Ent. Belg., vol. xxvii, p. lxxvii (1883), and *Tagiades everyx*, Mabille, Ann. Soc. Ent. France, vol. lxvi, p. 219, pl. ix, figs. 8a, 8b, male (1887), recorded by the describer from Ceylon and Malacca (*sic*) is a synonym of *S. minutus*. The *Apaustus sinhalus* of Plötz, Berl. Ent. Zeitsch., vol. xxix, p. 228, n. 19 (1885); idem, id., Stet. Ent. Zeit., vol. xlvii, p. 105, n. 1a (1886) described from Ceylon, is another synonym. Herr G. Weymer has sent de Nicéville a drawing of the type specimen of the latter in the collection of Herr Carl Ribbe. Neither of these species are given by Elwes and Edwards. It has never been bred.

200. *IAMBRIX SALSALA*, Moore.

Moore as *Astictopterus stellifer*, Butler. May not the *Hesperia naso* of Fabricius, though described from the Cape of Good Hope, be an older name for this species? Common at Colombo and in the low country generally in open ground. It is found nearly all over India, Burma, the Malay Peninsula, Java, Borneo and Hong-Kong. The larva feeds on bamboo and grasses.

201. *TARACTROCERA MÆVIUS*, Fabricius.

Moore as *Taractocera mævius*. A very common insect in the low country of Ceylon, but easily overlooked from its small size and jerky flight amongst low herbage. It is very common on Crow Island at the mouth of the Kelani river in the spring and autumn. It occurs in many parts of India and Burma, and in Borneo and Celebes. It has never been bred.

202. *AMPITTIA DIOSCORIDES*, Fabricius.

Moore as *A. maro*, Fabricius, but *dioscorides* is an older name by five years, *vide* Aurivillius, Ent. Tids., vol. xviii, p. 150, n. 65 (1897). Common in the low and middle hill country of Ceylon in open waste places. It has a wide distribution in India, Burma, the Malay Peninsula, Siam, Sumatra, Java, Bali, Sumba, Sambawa, Celebes, Ceram, Aru, Batjan, Halmahera, Ké Isles, Hainan Island, and Northern China. The larva feeds on rice and grasses.

203. *HYAROTIS ADRASTUS*, Cramer.

Not a common insect in the lower and middle hill districts, at Kandy and Punduloya, in April and July. It is common in many parts of India, Burma, Siam, the Andaman Isles, Sumatra, Java, Palawan, the Philippines and Hong-Kong. In Sumatra the larva feeds on the rattan cane, *Calamus* sp.

204. *MATAPA ARIA*, Moore.

Found at Colombo and Kandy in Ceylon in the low country only and is not common, flying in January and July more especially. It has a wide range, being found in many parts of India, Burma, the Andaman Isles, Sumatra, Nias, Java, Palawan, Bali, Lombok, Hong-Kong and Hainan. The larva feeds on bamboo.

205. *GANGARA THYRSIS*, Fabricius.

Common in the plains and low country only of Ceylon, at Colombo and Kandy. It has a wide range in India, Burma and Malaya. The larva feeds on palms.

206. *PADUKA LEBADEA*, Hewitson.

Moore as *Matapa subfasciata*, Moore. Originally described by Hewitson from Borneo. Dr. Moore's figure of his *M. subfasciata* in Lep. Cey. is extremely bad, and the description defective, no mention being made of the remarkable secondary sexual characters on the upper-side of the wings in the male. It is a very rare species everywhere,

Elwes and Edwards record it from Sikkim, Perak, Java and Pulo Laut, it occurs also in the Andamans, Singapore and Sumatra. Mr. E. E. Green obtained it in Ceylon, but we have no exact records as to where it may be looked for in the island. Dr. Moore briefly describes its transformations, and says that the larva feeds on *Palmaceæ*.

207. *NOTOCRYPTA FEISTHAMELII*, Boisduval.

Moore as *Plesioneura alysos*, Moore, and *P. restricta*, Moore. Messrs. Elwes and Edwards unite these two species, which, though typically distinct enough, are not constant. It has an immense range in India and Malaya, China, the Loö Choo Islands and Japan. In Ceylon it is not uncommon in the low and middle hill country, particularly so about Kandy and in the Central Province. The larva feeds on *Zinziberaceæ*, *Maranta*, and *Hedychium*.

208. *UDASPES FOLUS*, Cramer.

A very common insect in the low country of Ceylon. It occurs nearly all over India and Malaya, and in Indo-China, China, Formosa and Hainan. The larva feeds on *Curcuma*.

209. *TELICOTA BAMBUSÆ*, Moore.

An abundant low country insect in Ceylon, occasionally found in the middle hill district. It has a very wide range in India and Malaya, found also in China, Australia, and the islands of the Pacific. The larva feeds on bamboos and grasses.

210. *PADRAONA GOLA*, Moore.

Moore as *P. goloides*, Moore. It is widely distributed in Ceylon, occurring from the sea coast up to 5,000 feet, found at Kandy and Colombo commonly from January to March. Its range is almost all over India, China and Malaya to Northern Australia and the Fiji Islands. The larva feeds on soft grasses.

211. *PADRAONA DARA*, Kollar.

Moore as *P. pseudomæsa*, Moore, and *P. mæsoïdes*, Butler. Occurs commonly nearly all over Ceylon, from the plains up to 5,000 feet. Common all over India, Malaya and the Pacific, and found in China and Japan. The larva feeds on bamboos. M. Paul Mabille appears to have redescribed this species from "Java, Ceylon, and perhaps the neighbouring Islands" as *Pamphila taxilus* in Ann. Soc. Ent. Belg., vol. xxi, p. 38, n. 147 (1878). As far as the description reveals it agrees with *P. dara*, and is placed by Messrs. Elwes and Edwards as a synonym of that species.

## 212. HALPE CEYLONICA, Moore.

We have no exact records of the occurrence of this species in Ceylon, though Messrs. Elwes and Edwards give it from thence and from the Nilgiris. *H. moorei*, Watson, recorded by those gentlemen from Calcutta, the Khasi Hills, Burma, Trichinopoli and the Andaman Isles, is very doubtfully distinct from *H. ceylonica*, Messrs. Elwes and Edwards saying that the discal band on the underside of the hindwing in *H. moorei* is white, in *H. ceylonica* is yellowish-white, that it appears on the upperside in an indistinct suffused pale patch in *H. moorei*, but is absent in *H. ceylonica*. These two characters appear to us to be insufficient to separate the two species, *H. ceylonica* being obviously a variable insect. Should they be proved to be one, Moore's name will stand for the butterfly. Moore records *H. ceylonica* from Mergui, captured in January and March. It has not been bred.

## 213. HALPE EGENA, Felder.

Moore as *H. brunnea*, Moore. Originally described from "Kallupahani, Ceylon, 15th December." There is no doubt in de Nicéville's mind that *H. brunnea* equals *H. egena* as Dr. Moore suggests. *H. egena* is not mentioned by Messrs. Elwes and Edwards. Herr Plötz records it from Ceylon, to which island it appears to be confined, but we do not know exactly where it is found. In de Nicéville's collection is a single male from Punduloya, Moore described it from a single female example; Elwes and Edwards have seen a single pair, so it must be very rare. It has not been bred.

## 214. HALPE DECORATA, Moore.

A rare low country insect in Ceylon, to which Island it is restricted; recorded by Moore from Galle and Morowaka, and by Elwes and Edwards from Awissawella, all on or near the coast. In de Nicéville's collection are specimens from Densworth, Awissawella, taken in July by Mr. Thomas B. Butt. It has never been bred.

## 215. BAORIS OCEIA, Hewitson.

Moore as *B. penicillata*, Moore. In Ceylon it is a very common low country insect. It is found in many parts of India, Burma, the Andaman Isles, the Malay Peninsula, Sumatra, the Philippines and China. The larva feeds on bamboo.

## 216. CHAPRA MATHIAS, Fabricius.

Moore as *C. mathias* and *C. agna*, Moore. Widely distributed and abundant generally in Ceylon, especially so in the low country. Its habitat may be said to be Southern Asia from Syria on the west to



China and Japan on the east, and throughout Malaya to Australia. It is found also in Arabia. The larva feeds on rice and grasses.

217. PARNARA PHILIPPINA, Herrich-Schäffer.

Moore as *Baoris seriata*, Moore. This species is common at low elevations in Ceylon and about Kandy. It may always be known according to Messrs. Elwes and Edwards' definition in both sexes by having no spots in the discoidal cell of the forewing, but always with a spot placed anterior to and touching the submedian nervure of that wing, in the next species the latter is wanting. Moore's figure of the female of *Baoris kumara* (Lep. Cey., vol. i, pl. lxxix, fig. 2a) applies to *P. philippina*. Dr. A. Pagenstecher in *Jahr. des Nass. Ver. für Natur.*, vol. xxxvii, p. 207, pl. vii, fig. 1, *female* (1834) has described from Amboina and Ceylon a *Pamphila larika*, which the late Herr Carl Plötz also records from both islands. This species is almost certainly the same as *P. philippina*. *P. larika* is not referred to by Messrs. Elwes and Edwards. Herr J. Röber records *Pamphila larika*, Pagenstecher, from Key, and redescribes it, proposing for it the name of *Pamphila subfenestrata* if distinct (*vide* Tijds. voor Ent., vol. xxxiv, p. 321 (1891)). Mr. de Nicéville has received about 60 specimens of *P. philippina* from the Ké Archipelago, some of which agree with Herr Röber's description. It is a most variable species, and has been found in many parts of India, in Burma and Malaya as far east as the Ké Archipelago at any rate, and has also been recorded by Ribbe from the Pacific. It does not appear to have been bred.

218. PARNARA KUMARA, Moore.

Moore records this species from Kandy. We have no specimens of it from Ceylon, nor do Messrs. Elwes and Edwards record it from thence, but give it from the Nilgiris, Sikkim, Java and Borneo. It is doubtfully distinct (at any rate superficially, the prehensores as figured by Elwes and Edwards are distinct enough) from the last-named we think: *P. philippina* in the older name of the two. The larva feeds, according to Aitken, on rice, on bamboo according to Bell.

219. PARNARA CONJUNCTA, Herrich-Schäffer.

Moore as *P. narooa*, Moore. We have no specimens from Ceylon, and Moore gives no exact locality for it. It occurs in many parts of India, Burma, the Malay Peninsula, the Andamans and Nicobars, Sumatra, Nias, Java, Borneo, Lombok, Sumba, Sambawa, the Philippines, and Hong-Kong. Moore describes the larva but does not give its food-plant; Bell says it feeds on long grasses. A synonym of this species

not given by Elwes and Edwards is the *Hesperia alice*, Plötz, Stet. Ent. Zeit., vol. xlv, p. 45, n. 320 (1883), described from Mergui in Lower Burma and the Philippines. Herr George Weymer has kindly sent de Nicéville a coloured drawing of the type in the Berlin Museum.

220. *PARNARA GUTTATUS*, Bremer and Grey.

Moore as *P. bada*, Moore, who records it from Colombo. It is a common low country insect in Ceylon and has a wide range in India, China, Japan and Malaya. *Hesperia kolantus*, Plötz, Berl. Ent. Zeitsch., vol. xxix, p. 227, n. 13 (1885), and Stet. Ent. Zeit., vol. xlvii, p. 97, n. 316c (1886), described from India, is another synonym of this species not given by Elwes and Edwards. Herr G. Weymer has sent de Nicéville a coloured drawing of the type specimen in Herr Carl Ribbe's collection. The larva of *P. guttatus* feeds on rice and grasses.

221. *PARNARA COLACA*, Moore.

Moore as *P. cingala*, Moore. We have no exact locality for this species from Ceylon, and Moore gives none. It is found in many parts of India, the Andamans and Nicobars, and several of the Malayan islands. The larva feeds on *Graminaceæ*—grasses and rice.

222. *ISMENE ATAPHUS*, Watson.

Moore as *I. ædipodea*, Swainson. Recorded by Moore from Kandy, Balangada, and near Trincomali, scarce. It is found also in the Himalayas, Assam and Burma. The larva feeds on *Hiptage*.

223. *HASORA BADRA*, Moore.

Recorded by Moore from the Kottawa forest, rare. We have specimens from Ceylon but without exact locality. It is found in many parts of India, Burma, the Andamans, the Malay Peninsula, Sumatra, Nias, Java, Borneo, Bali, Lombok, Engano, Sumba, Sambawa, Celebes, the Philippines and China. It has not been bred.

224. *PARATA ALEXIS*, Fabricius.

Moore as *P. chromus*, Cramer. Widely distributed in Ceylon, found from the plains up to 6,000 feet. It has a wide range in India, is found in Burma, the Andamans, Java, Borneo, Pulo Laut, and Hong-Kong. The larva feeds on *Pongamia* and *Heynia*.

225. *PARATA BUTLERI*, Aurivillius.

*Hasora butleri*, Aurivillius, Ent. Tids., vol. xviii, p. 150, n. 68 (1897).

Moore as *P. alexis*, Fabricius. This species differs from *P. alexis*, Fabricius, in having the discal white band on the underside of the

hindwing very broad and well defined. It is found in the low country and up to 6,000 feet elevation; we have specimens from Colombo taken in June, and Trincomali taken in September and November. The larva has been reared on a climber, *Rourea* or *Derris*, in South India, where alone in addition to Ceylon it is found. Messrs. Elwes and Edwards sink this species as a synonym of "*Hasora*" *chromus*, Cramer.

226. *BIBASIS SENA*, Moore.

Rare in Ceylon, recorded from Kandy. It is found also in South India, the Western Himalayas, Sikkim, Assam and Siam. The larva feeds on *Combretum* and *Hiptage*.

227. *BADAMIA EXCLAMATIONIS*, Fabricius.

A common low country insect; found also in the middle hill district of Ceylon. It has an immense range, occurring throughout India, in China, Malaya to Australia and in the South Sea Islands. The larva feeds on *Terminalia*, *Ficus*, *Linociera*, and *Combretum*.

228. *RHOPALOCAMPTA BENJAMINI*, Guérin.

Moore as *Choaspes benjamini*. Not uncommon in the middle hill district of Ceylon from May to November, but difficult to capture in good condition. It is found also in South India, the Himalayas, Assam, Burma, Indo-China, China, Japan and Borneo (*Druce*). Dr. Moore describes the larva, but does not mention its food-plant. In India it feeds on *Sabia* and *Meliosma*.

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The late Herr Carl Plötz in Berl. Ent. Zeitsch, vol. xxix, p. 226, n. 7 (1885), and in Stet. Ent. Zeit., vol. xlvii, p. 92, n. 93c (1886), described a *Hesperia taprobanus* from Ceylon. Herr G. Weymer has sent de Nicéville a coloured drawing of the type specimen in Herr Carl Ribbe's collection, from which it appears to be the same species as *Zea mytheoides* from Celebes described by de Nicéville in Journ. Bomb. Nat. Hist. Soc., vol. xii, p. 157, n. 23, pl. AA, figs. 33, male; 34, female (1898). Herr Weymer notes that the species occurs at Tombugu in East Celebes. It is certainly not a Ceylonese species, and de Nicéville's name will stand for it, as Taprobana being the ancient name for Ceylon is misleading. Messrs. Elwes and Edwards do not mention this species in their monograph.

Again, Herr Plötz in Stet. Ent. Zeit., vol. xlvii, p. 106, n. 45b (1886), described *Apaustus luteipalpis* from Ceylon. As far as his poor description goes it applies to the female of *Iambrix salsala*, Moore, (No. 200 ante) and is probably that species. *A. luteipalpis* is not given by Messrs. Elwes and Edwards.

*On a new Genus of Butterflies from Western China allied to Vanessa.*—  
By LIONEL DE NICÉVILLE, F.E.S., C.M.Z.S., &c.

[Received 30th November ; Read 6th December, 1899.]

Genus *LELEX*, nov.

Differs from *Vanessa*, Fabricius, and *Pyrameis*, Hübner, the type of both being *Papilio atalanta*, Linnæus, in having the *palpi* very much shorter, hardly extending in front of the head, the *antennæ* also considerably shorter, with a larger club, the FOREWING with the second subcostal nervule given off a little beyond the apex of the discoidal cell instead of before its end, the HINDWING with the anal angle rounded instead of produced ; otherwise similar to *Vanessa*. Type, *Vanessa limenitoïdes*, Oberthür.

*LELEX LIMENITOÏDES*, Oberthür.

*Vanessa limenitoïdes*, Oberthür, Et. d' Ent., vol. xiii, p. 39, pl. ix, fig. 96 (1890) ; id., Leech, Butt. China, Japan, and Corea, vol. i, p. 254 (1892).

HABITAT: Tsé-Kou (*Oberthür*), Ta-chien-lu (*Leech*), both Western China.

I am indebted to M. Charles Oberthür for the gift of a single male of this remarkable butterfly from Tsé-Kou, captured in 1895 by M. R. P. Dubernard. Mr. Leech wrote of it "As its characters are not exactly those of a *Vanessa* it is probable that a new genus will have to be created for the reception of this insect." Not only does it differ widely in the form of the *palpi*, the length of the antenna with its larger club, and in the neuration of the forewing, but also in its coloration, there being no *Vanessa* except *V. antiopa*, Linnæus, (genus *Euvanessa*, Scudder), which is black with creamy-white markings, the disposition of the markings being, however, wholly different in the two species.

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*On a collection of birds from Manipur.*—By LIEUT. H. H. TURNER.  
Communicated by the Natural History Secretary.\*

[Received September 27th; Read November 1st, 1899.]

These birds were all obtained between the latitudes of 25° and 24° 30' and longitudes 95° and 93° 30'. The approximate latitude and longitude of the following places mentioned are given to the nearest minute:—

		Latitude.	Longitude.
Homalin	...	24° 52'	94° 58'
Kungalthana	...	24° 43'	94° 36'
Tamunga	...	24° 39'	94° 39'
Thyoliching	...	25° 0'	95° 46'
Khambiching	...	24° 46'	94° 24'
Maphitel	...	24° 51'	94° 15'
Kanpru	...	25° 4'	93° 55'

\* I am responsible for the identification of the species herein recorded, and for the notes in brackets. Lieutenant Turner has with great generosity, presented several specimens (belonging to the species marked with asterisks) to the Indian Museum, including the pick of the collection such rarities as *Certhia manipurensis*, *Dendrocopus pyrrhorthoræ*, and *Microperdia manipurensis*. Nat. Hist. Sec., A.S.B.

*Homalin* is in Upper Chindwin, Upper Burmah, and is situated on the east bank of the river Chindwin; its height above sea level is about 450 feet. There is a lot of dense jungle in the neighbourhood.

*Kungalthana* is situated at the head of the Kabaw Valley and is just on the border between Burmah and Manipur at the S.-E. corner of the latter state. Hills covered with dense jungle rise to about 4,000 feet on the east and north. To the west the hills are less densely covered with jungle, but rise to 5,000 feet. To the south lies the Valley of Kabaw. All round Kungalthana there is dense jungle, though in places there are breaks with parklike stretches of grass. It is about 800 feet above sea-level.

*Tamunga* is a hill about 3,400 feet high and densely covered with jungle. It lies about 6 miles south of Kungalthana.

*Thyoliching* is a hill about 6,500 feet high, thickly covered with jungle, mostly bamboo. It is one of the highest points on the range of hills running more or less parallel to the Chindwin River on its west bank.

*Khambiching* is a hill about 5,700 feet high, situated in the Naga hills about 20 miles east of Manipur. This hill is not nearly so thickly wooded as most of the hills I visited and consequently a great deal more bird life was to be seen. All the Sunbirds were, I think, got in this neighbourhood. I never saw a minivet of any sort west of Kham-biching.

*Maphitel* is a high hill about 6,700 feet high which overlooks the whole of the Manipur Valley, situated about 10 miles east of Manipur. It is very thickly wooded on all sides. Unfortunately my collector got ill here, and I was too busy to go out myself.

*Kanpru* is a high hill 8,400 feet high, to the North-West of Manipur; I did not visit this hill myself, but the Tragopans were got there.

*The Logtak* is a large lake about 10 miles south of the town of Manipur. There are thousands of duck and geese to be seen on its waters. The principal species that I noticed was the grey duck or spot-bill. A few pintail, gadwall, shoveller, white eyed pochard (a few only). I saw no mallard, and I believe they are never obtained in the Manipur Valley.

DENDROCITTA RUFA. *The Indian Tree Pie.*

One, Homalin, November, 1898. One, Kungalthana, December, 1898.

DENDROCITTA HIMALAYENSIS. *The Himalayan Tree Pie.*

One, Khambiching, December, 1898.

PARUS CINEREUS. *The Indian Grey Tit.*

One, Kungalthana, December, 1898.

SCAEO RHYNCHUS RUFICEPS. *The larger Red-headed Crow Tit.*

One, Thyoliching, December, 1898.

DRYONASTES RUFICOLLIS. *The Rufous-bellied Laughing Thrush.*

Two, Manipur Valley, March, 1899.

GARRULAX LEUCOLOPHUS. *The Himalayan White-crested Laughing Thrush.*

One, Thyoliching, December, 1898.

GARRULAX PECTORALIS. *The Black-gorgetted Laughing Thrush.*

Two, Tamunga, December, 1898.

Hume states that he never saw or heard this bird east of Manipur.

GARRULAX MONILIGER. *The Necklaced Laughing Thrush.*

One, Tamunga, December, 1898.

This was shot out of the same flock as the two *Garrulax pectoralis*, and bears out Hume's assertion that they go in mixed flocks.

POMATORHINUS SCHISTICEPS. *The Slaty-headed Scimitar Babbler.*

One, Thyoliching, December, 1898.

PYCTORHIS SINENSIS. *The Yellow-eyed Babbler.*

One, Manipur, March, 1899.

PELLORNEUM MANDELLII. *Mandelli's Spotted Babbler.*

One, Khambiching, December, 1898.

ALCIPPE PHAYRII. *The Burmese Babbler.*

One, Tamunga, November, 1898.

\*LIOPTILA GRACILIS. *The Grey Sibia.*

Two, Khambiching, December, 1898.

SIVA CYANUROPTERA. *The Blue-winged Siva.*

One, Khambiching, December, 1898.

ZOSTEROPS SIMPLEX. *Swinhoe's White-eye.*

Two, Khambiching, January, 1899.

*PTERUTHIUS ERYTHROPTERUS.* *The Red-winged Shrike-tit.*

One, Mahlong River, November, 1898. One Tamunga, December, 1898.

*AEGITHINA TIPHIA.* *The Common Iora.*

One, Manipur, March, 1899.

*CHLOROPSIS AURIFRONS.* *The Gold-fronted Chloropsis.*

Two, Homalin, November, 1898.

*CHLOROPSIS HARDWICKII.* *The Orange-bellied Chloropsis.*

Four, Tamunga, December, 1898. One, Khambiching, December, 1898.

*CHLOROPSIS CHLOROCEPHALA.* *The Burmese Chloropsis.*

One, hills between Kungalthana and Chindwin River, November, 1898. Two, Tamunga, November, 1898.

*MELANOCHLORA SULTANEA.* *The Sultan Bird.*

Two, hills east of Kungalthana, November, 1898.

*MINLA IGNEITINCTA.* *The Red-tailed Minla.*

One, Khambiching, December, 1898.

*HYPsipETES PSAROIDES.* *The Himalayan Black Bulbul.*

One, Khambiching, January, 1899.

Hume mentions having seen this species only once in the Naga hills.

\**HEMIXUS FLAVALA.* *The Brown-eared Bulbul.*

Three, Nampesa (5,000 feet), just west of Kungalthana.

Hume mentions this species as being common west of Manipur, but rare to the east.

\**HEMIXUS MACLELLANDI.* *The Rufous-bellied Bulbul.*

Six, Khambiching, January, 1899.

\**ALCURUS STRIATUS.* *The Striated Green Bulbul.*

Two, Khambiching, January, 1899.

*OTOCOMPSA FLAVIVENTRIS.* *The Black-crested Yellow Bulbul.*

Three, Tamunga, November, 1898.



\*SITTA NAGAENSIS. *Austen's Nut-Hatch.*

Two, Khambiching, January, 1899.

SITTA FRONTALIS. *The Velvet-fronted blue Nut-Hatch.*

One, Shombui, Naga hills, November, 1898. One specimen, Tamunga, December, 1898.

CHAPTIA AENEA. *The Bronzed Drongo.*

One, Khambiching, December, 1898.

DISSEMURUS PARADISEUS. *The large Racket-tailed Drongo.*

One, Tamunga, December, 1898.

\*CERTHIA MANIPURENSIS. *Hume's Tree-Creeper.*

One, Khambiching, January, 1896.

[Lieutenant Turner's specimen of this species quite bears out Messrs. Hume and Oates' opinion of its distinctness, as the buff throat and breast and longer bill are conspicuous at once. I should mention, however, that *C. discolor* also occurs in Manipur, as the Museum possesses a specimen procured there by Mr. R. D. Oldham.]

MEGALURUS PALUSTRIS. *The Striated Marsh-Warbler.*

Two, Manipur Valley, March, 1899.

PHYLLOSCOPUS PROREGULUS. *Pallas' Willow-Warbler.*

One, Khambiching, December, 1898.

PHYLLOSCOPUS SUPERCILIOSUS. *The Crowned Willow-Warbler.*

One, Khambiching, December, 1898.

LANIUS COLLURIOIDES. *The Burmese Shrike.*

One, Mahlong River, November, 1898.

LANIUS TEPHRONOTUS. *The Grey backed Shrike.*

One, Manipur, March, 1899.

PERICROCOTUS FRATERCULUS. *The Burmese Scarlet Minivet.*

Three, Kungalthana, November, 1898. Three, Tamunga, November, 1898.

PERICROCOTUS BREVIROSTRIS. *The Short-billed Minivet.*

One, Thyoliching, December, 1898.

\*PERICROCOTUS SOLARIS. *The Yellow-throated Minivet.*

One, Tamunga, November, 1898. One, near Khambiching, December, 1898.

CAMPOPHAGA MELANOSCHISTA. *The Dark-grey Cuckoo-Shrike.*

Two, Thyoliching, December, 1898.

GRAUCALUS MACII. *The Large Cuckoo-Shrike.*

One, Tamunga, November, 1898. One, near Khambiching, November, 1898.

ORIOIUS MELANOCEPHALUS. *The Indian Black-headed Oriole.*

Two, Homalin, November, 1898. One, Kungalthana, November, 1898.

ORIOIUS TRAILLII. *The Maroon Oriole.*

One, Tamunga, November, 1898.

AETHIOPSAR GRANDIS. *The Siamese Myna.*

One, Kungalthana, December, 1898.

SIPHIA STROPHIATA. *The Orange-gorgetted Flycatcher.*

One, Khambiching, December, 1898.

SIPHIA ALBICILLA. *The Eastern Red-breasted Flycatcher.*

One, Kungalthana, November, 1898.

CYORNIS CYANEUS. *The White-tailed blue Flycatcher.*

One, Thyoliching, December, 1898.

*The Grey headed Flycatcher.*

One, Khambiching, December, 1898.

PRATINCOLA MAURA. *The Indian Bush Chat.*

One, Manipur Valley, March, 1899.

OREICOLA FERREA. *The Dark grey Bush Chat.*

One, Tamunga, November, 1898. One, Manipur Valley, March, 1899.

HENICURUS IMMACULATUS. *The Black-backed Forktail.*

One, Kungalthana, November, 1898.

CHIMARRHORNIS LEUCOCEPHALUS. *The White-capped Redstart.*

One, Naklang River, December, 1898.

RHYACORNIS FULIGINOSUS. *The Plumbeous Redstart.*

One, Kungalthana, November, 1898.

IANTHIA RUFILATA. *The Red flanked Bush Robin.*

One, Khambiching, December, 1898.

COPSYCHUS SAULARIS. *The Dhayal or Magpie Robin.*

One, Manipur Valley, March, 1899.

KITTACINCLA MACRURA. *The Shama.*

One, Tamunga, December, 1898.

PETROPHILA CYANUS. *The Western Blue Rock Thrush.*

Two, Manipur Valley, March, 1899.

MYCEROBAS MELANOXANTHUS. *The Spotted-winged Grosbeak.*

One, Khambiching, January, 1899.

EMBERIZA AUREOLA. *The Yellow-breasted Bunting.*

Four, Manipur, March, 1899.

ANTHUS MACULATUS. *The Indian Tree Pipit.*

One, Mahlang River, November, 1898.

AETHOPYGA IGNICAUDA. *The Fire-tailed yellow-backed Sunbird.*

One, Khambiching, December, 1898. Two, Khambiching, January, 1899.

AETHOPYGA GOULDÆ. *Mrs. Gould's yellow-backed Sunbird.*

Four, Khambiching, January, 1899.

AETHOPYGA DABRYI. *Dabry's yellow-backed Sunbird.*

One, Chattah, Naga Hills (near Thyoliching). Two, Khambiching, January, 1899.

AETHOPYGA NEPALENSIS. *The Nepal yellow-backed Sunbird.*

Two, Khambiching, December, 1898.

\*ARACHNOTHERA MAGNA. *The Large streaked Spider-Hunter.*  
Four, Tamunga, December, 1898.

GEVINUS OCCIPITALIS. *The Black-naped green Woodpecker.*  
One, Tamunga, November, 1898.

GEVINUS CHLOROLOPHUS. *The Small Himalayan yellow-naped Woodpecker.*  
One, Tamunga, 1898.

\*DENDROCOPUS PYRRHOTHORAX. *The Red-breasted pied Woodpecker.*  
One, Khambiching, December, 1898.

[Lieutenant Turner's specimen of this rare species agrees well with Colonel Godwin-Austen's obtained at Aimole, Manipur and still in the Museum.]

DENDROCOPUS ATRATUS. *The Stripe-breasted pied Woodpecker.*  
Two, Khambiching, January, 1899.

IYNGIPICUS CANICAPILLUS. *The Burmese Pigmy Woodpecker.*  
One, Khambiching, January, 1899.

\*TIGA SHOREI. *The Himalayan Golden-backed three-toed Woodpecker.*  
One, Khambiching, December, 1898.

[This specimen has a rudimentary hallux, similar to, that of *Brachypternus aurantius*, but without a nail. As this rudiment is also present in a pair from Landour in the Asiatic Society's Collection of stuffed specimens,\* and in a skin from Bhamo collected by Dr. J. Anderson—which are all I have been able to examine—it looks as if it were characteristic of the species, and hence I fail to see how this can be kept separate from *Brachypternus*.]

CHRYSOCOLAPTES GUTTICRISTATUS. *Tickell's Golden-backed Woodpecker.*  
One, Kungalthana, November, 1898.

MEGALAMA MARSHALLORUM. *The Great Himalayan Barbet.*  
One, Khambiching, January, 1899.

THEREICERYX LINEATUS. *The Lineated Barbet.*  
One, Homalin, November, 1898.

\* Not entered in Blyth's catalogue, though the stands bear labels in his handwriting.

CYANOPS ASIATICA. *The Blue-throated Barbet.*

Three, Tamunga, December, 1898. One, Khambiching, January, 1899. Two, Manipur Valley, March, 1899.

CYANOPS FRANKLINI. *The Golden-throated Barbet.*

Two, Khambiching, in January, 1899.

CORACIAS AFFINIS. *The Burmese Roller.*

Two, Manipur Valley, March, 1899.

CERYLE VARIA. *The Indian pied Kingfisher.*

One, Manipur Valley, March, 1899.

HALCYON SMYRNENSIS. *The White-breasted Kingfisher.*

Five, Manipur Valley, March, 1899.

ANTHRACOCEROS ALBIROSTRIS. *The Indo-Burmese pied Hornbill.*

Two, Homalin, November, 1898.

HARPACTES ERYTHROCEPHALUS. *The Red-headed Trogon.*

Two, Thyoliching, December, 1898.

SURNICULUS LUGUBRIS. *The Drongo Cuckoo.*

One, Homalin, November, 1898.

CENTROPUS SINENSIS. *The Crow pheasant or Coucal.*

One, Manipur Valley, March, 1899.

PALÆORNIS ROSA. *The Eastern Blossom-headed Parrakeet.*

One, Homalin, November, 1898.

PALÆORNIS FASCIATUS. *The Red-breasted Paroquet.*

One, Maphild, January, 1899.

I also obtained two live specimens, male and female; the latter I have still, the former escaped.

ACCIPITER NISUS. *The Sparrow Hawk.*

One, Manipur Valley, March, 1899.

ACCIPITER VIRGATUS. *The Besra Sparrow Hawk.*

One, Manipur Valley, March, 1899.

TINNUNCULUS ALAUDARIUS. *The Kestrel.*

Four, Manipur Valley, March, 1899.

\*MICROHIERAX EUTOLMUS. *The Red-legged Falconet.*

One, Homalin, November, 1898. Three, Kungalthana, November, 1898.

TRAGOPAN BLYTHI. *The Grey-bellied horned Pheasant.*

Three, Kanpru, March, 1899.

EXCALFACTORIA CHINENSIS. *The Blue-breasted Quail.*

One, Kaupum (Manipur Silchar Road), March, 1899. One, Manipur, March, 1899.

COTURNIX JAPONICA. *The Japanese Quail.*

One, Manipur Valley, February, 1899.

I saw a dozen or so of these birds; they were driven out of the long grass as it was burning. I thought at the time they were common quail, or would have taken more trouble to obtain another specimen.

\*MICROPERDIX MANIPURENSIS. *Hume's Bush Quail or Manipur Quail.*

Five, Manipur Valley, February, 1899.

Two out of the five of these birds were obtained almost in the dark, whilst running on the ground, they could be heard calling at one's feet almost, but the grass on the spot where they were having only that afternoon been burnt they were very hard to distinguish. The other three were obtained on a different day and were driven out of the long grass by fire. [See the note on this species by Captain H. S. Wood, I.M.S., J.A.S.B., Pt. II, 1899, p. 110].

ARBORICOLA RUFIGULARIS. *Blyth's Hill Partridge.*

One, Sirohipuras, January, 1899.

TURNIX PUGNAX. *The Bustard Quail.*

One, Manipur Valley, March, 1899.

AMAURORNIS PHŒNICURUS. *The White-breasted Water-hen.*

One, Logtak, March, 1899.

GALLICREX CINEREUS. *The Kora or Water-Cock.*

One, Logtak, March, 1899.

SARCOGRAMMUS ATRONUCHALIS. *The Burmese Wattled Lapwing.*  
One, Manipur Valley, March, 1899.

HOPLOPTERUS VENTRALIS. *The Indian Spurwinged Plover.*  
One, Kungalthana, November, 1898.

ARDEOLA GRAYI. *The Pond Heron or Paddy Bird.*  
One, Manipur Valley, March, 1899.

\*NYROCA FERRUGINEA. *The Western White-eyed Pochard.*

One, Logtak. One, Manipur. [This shows that the Western White-eye does occur in Manipur, as stated by Hume, and doubted by Mr. E. W. Oates. (Game Birds of India, Vol. II, p. 331). I may mention that the Eastern species (*N. baeri*) is again scarce this cold season at Calcutta].

PODICIPES CRISTATUS. *The Great crested Grebe.*

Two, Logtak, March, 1899.

These birds are by no means uncommon on the Logtak between November and February; the above specimens were rather late sojourners.

PODICIPES ALBIPENNIS. *The Indian Dabchick.*

One, Logtak, March, 1899.

These were very numerous on the Logtak.

*Akakia : an Ancient Eastern Medicine.*—By DAVID HOOPER, F.C.S.

A substance called *Akakia* or *Aqāqiyā* is described in both old and modern works on Indian *Materia Medica*, and is occasionally found in the bazars of this country.

Dioscorides and Hippocrates are said to have described it as the juice of a prickly tree and lauded its properties. Dr. Dymock avers that this plant is mentioned by Theophrastus (iii. 4; iv. 3; vi. 1) under the name of *ακανθος*, and that Virgil (*Georg.* ii. 119) speaks of the same *acanthus* in the line “*baccas semper frondentis acanthi*,” no doubt in allusion to the globular inflorescence of the tree.

The botanical origin of the drug from the earliest records appears to be a bush or tree yielding an exudation similar to gum arabic. According to Arabian and Persian writers, the tree from which it is prepared is called “*Karaz*.” This is the fruit of *Acacia nilotica* of Delile

(*Fl. Ægypt.*, i. 963), the *Acacia vera* of Vesling (*Ægypt.*, p. 9, *Icon*), and is known as "Sant" among the Egyptians. These are all vernacular names and synonyms of one or more species, including *Acacia arabica*, the common *babūl* tree of this country.

This is not the first time a paper has been read before this Society on the subject of this remarkable medicine. In 1837 a communication was made by Mr. Lewis DaCosta, which consisted of a translation of the article on "Aqaqia" in the *Makhzan-al-Adwiyah* of Mahomed Khosru Khan. (See *Journal Asiatic Society of Bengal*, Vol. VI. part I, January to June, 1837, p. 392). No reference was made in the paper to the uses of the drug at that time, nor were any opinions offered as to the condition of the article as it was then sold or the estimation in which it was held by the people. Regarding the preparation of the extract, Pliny (24, 67) says that "the juice is left to thicken in the pods, which are steeped in rain water for the purpose, and then poured into a mortar, after which the juice is extracted by means of presses. It is then dried in the sun, and when dry, divided into tablets."

The method of preparing the extract, according to the *Makhzan*, is as follows:—The fresh, unripe fruits should be employed. These are bruised in a mortar, boiled in water over a gentle fire until the mixture assumes a thick consistence, then it is poured into moulds and set aside to dry, after which it is ready for use. Some authorities are careful in pointing out that the desiccation of the extract should be effected under the influence of the sun's rays, as a much superior preparation is supposed to be produced under these circumstances. The expressed juice, after a certain degree of concentration, is sometimes poured into bladders in which it is allowed to harden.

The little bladders full of *Akakia* found in Europe contain about five or six ounces each. That it was not unknown on the Continent in the early part of last century is evidenced by the fact that "Doctor *Akakia*" is the pseudonym under which Voltaire overwhelmed with ridicule Maupertuis a companion of Frederick the Great.

The drug reaches India *via* Bombay, and is imported into this city from the Red Sea ports and the Persian Gulf. It is sold in the bazars of Bengal and Bombay either in very thin black cakes about the size of a rupee, or in larger cakes two inches in diameter and half an inch in thickness. The wholesale price is two sērs for a rupee, and the commodity retails for about  $1\frac{1}{2}$  anna per chittak.

Various observers have noticed a difference in the character of the drug as sold in this country. It is usually a solid, heavy, brittle, dark coloured substance without any odour; the taste is insipid or sweetish at first, then astringent; it breaks with a shining fracture, and may be



reduced to a brown powder; it is partly soluble in water forming a red coloured mucilaginous liquid, leaving behind a quantity of brownish-green matter. Small fragments held up between the eye and the light have a reddish tinge similar to the glass of hock bottles. Other samples are coal black and quite insoluble in water.

Mohideen Sheriff, Khan Bahadur, a distinguished Muhammadan practitioner in Madras, discusses very fully in his "Materia Medica of Madras," the appearance, preparation and therapeutic uses of this extract. He describes two varieties met with in that city—a hard and a soft variety. The hard kind is black and brittle, like the substance described above; the soft kind is reddish or deep brown in colour, and even after being kept for a long time, it is sufficiently tough and plastic to be made into boluses. He considers all the hard varieties to be impure or not at all made from the pods of an *Acacia*. An extract made by himself from fresh pods had a soft consistence, an astringent taste, and a slight, peculiar odour.

I would not attempt to enumerate in this paper all the medicinal virtues ascribed to this drug. It has been used in the East, especially among the Muhammadan community, as a panacea. It is supposed to be cold and dry, astringent, styptic and tonic, and is used internally and externally in relaxed conditions of the mucous membranes. It is recommended for nervous debility, dysentery, diarrhœa of children, and as a collyrium in purulent conjunctivitis. Applied as a lotion to the face it is said to improve the complexion, and to grey hair to give a black colour. Made into an ointment with beeswax, or mixed with white of egg, it has been used for burns, scalds, inflammation and erysipelas; and in a powdered state it arrests hæmorrhage.

Further details of the effects said to result from the administration of this medicine will be found in Mr. DaCosta's translation of the chapter from the Makhzan, or in Dr. Mohideen Sheriff's work.

It will be well to turn our attention to the source of this wonderful medicament and endeavour to trace the origin of the useful therapeutic properties attributed to it.

*Babûl* pods are used in India chiefly in two connections. Firstly, they are astringent, and are employed for tanning leather and making ink; and secondly, they are employed by native agriculturists for feeding and fattening cattle. No poisonous action has been recorded concerning the pods, and no active alkaloid has been detected in them. The tannic acid peculiar to the *babûl* is one of the pyrogallol series, which affords a blue-black colour with persalts of iron.

*Babûl* or *bablah* pods have been analysed on various occasions by chemists, with the object, in most cases, to determine the amount of

tannic acid present. V. Wilbuszewitz, in 1886, estimating the acid by means of potassium permanganate, found 12·12 per cent., and by treatment with sulphuric acid, phlobaphene, ellagic and gallic acids were obtained as decomposition products.

Kay and Baston, by employing Procter's modification of Löwenthal's process for the estimation of tannin, found 22·44 per cent. in the pods. (Allen, *Commercial Organic Analysis*).

Marfat states that Bablah pods contain from 25 to 30 per cent. of tannin, analogous to that of nut-galls, besides a free acid and a large quantity of calcium salts.

During a chemical examination made in 1898, of a sample of *babul* pods collected in Bengal, I obtained 20·65 per cent., as the average of two concordant estimations. The complete analysis was as follows:—

Water	...	...	...	6·87
Tannic acid	...	...	...	20·65
Non-tanning soluble matters			...	15·15
Fibre	...	...	...	51·40
Ash ...	...	...	...	5·93
			...	100·00

A solid extract was afterwards made by exhausting the crushed pods with warm water at 60° C., and evaporating the reddish-brown liquid in a porcelain basin until it was dry. This extract, which should represent the Persian and Arabian drug, *Akakia*, was a dark brown, solid mass, almost entirely soluble in water, and possessing a strongly astringent taste. Its chief constituents were found to be—

Water	...	...	...	5·58
Tannic acid	...	...	...	59·80
Non-tanning soluble matters...			...	16·00
Insoluble substance		...	...	8·17
Ash	...	...	...	10·45
			...	100·00.

This, it will be noticed, is a highly astringent preparation, and resembles in its composition one of the forms of catch manufactured for tanners from the wood of *Acacia Catechu*.

It was thought probable that the fruit of the *babul* tree might contain an allied principle to that contained in the *Acacia concinna*, or soap-bean of South India, but no appreciable amount of a saponin-like body could be detected in the Bengal pods.

With a knowledge of what an extract of *babul* pods should be, the light of chemical inquiry was next directed towards the composition of trade samples of *Akakia*. Three specimens are exhibited in the Indian Museum, two of which are in the form of round black cakes, and one in a hard yellowish, resin-like mass.

One of the black cakes, obtained from the Panjab, merely softened in hot water, without dissolving. On igniting a small quantity on platinum foil, it burnt with a dense smoky flame, and left a residue of 58 per cent. of mineral matter. It had all the characters of pitch or asphalt. Another sample of the same shape and colour, but obtained from Bengal, was similar in appearance to that from the Panjab. It consisted of a pitch-like, resinous material, and yielded when ignited about 45 per cent. of siliceous ash. The third specimen labelled "from Hyderabad," was a vitreous substance of a yellowish-brown colour. It was composed of gum, resin, vegetable debris and sand. It afforded no reactions for tannin, and, like the previous samples, was altogether foreign to the products of species of *Acacia*.

Since these samples were examined a further attempt has been made to procure in Calcutta a genuine specimen of this extract, but from the diversely coloured and resinous articles supplied under this name it is evident that entirely different substance are regularly being sold by the bazar druggists in place of the once renowned *Akakia*.

The local specimens, of which there are three in number, are coloured respectively black, green and light brown. The black cake bears a resemblance to those previously described, but closer examination showed that the resinous principle consisted of shellac, while the other constituents were charcoal, and a liberal allowance of sandy mineral matter amounting to two-thirds of the weight of the whole.

The light brown specimen is a pure resin, and is no doubt allied to *Olibanum*, many varieties of which are obtained from species of *Boswellia*. The green lump is probably the same compound mixed with colouring matter. *Olibanum* seems also to be the basis of the resinous ingredient present in the Bengal variety.

The result of this inquiry shows a state of affairs which deserves explanation. Either the native apothecary is entirely ignorant of the nature of some of the drugs he dispenses, or he is recklessly or fraudulently practicing a system of substitution. The condition of the trade in the time-honoured drug *Akakia* is far from satisfactory, and it is only by practical investigations in this direction that we can hope to remedy it.

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*Notes on the Ploceidæ.*—By F. FINN, B.A., F.Z.S., Deputy Superintendent of the Indian Museum.

[Received November 29th; Read December 6th, 1899.]

1. *Ploceus rutledgii*, Finn, the summer plumage of *Ploceus megarhynchus*, Hume.
2. On the interbreeding of certain species of *Munia*.
3. An attempt at a natural subdivision of the Ploceine Finches.
4. Some experiments on Sexual Selection in the Avadavat.

1. PLOCEUS RUTLEDGII, THE SUMMER PLUMAGE OF *P. MEGARHYNCHUS*.

In the Proceedings of the Asiatic Society for July 1899, p. 77, will be found the diagnosis of an Indian species of Weaver-bird which I there named, believing it to be new, *Ploceus rutledgii*, after Mr. W. Rutledge, from whom the types were obtained. Mr. Rutledge would not sell the birds until assured that they would not be killed, and I am glad to say that his humanity has been justified by a very interesting occurrence. The birds, being kept alive, have in due course assumed an undress plumage very similar to that of the ordinary Bayas (*P. baya* and *P. atrigula*) but differing from this in most of the points which Mr. Hume pointed out as distinctive of his *P. megarhynchus*. As they also agree closely with this form in measurements, and were obtained from Nynce Tal (the types of *P. megarhynchus* having come from Kaladoongi, below that place) it seems to me obvious that my *P. rutledgii* is merely the summer plumage of that species, hitherto unknown, no doubt, by reason of the unhealthiness of its Terai habitat in the season when the birds are in full feather. Under the circumstances the promised plate seems to me unnecessary, and therefore I merely append below a description of this summer or breeding-plumage.

General colour bright yellow (brightest on head and dull and impure on rump), with the following exceptions;—lores, round the eye below, and ear-coverts, dark brown; a dull-black patch on each side of the breast before the shoulder; nape and hind neck, dull blackish brown; upper back, wings, and tail blackish brown, each feather edged, entirely or externally, with light brown, on the uppermost part of the back with yellow; under wing-coverts dirty white.

Iris bright light brown; bill black, fleshy-white at base; feet dark brownish fleshy, claws blackish horny.

Both specimens, as noted in P.A.S.B. (*loc. cit.*) were similar, but one was slightly duller than the other. It is also slenderer in make, though quite as long, and has never sung or attempted to weave, even when separated from its fellow, which continually uttered, when "in

colour," its harsh unpleasant song, and was an indefatigable weaver when it got grass to work with; it used to stuff bits of earth in the work. It still occasionally sings and weaves, and sometimes flies wildly about, as it often did when in colour. The other bird has always been much milder in demeanour, though more restless, and less tame. It was nearly a month later in completing its change of plumage; but latterly I have seen it also behave more like a normal male.

The brightest bird, the singer and weaver, measures; length about  $6\frac{1}{2}$ " ; bill from gape about '8" ; wing about 3" ; tail about 2.1" ; shank about '95." The tail is much more graduated in winter than in summer plumage, and the bill is in the former fleshy, horny on culmen and tip, instead of black as in the full-plumaged bird.

It may be noted as a remarkable fact that, though the primaries of these birds had been plucked before they came into Mr. Rutledge's possession, and grew again soon after the specimens were acquired by the Museum, yet these new quills were again moulted and replaced in the ordinary way with the other feathers.

A very characteristic point of *Ploceus megarhynchus* is the long tail and short wing; as is shown by the measurements of this specimen and of Mr. Hume's, the difference between the length of the wing and tail is only about the length of the shank; in this point, as well as in the large amount of yellow in the plumage, *P. megarhynchus* approaches *Plocœlla javanensis*. It also possesses, like that species, nuchal hairs, but so do all the Indian species of *Ploceus*, though the absence of these insignificant filoplumes is given, both by Mr. Oates in the Fauna of British India (Birds, vol. II, p. 174) and Dr. Sharpe in the British Museum Catalogue of Birds (vol. XIII, p. 406) as a character of the genus *Ploceus* as restricted by them.

It is not surprising that these authorities both united *P. megarhynchus* with *P. atrigula*, for no doubt there is a certain amount of intergradation between them, similar to that which occurs between *P. atrigula* and *P. baya*, as noticed by Mr. Hume (Stray Feathers, vol. VI, 1878, p. 400).

There are in the Indian Museum several specimens of *P. atrigula* showing an admixture of yellow with the buff of the breast, some of them procured by myself in Calcutta alive and kept so for a time to see if they would develop more of the yellow colouring—which they did not. Had I remembered this when I looked up *P. megarhynchus* and found that the types were in winter plumage and had been united with *P. atrigula* by the distinguished authors of the volumes of the "Fauna" and the "Catalogue" above quoted, I might have escaped following their very pardonable mistake which suppressed this magnificent species, by far the finest of the Asiatic Weavers.

Excluding, then, the two very easily distinguishable species *P. bengalensis* and *P. manyar*, typical males in summer plumage, of the remaining species, may be distinguished as follows:—

- |   |     |                          |
|---|-----|--------------------------|
| Size largest; entire under-surface yellow,    | ... | <i>P. megarhynchus</i> . |
| „ smaller; throat blackish; breast buff,      | ... | <i>P. atrigula</i> .     |
| „ smallest; throat dull black; breast yellow, |     |                          |
| abdomen white ... ..                          | ... | <i>P. baya</i> .         |

For the distinction of males in undress and females size will be the best guide, though this may not be very reliable in view of the probable occurrence of many intermediate specimens.

## 2. ON THE INTERBREEDING OF CERTAIN SPECIES OF MUNIA.

In January, 1897, I procured alive, in Tiretta Bazaar, Calcutta, a specimen of a *Munia* agreeing with *Munia malacca* in its general characters, but having the white portions of the plumage suffused with chestnut, and during the present year I have detected in cages of *M. malacca* many specimens showing more or less of this rufous colouration below, and have secured some for the Museum.

It is this occasional variation of the white lower parts, no doubt, which is alluded to by Mr. E. Bartlett (Monograph of the Weaver-birds, &c.), under this species, in his description of the female, which, he says, has “the white chest and sides strongly tinged with creamy-buff.” But among the rufous-washed specimens procured by me most turned out to be males, while even the small series at present possessed by this Museum of the pure *M. malacca* shows that the underparts of the female are white like those of the male, as stated by Dr. R. B. Sharpe (Brit. Mus. Cat. Birds, vol. XIII, p. 331) and implied by Dr. A. G. Butler (Finches and Weavers in Captivity, p. 244).

This colouration is evidently not a stain (like the rusty tinge on the under-plumage of waterfowl, which I have seen assumed in a single night by a male Pintail (*Dafila acuta*) kept unpinioned on the Museum tank, which he used to leave and return to). I conclude this to be the case from finding the other birds in the cages with the tinted ones to be clean and pure white, and from the fact that immature birds still showing the light-brown plumage moult out either rusty or pure white below, according to the colours shown at first. I have tested this in three specimens kept by Major Alcock in his aviary, two of which have proved to be hens, and one a cock.

This departure from the typical colouration of *M. malacca* is no doubt caused by casual interbreeding with the nearly allied *M. atricapilla*, and a similar explanation would no doubt apply to the yellow-marked specimens of *Ploceus atrigula* alluded to above. It would, however, be satisfactory to have the fact placed beyond doubt by pairing

the two species in captivity, which might easily be done. At the same time, in confirmation of the interbreeding theory, it may be mentioned that Dr. Butler in the work above quoted (p. 220) cites Dr. Karl Russ to the effect that the African *Aidemosyne cantans* and its very near ally the Indian *A. malabarica*, which do not meet in a wild state, interbreed indiscriminately in captivity. In view of cases like these, and of the fact that extreme forms of intergrading species, such as *Corvus corone* and *C. cornix*, and *Coracias indica* and *C. affinis* are positively known to pair up together, I cannot accept the theory that such intermediate specimens as occur midway in the range of intergrading forms represent the parent species in its as yet undifferentiated form, as has been advanced by some naturalists. For the progenitor of two given species need not have necessarily been an absolutely intermediate type, though the hybrid may be so, as has been proved by experimental breeding. For instance, we may presume that the ancestor of two species the males of which exhibit decorative colours, would have resembled the duller females and young of the existing forms; e.g., the primitive ancestor of the common Bullfinch (*Pyrrhula europæa*) no doubt resembled *P. murina* of the Azores, and that of the Linnet (*Linota cannabina*) the duller coloured Twite (*Linota montium*). Yet when these two Finches are crossed in captivity, the "mule" has a pink breast, a piece of decorative coloration which was almost certainly absent in the common progenitors of the Bullfinch and Linnet genera.

Lastly there is strong reason to suspect that species arise suddenly as far as colour-variations are concerned. The Red-headed form of the beautiful Gouldian finch (*Poephila mirabilis*), is an example, and is especially interesting as showing how such sports may tend to increase, as it has been found by Dr. Butler to be more attractive to the hen than the less brilliant black-headed variety. (*Op. cit.* p. 176).

### 3. A SUGGESTION FOR A MORE NATURAL CLASSIFICATION OF THE PLOCEIDÆ.

Considering that this group of Passerine birds has been studied far more thoroughly than any other, being well known in captivity (in which state many species breed) it is rather remarkable that ornithologists have not availed themselves to a greater extent of the exceptional opportunities thereby afforded them of arriving at a natural classification of the group. As a matter of fact, any one who has studied these birds in life will see that the greater or less development of the first primary can hardly be deemed a character of importance as contrasted with the marked difference of colouration, general size, and habits, which separate the true Weavers, with their near allies the Whydahs, on one hand,

from the Munias or Mannikins, Grassfinches and Waxbills on the other. We can hardly hope for anatomical characters of distinction in such a group as the Oscinine Passeres, and so in my search for a structural character to separate these sections, already partially indicated by Gray in the "Hand List" and by Dr. Butler in his valuable work, I studied our collections in the Indian Museum with a view to discovering an external one which should be correlated with the peculiarities of plumage and disposition so long familiar to fanciers. This I have found, I think, in the prolongation of the culmen on to the forehead, which obtains in Weavers and Whydahs to a far greater extent than in the Mannikins, Waxbills, and Grassfinches. I should therefore diagnose the two groups as follows:—

- A. Posterior end of the culmen produced back upon the forehead, so that the length from its hinder end to a point midway between the nostrils exceeds the breadth of the bill at this point, and a line drawn between the nostrils forms the base of an isosceles triangle ..... Weavers and Whydahs—*Ploceinæ*.

This group averages much larger than the others, some of its members being as large as a Thrush, and many as big as Sparrows; the upper plumage is generally striated like a Lark's in females and males out of breeding-plumage: the male as a rule undergoes a marked change of plumage at the breeding-season: the note is loud and harsh, and the disposition, although the birds are social in habit, savage and quarrelsome, little affection being manifested even between the sexes. The Whydahs cannot be separated from the true Weavers, as there is a complete gradation between the two groups.\*

- B. Posterior end of the culmen only slightly invading the forehead, so that the length from its hinder end to a point between the nostrils is less than the breadth of the bill there, and a line drawn between these forms the base of an approximately equilateral triangle. Munias, Waxbills, and Grassfinches *Spermestinæ*.

The birds of this group are all small, none equalling a common sparrow in size, though the biggest, the well-known Java Sparrow (*Munia oryzivora*) is nearly as large, and far bigger than many *Ploceinæ*; but few approach this bird in stature, and some are among the most minute of Passerine birds. They never display a lark-like striated plumage, nor does the plumage of the male undergo a change, except in the Avadavats (*Sporæginthus amandava* and *S. flavidiventris*). Their notes are low and often pleasant, and their disposition generally

\* Through *Penthetria*, *Penthetriopsis*, and *Urobrachya* on the one hand, *Vidua* and *Hypochera* on the other.



affectionate and caressing to a degree, even with birds of alien species. Egg always white.

#### 4. SOME EXPERIMENTS ON SEXUAL SELECTION IN THE AVADAVAT.

The affectionate and caressing disposition of the *Munia* group, above alluded to, suggested one of them as a fit subject for experiments in Sexual Selection, the direct evidence for which is as yet somewhat to seek. And as the Avadavat (*Sporæginthus amandava*) shows a marked sexual difference in colouration during the breeding-season and varies in the intensity of this nuptial decoration of the males, it seemed the best species to select, being also very easy to procure. Accordingly, having procured a three-compartment cage, and fitted it with two perches running through all three compartments, which were separated by wire netting, so that the birds could easily see each other and sit side by side, I made the following experiments with this species:—

##### No. I.

Placed in the cage on *August 27th*, three birds just bought, all from the same small cage in the Bazaar:—a hen ( $\alpha$ ), the only one in the lot from which these were taken; a bright coloured scarlet-red cock (A) well spotted with white, and a dull copper-red cock (B), deficient in spots on the breast. A lost some of his tail in handling.

*August 28th.* All birds well, but wild; both cocks trying to get in with hen; hen inclined to try and get in with cock A.

*August 29th.* A, which was not quite so active as B yesterday, looks very sick; hen nevertheless sometimes inclined to sit on his side of her compartment. Both cocks trying to get to her, and sitting much closer to the side than she does.

*August 30th.* A looking as well as before to-day; hen sitting mostly at his side of the cage, and the dung there proves she has roosted on that side against the wire.

*August 31st.* A still looking well, and hen markedly inclined to sit mostly his side; B not looking very well; one of them singing.

*September 1st.* A well, hen markedly inclined to sit by him; B looking very seedy. One bird still singing. (I think A in both cases). Hen has still roosted on his side (A's).

*September 2nd.* A well, hen definitely sitting by him: has evidently roosted that side all the time; B looking very seedy still.

*September 3rd.* A well, B dead; I think he has been sickly all along, as he is very thin; but as above noted, he was lively enough at first. He has had diarrhoea of late. He ate small millet readily enough, but I don't think took much of a larger seed I gave later, which the other eat all right. (I gave them subsequently small millet).

## No. II.

*September 3rd.* Removed A (who I found was minus one hind claw, lost some time since) and replaced him and B by two birds procured from same dealer, from a cage containing cocks only. These did not differ so much as A and B, but one (C) was more scarlet and better spotted than the other (D) which was coppery in hue. Cleaned away dung from under hen's top perch, and put C in B's place, and D in A's, so that locality could make no odds. C is minus some of his tail, as A was.

*September 4th.* Hen, though she has evidently roosted next D, in the old place, showed a marked preference for C's side. She is hardly so well as usual, and has slight diarrhœa, D wants to get in with her. Both he and C look well. One was singing to-day.

*September 5th.* All birds well: one singing; hen mostly on side of C. I think she roosted next him last night.

*September 6th.* All birds well; heard D singing; the hen sits sometimes on his side, but I think, on the whole, more on C's, judging especially by the dung deposited.

*September 7th.* Hen sitting on both sides, most on C's in afternoon at all events. She sits very close to the wire now. Have had cage well cleaned.

*September 8th.* Hen still varying, but at evening sitting most by C. I doubt whether she roosted by him last night, however, though evidently keeping his side by day.

*September 9th.* Hen varying a little, but sitting mostly very close to C in morning. Heard C singing. Not observed in afternoon, being Saturday. Quite settled to C, I think.

*September 10th.* Hen sitting near D when I first saw her, settled near C as usual at noon. Removed her.

## No. III.

*September 11th.* Replaced hen by another ( $\beta$ ) a particularly fine big bird, got from same dealer, out of a cage containing hens only. Hen sat close to D at first, latterly to C.

*September 12th.* Hen distinctly favouring C, and often sitting near him; heard him sing once.

*September 13th.* Hen seen once or so sitting by D, but oftener by C; cage cleaned, and dung seems to show she has been more on D's side than C's to-day. Yet appearances as above stated.

*September 14th.* Hen has evidently roosted on C's side. Sitting mostly by D, to-day; heard him sing. Late, when she was sitting by D, C sang several times, and she went and sat by him a little while.

*September 15th.* Hen seems to have roosted by D: she has sat on the whole more by him to-day, as proved by dung and observation. Both cocks have been singing, about equally well. Had her cage cleaned.

*September 16th.* Hen apparently roosted close to C, and on the whole inclines to him to-day. I had her cage cleaned again to-day. Heard C sing when she was sitting by him.

*September 18th.* Made no observations yesterday, but cage was cleaned about midday, and dung showed plainly to-day hen had roosted by C; she had also sat much near D. Hen's cleaned again first thing after examination. Saw her sitting by D to-day, and dung seems to show she has sat there more; but at evening much inclining to sit by C.

*September 19th.* Dung showed hen had roosted by C, and though sitting more by D at first, in the afternoon and evening she was settled by C; D very anxious to get in with her, as he has *always* been; I have not seen C equally so.

*September 20th.* Was not quite sure from state of cage which side hen had roosted; had it cleaned, and found later she had sat both sides; a little more by D; in afternoon sitting by C, however, as usual. Caught both cocks, and let them in with her together.

D's tail much disarranged by his frequent attempts to get to her. There was no fight, however, and she seemed rather inclined to sit by D, so I released the lot.

It is obvious from these experiments that hen (*a*) preferred the brighter-coloured males, while no such certain conclusion can be come to in the case of (*β*) Possibly the superior brilliancy of C was compensated for by D's obvious eagerness. It should be remembered also that brilliant colour in many birds at all events is a sign of high condition and superior age, so that the problem to be dealt with is by no means a simple one. All I can claim to have shown in these few experiments is that the method of conducting them, suggested by Moseley (*Naturalist on the Challenger*, p. 373) is a perfectly feasible one, given a sufficiently demonstrative species varying in colouration. A more extensive series would no doubt result in a definite settlement of this most interesting question, and such can easily be made by any fancier of birds.

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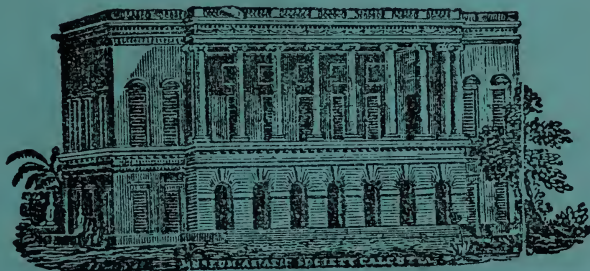
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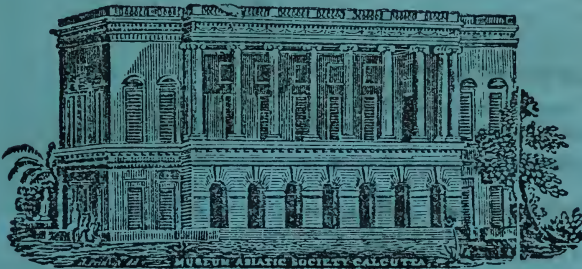
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