# FURTHER NOTES ON CRUSTACEA DECAPODA IN THE INDIAN MUSEUM.

## VIII. On the Decapod Crustacea collected by the Bengal Pilot Service off the Mouth of the River Hooghly. Brachygnatha (Oxyrhyncha and Brachyrhyncha).

*By* B. Chopra, *D.Sc., Zoological Survey of India, Calcutta.*

(Plate IX.)

The Dromiacea and the Oxystomata of the Sandheads, off the mouth of the Hooghly River, have already been dealt with in the present seriee of notes[1]; an account of the remaining crabs, comprising the tribe Brachygnatha, is given in this paper. Both the sub-tribes of the Brachygnatha, namely the Oxyrhyncha and the Brachyrhyncha—the latter including all the crabs formerly grouped under the old, well-known and convenient names of Cyclometopa and Catometopa—are well represented at the Sandheads. In the Oxyrhyncha, the Maiidae have six representatives in the Sandheads fauna, all belonging to more or less common and widely distributed species, while the Parthenopidae are represented by two species only, one of which is recorded from this locality for the first time. In the Brachyrhyncha the apparent scarcity of the Catometopes in this area is very remarkable; only one species of this large group of crabs, the somewhat rare *Scalopidia spinosipes* Stimpson (family Gonoplacidae) is present in the Sandheads collection. The Cyclometopa, on the other hand, seem to flourish in this locality, and are represented by three families, Portunidae, Corystidae and Xanthidae. Of these the Portunidae are the commonest, both in species and in individuals. Some of the species of this family in the present collection are somewhat rare, and a number of these are recorded from the Sandheads for the first time. The Xanthidae are represented by four species, all of which are more or less rare. Finally the aberrant family Corystidae is represented in the fauna by only one specimen of the uncommon genus *Gomeza* Gray, which has had to be given a new varietal name.

I give below a list of species dealt with in the present paper; an asterisk placed before the name of a species indicates that it is recorded from the Sandheads for the first time.

Oxyrhyncha.
  Maiidae.
    Pisinae.
      *Hyastenus dicanthus* (de Haan).
      *Doclea ovis* (Herbst).
      *Doclea canalifera* Stimpson.
      *Doclea gracilipes* Stimpson.
      *Doclea tetraptera* Walker.
      *Phalangipus longipes* (Linn.).

[1] Chopra, *Rec. Ind. Mus.* XXXV, pp. 25-52 (1933) and XXXVI, pp. 477-481, pl. viii (1934).

Parthenopidae.
*Lambrus* (*Platylambrus*) *prensor* Herbst.
* *Cryptopodia angulata* M.-Edw. & Lucas.

Brachyrhyncha.
Portunidae.
Lupinae.
*Neptunus* (*Neptunus*) *sanguinolentus* (Herbst).
*Neptunus* (*Neptunus*) *pelagicus* (Linn.).
*Neptunus* (*Hellenus*) *hastoides* (Fabr.).
* *Neptunus* (*Hellenus*) *pulchricristatus* Gordon.
*Neptunus* (*Lupocycloporus*) *gracilimanus* (Stimpson).
*Charybdis* (*Goniosoma*) *cruciatus* (Herbst).
* *Charybdis* (*Goniosoma*) *merguiensis* (de Man).
* *Charybdis* (*Goniosoma*) *miles* (de Haan).
* *Charybdis* (*Goniosoma*) *variegata* (de Haan).
* *Charybdis* (*Goniosoma*) *callianassa* (Herbst).
*Charybdis* (*Goniosoma*) *rostrata* (A. M.-Edwards).
* *Charybdis* (*Goniohellenus*) *vadorum* Alcock.
Caphyrinae.
*Lissocaricinus arkati* Kemp.
Corystidae.
* *Gomeza distincta* (de Haan), var. *indica*, nov.
Xanthidae.
Xanthininae.
* *Halimede tyche* (Herbst).
*Liagore rubromaculata* de Haan.
* *Galene bispinosa* (Herbst).
* *Galene granulata* Miers.
Gonoplacidae.
Rhizopinae.
* *Scalopidia spinosipes* Stimpson.

Some of the species that have proved of interest either from a taxonomic point of view or on account of their comparative rarity or distribution may be briefly referred to here. In the Maiidae some of the species of *Doclea* are very similar to one another, and the separation of the common *Doclea ovis* from Ortmann's *Doclea japonica* has presented special difficulties. An examination of a large number of specimens of these two forms preserved in the Indian Museum collection has, however, shown that the two are identical, and that Ortmann's *japonica* must, therefore, be considered a synonym of the variable *D. ovis*. *D. canalifera* of Stimpson is quite distinct from *D. ovis* or *D. japonica*, and the last mentioned species cannot, therefore, be included in the synonymy of Stimpson's form, as was suggested by Miss Rathbun [1] and Balss [2]. For reasons given by Miss Rathbun [3], I have adopted the name of *Phalangipus longipes* for the form that has so long been known as *Egeria arachnoides* (Rumph.). It is a pity to have to give up

[1] Rathbun, *Proc. U. S. Nat. Mus. Washington* XXVI, p. 29 (1902).
[2] Balss, *Arch. Naturgesch.* XC, Heft 5, p. 30 (1924).
[3] Rathbun, *Proc. Biol. Soc. Washington* XI, pp. 159, 160 (1897).

such an old and well-known name, but under the existing rules of zoological nomenclature there is no help for it. In the Portunidae Miss Gordon [1] has shown that *Neptunus spinipes* of Alcock [2] is not the form that Miers[3] had described under that name; an examination of the Indian material of Alcock's *spinipes* has fully borne out Miss Gordon's contention, and her name of *pulchricristatus* has, therefore, been adopted for it. In the same way it is clear that *Neptunus gracilimanus* as recognised by Alcock[4] is distinct from Stimpson's [5] species of that name, but A. Milne-Edward's (and Alcock's)[6] *whitei* is identical with it. For Alcock's *gracilimanus* Miss Rathbun's[7] name *innominatus* must, therefore, be employed. Alcock had described a new variety of *Charybdis hoplites* (Wood-Mason) under the name *vadorum* [8]; I have found it necessary to raise this variety to a specific rank and to include the species recently described by Miss Gordon[9] under the name of *sinensis* in its synonymy. Kemp's *Lissocarcinus arkati*[10] was so far known from female specimens only; from some adult males in the present collection I am able to supply a description of this sex also. In the family Corystidae a new variety of the Japanese *Gomeza distincta* (de Haan) has been described; the genus is somewhat rare in Indian waters. In the Xanthidae *Halimede tyche* (Herbst) is recorded from the Sandheads and the question of its synonymy is discussed. *Galene bispinosa* (Herbst), a somewhat rare species, is quite common at the Sandheads, while Miers' *Galene granulata*[11], which was hitherto known only from Australia and Singapore also occurs here. The latter species was so far somewhat inadequately described and I have, therefore, given a fresh illustration and have also added some descriptive notes on it. As mentioned above the only representative of the Catometopes at the Sandheads is *Scalopidia spinosipes* Stimpson of the family Gonoplacidae: the species is rather rare. All the questions referred to above are fully discussed in the following pages in their appropriate places.

In the present paper, as previously, I have closely followed Alcock in the classification and arrangement of species, as given in his masterly account of the Indian crabs in the series of papers entitled "Materials for a Carcinological Fauna of India" I have not considered it necessary to give anything like complete synonymies; in many cases Alcock's work alone is referred to and at most one or two later important references only are added.

Miss Gordon[12] has recently directed attention to the importance of studying the abdominal appendages of the male in view of their providing characters of considerable systematic value. I have paid special

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[1] Gordon, *Journ. Linn. Soc. London (Zool.)* XXXVII, p. 534 (1931).
[2] Alcock, *Journ. As. Soc. Bengal* LXVII, pp. 39, 40 (1899).
[3] Miers, *Challenger Brachyura (Zool.* XVII), p. 178, pl. xv, fig. 1 (1886).
[4] Alcock, *loc. cit.*, p. 45.
[5] Stimpson, *Smithsonian Misc. Coll.* XLIX, p. 77, pl. x, fig. 3 (1907).
[6] Alcock, *loc. cit.*, p. 44 (1899); a reference to Milne-Edward's paper is given in Alcock's synonymy.
[7] Rathbun, *Proc. Biol. Soc. Washington* XXII, p. 114 (1909).
[8] Alcock, *loc. cit.*, p. 67 (1899).
[9] Gordon, *loc. cit.*, pp. 534-536 (1931).
[10] Kemp, *Rec. Ind. Mus.* XXV, pp. 405-408, pl. x, fig. 1 (1923).
[11] Miers, "*Alert*" *Crust.*, p. 208, pl. xx, fig. A (1884).
[12] Gordon, *loc. cit.*, pp. 525, 526 (1931).

attention to these appendages in the course of my present work, and have found them to afford in many cases useful characters in separating males of closely allied species. This has been specially so in the case of some species of *Doclea* and in some of the Portunids. For purposes of future reference and comparison I have given figures of the anterior male appendages of most of the species dealt with in this paper.

The physical conditions prevailing at the Sandheads, so far as known at present, have been briefly described in an earlier paper [1], but for convenience of reference it may be mentioned that this area lies roughly in 21°N. and 88°E. The salinity of the surface water is somewhat lower than that of the outlying parts of the Bay of Bengal, and varies a great deal at different times of the year. The water is richly laden with fine silt brought down by the Hooghly and the neighbouring branches of the Ganges from the rich alluvial plains of upper India. The depth in most places is about 20 fathoms, and the bottom consists of soft ooze-like mud, with patches of sand and mud here and there.

The photographs and text-figures illustrating this paper have been made under my supervision by Babu Subodh Mondul, one of the talented artists of the Zoological Survey of India, with his usual skill and accuracy, and I owe him my best thanks for the care with which he has done the work. To my chief Dr. Baini Prashad I am greatly indebted for constant help and valuable suggestions throughout the course of my work and for going through the manuscript with me. I am also thankful to Dr. Heinrich Balss of München for helping me in clearing up some doubts about the rare Xanthid *Galene granulata* Miers, and to Dr. F. H. Gravely of Madras for lending to me for study, from the Museum under his charge, the only specimen of *Medaeus rouxi* Balss in his collection.

## Tribe BRACHYGNATHA.

## Subtribe *OXYRHYNCHA.*

### Family MAIIDAE.

### Subfamily *PISINAE.*

### **Hyastenus dicanthus** (de Haan).

1895. *Hyastenus dicanthus,* Alcock, *Journ. As. Soc. Bengal* LXIV, pp. 210, 211.

1924. *Halimus dicanthus,* Balss, *Arch. Naturgesch.* XC, Heft 5, p. 32.

A single male example of this somewhat common species is present in the Sandheads collections; it was collected by "Lady Fraser" in May, 1926. The carapace length, including the long rostral horns, is 36 mm., while the greatest breadth, inclusive of the epibranchial spines, is 24·5 mm. The specimen is probably immature.

The Sandheads example agrees closely with Alcock's description of the species, and with named examples in the Museum collection. The carapace, when denuded, is smooth and polished, but the tubercle on the gastric region is somewhat inconspicuous. Alcock has described this tubercle as acuminate, and most of the specimens in the Museum

[1] Chopra, *Rec. Ind. Mus.* XXXV, pp. 25, 26 (1933).

collection, including several young ones, have the tubercle more or less sharp and quite prominent. There is no spine on the intestinal region, but an inconspicuous thickening in the form of a low tubercle is present. In two large examples from Australia in the Museum collection there is a more or less distinct tubercle near the middle of the posterior border of the carapace. The chelipeds in the Sandheads example, as is the case in young males, are slender, and shorter than the carapace including rostrum. The abdomen consists of seven distinct segments, and is concave along the sides. On the second and third segments, especially the third, there are distinct convexities.

Besides specimens from Australia and the Chinese Sea, *H. dicanthus* is represented in the Indian Museum collection by examples from the Mergui Archipelago, Tavoy, the Andaman Islands, Orissa Coast and Ceylon. There is also a doubtful specimen from Bombay. The species has a very wide range of distribution over the Indo-Pacific area, occurring from New Zealand to the east coast of Africa [1]. In the north the species does not appear to extend beyond Japan.

*H. dicanthus* closely resembles *H. spinosus* A. Milne-Edwards [2], but the latter has always two spines on the gastric region, in addition to a spine on the intestinal region also. The specimen from Durban referred by Stebbing[3] to *H. dicanthus* resembles Milne-Edwards' species in these characters.

On the authority of Miss Rathbun[4] the generic name *Halimus* has been extensively employed in preference to *Hyastenus* White, but Calman[5] has shown that there is no justification for giving up White's name.

### **Doclea ovis** (Herbst).

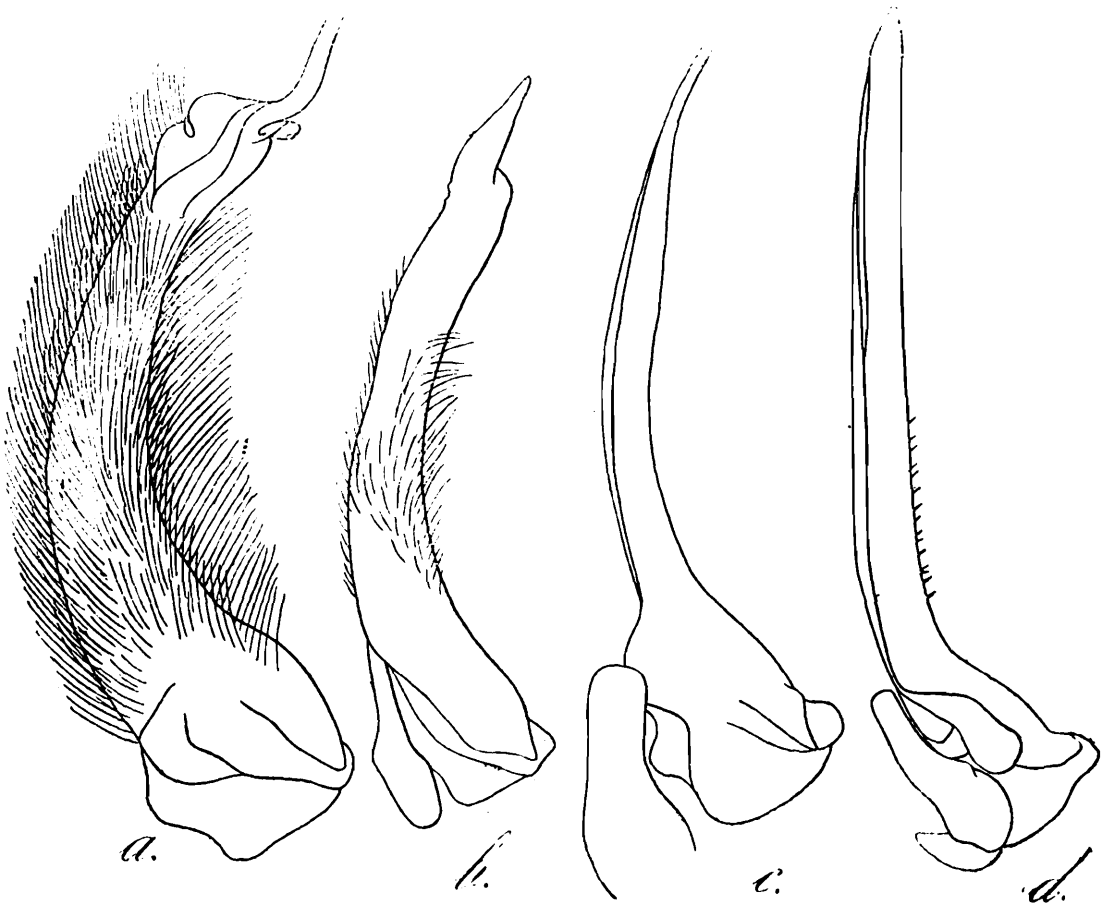
1895. *Doclea ovis* and var. *japonica*, Alcock, *Journ. As. Soc. Bengal* LXIV, pp. 227, 228.
1924. *Doclea canalifera*, Balss, *Arch. Naturgesch.* XC, Heft 5, p. 30 (*partim*).

In the Sandheads collection there are eleven specimens, four of which agree closely with the descriptions of *Doclea ovis*, four appear referable to de Haan's *Doclea japonica*, while the remaining three appear in certain characters to be intermediate between the two; these last I find difficult to refer with any degree of certainty either to the one or to the other. Alcock in considering *D. japonica* as a variety of *D. ovis* mentioned that the only difference between the two is in the presence, in de Haan's species, of an additional spine on the branchial region, and of a coarse spine or a blunt tooth just above the middle of the posterior border of the carapace. He pointed out, however, that in *D. ovis* also traces of tubercles are generally present in place of these spines. I have examined a large number of specimens of both these forms in our collection, and have found that in respect of the development of these tubercles or spines they can be arranged in a more or less regular series. Typically in *D. ovis* there are two spines on the antero-lateral margin (in addition

[1] Stebbing, *Ann. S. Afric. Mus.* VI, pp. 5, 6 (1908).
[2] A. Milne-Edwards, *Nouv. Arch. Mus. Paris* VIII, p. 250 (1872).
[3] Stebbing, *loc. cit.*, pp. 5, 6 (1908).
[4] Rathbun, *Proc. Biol. Soc. Washington* XI, p. 157 (1897).
[5] Calman, *Ann. Mag. Nat. Hist.* (8) XI, pp. 313, 314 (1913).

to the sub-hepatic), and posterior to these and on a higher level there is always a more or less blunt tubercle, which is only clearly seen on denuding the specimen. In some specimens this tubercle is quite large, and is sometimes even sharply pointed, more or less like a coarse spine. At the other end of the series are the specimens that are referable to *japonica ;* in these the tubercle is replaced by a distinct spine, as large or even larger than the two anterior spines. Similarly a tubercle on the posterior margin of the carapace is present in all our specimens of *D. ovis ;* in some it is low, while in others it is quite prominent and somewhat sharp. In specimens of *japonica* it is always more or less sharp.

In the three intermediate specimens from the Sandheads the tubercle on the posterior margin is fairly prominent, and in at least one of them is somewhat sharp. The last lateral spine is sharp in all the three examples ; in one it is like a large, sharply-pointed tubercle, while in the other two it is a well-formed spine differing from that of typical *japonica* only in its being shorter than the two anterior spines.




TEXT-FIG. 1.—Left anterior pleopod of male in *a. Doclea ovis* (Herbst) : ×5½, *b. Doclea canalifera* Stimpson : ×5½, *c. Doclea gracilipes* Stimpson : ×8, *d. Doclea tetraptera* Walker : ×9½.

A careful examination of our material has not revealed any other important difference between these two forms, and I am, therefore, of the opinion that de Haan's *D. japonica* is only a synonym of *D. ovis* (Herbst). The species is no doubt variable in the form of the third spine on the lateral border, and also to a certain extent, in that of the tubercle on the posterior border of the carapace.

I have carefully examined the anterior male appendages in a number of specimens of both the forms, and have failed to find any material difference between the two. In both the appendage is rather stout (text-fig. 1*a*) and is straight. There is a long, somewhat curved and forwardly-directed, finger-like process near the tip, and another somewhat rounded process, pointing outwards and somewhat forwards, on the outer margin just behind the tip. The outer margin is densely hairy and the terminal portion of the inner margin is hardened and chitinised. There are certain slight variations in the shape of the two processes, but these do not appear to be associated with the characters that are employed for distinguishing *ovis* from *japonica*.

Balss, probably on the authority of Miss Rathbun [1], has considered *Doclea japonica* as a synonym of *D. canalifera* Stimpson, but in the latter species the third lateral spine is very long and there is a long spine at the posterior margin.

*Doclea ovis* is represented in the Indian Museum collection by a number of specimens from Mergui, the Sandheads and the Orissa and Madras coasts. All the examples that have been called var. *japonica* are from the Sandheads.

The species has a wide range over the Indo-Pacific region.

### **Doclea canalifera** Stimpson.

1895. *Doclea canalifera*, Alcock, *Journ. As. Soc. Bengal* LXIV, p. 228.
1902. *Doclea canalifera*, Rathbun, *Proc. U. S. Nat. Mus. Washington* XXVI, p. 29 (*partim*).
1907. *Doclea canalifera*, Stimpson (Rathbun), *Smithsonian Misc. Coll.* XLIX, pp. 7, 8, pl. i, fig. 4.
1924. *Doclea canalifera*, Balss, *Arch. Naturgesch.* XC, Heft 5, p. 30 (*partim*).

In the Sandheads collection there are four specimens that I refer to Stimpson's *D. canalifera*. There are two males and two females, and except for one mutilated male, are all young.

As is clear from the descriptions of Alcock and Stimpson, the present species is characterised by the possession of a remarkably deep and well-defined pterygostomian canal, in addition to having long epibranchial and posterior spines. Some of the spines on the dorsal surface of the carapace are also long. *Doclea ovis* (with which is included *D. japonica*) is undoubtedly its nearest ally, but in this form the spines are greatly reduced and are generally replaced by tubercles.

Besides the three spines on the branchial border of the carapace, there is a largish spine on the pterygostomian region, another at the external angle of the buccal cavern, and the outer angle of the basal antennal joint is also spiniform. Between the antennal angle and the spine at the outer corner of the buccal cavern a very small spine is generally present, and a small blunt tubercle can be seen at the base of the pterygostomian spine also, between it and the tooth at the outer angle of the buccal cavern.

As remarked by Nobili [2], the rostral spines are much longer in the young than in older specimens, and their tips are also generally some-

[1] Rathbun, *Proc. U. S. Nat. Mus. Washington* XXVI, p. 29 (1902).
[2] Nobili, *Boll. Mus. Zool. Torino* XVIII, No. 455, p. 28 (1903).

what divergent. The dorsal spines are also generally longer in smaller examples.

The anterior abdominal appendages of the male (text-fig. 1*b*) are different from those of the preceding species. These are rather stout and more or less straight. The terminal part is in the form of a somewhat curved finger-like projection arising from one end of the truncate anterior margin.

I am unable to agree with Balss in considering Ortmann's *Doclea japonica* as a synonym of the present species. In *D. canalifera*, in addition to some other characters also, the epibranchial spines and the spine at the posterior border of the carapace are long and the spines on the gastric and the cardiac regions are well developed ; in *japonica* all these spines are greatly reduced. The anterior abdominal appendages of the male also are quite different in the two forms (see text-figs. 1*a* and 1*b*).

*D. canalifera* is fairly common at the Sandheads and has been recorded from this locality on a number of previous occasions also. Besides this locality, the species is represented in the Indian Museum collection by numerous small specimens from the Arakan and the Orissa coasts. Stimpson described the species from Hongkong, while Nobili [1] obtained it from Singapore and Miss Rathbun[2] from the Gulf of Siam. There are also some other records of the species from the eastern parts of the Indo-Pacific region, but that of Miss Rathbun (1902) from Japan is somewhat doubtful, as it is not clear whether her specimens were referable to *D. japonica* or to the present species.

## **Doclea gracilipes** Stimpson.

1895. *Doclea gracilipes*, Alcock, *Journ. As. Soc. Bengal* LXIV, pp. 229, 230.
1907. *Doclea gracilipes*, Stimpson (Rathbun), *Smithsonian Misc. Coll.* XLIX, pp. 6, 7, pl. i, fig. 1.

One young male specimen of this very variable species is in the present collection. It has a carapace length of about 32 mm. from the tip of the rostrum to the base of the long posterior spine. The specimen appears to be typical in every respect.

The anterior male appendages (text-fig. 1*c*) are more or less straight, there being only a slight bending about the middle. The distal half of the appendage is abruptly narrowed and the tip is sharply pointed.

Besides the present specimen, the species has already been recorded from the Sandheads. In the Indian Museum collection there are specimens from Hongkong, the Mergui Archipelago, the Andaman Islands, the Sandheads and the Orissa coast. Laurie [3] has recorded it from the Gulf of Manaar and the coast of Ceylon. The species was originally described from Hongkong.

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[1] Nobili, *Boll, Mus. Zool. Torino* XVIII, No. 455, p. 28 (1903).
[2] Rathbun, *Skrift. K. Dansk. Vidensk. Selsk. Copenhagen* (7) V, p. 318 (1910).
[3] Laurie, *Ceylon Pearl Oyster Fish. Rept.* V, p. 381 (1906).

## **Doclea tetraptera** Walker.

1895. *Doclea tetraptera*, Alcock, *Journ. As. Soc. Bengal* LXIV, pp. 231-233.

As pointed out by Alcock, the present species resembles very closely *Doclea calcitrapa* White [1], the most important difference between the two being that in White's species the legs are very much longer and somewhat more slender. The disposition of hairs on the legs is also different in the two species, and the palm of the male chela in White's species does not appear to be elegantly carinated on the lower border, as in the case of *D. tetraptera*. In most other characters, however, the two species appear to be very closely similar.

*D. tetraptera* is represented in the present Sandheads collection by four specimens, three females, of which two are ovigerous, and one young male. They agree in every respect with the published descriptions of the species, as also with the Indian Museum specimens named by Alcock. The disposition of the hairs on the walking legs and the chelipeds is very characteristic in this species. The chelipeds in the young male are very slender like those of the female, and the palm is not particularly inflated.

The anterior abdominal appendages of the male (text-fig. 1*d*) are straight and stout throughout, except right at the tip, where a sharp angle is formed. There are a few spinules on the basal part of the outer border.

The species does not grow to a large size, the largest male specimen in the Museum collection has its carapace, including the rostrum, but excluding the long posterior spine, about 46 mm. long, while the breadth, exclusive of the lateral spines, is 35 mm. A large egg-bearing female in the present collection is 40 mm. long and about 31 mm. broad.

The species appears to be fairly common at the Sandheads; all the specimens in the Museum collection, excepting one very young example [2] from the Gulf of Martaban, are from this locality. The species was originally described from Singapore, and has also been recorded from the Gulf of Siam by Miss Rathbun [3].

## **Phalangipus longipes** (Linn.).

1895. *Egeria arachnoides*, Alcock, *Journ. As. Soc. Bengal* LXIV, pp. 223, 224.

As pointed out by Miss Rathbun [4], Leach's generic name *Egeria* (or *Aegeria*, as it has been spelt by some of the earlier writers) cannot be employed in the Oxyrhyncha, as it has already been used in the Mollusca, as early as 1804-1805. The other names used for the forms included under *Egeria* Leach, *viz.*, *Leptopus* Lamarck and *Stenopus* Leach, are also preoccupied. Miss Rathbun has, therefore, revived, in a restricted sense, the composite name *Phalangipus*, which Latreille used in 1828[5] for *Libinia*, *Doclea* and *Egeria*—all genera of Leach 1815.

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[1] Adam and White, '*Samarang*' *Crust.*, p. 7, pl. i, fig. 2 (1848).

[2] This specimen differs in some minor characters from the larger examples, but is most probably referable to the present species.

[3] Rathbun, *Skrift. K. Dansk. Vidensk. Selsk. Copenhagen* (7) V, p. 318 (1910).

[4] Rathbun, *Proc. Biol Soc. Washington* XI, pp. 159, 160 (1897).

[5] According to Sherborn and Woodward [*Ann. Mag. Nat. Hist.* (7) XVII, p. 578 (1906)] the date of publication of this part of Latreille's work is 1828, and not 1825, as mentioned by Miss Rathbun and several other authors.

The two first-named of these genera are still valid, but *Egeria* being preoccupied, the use of *Phalangipus* in its place appears to be permissible under the operation of Art. 30 of the International Code (see also Opinion 9).

The pre-Linnean name *arachnoides* Rumphius 1711 must, according to the rules of zoological nomenclature, give place to the Linnean name *longipes*. *Egeria indica* Leach and *Egeria herbstii* Milne-Edwards appear to be only synonyms of *longipes*.

*Phalangipus longipes* appears to be a very common species at the Sandheads; in the present collection it is represented by 24 examples, 16 males and eight females, collected on eight different occasions between 1922 and 1932. All the females, except one young specimen, are ovigerous; most of the males also appear to be adult.

The Sandheads specimens agree closely with Alcock's excellent description, as also with our named material. As usual the abdomen in the male consists of seven distinct somites. The first segment has a prominent keel-like median projection posteriorly; the second and the third segments also have traces of similar projection, while the remaining segments, except the terminal, have a small thickening each in the middle line near the distal border. Besides these the third somite has two fairly large tubercles, one on each side near the lateral border. In the female the three basal segments have keel-like median projections, while the third has in addition two lateral projections. The composite segment 4-6 has two pairs of small projections on the sides near the base, one pair appearing to belong to the fourth and the other to the fifth somite.

An examination of a large number of specimens of both sexes in the Indian Museum collection has shown that the present species is very variable in the size and disposition of the spines on the dorsal surface of the carapace and, to some extent, in the length and proportion of the chelipeds and the last pair of walking legs.

The banding of the ambulatory legs in red, as mentioned by Alcock and de Man [1], is faintly visible in some of the Sandheads specimens.

*P. longipes* occurs quite commonly in the Indian waters. Besides specimens from Formosa and Hongkong, the species is represented in the Indian Museum collection by numerous examples from Mergui, Tenasserim coast, Nicobar Islands, Delta of the Irrawady, Chittagong coast, Sandheads, and from several localities off the Orissa and Madras coasts. There are no specimens from the western coast of the Indian Peninsula, or from any locality in the Arabian Sea.

The species has also been recorded from several other localities in the eastern parts of the Indo-Pacific region and from the Laccadives and Maldives by Borradaile [2].

A number of specimens have a few Cirripedes attached on the dorsal surface of the carapace, especially near the joints of the legs, and several in the older collection are infested with Rhizocephala.

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[1] De Man, *Vidensk. Medd. naturhist. Foren. Kobenhaven* LXXXVII, pp. 106-108 (1929).

[2] Borradaile, *Fauna Geog. Maldive and Laccadive Arch.* II, p. 688 (1903).

## Family PARTHENOPIDAE.

### **Lambrus (Platylambrus) prensor** Herbst.

1895. *Lambrus (Platylambrus) prensor*, Alcock, *Journ. As. Soc. Bengal* LXIV, pp. 262, 263.
1931. *Lambrus (Platylambrus) prensor*, Flipse, *Rijks Mus. Nat. Hist. Leiden* XIV, pp. 91-93.

This rather common Indian species is represented by seventeen examples in the present collection; out of these ten are males and seven females. Of the latter three are ovigerous, the largest of these being about 27 mm. broad across the carapace, excluding the lateral spines. The species appears to be very common at the Sandheads, and has already been collected there on a number of occasions.

The present specimens agree closely with the published descriptions of the species, as also with named examples in the Museum collection.

*L. (Platylambrus) prensor* is a fairly common species in the Indian waters. In the Indian Museum there are specimens from Penang, the Andaman Islands, the Arakan coast, the Sandheads and from a number of localities along the Orissa and Ganjam coasts.

Flipse gives the distribution of the species as Orissa coast, Yanaon (Madras coast), Singapore, Benkalis Island and Soerabai (Indian Archipelago). I have not been able to verify his record of the species from Ceylon [1]. The species lives in shallow waters only.

### **Cryptopodia angulata** Milne-Edwards & Lucas.

1895. *Cryptopodia angulata*, Alcock, *Journ. As. Soc. Bengal* LXIV, pp. 282, 283.

*C. angulata* appears to be fairly common at the Sandheads; there are in the present collection fourteen examples, seven males and seven females, collected between 1923 and 1932.

The present specimens agree fairly closely with the original description of the species by Milne-Edwards and Lucas [2], as also with Alcock's account of it. In some examples the triangular depression on the carapace is more or less shallow, while in others it is quite deep—almost as deep as described by Alcock for his variety *cippifer*.[3] The depression appears to be deeper in smaller specimens than in larger ones. Another character that Alcock mentioned for his variety is the presence of some sharp spines on the ridges that bound the triangular depression on the carapace. There are two spines close together side by side in the middle line in front, one at either branchial angle, and one in the middle line posteriorly, on the summit of the cardiac region. All these spines are very clearly seen in the six specimens on which Alcock based his variety. In most of the Sandheads examples the position of these spines is indicated by large or small tubercles, which, though mostly blunt, are somewhat sharp in a few cases. In one small individual the tubercles at the branchial angles are replaced by small spines, while at the anterior angle of the triangle there are small sharp tubercles.

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[1] Flipse, *Siboga Exped. Rep.* XXXIX C [2], p. 79 (1930).

[2] Milne-Edwards and Lucas, *Arch. Mus. Hist. Nat. Paris* II, pp. 481, 482, pl. xxviii, figs. 16-19 (1841).

[3] Alcock, *Journ. As. Soc. Bengal* LXIV, p. 283 (1895); *Ill. Zool. Investigator, Crust.*, pl. xxiii, fig. 4 (1897).

In no Sandheads specimen, however, is there a full complement of spines, or even sharp tubercles, that characterise the variety ; the spine on the posterior border of the depression, on the summit of the cardiac region, is invariably absent. The amount of granulation on the upper surface of the globular carpus of the chelipeds also appears to be variable ; in most examples the carpus is smooth, while in some the condition almost approaches that found in the variety *cippifer*.

As usual in the genus the abdomen in the male has only five distinct somites, segments 3-5 being more or less coalesced. Milne-Edwards and Lucas say that " l'abdomen offre sept segments distincts dans les deux sexes ", but this is obviously a mistake, so far as the males are concerned. The segments, except the terminal, are more or less keeled transversely in the middle, and there is a sharp upright spine on the sixth segment. There are also a few small, scattered tubercles on the composite segment 3-5 and on the sixth segment. In the female also the segments are keeled and some of them are sharply tuberculate.

*C. angulata* does not appear to be a common species in the Indian waters. Apart from the present specimens, it is represented in the Museum collection by a single specimen, collected by the Marine Survey, off Hanawar along the western coast of India, at a depth of 28 fathoms ; the correct identification of this specimen, as mentioned below, is far from certain. Alcock recorded the species from the Orissa coast also, but unfortunately the material on which this record is based cannot at present be traced in the collections.

The type-locality of the species is not known. Apart from this, *C. angulata*, as so far recorded, is restricted to the Indian waters only. According to Alcock it occurs along both the coasts of the Indian Peninsula, while his variety *cippifer* is known from Karachi only. The present record of the species from the Sandheads somewhat extends its range along the eastern coast. I have not been able to verify Flipse's [1] record of the species from Ceylon ; he also gives the distribution of the species as the Orissa and Malabar coasts.

The large male specimen from off Hanawar, as mentioned by Alcock, has the dorsal surface of the carapace and the chelipeds profusely granular, and their borders far more sharply toothed than is usually the case in this species. It is possible this specimen represents an undescribed species.

## Subtribe *BRACHYRHYNCHA*.

### Family PORTUNDIDAE.

### Subfamily *LUPINAE*.

**Neptunus (Neptunus) sanguinolentus** (Herbst).

1899. *Neptunus sanguinolentus*, Alcock, *Journ. As. Soc. Bengal* LXVIII, pp. 32, 33.

1922. *Neptunus (Neptunus) sanguinolentus*, Balss, *Arch. Naturgesch.* LXXXVIII, Heft 11, pp. 106, 107.

1925. *Neptunus sanguinolentus*, Delsman and de Man, *Treubia* VI, p. 310.

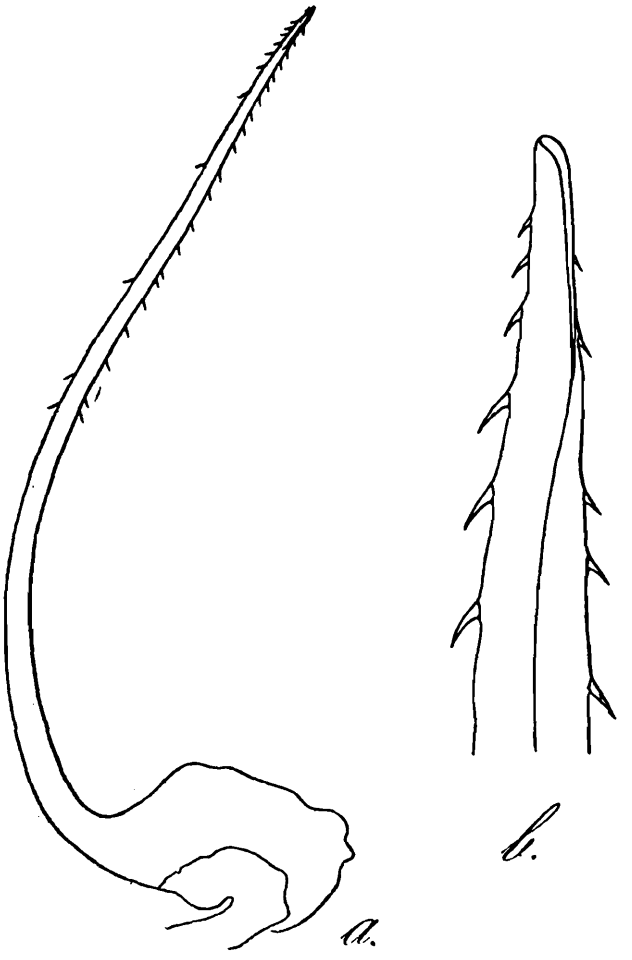
In the Sandheads collection there are twelve specimens that are referable to the present species ; of these nine are males and three females.

[1] Flipse, *Siboga Exped. Rep.* XXXIX C [2], pp. 78 and 82 (1930).

All the females are ovigerous. The largest male specimen is about 120 mm. broad across the carapace, including the large lateral spines, while the largest female has a corresponding breadth of 126 mm.

All the specimens agree closely with Alcock's description, as also with specimens named by him in the Indian Museum collection. In younger specimens, as is usually the case, the spines on the antero-lateral margins of the carapace are sharply pointed and are proportionately long; these tend to wear off with age, and in large examples are somewhat blunt and proportionately short.

The anterior male appendages are as shown in the accompanying text-figure. These are quite straight and have no sharp bend near the tip. The margins in the distal part are beset with somewhat stout spines.




TEXT-FIG. 2.—*Neptunus* (*Neptunus*) *sanguinolentus* (Herbst). *a*. First left pleopod of male: ×*ca*. 4. *b*. Tip of the same enlarged: × 32.

The three large red spots on the posterior part of the carapace are very characteristic of this species, and can generally be made out even in specimens that have long been preserved in spirit.

*N. sanguinolentus* occurs quite commonly in the Indian coastal waters. In the Museum collection there are specimens from Hongkong, the Andaman Islands, the mouth of the Hooghly river, several localities along the eastern coast of the Indian Peninsula, Ceylon, Malabar coast, Karachi and the Persian Gulf.

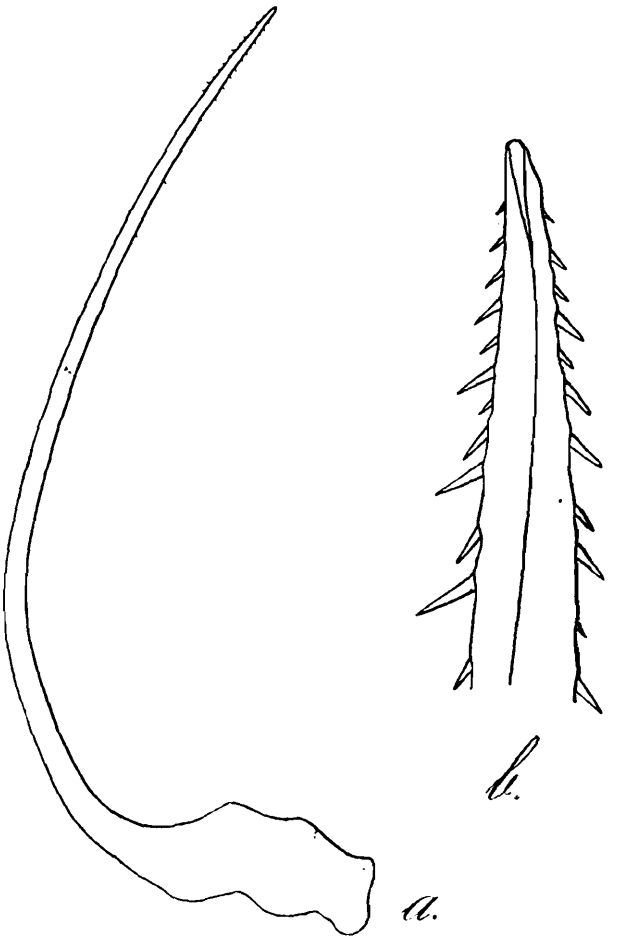
The species has a very extensive range over the Indo-Pacific region. Delsman and de Man give its distribution as : " Red Sea (Coast of Erythraea), Natal, Cape of Good Hope, Indian Ocean, Indian Archipelago, China Sea, Japan, Hawaiian Islands, East- and South-Australia"

De Man[1] has recorded the species from fresh waters of the Malay Archipelago also.

### Neptunus (Neptunus) pelagicus (Linn.).

1899. *Neptunus pelagicus,* Alcock, *Journ. As. Soc. Bengal* LXVIII, pp. 34, 35.
1922. *Neptunus (Neptunus) pelagicus,* Balss, *Arch. Naturgesch.* LXXXVIII, Heft II, p. 107.
1925. *Neptunus pelagicus,* Delsman and de Man, *Treubia* VI, pp. 309, 310.
1930. *Neptunus pelagicus,* Monod, *Zool. Anz.* XCII, p. 140.
1933. *Neptunus pelagicus,* Steinitz, *Publ. Stat. Zool. Napoli* XIII, p. 150.

Four specimens, three males and one female, are in the Sandheads collections. One young male has a carapace breadth (including the long lateral spines) of 89 mm. only, while the other two are 134 and 140 mm. broad respectively. The single female is non-ovigerous, and has an extreme breadth of the carapace of 123 mm.




TEXT-FIG. 3.—*Neptunus (Neptunus) pelagicus* (Linn.). *a.* First left pleopod of male : ×3. *b.* Tip of the same enlarged : ×32.

As is usual in the species the anterior border of the merus of the large cheliped is armed with three large spines, but in the female specimen in the present collection there are four large spines, in addition to a small one, on this border.

[1] De Man, *Abh. Senkenb. Natur. Ges. Frankfurt* XXV, p. 642 (1902).

All the specimens carry a few Lepadids on the dorsal surface of the posterior part of the carapace.

The anterior appendages of the male are more or less like those of the preceding species, though the distal part seems to carry a larger number of spines (text-fig. 3).

The general colouration of the species has been described by Alcock and several other writers. In two large freshly preserved males the general colour was observed to be pinkish-purple, with the tips of the chelae and the distal segments of the legs purple. The carapace was somewhat dirty-brownish, with the gastric region orange. There were extensive whitish spots on the carapace and legs. As remarked by Munro Fox [1], the females are not brilliantly coloured like the males, but are sand-coloured.

In the Indian Museum there is a large number of specimens of this species from several localities from Penang to the Persian Gulf.

Delsman and de Man give the distribution of the species as follows :—" Red Sea (Suez), Mediterranean (Port Said), Indian Ocean (Natal, Zanzibar, Mozambique, Madagascar, Coasts of India), Persian Gulf, Mergui Archipelago, Singapore, Indian Archipelago, Philippines, coasts of Australia (Port Jackson, Swan River, Shark Bay, Western Australia), New Zealand, New Caledonia, Tahiti, China Sea, Japan."

In 1924 Munro Fox [2] discussed the migration of this species through the Suez Canal into the Mediterranean Sea and opined that Haifa, on the coast of Palestine, was perhaps near the limit of its penetration to the north-east, while on the west the crab had definitely been reported from Mersa Matruth, a little over 500 kilometres from Port Said, where its presence was first noticed in 1898. Six years later Monod was able to show that the species had travelled up along the coasts of Palestine and Syria to the extreme point of the Gulf of Alexandretta, about 800 kilometres from Port Said. The further migration of this crab along the coast of Asia Minor on one side and along that of Egypt on the other is not known. Steinitz has also recorded this species from the Mediterranean.

### Neptunus (Hellenus) hastoides (Fabr.).

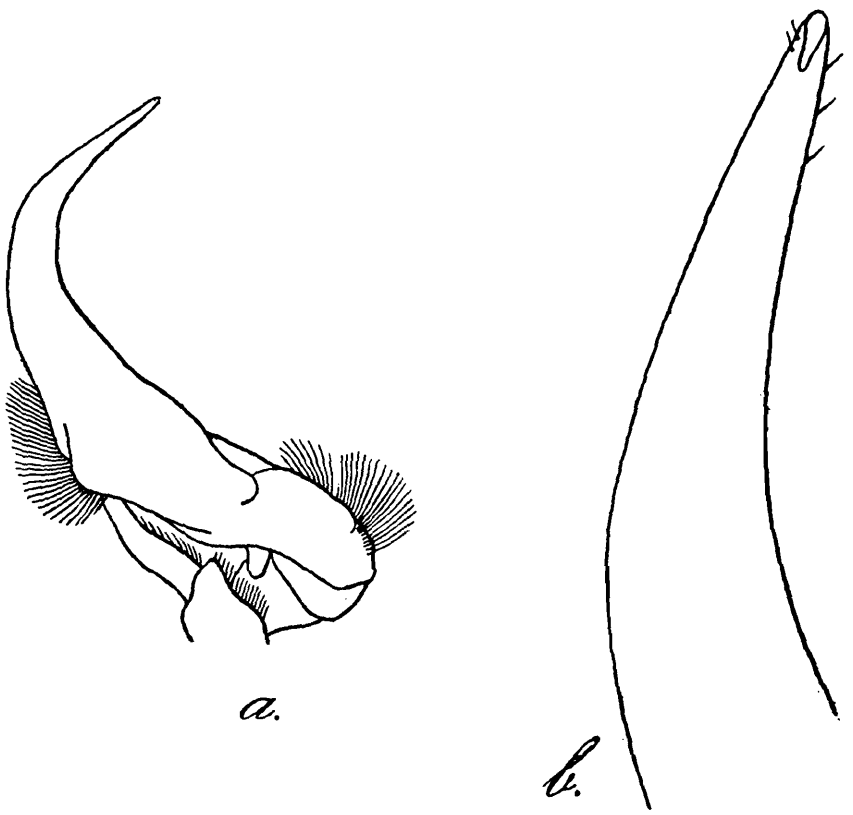
1899. *Neptunus (Hellenus) hastoides,* Alcock, *Journ. As. Soc. Bengal* LXVIII, pp. 38, 39.
1922. *Neptunus (Hellenus) hastoides,* Balss, *Arch. Naturgesch.* LXXXVIII, Heft 11, *p.* 108.

The present species is represented by four specimens in the Sandheads collection ; out of these three are males, ranging from 35 mm. to 37 mm. in the extreme breadth of the carapace (including the long epibranchial spines), while the single female, which is apparently young, is 34 mm. across the carapace. According to Alcock in egg-bearing females the carapace, including the spines, is 42 mm. broad.

The first abdominal appendage of the male is rather short, and, as illustrated in the accompanying text-figure, is considerably curved a little behind the tip. There are very few hairs on the distal part.

[1] Munro Fox, *Trans. Zool. Soc. London* XXII, p. 217 (1927).
[2] Munro Fox, *Nature* CXIII, pp. 714, 715 (1924); also *Trans. Zool. Soc. London* XXII, p. 217 (1927).

The blackish-brown mark on the tip of the dactylus of the last pair of legs seems to be a constant feature of this species, and can be made out even in examples that have long been preserved in spirit.




TEXT-FIG. 4.—*Neptunus* (*Hellenus*) *hastoides* (Fabr.). *a*. First left pleopod of male, with part of the second pleopod, seen near the base: ×*ca.* 9. *b*. Tip of the first pleopod enlarged: ×*ca.* 46.

*N. hastoides* is frequently met with at the Sandheads, for besides the present specimens the species has already been recorded from this locality on a number of previous occasions. It occurs quite commonly along the eastern coast of India from the Sandheads to the Palk Straits, and has been recorded by Laurie [1] from the coasts of Ceylon also. In addition there are specimens in the Museum collection from Hongkong, the Andaman Islands, Gulf of Martaban and the Persian Gulf. Most of the specimens have been collected in shallow waters, though some from the Bay of Bengal, off the Orissa coast, are from a depth of 31 fathoms.

Balss gives the distribution of the species as: "Japan, Kobi, Tokiobai, Tanagawa, Wakanuura, Nagasaki, Hongkong, Malakka, Singapore, Penang, Neu-Guinea, Ceylon, Andamanen, Laccadiven, Vorderindien, Zanzibar."

It is difficult to say whether Laurie's variety *unidens*, based on a single incomplete specimen, is referable to the present species or not. The character of the frontal teeth, on which the variety is primarily based, shows such fundamental difference from the typical species that the possibility of Laurie's specimen being abnormal cannot be overlooked.

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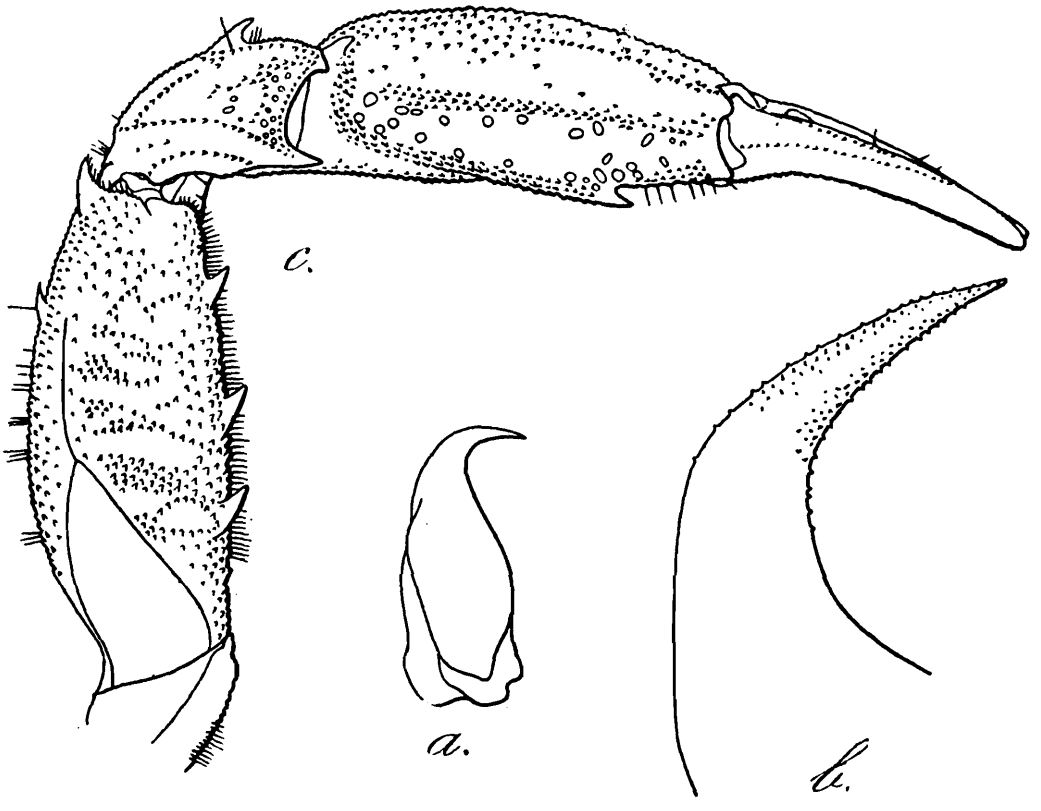
[1] Laurie, *Ceylon Pearl Oyster Fish. Rep.* V, p. 414 (1906).

**Neptunus (Hellenus) pulchricristatus** Gordon.

1899. *Neptunus* (*Hellenus*) *spinipes*, Alcock, *Journ. As. Soc. Bengal* LXVIII, pp. 39, 40 [*nec* 1886, *N. spinipes*, Miers, *Challenger Brachyura* (*Zool.* XVII), p. 178, pl. xv, fig. 1].

1931. *Neptunus* (*Hellenus*) *pulchricristatus*, Gordon, *Journ. Linn. Soc. London* (*Zool.*) XXXVII, p. 534.

On comparing specimens of Alcock's *N. spinipes* with the Challenger type-specimens of the species preserved in the British Museum, Miss Gordon came to the conclusion that the two were not identical and that the former required a new name. An examination of a large number of specimens referred by Alcock to Miers' species has fully justified Miss Gordon's conclusions. The last pair of spines on the antero-lateral borders are very much longer in the Indian examples, so that the carapace breadth, including the spines, is generally not less than 2·3[1] times the carapace length, and in some cases is as much as 2·6 times; in Miers' species, as stated by Miss Gordon, it is always less than two times. The antero-lateral borders are not sharply dentiform in the Indian material, there being eight blunt lobes (some of which are obsolete) in front of the large lateral spines; in the Challenger specimens there are distinct teeth. In many of our specimens, however, the lobes are considerably more distinctly separated from one another than shown




TEXT-FIG. 5.—*Neptunus* (*Hellenus*) *pulchricristatus* Gordon. *a*. First left pleopod of male : ×9. *b*. Tip of the same enlarged : ×45. *c*. Left cheliped of male, upper and somewhat inner view : ×*ca*. 5.

in Miss Gordon's figure. In the true *spinipes*, as stated by Miers and Miss Gordon, the postero-lateral angles are never spiniform; in Alcock's specimens the posterior border forms "an acutely dentiform angle of junction" with the postero-lateral border. In many of the Indian

[1] In some Persian Gulf examples (*vide infra*) the carapace breadth is a little less than 2·3 times the carapace length.

specimens there is a distinct, sharp spine at this junction, even better developed than shown in Miss Gordon's figure. The second and third abdominal terga in both sexes have their crests " elegantly denticulated " in all the Indian examples ; in Miers' species, though these crests are better developed, the beading or denticulation is said to be more or less absent. The anterior abdominal appendages of the male, as shown by Miss Gordon, are also different in the two species. I give here a figure of one of these appendages as seen in a large male specimen identified by Alcock as *N. spinipes*. These appendages are short and stout, except near the tip, where they are sharply bent. The terminal part is sharply pointed and is beset with very minute spines, more or less arranged in rows.

Another point of difference between the two species, not mentioned by Miss Gordon, refers to the number of teeth on the palm of the chelipeds. Miers[1] has described two spines on " the supro-internal margin (whereof the distal one is small and placed just above the dactyl), and one at the base near the articulation with the wrist," and his figure, (Plate xv, fig. 1*b*) shows the two anterior spines very distinctly. In the Indian Museum material there is only one spine (text-fig. 5*c*) at the distal end of the palm corresponding to the second spine of Miers' figure, the first spine (" just above the dactyl ") being altogether absent. The supro-internal angle is sometimes a little acute, but there is never anything like the spine shown in Miers' figure.

There are four specimens of the present species in the Sandheads collection, collected on three occasions between January and March, 1923. They are all males, having a carapace length ranging between 17 and 22 mm. They agree in every respect with Alcock's and Miss Gordon's descriptions of the species, as also with named material in the Museum collection. The species does not appear to be very common at the Sandheads, and is being recorded from this locality for the first time.

*N. pulchricristatus* is known from several localities along the eastern coast of India ; there are also specimens in the Museum collection from the Andamans, the Delta of the Irrawady, off the Akyab coast, the Gulf of Oman and the Persian Gulf. In the Indian waters the species has not been recorded from depths exceeding 35 fathoms, but the Persian Gulf specimens were dredged from depths ranging from 35 to 49 fathoms.

The species has a very wide range over the Indo-Pacific area, being known from localities as far apart as Hongkong and the Persian Gulf. Laurie[2] recorded *N. spinipes* from Galle on the Ceylon coast and also referred Henderson's[3] specimens of *N. andersoni* from the Gulf of Martaban to this species. Laurie had, however, compared his material with the Challenger types in the British Museum, and it is, therefore, likely that his specimens are referable to Miers' species, rather than to the present one.

Some of the Persian Gulf specimens in our collection differ from others in a few minor characters. The lateral spines are somewhat proportionately shorter, so that the carapace breadth (including the spines)

[1] Miers, *Challenger Brachyura* (*Zool.* XVII), p. 178, pl. xv, fig. 1 (1886).
[2] Laurie, *Ceylon Pearl Oyster Fish. Rept.* V, p. 415 (1906).
[3] Henderson, *Trans. Linn. Soc. London* (*Zool.*) V, pp. 368, 369 (1893).

is sometimes only 2·1 times the carapace length, and in no Persian Gulf example has it been found to be more than 2·4 times. The lobes on the antero-lateral borders in some examples are also a little more dentiform than is generally the case, though they are never like the well-formed teeth of *N. spinipes*. The postero-lateral angles are generally spiniform, but in some specimens they are a little less pronounced. The eyes in all the Persian Gulf specimens have a distinct reddish tint; in the material from other localities they are of the colour of dark slate, almost verging to black. In every other particular, however, these specimens agree so closely with the Indian examples of the species named by Alcock, that in my opinion there cannot be any doubt about their specific identity.

**Neptunus (Lupocycloporus) gracilimanus** (Stimpson).

1858. *Amphitrite gracilimanus*, Stimpson, *Proc. Acad. Nat. Sci. Philadelphia* X, p. 38; also 1907. *Smithonian Misc. Coll.* XLIX, p. 77, pl. x, fig. 3.
1899. *Neptunus* (*Lupocycloporus*) *whitei*, Alcock, *Journ. As. Soc. Bengal* LXVIII, pp. 44, 45 (*nec Neptunus gracilimanus*[1] Alcock, *loc. cit.*, p. 45).
1922. *Neptunus* (*Lupocycloporus*) *gracilimanus*, Balss, *Arch. Naturgesch.* LXXXVIII, Heft 11, p. 108.

Though it was no doubt somewhat difficult to recognise adequately this species from the brief Latin diagnosis published by Stimpson in 1858, the publication, by Miss Rathbun in 1907, of Stimpson's fuller description and illustration makes it abundantly clear that the form described by A. Milne-Edwards[2] in 1861 under the name of *Achelous whitei* is the same which Stimpson had diagnosed three years earlier as *Amphitrite gracilimanus*. Stimpson's later description corresponds almost exactly with that of Milne-Edwards, and applies fairly well to his figure also. The lateral spine in Milne-Edwards' figure is shown as somewhat shorter than in Stimpson's, but, as hinted by Henderson[3], this character is probably variable to a certain extent. The only other difference between the two is that Stimpson does not mention the presence of a short spine on the posterior border of the merus of the last pair of legs, and it is difficult to say whether this spine is shown in his figure or not; it is, however, always present in this species.

I refer to the present species five examples collected at the Sandheads on three occasions in 1923. Of these there are three males, the largest having a carapace length of 25 mm., and a breadth (including the spines) of 48 mm., and two non-ovigerous females, the larger of the two having its carapace 15 mm. long and 28 mm. broad. The species has also been previously recorded from this locality.

All the Sandheads specimens agree closely with the descriptions given by Stimpson, Milne-Edwards and Alcock. The fine pearly granules on the arms, the costae on the wrists and palms of the chelipeds, and a few scattered ones on the carapace are constant features of the species.

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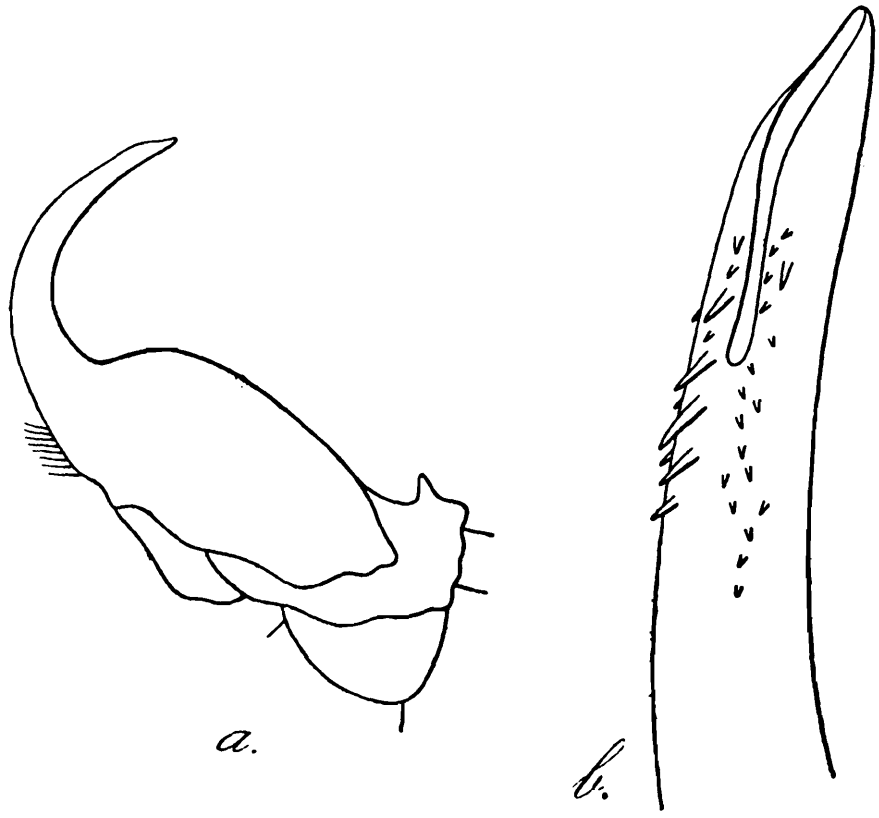
[1] As stated by Alcock, the form described by him as *gracilimanus* is quite distinct from *whitei*, and Miss Rathbun has proposed the name of *innominatus* for it [*Proc. Biol. Soc. Washington* XXII, p. 114 (1909)]. I have also examined the specimens that Alcock called *gracilimanus*, and am of the opinion that they cannot be referred to any of the known species of *Neptunus* (*Lupocycloporus*).

[2] Milne-Edwards, *Arch. Mus. Nat. Hist. Paris* X, p. 343, pl. xxxi, fig. 6 (1861).

[3] Henderson, *Trans. Linn. Soc. London* (*Zool.*) V, p. 371 (1893).

The merus of the external maxillipeds has its antero-external angles pronounced.

The anterior abdominal appendages of the male are figured in the accompanying illustration. They are superficially like those of the two preceding species of *Neptunus* (*Hellenus*), but the terminal portion is longer and is more sharply bent. The minute spines near the tip are also differently arranged.




TEXT-FIG. 6.—*Neptunus* (*Lupocycloporus*) *gracilimanus* (Stimpson). *a*. Anterior left pleopod of male : × 9. *b*. Tip of the same enlarged : × 47.

*N. gracilimanus* is recorded from the Indian waters from Port Blair in the Andaman Islands, the Sandheads, Balasore Bay and Chilka, Bight on the Orissa coast, and the Palk Straits between India and Ceylon ; Henderson recorded the species from the Gulf of Martaban, while Laurie[1] examined specimens from the Gulf of Manaar and off Mutwal Island.

The present species has a very wide range of distribution over the Indo-Pacific area, having been recorded from several localities from the south of New Guinea to the eastern coast of India. It was originally described by Stimpson from Hongkong, while the material on which Milne-Edwards based his *Achelous whitei* was obtained from the coasts of Borneo.

### **Charybdis (Goniosoma) cruciatus** (Herbst).

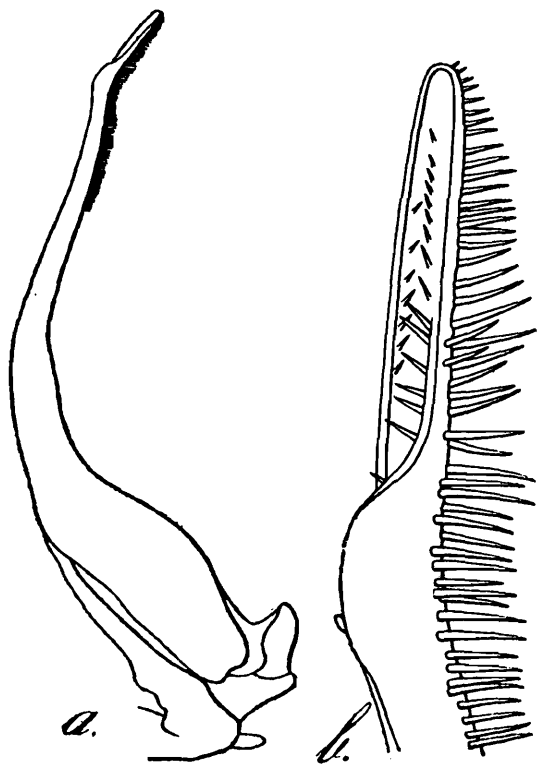
1899. *Charybdis* (*Goniosoma*) *crucifera*, Alcock, *Journ. As. Soc. Bengal* LXVIII, pp. 51-53.
1922. *Charybdis crucifera*, Balss, *Arch. Naturgesch.* LXXXVIII, Heft 11, p. 104.
1925. *Charybdis* (*Goniosoma*) *cruciatus*, Delsman and de Man, *Treubia* VI, pp. 311, 312.

This is one of the commonest species of the family Portunidae found at the Sandheads. In the present collection there are 10 male specimens

[1] Laurie, *Ceylon Pearl Oyster Fish. Rep.* V, p. 416 (1906).

(seven of which are of a large size), besides a number of non-ovigerous females and young examples.

For purposes of comparison with other species of the genus I give here a figure of the anterior abdominal appendages of the male. These are more or less straight, with the tip bluntly pointed. There is a thick fringe of longish hairs on the distal part of the outer margin and a few short scattered hairs on the upper surface also.




TEXT-FIG. 7.—*Charybdis* (*Goniosoma*) *cruciatus* (Herbst.) *a*. Left anterior pleopod of male : × 2½. *b*. Tip of the same enlarged : × 16½.

One young female in the Sandheads collection, though apparently referable to the present species, shows some unusual characters. The first lobe on the antero-lateral margin of the carapace is only very faintly notched ; the teeth of the outermost pair on the frontal margin are distinctly narrower and less bluntly pointed than those of the other two pairs, as is sometimes the case in very young examples ; the arm of the cheliped on one side of the body bears four large spines on its anterior border (on the other side there are only three, as is normally the case in this species) ; there are four minute spinules on the posterior border of the propodus of the last pair of legs (these are clearly seen on the leg of one side only) ; and lastly all the four spines on the dorsal surface of the palm are sharply pointed, as is sometimes the case in very young individuals.

One large male specimen has its abdomen shaped somewhat like that of a young female, though the male appendages appear to be normally developed ; this is no doubt due to the presence of a Rhizocephalan parasite, that is seen attached on the under side of the abdomen.

*Charybdis cruciatus* is a very common species in the Indian waters, occurring extensively both in the Bay of Bengal and the Arabian Sea. Delsman and de Man give its distribution as : " Indian Ocean, South Africa (Port Alfred), Indian Archipelago, China Sea, Japan, Australia."

**Charybdis (Goniosoma) merguiensis** (de Man).

1899. *Charybdis (Goniosoma) merguiensis*, Alcock, *Journ. As. Soc. Bengal* LXVIII, pp. 55, 56.
1930. *Charybdis (Goniosoma) merguiensis*, Monod, *Zool. Anz.* XCII, p. 140.
1933. *Charybdis merguiensis*, Steinitz, *Publ. Stat. Zool. Napoli* XIII, pp. 151, 152.

I refer to this species one large female ovigerous specimen collected at the Sandheads in January, 1928, along with some examples of the preceding species. The present specimen agrees closely with de Man's[1] excellent and detailed description of the species, as also with the numerous Indian Museum examples named by Alcock. The Sandheads specimen has a carapace length of 37 mm. and a breadth of 64 mm., as measured between the tips of the last antero-lateral spines.

The proportion between the carapace length and its extreme breadth seems to differ considerably in the two sexes. According to de Man the proportion between the carapace breadth measured from tip to tip of the last antero-lateral spines to its length is as 21:13, or in other words, the length is contained 1·61 times in the total breadth ; according to Alcock this figure is roughly 1·50. In the Indian Museum collection I find that in large males (carapace length 38-45 mm.) the length of the carapace is contained 1·53 to 1·56 times in the breadth, and even in smaller individuals of this sex the proportion is about the same. There are no ovigerous females in the Museum collection, but in specimens 28-32 mm. long the proportion between length and breadth varies between 1·62 and 1·67. In the Sandheads specimen, an ovigerous female, this figure is about 1·73 and in de Man's figure of the species, which is that of a female, the proportion is about the same. It is thus seen that size for size females are proportionately broader than males ; in males the length is about two-thirds the greatest breadth, while in large females it is almost four-sevenths.

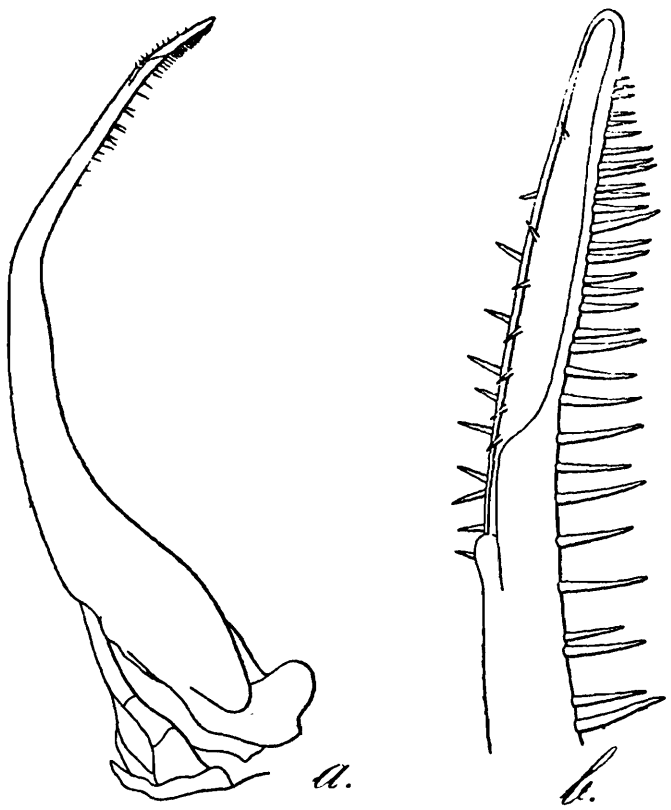
As mentioned by de Man the shape of the frontal teeth varies considerably with age ; the smaller examples in the Museum collection bring out this point very clearly. The merus of the external maxilliped has a prominent expansion of its antero-external angle. The spine on the posterior border of the carpus of the last pair of legs is a characteristic feature of the species.

Monod and Steinitz have both referred to the presence of a strongly-arched " Querlinie " behind the front, and Monod has shown its exact position in his figure of the species. In the large number of specimens in the Indian Museum that I have examined I find that in the material from the Persian Gulf this " line " is strongly indicated as a somewhat shallow groove, fringed with a thick short pile on its edges and running almost exactly as shown in Monod's figure. The specimens from the other localities are much less hairy than those from the Persian Gulf and though the groove is faintly indicated in the identical position it is very inconspicuous on account of lack of fur on its edges. The dark red spots on the carapace mentioned by Monod and shown in his figure are not visible in any of the older Indian specimens, but in the example from the Sandheads they can be made out more or less clearly. These

[1] De Man, *Journ. Linn. Soc. London (Zool.)* XXII, pp. 82-88, pl. v, figs. 3, 4 (1887).

spots no doubt become faint and obliterated in specimens that have long been preserved in spirit. The Persian Gulf examples have the sternum of the abdomen and the hands finely hairy, as described by Steinitz for his specimens from the Palestine coast.

The anterior male abdominal appendages are of the same type as in the preceding species, but the outer margin and the upper surface appears to be somewhat less hairy. The inner margin in its distal part is also beset with hairs, and is notched off in a small rounded lobe a little way behind the tip. In the Persian Gulf specimens, which, in addition to being more hairy than those from the other localities, show one or two




TEXT-FIG. 8.—*Charybdis* (*Goniosoma*) *merguiensis* (de Man). *a*. Left anterior pleopod of male :× 5. *b*. Tip of the same enlarged :× 31.

other minor differences also, the male appendages are quite similar to those in examples from the more eastern parts of the Indo-Pacific region.

The tips of all the teeth on the antero-lateral borders, of all the spines on the chelipeds, and of the two spines (one on the merus and the other on the carpus) on the last legs are of a dark brown colour, even in specimens that have long been preserved in spirit. The distal portions of the fingers and their inner margins are also of the same colour.

The species is represented in the Indian Museum collection by specimens from Hongkong, Singapore, Mergui Archipelago, Andaman Islands, Karachi and the Persian Gulf. Monod and Steinitz have recorded it from the coasts of Palestine in the Mediterranean. *C. merguiensis* appears to be one of the few species that, with the opening of the Suez Canal, have been able to penetrate into the Mediterranean Sea. Unlike *Neptunus pelagicus* (*vide supra* p. 477) the present species does not appear to have beome very common in the eastern parts of Mediterranean so far, but, as remarked by Steinitz, the presence of young individuals along the coast of Palestine, shows that it is getting firmly

established there. The range of the species, as at present known, is, therefore, from Hongkong to the coast of Palestine in the Mediterranean.

The present is the first record of the species from the eastern coast of the Indian Peninsula.

### **Charybdis (Goniosoma) miles** (de Haan).

1899. *Charybdis* (*Goniosoma*) *miles*, Alcock, *Journ. As. Soc. Bengal* LXVIII, pp. 62, 63.

In the Sandheads collection there are three examples referable to the present species; these are registered as under :—

| | | | |
|---|---|---|---|
| C 1767/1 | Sandheads, off the mouth of the Hooghly River. | "Fraser" 22nd March, 1923. | 2 ♀♀, non-ovigerous. |
| C 1768/1 | Ditto. | "Lady Fraser" May 1928. | 1 ♂, carapace length 35 mm. |

Of the two females, one has a carapace length of 18·5 mm., while the other is a very immature specimen, having its carapace about 11 mm. long only.

The length of the carapace in the present examples, as also in the three specimens already in the Indian Museum collection, is slightly less than three-fourths of its extreme breadth (ranging from 0·68 to 0·72). A very characteristic feature of the present species is that the orbits show a considerable dorsal inclination, and their greatest diameter (a distance in a straight line measured between the tips of the supra-internal and supra-external orbital teeth of one side) is about half of the frontal breadth or the distance between the orbits (measured between the tips of the two inner supra-orbital teeth). In this respect it is seen that in the young example from the Sandheads that I have examined (text-fig. 9*a*) the front is proportionately narrower, so that the greatest diameter of the orbit, measured as indicated above, is considerably more than half of the frontal breadth. It should also be noticed that in de Haan's[1] figure of the species the distance between the orbits is considerably more than twice their greatest diameter.

As remarked by de Man[2] in the case of *Charybdis merguiensis*, I have noticed in the present species also that in very young specimens the frontal teeth are blunt and rounded, and that they assume the shape characteristic of this species only when the individual grows in size. In the small Sandheads specimen referred to above the median teeth are only bluntly rounded lobes, separated from one another by a somewhat deep incision. The teeth of the next pair are not sharply separated off from those of the median pair; these are separated from the sub-median teeth by deep and broad incisions. The inner supra-orbital angles are barely noticeable; they are in the form of broad lobes, hardly separated off either from the upper orbital border or from the front proper. The outer supra-orbital angle, or the first tooth of the antero-lateral border, is a large broad tooth faintly notched in the middle and with its anterior angle sharply acute.

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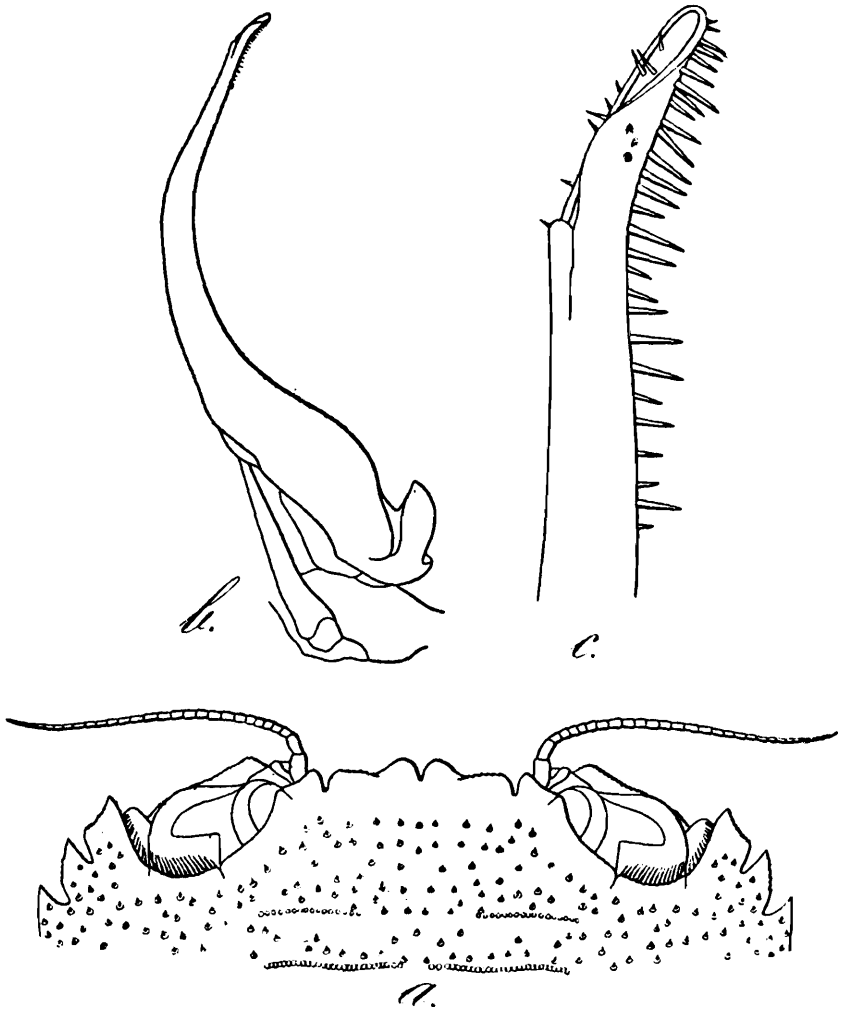
[1] De Haan, *Faun. Japon. Crust.* p. 41, pl. xi, fig. 1 (1835).

[2] De Man, *Journ. Linn. Soc. London* (*Zool.*) XXII, pp. 84, 85 (1887).

The anterior male appendages are as illustrated in the accompanying text-fig. 9*b* and *c*. They have a general resemblance to those of *C. merguiensis*, but the inner margin is less hairy, and the rounded lobe on this margin is somewhat nearer to the tip.




TEXT-FIG. 9.—*Charybdis* (*Goniosoma*) *miles* (de Haan). *a*. Fronto-orbital region of a young female from the Sandheads, with a carapace length of about 11 mm.: × 5. *b*. Left anterior pleopod of male : × 5. *c*. Tip of the same enlarged : × 31.

Alcock has described the colour of the species in life. A specimen collected in the Gulf of Martaban after the publication of Alcock's work has the following note on its colouration : " Reddish brown on dorsum, with white spots ¼ inch from posterior (?) antral angles. Points of clippers vermilion red. Ventrum white and pinkish in parts."

In Indian waters the species was so far collected in the Gulf of Martaban only at a depth of 53-67 fathoms. The present specimens are from much shallower waters (about 20 fathoms).

Parisi[1] gives the distribution of the species as : Japan, Sagami Bay, Kii, Honkong and Gulf of Martaban. The present record from the Sandheads only slightly extends the range of the species westwards. *C. miles* is thus so far known to be restricted to the eastern part of the Indo-Pacific area only.

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[1] Parisi, *Atti. Soc. Ital. Sci. Nat.* LV, p. 175 (1916).

**Charybdis (Goniosoma) variegata** (de Haan).

1899. *Charybdis (Gonoisoma) variegata*, Alcock, *Journ. As. Soc. Bengal* LXVIII, pp. 60, 61.
1922. *Charybdis variegata*, Balss, *Arch. Naturgesch.* LXXXVIII, Heft 11, pp. 104, 105 (*partim*).

Balss has expressed the opinion that the form described by Miers[1] as *Goniosoma variegatum*, var. *bimaculatum*, which Alcock[2] considered as a distinct species of the subgenus *Gonioneptunus* of the genus *Charybdis*, is referable to the *forma typica*. He believes that the chief character on which Alcock separated the species *bimaculata*, namely the inclusion of the antennal flagellum in the orbital hiatus, on account of the lobular projection at the outer angle of the basal antennal joint not touching the front, is only a feature of young specimens in the genus *Charybdis*. With this view I can express only partial agreement, for in some young examples that I have seen the flagellum is almost totally excluded from the orbit. In the Indian Museum collection, in addition to the two young specimens that Alcock referred to Miers' *bimaculata*, there is one of the *Challenger* duplicates. This is a large male specimen and even in this the lobular projection of the basal antennal joint does not touch the front, so that the flagellum clearly lies in the upper part of the orbital hiatus. In addition there are some other characters also, which Balss seems to have overlooked, in which *C. bimaculata* differs from the present species. The broad tooth on the lobule at the outer angle of the basal antennal joint, so characteristic of *C. variegata*, is not represented in Miers' species. The junction formed between the posterior and the postero-lateral borders of the carapace is more angular in *bimaculata* than in de Haan's species; there is a distinct terminal spine on the posterior border of the arm, which is totally absent in *C. variegata*; and the sixth segment of the male abdomen has a totally different shape in the two species. There are other differences also, but those mentioned above are sufficient to show that *C. bimaculata* (Miers) is a distinct species, as Alcock considered it, and cannot be regarded as a synonym of *C. variegata*, as suggested by Balss.

I refer to the present species two specimens, a large male and a very young female, from the Sandheads collection. They agree in every respect with the named material in the Museum collection.

The carapace is proportionately broad in the present species, the length being a little over half to about four-sevenths of the extreme breadth. The frontal teeth, especially those of the two middle pairs, are considerably more blunt in young individual than in grown up specimens.

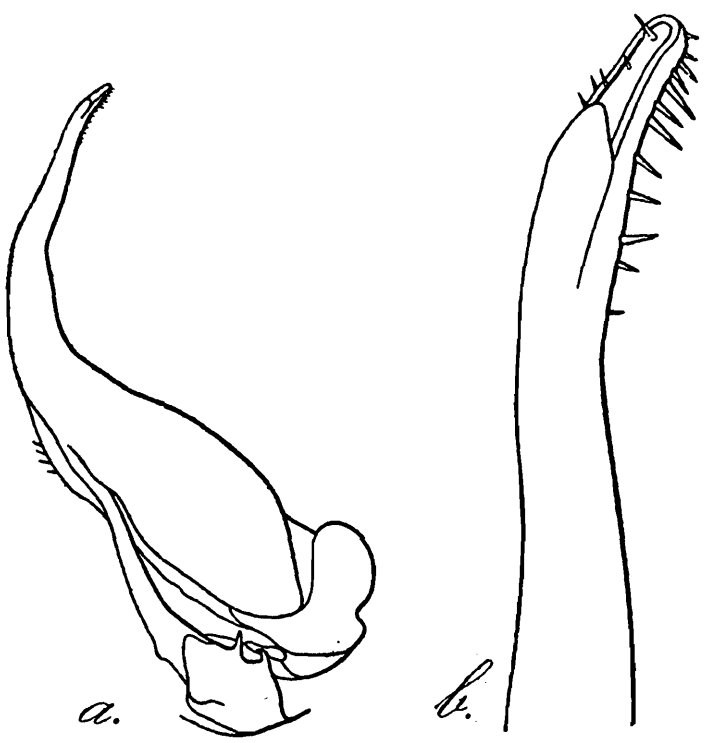
The eyes have a strong dorsal inclination, and the greatest diameter of the orbit, *i.e.*, the distance between the tips of the outer and inner supra-orbital teeth of one side, is half (or even a little more than half) of the inter-orbital space, or the distance between the tips of the two inner supra-orbital teeth. Alcock has mentioned this distance as about two-fifths, but in a number of specimens that I have measured for this

[1] Miers, *Challenger Brachyura* (*Zool.* XVII), p. 191, pl. xv, fig. 3 (1886).
[2] Alcock, *Journ. As. Soc. Bengal* LXVIII, pp. 69, 70 (1899).

purpose I have found it to vary from ·48 to ·55. In young individuals the orbits are slightly larger proportionately.

The large, broad tooth on the lobule at the outer angle of the basal antennal joint is a very characteristic feature of this species, which, according to Alcock, is not shared by any other Indian species of the genus.

The anterior abdominal appendages of the male, as seen in text-fig. 10, are only slightly different from those of the three preceding species. The distal part of the outer margin is sparsely clad with hairs and there is no distinct lobule on the inner margin behind the tip.




Text-fig. 10.—*Charybdis* (*Goniosoma*) *variegata* (de Haan). *a*. Left anterior pleopod of male : × *ca.* 8. *b*. Tip of the same enlarged : ×45.

*Charybdis variegata* is represented in the Indian Museum collection by numerous specimens from Nagasaki, Hongkong, the Ganjam and Madras coast, the Palk Strait and the Persian Gulf. Balss has mentioned the Red Sea also as one of the localities from which the species has been recorded. *C. variegata* has thus a wide range over the Indo-Pacific region, occurring from Japan to the Red Sea.

### **Charybdis (Goniosoma) callianassa** (Herbst).

(Plate IX, fig 1.)

1899. *Charybdis* (*Goniosoma*) *callianassa*, Alcock, *Journ. As. Soc. Bengal* LXVIII, pp. 57-59.

1925. *Charybdis* (*Goniosoma*) *callianassa*, de Man, *Treubia* VI, pp. 324-326.

The two specimens from Sumatra referred to the present species by de Man agree fairly closely with the descriptions of the species by Alcock and A. Milne-Edwards,[1] as also with our named material. There are, however, two points in which, as pointed out by de Man, the

[1] A. Milne-Edwards, *Arch. Mus. Hist. Nat. Paris* X, pp. 382, 383 (1861).

Sumatran examples differ from typical examples from the Indian waters. A faintly marked granular ridge is always present on the cardiac region of the carapace in the Indian specimens; in de Man's examples it is said to be totally absent, although the cardiac region itself is convex. The second point of difference refers to the spines on the wrist of the cheliped. Both Milne-Edwards and Alcock have described the wrist as having a large spine on the inner angle and three spinules at the outer angle. In de Man's specimens there are only two spinules at the outer angle, " the granular ridge on the upper side not terminating in a spine." In a very large number of the Indian Museum specimens that I have examined, a ridge is always present on the cardiac region, though in several instances it is very faint. Similarly there are three small spines on the outer surface of the wrist, and though the spine terminating the ridge on the upper side is always the smallest of the three, and in some cases is very minute, all the three of them can always be made out more or less distinctly. There are, however, in the Museum collection two specimens, one from Bombay and the other from Karachi, which differ from other specimens in the two points mentioned above, namely, the ridge on the cardiac region is missing and there are only two spinules at the outer angle of the wrist. It is thus seen that these two characters are constant in some specimens, which otherwise very closely resemble typical examples of *C. callianassa*; these possibly represent a distinct variety of this species.

There are two specimens referable to the present species in the Sandheads collection. One of these is an ovigerous female, and the other a very young example of the same sex. Both the specimens agree closely with typical examples of the species.

As remarked by previous workers the last spine on the lateral border is proportionately longer in the female, so that the carapace length as compared to its extreme breadth is more in the male than in the female. In the Indian specimens that I have measured, the carapace length in the males is generally ·63 or ·64 of its extreme breadth, while in the female it may be as low as ·56. In the specimens described by de Man the length in the male is about three-fourths (·74) of the breadth, while in the female even it is about two-thirds (·67).

On account of the short thick pile on the carapace the ridges across its surface are generally not very prominent, and the one on the cardiac region is sometimes somewhat indistinct.

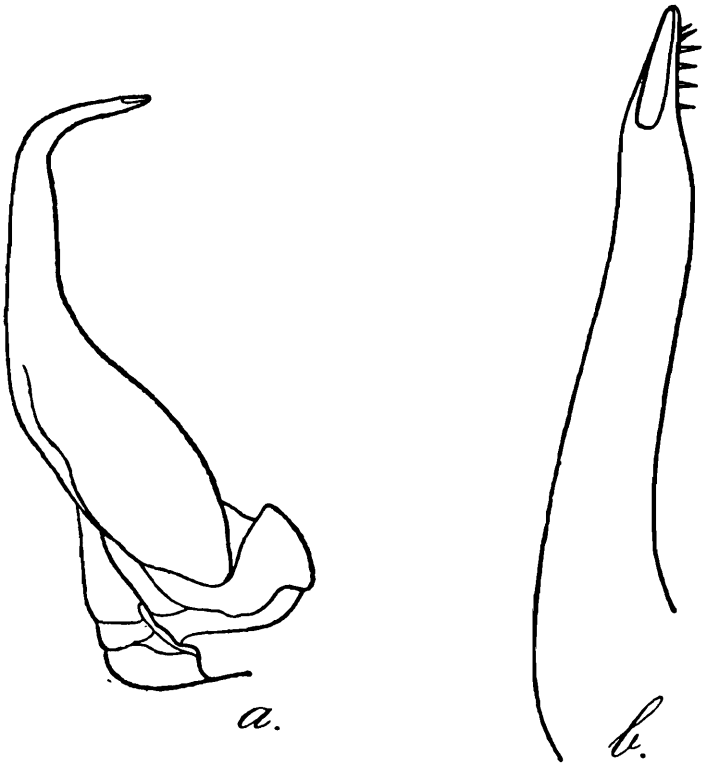
The orbits (Plate ix, fig. 1) have a fairly pronounced dorsal inclination (though not quite as much as in *C. variegata*), and the distance between the outer and inner supra-orbital angles of one side is only a little less than half of the distance between the tips of the two inner angles. In de Man's figure this distance is slightly more than half, while according to Alcock the major diameter of the orbit is a little more than a third of the inter-orbital distance.

The chelipeds are as described by Alcock and de Man. In all the examples that I have seen there are only two large spines on the anterior border of the arm—though sometimes a third smaller spine is present proximal to these two—and three spinules on the outer angle of the wrist; the spinule terminating the ridge on the upper surface of the

wrist is always reduced. The greatly inflated palm is a very characteristic feature of this species.

The abdomen of the male is as described by de Man, and the short transverse carina on the fourth somite is clearly seen in the Indian examples also. The sixth somite is broader than long; its sides in the basal half are more or less parallel, while in the distal half they are curved. The angles adjoining the seventh somite are rounded.

The anterior male appendages are markedly different from those of all the preceding species of this genus. They are sharply bent a little way behind the tip, which is also somewhat more sharply pointed. There are only a few hairs on the outer border quite close to the tip.




TEXT-FIG. 11.—*Charybdis* (*Goniosoma*) *callianassa* (Herbst). *a*. Left anterior male appendage : × *ca*. 8. *b*. Tip of the same enlarged : × 45.

*Charybdis callianassa* is represented in the Indian Museum collection by a large number of specimens from the east coast of the Indian Peninsula, and from Bombay and Karachi. It is now recorded from the Sandheads for the first time. The range of distribution of the species over the Indo-Pacific area is not very extensive; except from the Indian waters it has only been recorded from the Gulf of Siam by Miss Rathbun[1] and from the coast of Sumatra by de Man. Kemp[2] has also recorded the species from the mouth of the Talé Sap in Siam.

### **Charybdis (Goniosoma) rostrata** (A. M. Edwards).

1899. *Charybdis* (*Goniosoma*) *rostrata*, Alcock, *Journ. As. Soc. Bengal* LXVIII, pp. 59, 60.
1925. *Charybdis* (*Goniosoma*) *rostrata*, de Man, *Treubia* VI, pp. 326-328.

*Charybdis rostrata* appears to be one of the commonest Portunids at the Sandheads, for besides the specimens in the present collection,

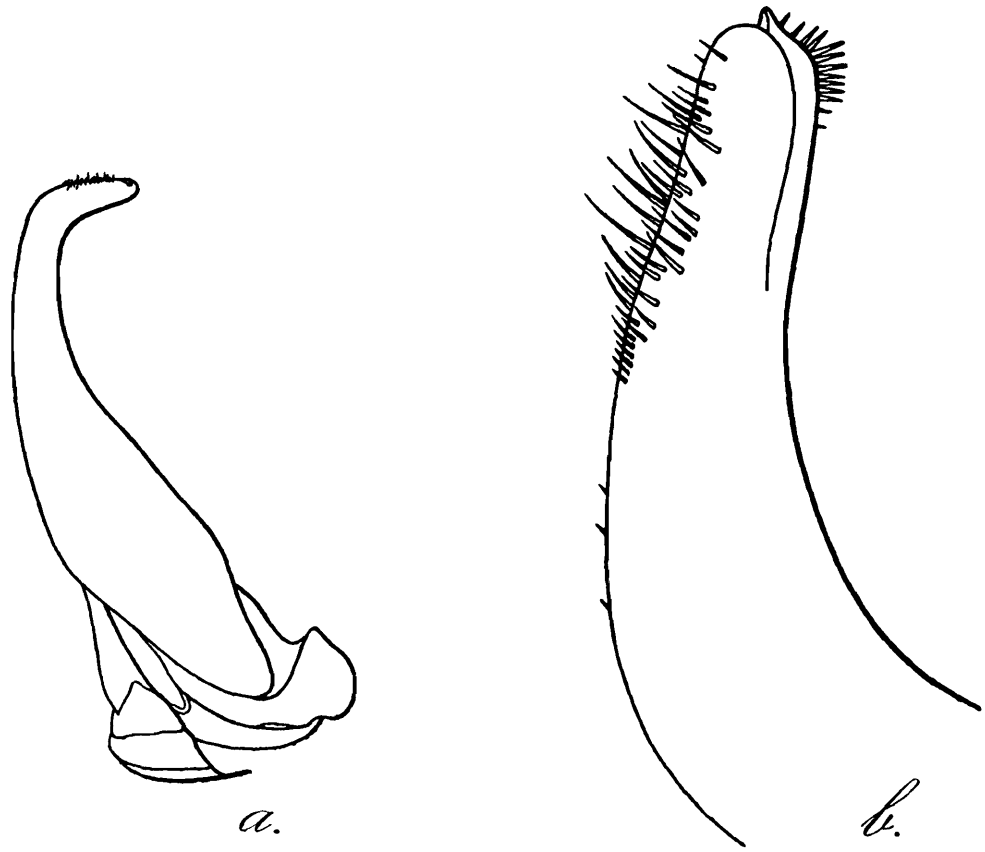
[1] Rathbun, *Skrift. K. Dansk. Vidensk. Selsk. Copenhagen* (7) V, p. 364 (1910).
[2] Kemp, *Mem. As. Soc. Bengal* VI, p. 250 (1918).

the species is represented in the Museum collection by numerous examples collected from this locality on previous occasions also. I now refer to this species seven specimens, one female and six males, with the carapace ranging in length from 17·4 to 24·5 mm., and in breadth (including the spines) from 23·9 to 32·8 mm.

Apart from several other characters the present species is easily recognised by its comparatively large and prominent median frontal teeth. The teeth of the next pair are broad and slope outwards, while those of the outermost pair are narrow and almost straight.

The last spine on the antero-lateral borders is proportionately longer in the female than in the male, so that the carapace is proportionately longer (as compared to its extreme breadth) in the males than in the other sex. In a number of male specimens that I have measured the length (including the median frontal teeth) is between ·70 and ·75 of the carapace breadth, including the lateral spines. In females, on the other hand, the length ranges between ·64 and ·67 only of the extreme breadth. The greatest diamater of the orbit is, in most cases, only a little less than half of the distance between the two inner supra-orbital angles.

In the chelipeds the arm has two large spines on the anterior border, though there is sometimes a knob-like projection, or one or two small teeth, proximal to these spines. The wrist has, in all the specimens that I have examined, only two spinules at the outer angle, the ridge on the




TEXT-FIG. 12.—*Charybdis (Goniosoma) rostrata* (A. M.-Edw.) *a.* Left anterior male appendage : × *ca.* 8. *b.* Tip of the same enlarged : × 45.

upper surface of the wrist having no spine at its end. The palms are greatly inflated, considerably more so in the male than in the female, and bear only two spines on the upper surface, one near the wrist joint, and the other a little way behind the junction of the dactylus. In one

or two specimens the spine near the finger joint is missing. The fingers, especially those of the smaller chela, are thin and long.

As mentioned by de Man the lower border of the orbit is considerably more concave in the present species than in preceding one.

The anterior male abdominal appendages are sharply bent a little behind the tip as in *C. callianassa*, but the tip itself is thick and bluntly rounded. The inner margin is also thickly hairy.

*Charybdis rostrata* is represented in the Indian Museum collection by a large number of specimens from the Mergui Archipelago, the Gulf of Martaban, the Delta of the Irrawady, the Andaman Islands, the Delta of the Ganges and the Chilka Lake on the Orissa coast. Alcock has also mentioned specimens from off Ceylon. De Man's example was collected in the Amphitrite Bay in the Strait of Malacca.

As at present recorded the geographical distribution of *C. rostrata* appears to be limited to the Bay of Bengal only. It is a shallow water species occurring all along the coast from the Malacca Straits to the coast of Ceylon.

### **Charybdis (Goniohellenus) vadorum** Alcock.

(Plate IX, fig. 2.)

1899. *Charybdis (Goniohellenus) hoplites*, var. *vadorum*, Alcock, *Journ. As. Soc. Bengal* LXVIII, p. 67.

1931. *Charybdis (Goniohellenus) sinensis*, Gordon, *Journ. Linn. Soc. London (Zool.)* XXXVII, pp. 534-536.

From Miss Gordon's somewhat brief description and figures of the species recently described by her under the name of *C. sinensis*, it appears that her specimens are referable to Alcock's variety *vadorum* of *Charybdis hoplites* (Wood-Mason). Unfortunately the description published by Alcock is too meagre for the proper recognition of his variety, and he has given no figures to illustrate it. A careful examination of the specimens preserved in the Museum collection has, however, made it abundantly clear that *sinensis* of Miss Gordon is synonymous with Alcock's *vadorum*.

The two principal characters on which Miss Gordon relied for the setting up of her species refer to the shape of the sixth abdominal somite of the male, and the shape of the anterior male appendages. I have figured both these parts from a typical specimen of *vadorum* in our collection, and a comparison of my figures (text-fig. 13, *b*, *c* and *d*) with those of Miss Gordon (text-fig. 12, *c*, *d*, *d'*) establishes the essential similarity between the two. Alcock described the sixth segment of the male abdomen in *C. hoplites*[1] as " truncate-triangular, having almost no curve to the sides," and this description, though quite accurate for this species (as also seen in Miss Gordon's text-figure 12*a*), is not applicable to his variety. In the latter the sixth somite is exactly as described by Miss Gordon; it is broadest in the middle, narrowing somewhat abruptly at the two ends, and the lateral borders are deeply curved inwards. The anterior male appendage also markedly differs from that of *C. hoplites*, the difference being clearly seen from Miss Gordon's figures 12 *b*, *b*[1],

[1] Alcock, *Journ. As. Soc. Bengal* LXVIII, pp. 66, 67 (1899); *Ill. Zool. Investigator, Crust.*, pl. xxili, fig. 6 (1897).

on the one hand and 12 *d*, *d'* on the other. The comparatively strong spine on the inner border, a little way behind the tip seems to be a characteristic feature of the present species, and this is clearly brought out both in my figure and Miss Gordon's. The three or four hairs on this border distal to the spine are not shown in Miss Gordon's figure, but these may have been rubbed off in her specimen.

In addition to the two points mentioned above, Miss Gordon enumerates a few other minor characters also in which her species differs from *C. hoplites* ; almost all of them are equally applicable to *vadorum* also.

On account of the important difference in the shape of the sixth abdominal segment of the male, the structure of the male appendages, and in some other characters also, I am of the opinion that Alcock's variety *vadorum* deserves specific rank. I give below a description of the species.

In the characters of the carapace, as also in several other respects, the present species very closely resembles *C. hoplites* (Wood-Mason). The carapace (Plate ix, fig. 2) is somewhat sparsely covered with a short tomentum, and is rather depressed. The regions are well defined and are areolated ; the convexities of the areolae are prominent and some of them are granular. As usual the gastric region is subdivided into three subregions, the cardiac into two and on the inner part of each branchial region there is a very prominent convexity, which is always granular. The length of the carapace is half, or slightly more than half of its greatest breadth, including the last spines of the antero-lateral borders. In females the carapace is slightly broader proportionately, owing to the lateral spines being somewhat longer than in males. A slightly sinuous granular ridge transversely crosses the middle of the gastric region, and anterior to this the two subregional convexities of this region are also somewhat ridge-like. There is another prominent granular ridge on each branchial region ; it starts from the tip of the last spine of the antero-lateral border, runs strongly arching forwards and terminates well before reaching the middle of the carapace.

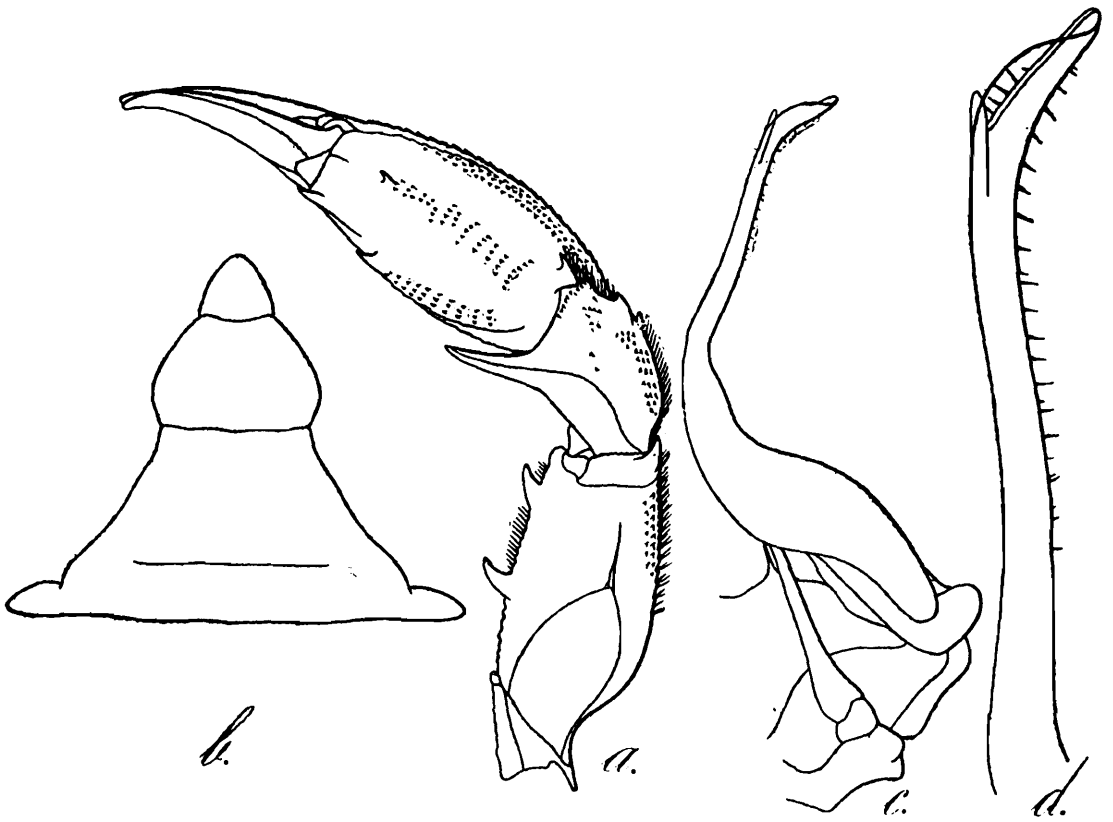
As usual the front is cut into six rounded lobes, in addition to the dentiform inner supra-orbital angles. The median lobes are large and rounded and slightly project beyond the others ; they are separated from one another by a prominent median fissure. The lobes of the next outer pair are rather small, are also bluntly rounded and are only indistinctly separated from those of the median pair. The outermost lobes are separated from those of the submedian pair by deep and wide gaps, and are not quite as blunt as those of the two inner pairs. The inner supra-orbital angle is in the form of a fairly large broad tooth, with a more or less acutely-pointed apex.

The orbits have a pronounced dorsal inclination, and the distance between the outer and the inner supra-orbital angles of one side is slightly more than half the breadth of the front. The upper border of the orbit is finely crenulate and the fissure near its outer end is somewhat obscure, while that on the inner side is rather deep and broad. The lower border is also crenulate in the middle and its inner angle is produced into a large bluntly rounded lobe.

The antero-lateral borders are cut into six teeth (including the outer orbital angles) separated from one another by fairly deep notches.[1] The first teeth, as also some of the others, are more or less acutely pointed, while those of the last pair are large, outwardly-directed spines, very much longer than the teeth preceding them. The posterior margins of the first five teeth are minutely serrate.

The posterior border of the carapace is straight, and forms a prominent " dog's eared " angle at its junctions with the postero-lateral borders.

The chelipeds (Plate ix, fig. 2, and text-fig. 13*a*) are as in *C. hoplites*. They are a little more than twice the length of the carapace, and are, as usual, covered with granular squamiform markings. There are two large spines on the anterior border of the arm, and one somewhat smaller spine at the distal end of the posterior border. The spine at the inner angle of the wrist is very long, and there are only two spinules at the




TEXT-FIG. 13.—*Charybdis* (*Goniohellenus*) *vadorum* Alcock. *a*. Right cheliped of male from a specimen in the type-series, upper view : × 3½. *b*. Terminal part of male abdomen of a Sandheads specimen : ×5. *c*. Left anterior male appendage of a type-specimen : × *ca*. 12. *d*. Tip of the same enlarged : × 30.

outer angle. In *C. hoplites* there are always three spinules at the outer angle, but in the present species the ridge on the upper surface does not terminate in a spinule. The squamiform markings on the palm are much less developed in the present species than in *C. hoplites*, though in general shape, etc., the palm in the two species is very similar. There are four spines on the palm, one near the junction with the wrist and the other three at the distal end, one quite close to the finger-joint, and the remaining two placed more or less side by side a little way behind it. The

[1] The incisions between the marginal teeth superficially appear to be less deep than they really are ; this is due to the presence of long and thick hairs under the margins of the carapace. On removing the hair and cleaning the specimen the incisions are seen to be deep, giving the teeth the appearance of somewhat square-cut lobes, more or less like those seen in *C. hoplites*.

fingers are proportionately longer and thinner in the smaller chela than in the larger one. They have large teeth on their cutting edges and the pointed tips cross one another when the fingers meet.

In the last pair of legs the merus is a little less than two-thirds as broad as long, and in addition to the usual strong spine at the distal end of its posterior margin, has the outer angle of its distal border also strongly spiniform. Both these spines are clearly seen in figure 2 on Plate ix. The second spine is present in *C. hoplites* also, and though not mentioned by Alcock in his description of the species, is clearly seen in his illustration (*Ill. Zool. Investigator, Crust.*, pl. xxiii, fig. 6). There are five or six spinules on the posterior border of the propodus.

The abdomen in both the sexes has the second and third terga transversely carinate, in addition to there being a shorter carina on the fourth tergum also. The sixth segment in the male (text-fig. 13*b*) is somewhat barrel-shaped and is much broader than long. It has its maximum breadth about the middle, and narrows considerably at both ends. The lateral margins are strongly convex. The seventh segment is short, triangular and broadly rounded at the tip. The anterior male appendages (text-fig. 13*c* and *d*) are as shown in the accompanying text-figure. The large bluntly-pointed spine on the inner border, a little behind the tip appears to be a characteristic feature of the species.

*C. vadorum* does not grow to a large size, egg-laden females in the collection have a carapace length of about 12·5 mm. The males are slightly larger.

Alcock gave the locality of his variety as Orissa coast, Persian Gulf and the Arakan coast, but in addition to these there are also specimens in the Museum collection, which Alcock had presumably examined, from the Delta of the Irrawady, the Vizagapatam coast and the Gulf of Oman. I have carefully re-examined all the specimens in our collection, and have come to the conclusion that the examples from the Persian Gulf and the Gulf of Oman cannot be referred to the present species. The sixth abdominal segment of the male and the anterior male appendages in these specimens are not like those of *C. vadorum*, and in some other characters also there are rather important differences. It is possible that these specimens may be referable to Alcock's dwarf variety *pusilla*[1] of *C. hoplites*. The two examples from the Gulf of Oman are very young, but in the larger of the two, a male, the sixth segment of the abdomen is like that of Wood-Mason's species or of its variety *pusilla*.

*C. vadorum* is represented in the Sandheads collection by two examples registered as under :—

| | | | |
|---|---|---|---|
| C 1770/1 | Sandheads, off the mouth of the Hooghly River. | "Fraser" 20th Feb., 1923. | 1 ♀ ovig., 12·8 mm. long. |
| C 1771/1 | Ditto. | "Lady Fraser" June, 1932. | 1 ♂, 13·2 mm. long. |

Both the specimens agree closely with the description given above, as also with our named examples. The species is recorded from the Sandheads for the first time.

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[1] Alcock, *Journ. As. Soc. Bengal* LXVIII, p. 67 (1899).

As at present recorded the geographical range of the species is restricted only to the eastern parts of the Indo-Pacific area. In Indian waters it is confined to the Bay of Bengal only (Delta of the Irrawady, Arakan coast, Sandheads, Orissa and Vizagapatam coasts). Miss Gordon's record from Hongkong considerably extends its range eastwards. The species lives in shallow waters only, all our specimens having been, collected in depths ranging between 7½ and 20 fathoms. *C. hoplites*, on the other hand, is mostly found in comparatively deep waters.

Alcock did not designate any specimens as types, and as specimens from a number of localities are now mixed up in one bottle, the task of selecting one specimen as the type becomes difficult. The three examples from east of the Terribles (Arakan coast) are still preserved separately, but all of these are females, and as the species is primarily based on male characters, it is not desirable to select these as the types. I have, therefore, to designate the remaining nine specimens from the Indo-Burmese coast (Delta of the Irrawady, Orissa and Vizagapatam coast) as the type-series.

| | | | |
|---|---|---|---|
| C 1769/1 | Indo-Burmese coast, Bay of Bengal. | Marine Survey | 44 ♂♂, 3 ♀♀ (ovig.) & 2 Juv. TYPE-SERIES. |

Measurements, in millimetres, of four specimens from the type-series and two from the Sandheads are given below :—

| | Type-series. | | Sand-heads. | Type-series. | | Sand-heads. |
|---|---|---|---|---|---|---|
| Sex .. | ♂ | ♂ | ♂ | ♀ | ♀ | ♀ |
| Carapace length .. | 12·9 | 13·7 | 13·2 | 12·5 | 12·6 | 12·8 |
| Carapace breadth (maximum) | 24·6 | 27·4 | 23·6 | 24·1 | 25·3 | 24·8* |
| Fronto-orbital breadth | 12·0 | 13·5 | 13·4 | 13·0 | 13·6 | 13·2 |
| Breadth of front .. | 6·5 | 6·8 | 6·5 | 6·2 | 6·5 | 6·4 |
| Breadth of orbit .. | 3·5 | 3·7 | 3·7 | 3·5 | 3·7 | 3·6 |

* The last antero-lateral spine of one side is slightly broken.

As indicated above the present species resembles very closely *C. hoplites* (Wood-Mason), but can be easily distinguished from it by the characters enumerated by Alcock and Miss Gordon.

## Subfamily *CAPHYRINAE.*

### **Lissocarcinus arkati** Kemp.

(Plate IX, fig. 3.)

1923. *Lissocarcinus arkati*, Kemp, *Rec. Ind. Mus.* XXV, pp. 405-408, pl. x, fig. 1.

1931. *Lissocarcinus arkati*, Gordon, *Journ. Linn. Soc. London (Zool.)* XXXVII, p. 523.

Kemp described the present species in 1923 from specimens obtained at the Sandheads, basing his description chiefly on characters of female individuals. Later Miss Gordon recorded the species from Hongkong, but her specimen also was a female. Since the publication of Kemp's

description six more specimens of this species, all collected at the Sandheads, have been added to the Museum collection. Four of these are large males, having a carapace length ranging from 16·2 to 21·5 mm., and two are ovigerous females 11·6 and 20·5 mm. long. It is, therefore, now possible to compare Kemp's excellent and detailed description with male examples, and to indicate the few minor points in which the two sexes differ.

The specimen examined by Miss Gordon differs from Kemp's description and figures in two points. The transverse ridges on the carapace, so characteristic of the species, are restricted to the anterior part only, and the posterior border of the carapace is equal to the fronto-orbital breadth. According to Kemp, the ridges extend practically on the entire surface of the carapace and the posterior border of the carapace is distinctly shorter than the fronto-orbital. Four out of the six present specimens agree with Miss Gordon's example in the character of the carapace ridges, but in all of them the posterior breadth of the carapace is shorter than the breadth at the fronto-orbital border.

The general shape of the carapace is as described by Kemp. The length is about four-fifths of the breadth, but in smaller individuals the carapace is slightly longer proportionately. The carapace is broad posteriorly, slightly more so in females than in males. In the four large males that I have examined the posterior border is a little over half (about ·55) of the carapace breadth ; in the females, as described by Kemp, it is only a little less than two-thirds (·62 to ·65).

The carapace is convex in both directions, but the convexity is more marked in females than in males. The transverse setose ridges on the carapace, described by Kemp, are a very prominent feature of the species, but the extent of these ridges on the carapace in my specimens differs markedly from what is shown in Kemp's figure. In three male specimens the ridges are confined only to the anterior half, or a little less than half, of the carapace (Plate ix, fig. 3), stopping short well in front of the cardiac region. On the sides, however, they extend further backwards, but stop considerably in advance of the bases of the last pair of legs. In the remaining male and the larger of the two females, the ridges extend a little further backwards, but even in these two specimens only a little more than half of the anterior surface of the carapace in the middle line has ridges on it. In the small female the ridges are as described by Kemp.

The fronto-orbital border is very broad, and in large individuals is somewhat less than three-fourths the greatest breadth of the carapace, but in smaller examples is proportionately broader. Unlike Miss Gordon's specimen, the fronto-orbital border is broader than the posterior margin of the carapace in all the Indian specimens. The front is as described by Kemp, but is slightly broader in smaller individuals than in adults. The front is distinctly notched in the middle line, though in one of Kemp's ovigerous females the frontal margin is practically entire.

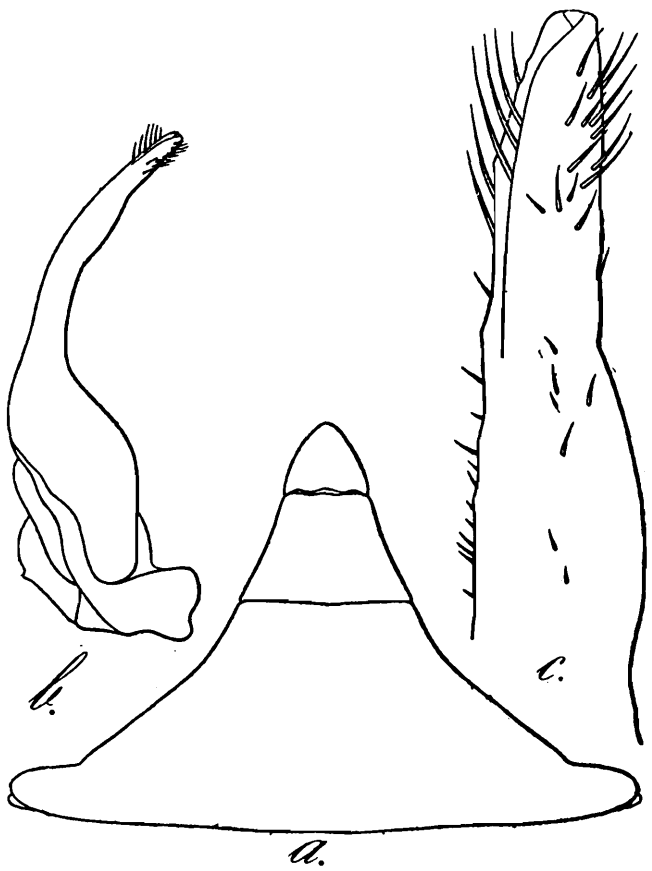
The antero-lateral margins and the marginal teeth are similar in the two sexes.

The basal antennal segment is strongly produced at its antero-external angle, where it is almost bluntly dentiform, and, as mentioned by Kemp, is carinate. The merus of the external maxilliped is not prominently produced at its antero-external angle.

The chelipeds are markedly unequal in large males, and less so in females and smaller males, the chief difference being in the thickness of the palm. In all our specimens the right chela is larger than the left. The detailed description of the female cheliped given by Kemp equally applies to the males also; the tuft of setae are equally abundant in both the sexes. The fingers of the larger cheliped are short and stout, with the tips blunt, while in the smaller cheliped the fingers are long and narrow and their tips are sharp and overlapping. The fingers, except near the base, are conspicuously dark slate-grey.

The first three walking legs are subequal, and are shorter than the chelipeds. All the legs are as described in the female.

In the male abdomen (text-fig. 14*a*), as is usual, segments 3-5 are fused, though the third segment is somewhat indicated on the sides by notches. The whole abdomen is in the shape of a large triangle, very broad at the base, and with sides strongly concave. The second segment has a low inconspicuous carina running transversely from side to side. The sixth segment is somewhat rectangular, with the




TEXT-FIG. 14.—*Lissocarcinus arkati* Kemp. *a*. Terminal part of male abdomen: ×3½. *b*. Left anterior male appendage: ×7. *c*. Tip of the same enlarged: ×30.

distal margin shorter than the proximal. The lateral margins are concave, and the length of the segment is considerably less than its proximal breadth. The terminal segment is triangular in outline, with the tip rounded. The anterior male appendages are rather stout and straight, without any bend near the tip. The inner margin is sparsely

hairy behind the tip, while the tip itself, which is blunt, is beset with a small number of longish hairs. There are a few scattered hairs on the upper surface also.

*Lissocarcinus arkati* appears to be fairly common at the Sandheads, and has been collected there on a number of occasions. The only other record of the species is that of Miss Gordon from Hongkong. One of the present specimens has a small Cirripede attached to the arm of the right cheliped (Plate ix, fig. 3).

The measurements, in millemetres, of the present Sandheads specimens and proportions of certain measurements in all the specimens so far recorded are given below :—

| | Sandheads specimens. | | | | | Kemp's specimens Sandheads. | | | | | Miss Gordon's specimen Hongkong. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sex | ♂ | ♂ | ♂ | ♂ | ♀ (ovig.) | ♀ (ovig.) | ♀ (ovig.) | ♀ (ovig.) | ♀ | ?♂[1] | ♀ (ovig.) |
| Carapace length | 21·5 | 20·0 | 16·2 | 20·0 | 20·5 | 11·6 | .. | .. | .. | .. | .. |
| Carapace breadth | 25·7 | 23·9 | 19·5 | 24·3 | 25·0 | 13·4 | .. | .. | .. | .. | .. |
| Fronto-orbital breadth | 17·3 | 16·1 | 13·5 | 16·6 | 17·2 | 10·0 | .. | .. | .. | .. | .. |
| Breadth of front[2] | 8·2 | 7·8 | 6·4 | 8·2 | 8·4 | 4·6 | .. | .. | .. | .. | .. |
| Breadth of posterior margin | 14·1 | 13·5 | 11·0 | 13·2 | 16·0 | 8·6 | .. | .. | .. | .. | .. |
| Carapace length / Carapace breadth | ·83 | ·83 | ·83 | ·82 | ·82 | ·86 | ·85 | ·80 | ·83 | ·90 | ·81 |
| Fronto-orbital breadth / Carapace breadth | ·67 | ·66 | ·69 | ·68 | ·68 | ·74 | ·72 | ·68 | ·70 | ·80 | ·67 |
| Frontal breadth / Carapace breadth | ·31 | ·32 | ·32 | ·33 | ·33 | ·34 | ·32 | ·31 | ·32 | ·37 | ·33 |
| Posterior breadth / Carapace breadth | ·55 | ·56 | ·56 | ·54 | ·64 | ·64 | ·63 | ·62 | ·65 | ·59 | ·67 |

[1] A careful examination of this very immature specimen has shown it to be a female. The abdominal appendages are of the female type.

[2] The inner orbital angles are excluded, when measuring the frontal breadth.

## Family CORYSTIDAE.

### **Gomeza distincta** (de Haan), var. **indica,** nov.

(Plate IX, figs. 4 and 5.)

1905. *Gomeza distincta,* var., MacGilchrist, *Ann. Mag. Nat. Hist.* (7) XV, p. 263.

The carapace (Plate ix, fig. 4) is oval in outline, and is strongly convex both antero-posteriorly and from side to side. The regions are strongly demarcated, and form more or less independent swellings, considerably raised above the general level of the carapace. The gastric and the hepatic regions are indicated by grooves practically all round, and the cardiac and the intestinal regions are similarly separated from the branchial. The subregions of the gastric and the branchial regions are only faintly indicated, and there is an indistinct groove a little on the inside of the carapace margins, giving the impression of the raised central parts of the carapace being marked off from a marginal rim.

The general surface of the carapace is very profusely and prominently covered with minute granules, in addition to a large number of tubercles, more or less arranged in three longitudinal rows. Several of these tubercles are surmounted by short blunt spines. In the median row there are four tubercles (three rather large and one small) on the gastric region, one large one on the cardiac and two on the intestinal; in the outer row of each side there is one tubercle on the hepatic and four or five on the branchial region. On the outside of this row there is one tubercle on each epibranchial region. On the anterior part of the gastric region, in addition to the tubercles there are some minute, sharp spines, with comparatively broad bases. Of these, there are two placed side by side in the middle line near the anterior edge of the gastric region, and behind these there are four in a transverse row, one on each hepatic lobe near its anterior edge, and the other two on the two protogastric lobes. The fronto-orbital region is rather broad, and is divided into two by a longitudinal groove in the middle line. Like the rest of the carapace, this part also is thickly studded with granules, and has, in addition, two minute spines, one on each side of the groove.

The carapace is distinctly longer than broad, the greatest breadth, measured between the tips of the third lateral spines, is about three-fourths of the length, in the middle line, including the frontal teeth.

The front is prominent, narrow and laminated, and ends in two conspicuous, sharp spines, with broad bases and more or less parallel outer margins. The bases of the spines and the frontal margin are strongly serrate, and the tips of the spines are sharply marked off from the broad basal portions. The front is projecting, the tips of the frontal spines almost reaching to the end of the second segment of the antennal flagellum.

The orbits are very slanting. The inner supra-orbital tooth has a very broad base, forming a sort of hood over the small eye. It is separated from the frontal spine of its side by a broad and deep gap, and does not quite reach the tip of the latter. It ends in a sharp spine, distinctly marked off from the base, and points forwards and somewhat outwards. The upper margin of the orbit is very prominently serrate, some of the serrations being almost spine-like. The true orbital margin, as distinct from the margin of the hood-like projection formed by the base of the inner supra-orbital tooth, is short, and has an inconspicuous fissure near its outer angle. The outer supra-orbital tooth, or the first tooth of the antero-lateral border, is much smaller than the inner, but has a broad base with serrated margins, and a sharply-pointed tip. The inferior orbital border (Plate ix, fig. 5) is also slanting, and is markedly serrate. The infra-orbital spine is much shorter than the inner supra-orbital, and has the usual broad base, and the sharply marked-off pointed tip.

The pterygostomian regions (Plate ix, fig. 5) are finely granular, and have a strong granular ridge running longitudinally from the base of the infra-orbital spine to the level of the fourth spine on the lateral margin.

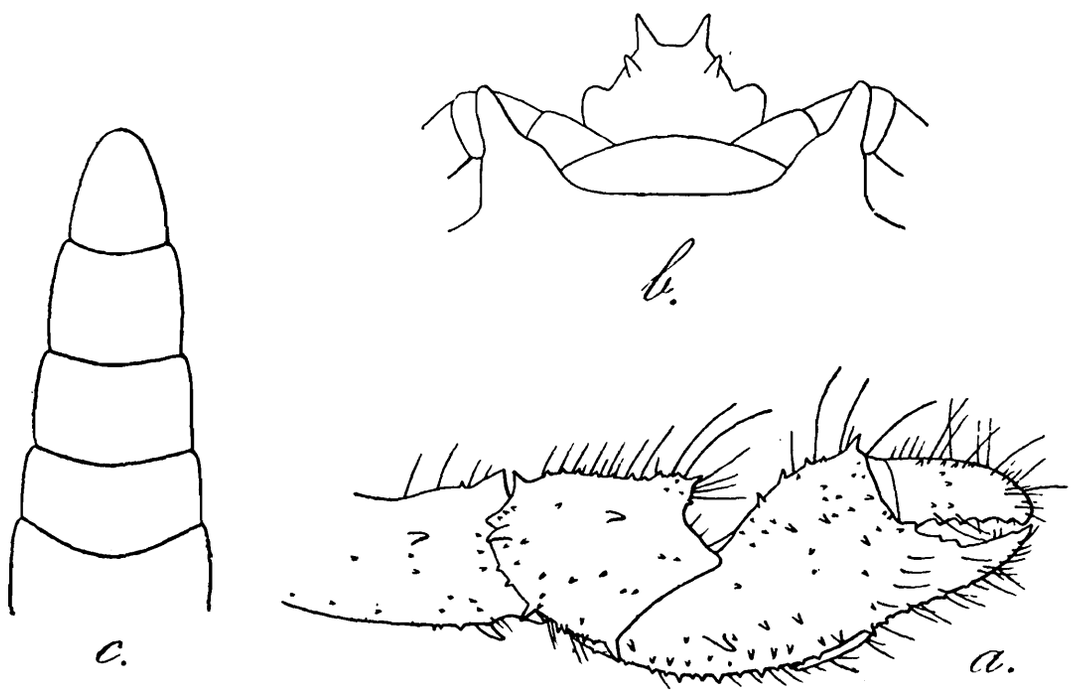
The antennules fold longitudinally. The basal antennal joint is broad, and is wedged in the orbital hiatus, which it completely fills to the total exclusion of the antennal flagellum. The basal joint has a

few minute, sharp spinules, chiefly near its outer margin. The flagella are very long, profusely hairy, and some of the basal segments are serrate on the margins.

The ridge bordering the buccal cavern (Plate ix, fig. 5) is strongly developed, and near its anterior end, where it curves inwards, has a few small spinules on it. The outer maxillipeds leave a large gap in the middle, and have a somewhat pediform cast. The ischium is considerably longer than broad and the merus has its antero-external angle rounded. The flagellum is articulated on the inner border of the merus near its antero-internal angle. The flagellum of the exognath is well developed and plumose.

The lateral margins of the carapace are regularly arched, and there is no demarcation between the antero- and postero-lateral margins. The lateral borders are armed with ten strong spines, with broad serrate bases, and sharply marked-off tips. The first four spines are larger than the others; of the former the second is the largest, first and third are subequal, while the fourth is the smallest. The remaining six spines are considerably smaller than the first four, but the disproportion in size between these two sets of spines is much less than that shown in de Haan's[1] figure of *G. distincta* or in Balss'[2] figure of the variety *formosae*. The last pair of spines are larger than those immediately preceding them and are placed at the junctions of the lateral and posterior margins. The broad basal parts of all the spines, and the margin of the carapace between the spines are serrate.

The posterior margin of the carapace is short and straight, and is not serrate.




TEXT-FIG. 15.—*Gomeza distincta*, var. *indica*, nov. *a*. Right cheliped of male, outer and somewhat upper view: ×*ca*. 22. *b*. Basal two segments of male abdomen: ×*ca*. 40. *c*. Terminal part of male abdomen: ×*ca*. 40.

The chelipeds (text-fig. 15*a*) are stouter, but not appreciably longer than the walking legs. They are thickly clothed with long hairs,

[1] De Haan, *Faun. Japon. Crust.* pl. xiii, fig. 2 (1835).
[2] Balss, *Arch. Naturgesch.* LXXXVIII, Heft 11, pl. ii, fig. 5 (1922).

especially on and near the margins. The arm is trigonous, with the outer surface having a few scattered, minute granules, and the inner and the lower surfaces smooth. There is a sharp spine near the distal end of the upper margin, and a small, blunt, tooth-like lobe with serrated margins, followed by a sharp spine, at the distal end of the outer margin, which also is finely serrate. The wrist is studded with granules, its free margins are serrate, and it has a sharp terminal spine with broad base, and sharp tip, at the inner margin. There is also a small, somewhat blunt spine at the proximal end of this margin. On the outer border of the wrist the granules are sharp, and some of these are like small spinules, among which at least one comparatively large spine is noticeable. On the outer surface of the wrist also two somewhat large spines, one behind the other near the inner margin, and three shorter ones arranged in a longitudinal row about the middle can be seen. On the outer surface of the palm, especially in its lower half, the granules are arranged in longitudinal rows. Most of the granules are sharp, some being spine-like, and are interspersed with hairs. On this surface two or three spines arranged in a row, one just in front of the wrist joint, and one or two in the middle, stand out as much larger than the others. The upper margin of the palm is sharply serrate, one or two serrations being almost spine-like; the lower margin is also serrate. The inner surface of the palm appears to be smooth. The fingers are broad at the base and taper to finely pointed tips. The dactylus is arched, and the fingers leave a small gap when their tips meet. Their cutting margins are provided with four or five subequal sharp teeth. The fingers, like the other parts of the chelipeds, are fringed with long hairs, and their margins, the upper margin of the dactylus and the lower margin of the fixed finger, are finely serrate. The dactylus is longer than the upper border of the palm.

The walking legs are long, and are fringed with long hairs. The lower border of the merus is faintly serrate.

The male[1] abdomen (Plate ix, fig. 5 and text-fig. 15*b* and *c*), in the single, possibly immature specimen that I have examined, is very short and slender, in the natural position not even reaching up to the bases of the second pair of walking legs. In front of the adbomen there is a deep groove extending forwards to the bases of the chelipeds. All the seven segments are distinct, though the line of demarcation between the fifth and the sixth segments is somewhat less clearly marked than those between the other segments. The second segment (text-fig. 15*b*) has four spines in two rows on about the middle of its surface. Of these the two in proximal row are small, while the distal ones are large and prominent. All the four spines can be seen from the dorsal surface, but the two large ones are visible from below also. At its base the second segment has two lobular projections, one on each side. The sixth segment (text-fig. 15*c*) is anteriorly narrowed and has straight and convergent sides. The seventh segment is somewhat triangular, with a rounded tip. On account of the small size of the specimen and its delicate nature the abdominal appendages have not been examined.

[1] The abdominal appendages have not been examined, but the shape of the abdomen is very much like that of a male specimen.

*Type-specimen.*—C 1766/1, Zoological Survey of India (*Ind. Mus.*).

*Locality.*—The single specimen, on which the present variety is based, was collected by the Pilot vessel "Lady Fraser" in February, March, 1928, at the Sandheads, off the mouth of the Hooghly River. The depth of water in this locality is about 20 fathoms, and the bottom for the most part consists of soft ooze-like mud, with admixture of sand here and there. MacGilchrist's specimen, which is referred to this variety, was collected in the Persian Gulf, at a depth of 53 fathoms.

The measurements and proportion of the single specimen of the present variety, and, for purposes of comparison, those of *G. distincta*, and of its variety *formosae*, are given below. The measurements in the case of the two latter forms have, for the most part, been taken from their published figures, and as Balss' illustration of *formosae* is rather poor, the measurements may not be accurate.

| | var. *indica*. | *G. distincta*. | var. *formosae*. |
|---|---|---|---|
| Length of carapace to the tips of frontal spines | 6·1 | 43·0 | ?40·0 |
| Breadth of carapace including 3rd lateral spines | 4·6 | 30·0 | ?26·0 |
| Breadth of carapace between tips of outer supra-orbital spines | 3·3 | 23·0 | ?19·0 |
| Breadth of carapace between tips of inner supra-orbital spines | 1·8 | 9·0 | 8·5 |
| Breadth of carapace between tips of infra-orbital spines | 2·2 | 12·0 | 13·0 |
| $\frac{\text{Carapace breadth}}{\text{Carapace length}}$ .. .. .. | ·75 | ·70 | ?·65 |
| $\frac{\text{Breadth at outer supra-orbital spines}}{\text{Carapace breadth}}$ .. | ·71 | ·76 | ?·73 |
| $\frac{\text{Breadth at inner supra-orbital spines}}{\text{Carapace breadth}}$ | ·39 | ·30 | ?·36 |
| $\frac{\text{Breadth at infra-orbital spines}}{\text{Carapace breadth}}$ .. | ·47 | ·40 | ?·50 |

From the foregoing description it is seen that the present form very closely resembles de Haan's *Gomeza distincta*, of which it appears to be only a local variety. De Haan's description is rather meagre, but his figure considerably helps one in properly diagnosing his species. The Indian variety resembles the *forma typica* in the general shape of the body, and in having a thickly granular carapace, with three longitudinal rows of tubercles more or less similarly arranged. In both, the borders of the carapace are provided with four large and six smaller spines. The front and the supra-orbital teeth are similar; the chelipeds are thickly granulated in both; and the disposition of the spines and teeth is not very different in the two. The Indian form can, however, be easily distinguished from de Haan's species by the shorter infra-orbital spines, and by the fact that the posterior six spines on the lateral border of the carapace, though definitely smaller than the first four, are proportionately larger. The number and disposition of the tubercles and spines on the dorsal surface of the carapace is not exactly similar; the granules on the chelae are arranged in regular rows in the Indian variety; and the number of spines on the different segments of the

chelipeds appears to be larger in the present form. Further, the upper margin of the orbit proper, as distinct from the outer margin of the basal part of the inner supra-orbital spine, is distinctly serrate; in de Haan's figure it is shown as smooth. The antennal flagella and the walking legs are less hairy in the new variety, and most of the spines consist of broad bases with strongly serrate, or even spinose, margins, and long, abruptly-narrowed, bare tips.

The variety of de Haan's species described by Balss under the name of *formosae* differs from the typical species in having the upper surface of the carapace uniformly granulated, without any large tubercles or spines on it; in having the upper margin of the orbit serrate; and the granules on the palm arranged in rows. The Indian variety agrees with *formosae* in the last two characters, but differs from it in having a number of large tubercles and spinules on the carapace. The infra-orbital spine is also much shorter than shown in Balss' figure.

The Persian Gulf specimen, which MacGilchrist considered to represent a variety of *G. distincta*, is no doubt referable to the present variety. Unfortunately this specimen cannot at present be found in the Indian Museum collection, but the two characters mentioned by MacGilchrist, in which his specimen differed from de Haan's species, are shared by the present variety also. In any case the Persian Gulf specimen is not referable to Balss' variety *formosae*.

Like *G. distincta*, the present form differs from *G. bicornis*[1] Gray, among several other characters, in the different shape of the frontal teeth, and in having a large number of prominent tubercles on the carapace. Laurie[2] considers *G. bicornis* as a very variable form, but it is possible that he was dealing with more than one species. The short infra-orbital spines in some of his examples suggest the presence of the new variety also in his material.

## Family XANTHIDAE.

### Subfamily *XANTHININAE*.

### **Halimede tyche** (Herbst).

(Plate IX, fig. 6.)

1801. *Cancer tyche*, Herbst, *Crabben und Krebse* III, Heft 2, pp. 35, 36, pl. lii, fig. 3.
1893. *Halimede thurstoni*, Henderson, *Journ. Linn. Soc. London* (2) V, p. 360, pl. xxxvi, figs. 13, 14.
1910. *Halimede tyche*, Rathbun, *Skrift. K. Dansk. Vidensk. Selsk. Copenhagen* (7) V, p. 352 (*partim*).
1922. *Halimede tyche*, Balss, *Arch. Naturgesch.* LXXXVII, Heft 11, p. 129 (*partim*).
1925. *Halimede tyche*, Odhner, *Goteborgs Vetensk. Handl.* XXIX, No. 1, pp. 81, 82.

On the authority of Miss Rathbun it had been believed generally that de Haan's[3] *Halimede fragifer* from Japan is the same form as Herbst

[1] Gray, *Zool. Miscell.*, p. 39 (1831). De Haan's *vigintispinosa* [*Faun. Japon. Crust.*, p. 44, pl. ii, fig. 5 (1835)] is no doubt identical with Gray's *bicornis*, but it appears to me somewhat doubtful if the form described by A. Milne-Edwards [*Nouv. Arch. Mus. Paris* X, pp. 52, 53, pl. iii, fig. 5 (1874)] under de Haan's name is really referable to Gray's species.

[2] Laurie, *Ceylon Pearl Oyster Fish. Rep.* V, pp. 421, 422 (1906).

[3] De Haan, *Faun. Japon. Crust.*, p. 47, pl. xiii, fig. 4 (1835).

had described in 1801 under the name of *Cancer tyche*. She recognised three species as referable to the genus *Halimede* de Haan, *viz.*, *H. tyche* (=*H. fragifer*), *H. thurstoni* Henderson and *H. ochtodes* (Herbst). Odhner on an examination of a photograph of Herbst's type-specimen of *Cancer tyche*, deposited in the Berlin Museum, has expressed the opinion that *tyche* and *fragifer* are quite distinct, while, on the other hand, Henderson's *H. thurstoni* is only a synonym of Herbst's *tyche*. Thus according to Odhner also there are three species in the genus *Halimede*, *viz.*, *H. fragifer*, the genotype, *H. tyche* (=*H. thurstoni*) and *H. ochtodes*. The form recently described by Balss[1] as *H. dofleini* is, according to Odhner, only a variety of the Japanese *fragifer*, while Nobili's[2] *H. hendersoni* and Haswell's[3] *Medaeus nodosus* are synonymous with *H. ochtodes* (Herbst).

The chief difference between the three species is in the abundance, or otherwise, of the flattened, raised prominences on the carapace and the chelipeds. In *H. fragifer* the carapace is profusely covered with these prominences, which even in small specimens are said to be well developed. In *H. tyche*, according to Odhner, these are confined to the orbital and the lateral margins and the hepatic regions of the carapace, exactly as described by Henderson for *H. thurstoni*; in *H. ochtodes* there are no raised, flattened prominences on the carapace.

In the Sandheads collection there is one specimen that I refer to *Halimede tyche* (Herbst) :—

| | | | |
|---|---|---|---|
| C 1764/1 | Sandheads, off the mouth of the River Hooghly. | "Lady Fraser" Feb., March, 1928. | 1 ♂. |

The specimen is rather small, with a carapace length of 7·4 mm., and a breadth of 8·8 mm. It agrees closely with Henderson's description of *H. thurstoni*, but differs from it in having the two lobes of the front much broader and more or less square cut. The deep incision between the lobes is well marked and the margins of the lobes are finely, but distinctly crenulate. According to Henderson's description and figure the anterior margins of the lobes are strongly convex, but in my specimen these are practically straight (Plate ix, fig. 6) and somewhat slanting outwards. The lobes are broad like those of *H. fragifer*, but their anterior borders are not concave.

The carapace is covered with short tufts of hairs, arising from groups of small clustered granules. The raised, flattened tubercles, so characteristic of *H. fragifer*, are here reduced to two only, one on each hepatic region, opposite the second blunt tooth on the antero-lateral margin. In addition to these two flattened prominences, there is another on the right protogastric lobe; on the left side this is missing, but its place is indicated by a cluster of small granules. This prominence is not mentioned by Henderson. The prominence at the outer orbital angle and the flattening of the infra-orbital border is exactly as described by Henderson.

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[1] Balss, *Arch. Naturgesch.* LXXXVIII, Heft 11, p. 129, pl. ii, figs. 1, 2 (1922).
[2] Nobili, *Bull. Sci. France Belgique* XL, pp. 123-125, pl. vi, fig. 31 (1906).
[3] Haswell, *Cat. Australian Crust.*, pp. 52, 53 (1882).

Of the three teeth on the antero-lateral border of the carapace, the first, a little behind the flattened outer orbital tooth, is the smallest, and the third the largest. Between the outer orbital angle and the first tooth of the lateral border a small sub-hepatic tooth is visible even from above.

The orbits are very slanting, have a strong dorsal inclination, and most of the infra-orbital border is visible from above. There is a large groove between the front and the upper orbital border, where the antennal flagellum is lodged. There are two other fissures near the outer end of the upper border, which is serrate, especially near its inner end. The eyes are small. The infra-internal angle of the orbit is markedly pronounced.

The chelipeds are subequal and are considerably stouter, but not very much longer, than the walking legs. The raised, flattened tubercles are present only on the upper and outer surface of the wrist, and the upper surface of the palm ; on the outer surface of the palm there are ordinary tubercles or granules arranged in longitudinal rows. At the inner angle of the wrist there are two short, thick and blunt spines. The fingers are broad and stout and do not leave any gap when they meet. The somewhat pointed tips overlap when the fingers are apposed. On the basal part of the upper surface of the dactylus there are some small, sharp tubercles, more or less arranged in rows.

The walking elgs are thickly clothed with tufts of hairs. There are traces of a carina on the posterior surface of the carpus, and the dactylus is only slightly longer than the propodus.

The abdomen of the specimen is missing, but judging by the groove in which the abdomen is lodged, it must have been long, narrow and somewhat acutely pointed.

Herbst's figure of the species is rather poor, but the flattened tubercles on the carapace and the chelipeds appear to be greatly reduced, as in Henderson's *H. thurstoni*. There does not seem to be any doubt that Henderson's species is synonymous with *H. tyche* (Herbst).

The form recently described by Balss[1] as *Medaeus rouxi* from the Gulf of Manaar is very much like the present species, at least superficially. In Balss' specimen the front is, however, more slanting outwards, the last tooth on the lateral margin is not the largest, and the flattened tubercles on the chelipeds are somewhat different in number and disposition. The male abdomen also is not long and narrow, as is the case in the genus *Halimede*. Except for the character of the male abdomen, one would be inclined to include Balss' species in the genus *Halimede*. Through the courtesy of Dr. Gravely, Superintendent, Madras Museum, I have examined one of the two specimens (a female from Krusadai Island, preserved in the Madras Museum) on which Balss based this species, and find that in a very large number of characters this example shows a close resemblance to the genus *Halimede*.

As so far recorded the genus *Halimede* appears to be rather rare. *H. tyche* was described by Herbst from " Ostindien " The only other authentic records of the species are those of Henderson, under the name *H. thurstoni*, from Tuticorin and of Miss Rathbun, under the same

[1] Balss, *Rec. Ind. Mus.* XXXVII, pp. 45, 46, pl. ii, figs. 1, 2 (1935).

name, from the Gulf of Siam. From Miss Gordon's[1] record of the species from Hongkong one cannot be sure whether the species she had in her collection was the true *tyche*, or de Haan's *fragifer*. The occurrence of the species off the mouth of the River Hooghly is of interest.

### **Liagore rubromaculata** de Haan.

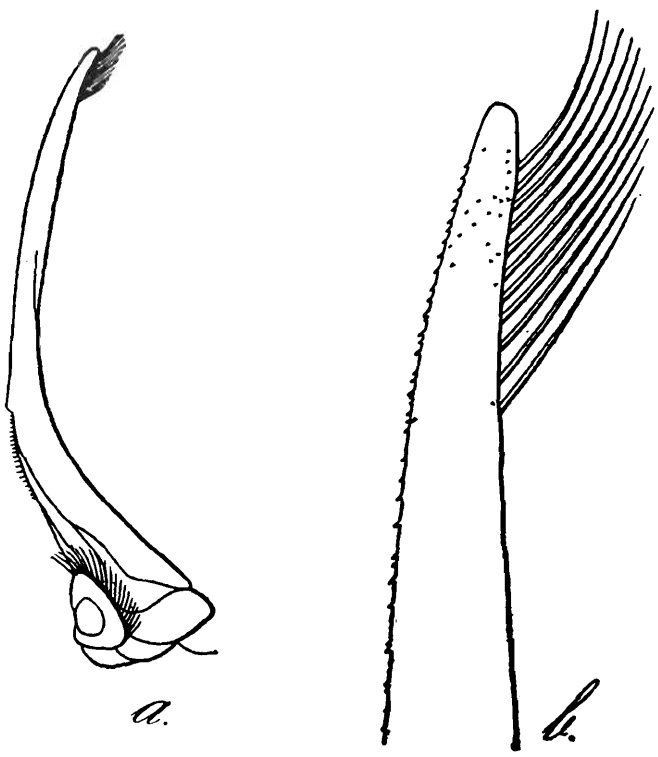
1898. *Liagore rubromaculata*, Alcock, *Journ. As. Soc. Bengal* LXVII, pp. 93, 94.
1923. *Liagore rubromaculata*, Kemp, *Rec. Ind. Mus.* XXV, pp. 408, 409, pl. x, fig. 2.

I refer to this somewhat rare species two male specimens from the Sandheads :—

| | | | |
|---|---|---|---|
| C 1763/1 | Sandheads, off the mouth of the Hooghly River. | "Lady Fraser" Nov., 1923. | 2 ♂ ♂. |

The larger of the two specimens has a carapace length of 24 mm., and a breadth of 33 mm., while the other specimen is 20·5 mm. long and 29 mm. broad. The specimens agree very closely with Alcock's description as also with our named specimens.

As mentioned by Kemp, the antero-lateral borders of the carapace are obscurely divided into four blunt lobes. The front is divided into two lobes by a notch, and there is a very short and somewhat deep groove running longitudinally behind the notch. This groove is not shown in Kemp's figure, but can be made out more or less clearly in most of our specimens.




TEXT-FIG. 16.—*Liagore rubromaculata* de Haan. *a*. First left pleopod of male : ×5. *b*. Tip of the same enlarged : ×30.

The first pleopods of the male (text-fig. 16) are long and straight. The tip is somewhat bluntly pointed and a short portion of the outer

[1] Cordon, *Jour. Linn. Soc. London (Zool.)* XXXVII, p. 528 (1931).

margin just behind the tip is beset with close long setae. The inner margin is finely crenulate.

The larger of the two present specimens is completely bleached, but the smaller one still shows the red spots on the carapace, as illustrated by Kemp.

In the Indian Museum there are specimens of *L. rubromaculata* from Hongkong, mouth of the Irrawady, mouth of the Hooghly, and the Persian Gulf. The species was originally described from Japan, and has also been recorded from China. Miss Gordon[1] also obtained the species from Hongkong.

### **Galene bispinosa** (Herbst).

1898. *Galene bisponosa*, Alcock, *Journ. As. Soc. Bengal* LXVII, pp. 136, 137.

This is the commonest Xanthid found at the Sandheads. In the present collection there are nine specimens that are referable to this species ; of these six are males, and the other three non-ovigerous females. The largest male has a carapace length of 41 mm., and a breadth (excluding the short, blunt spines of the antero-lateral margins) of 55 mm., while the smallest male is 33 mm. long and 43 mm. broad across the carapace. Of the females the largest is 38 mm. long and 53 mm. broad, while the smallest has a carapace length of 25 mm. and a breadth of 33 mm.

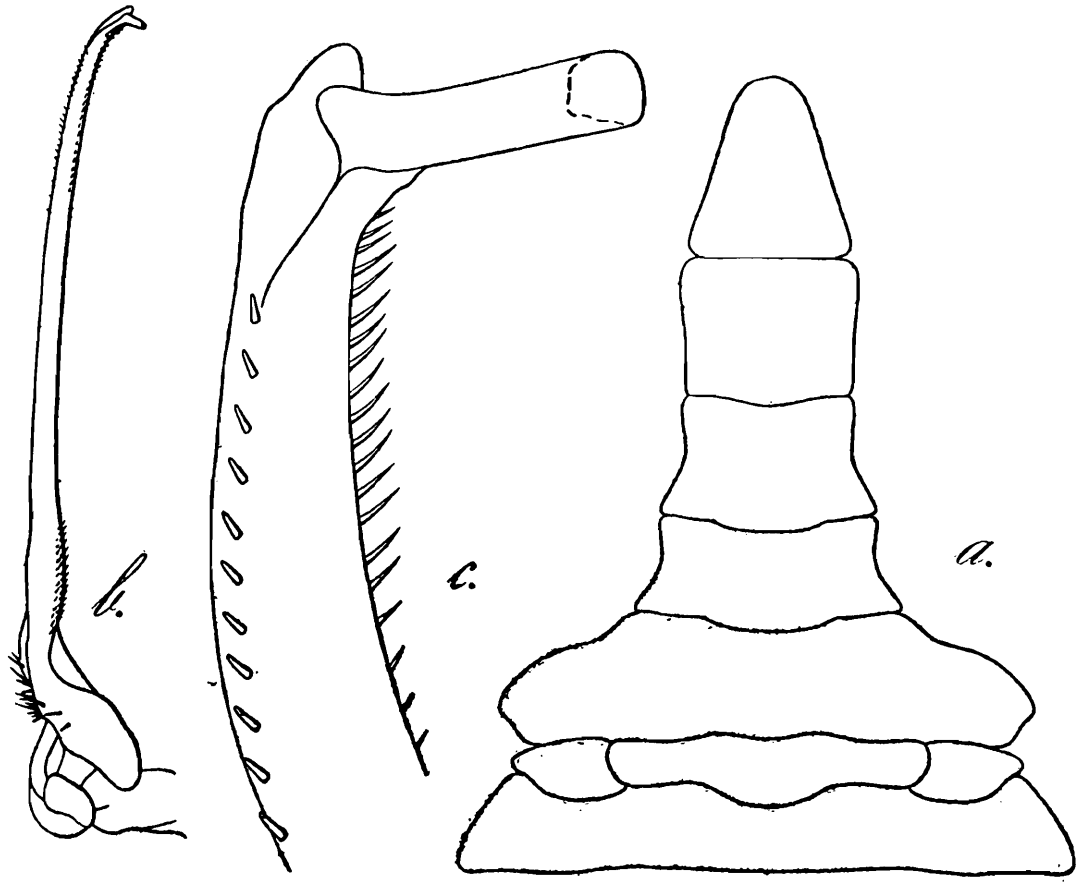
Alcock has referred to the variability of this species in the amount of granulation on the carapace and the chelipeds. The present specimens also illustrate this point very clearly. The carapace is generally sparsely granulate a little on the inside of the lateral borders, but sometimes there are a few granules near the outer limits of the hepatic and the epibranchial regions also. The general surface of the carapace, however, though sometimes pitted, is never granulate. On the ventral surface the sub-hepatic regions, and sometimes the median thoracic sternal plate, are also granular. In the same way the chelipeds may be almost smooth, or small, but sharp, granules may cover almost entirely the surface of the wrist and a greater part of the outer surface of the palm. Generally, however, the distal part and the upper half of the outer surface of the palm is smooth.

The male abdomen (text-fig. 17*a*) is long and narrow, and has all the seven segments distinct. The three basal segments are laterally expanded and occupy almost the entire space between the bases of the legs. The sixth segment is rectangular, with the breadth exceeding the length, and the sides are practically straight or only slightly concave about the middle. In the female also all the seven somites are distinct, but the first somite only is laterally expanded. The anterior pleopod of the male is as illustrated in the accompanying text-figure. The blunt, finger-like process on the outer margin just behind the tip appears to be a very unusual, but characteristic feature of the present species. These appendages are long and straight.

*Galene bispinosa* appears to be a somewhat rare species. Alcock recorded it from Hongkong, Tenasserim and the Vizagapatam coast; there is also in the Museum collection one large male specimen from

[1] Gordon, *Journ. Linn. Soc. London (Zool.)* XXXVII, p. 528 (1931).

the Matlah River in the Gangetic Delta. The comparative abundance of the species at the Sandheads is noteworthy.




TEXT-FIG. 17.—*Galene bispinosa* (Herbst). *a*. Distal part of male abdomen: ×3. *b*. First left pleopod of male: × *ca*. 4. *c*. Tip of the same enlarged :×32.

Herbst has not given the provenance of his specimen. De Haan's material was from Japan, and Parisi's[1] record is also from the same locality. Miss Gordon[2] again obtained the species at Hongkong.

## **Galene granulata** Miers.

(Plate IX, fig. 7.)

1848. *Galene granulata*, Miers, "*Alert*" *Crust.* p. 208, pl. xx, fig. A.
1903. *Galene granulata*, Nobili, *Boll. Mus. Zool. Torino* XVIII, No. 455, pp. 32-34.

This species resembles very closely the preceding one, but according to Miers and Nobili differs from it in three, more or less important, characters. The entire surface of the carapace and the chelipeds is profusely granular, whereas in *G. bispinosa* (Herbst) only the borders of the carapace, the outer surface of the wrist and the proximal parts of the palm are sparsely granulate; there are three teeth on each lateral margin of the carapace, whereas in Herbst's species there are only two, the anteriormost being more or less obsolete; and of the two teeth on each frontal lobe the outer one is very much reduced, and the inner far more prominent than the outer, whereas in *G. bispinosa* both the teeth are more or less equally developed.

[1] Parisi, *Atti. Soc. Ital. Sci. Nat.* LV, p. 183 (1916).
[2] Gordon, *Journ. Linn. Soc. London (Zool.)* XXXVII, p. 527 (1931).

In the Sandheads collection there are two specimens that are referable to the present species :—

| | | | |
|---|---|---|---|
| C 1761/1 | Sandheads, off the mouth of the River Hooghly. | "Fraser" 24th April, 1925. | 1 ♀. |
| C 1762/1 | Ditto. | "Lady Fraser" Feb., March, 1928. | 1 juv. ♀. |

The specimens are rather small, and even the larger of the two is probably immature. In the larger specimen the length of the carapace from the posterior margin to the tip of the inner frontal tooth is 13·0 mm., while the greatest breadth of the carapace between the tips of the third lateral spines is 17·5 mm. The smaller example is only 4 mm. long and 5·2 mm. broad.

Both the specimens agree fairly closely with Miers' description, as also with the more detailed account of Nobili.

The length of the carapace is about three-fourths of its greatest breadth, more or less like that of the preceding species, but the regions of the carapace are better defined. The grooves and the granules on the carapace agree exactly with Nobili's description, but there are two shallow longitudinal grooves one on each side of the frontal region and another transverse one behind each orbital margin. These grooves are indicated in Miers' figure also. The first tooth on the antero-lateral border is much smaller than the two succeeding ones, especially in the larger specimen, but all the three of them are distinct, and almost as large as shown in Miers' figure. The teeth are somewhat sharper in the smaller example than in the other. The front is distinctly divided into two lobes by a deep and broad notch, and the margins of each lobe are more or less straight. In the larger specimen, of the two teeth on each frontal lobe the outer one is much smaller than the inner, but in the samller example, it is the inner tooth which is obsolete, the outer one being fairly large. In this respect the smaller specimen appears to be abnormal[1].

The grooves on the upper border of the orbit are not clearly seen. There is a wide gap at the inner end of the lower border of the orbit, and on account of the shortness of the basal antennal joint the antennal flagellum lies in this gap. Both the upper and the lower borders of the orbit are crenulate, and there is a prominent lobe at the inner angle of the lower border, which is visible from above.

The anterior border of the merus of the external maxillipeds is concave about the middle and the flagellum is articulated at the antero-internal angle.

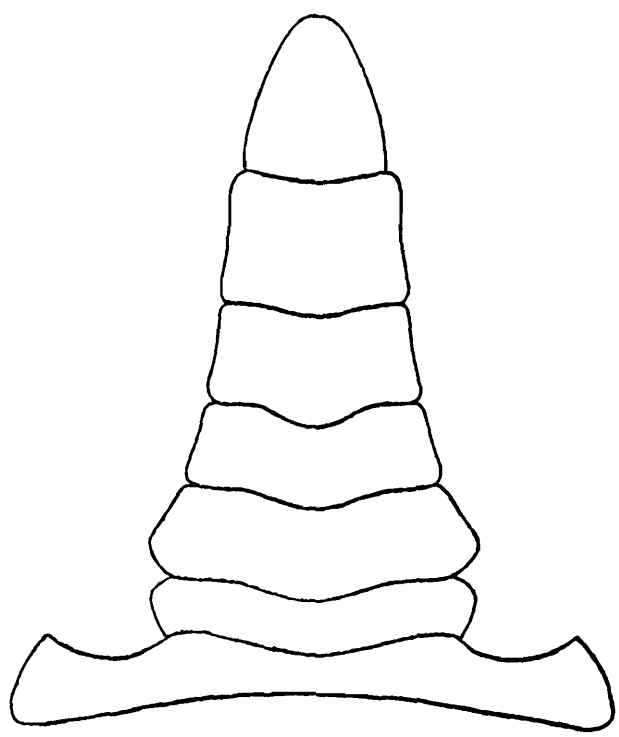
The chelipeds are as described by Nobili, except that there are two teeth at the inner angle of the wrist, the lower one of which, in the larger specimen, is bispinose. They are more hairy than in the preceding

[1] Dr. H. Balss of München has kindly examined this specimen at my request, and has identified it as *Galene granulata.*

species, and the sharp tubercles on the outer surface of the wrist and palm are almost spine-like. The disposition of the tubercles is more or less as described by Nobili. In the larger chela the fingers are broad at the base, somewhat bluntly pointed at the tips, and have large molariform teeth. In the smaller chela the fingers are comparatively thin and sharply pointed and the teeth are smaller.

The legs are as described by Nobili.

In both the specimens before me all the seven somites of the abdomen are distinct. The first segment is laterally expanded and occupies the entire space between the bases of the last pair of legs. The other seg-



Text-fig. 18.—*Galene granulata* Miers. Abdomen of young female : ×7½.

ments are narrowed, and the abdomen has more or less the appearance characteristic of the male.

*Galene granulata* was described by Miers from a specimen from Port Darwin on the coast of North Australia, while Nobili's example was collected at Singapore. The record of the species from the Sandheads extends its range considerably. The species seems to be rather rare.

All the specimens of *G. granulata* so far recorded are small and were probably immature. The type-specimen from Port Darwin is only 11·5 mm. long, while that of Nobili from Singapore has a carapace length of only 8 mm. The larger example from the Sandheads is slightly bigger than Miers', but, judging from the shape of the abdomen, is no doubt immature. As suggested by Miers, it is, therefore, possible that *G. granulata* is only a young form of *G. bispinosa* (Herbst). Some of the characters in which Miers' species differs from Herbst's probably vary to a certain extent with age. All the specimens of *G. bispinosa* that I have seen are large. A comparison of the male appendages of *Galene granulata* with those of Herbst's species will probably settle the question of the validity of the former species.

## Family GONOPLACIDAE.

### Subfamily *RHIZOPINAE*.

### **Scalopidia spinosipes** Stimpson.

1900. *Scalopidia spinosipes*, Alcock, *Journ. As. Soc. Bengal* LXIX, pp. 325-326.
1918. *Scalopidia spinosipes*, Tesch, *Siboga Exped. Rep.* XXXIX C[1], pp. 224-226, pl. xiv, fig. 3.

One specimen in the Sandheads collection is referred to this somewhat rare species :—

| | | | |
|---|---|---|---|
| C 1765/1 | Sandheads, off the mouth of the River Hooghly. | "Fraser" 11th Jan., 1924. | 1 ♀. |

The specimen agrees very closely with Alcock's description and our two named examples from Hongkong, but differs from Tesch's account in one or two rather minor points.

The length of the carapace is about three-fourths of the breadth. In all the specimens so far recorded the breadth varies between 1·30 and 1·39 of the length. The surface is minutely punctate, and the grooves are rather shallow and somewhat indistinct, as described by Tesch. The front is deflexed, and in dorsal view is prominently notched, but in frontal view the anterior border appears to be straight and entire. Tesch failed to find any spine at the junction of the antero-and postero-lateral borders, but in all the three examples that I have seen a distinct, though small, spine is always present.

The chelipeds are unequal, the right one being larger than the left, but the difference in size between the two chelae is not marked as mentioned by Tesch. The detailed description of the chelipeds given by Tesch applies more or less exactly to our specimens also, but the granulation on the various segments is better developed in at least one of the Hongkong examples. All the three margins of merus are more or less crenulate and the two small teeth, one sub-terminal on the upper border, and the other about the middle of the inner border (in the large chela only), are clearly seen in both the Hongkong specimens, but the last mentioned tooth is missing in the Sandheads specimen. The inner angle of the wrist is sharply spiniform, but in addition there is a distinct, sharp spinule at the outer angle also, as described by Alcock. In the Hongkong example, referred to above, there are sharp granules on the distal border of the wrist, and a few scattered ones on the upper surface also. In the example from the Sandheads there are similar granules on the upper and lower margins of the palm ; these are better seen in the smaller chela. The palm and the fingers are as described by Tesch, but the arrangement of the teeth on the cutting edges of the fingers is somewhat different in all the three examples.

The third walking legs are remarkably long, being about three times the length of the carapace. The merus is broad and flattened, its breadth being about one-third of the length, is trigonous like some of the other segments, and has its margins more or less evenly spiny. All the legs are profusely spiny as described by Alcock, and the dactyli of the last pair are characteristically curved.

One of the Hongkong specimens is a male and its abdomen is exactly as described and figure by Tesch. In the female all the seven segments are distinct and the margins are hairy. The third segment is not laterally projecting as in the male, but the two longitudinal grooves on it can be indistinctly made out.

*Scalopidia spinosipes*, as so far recorded, appears to be a somewhat rare species. In the Indian Museum there were so far only the two Hongkong examples mentioned by Alcock, though the species had also been recorded from Indian waters by Henderson[1] from the Gulf of Martaban and by Laurie[2] from the Gulf of Manaar. The only other records of the species, so far as I am aware, are from Hongkong, the type-locality, by Stimpson[3], Alcock and Miss Gordon[4], from the Gulf of Siam by Miss Rathbun[5] and from Lombok and Macassar in the Flores Sea by Tesch.

The measurements, in millimetres, of the Sandheads example and of the two specimens from Hongkong are given below :—

| | Sandheads. | Hongkong. | Hongkong. |
|---|---|---|---|
| | ♀ | ♂ | ♀ |
| Length of carapace .. .. | 13·2 | 11·5 | 11·2 |
| Breadth of carapace | 18·0 | 15·2 | 14·9 |
| Breadth of front .. | 4·5 | 3·8 | 3·6 |
| Breadth of Fronto-orbital border | 8·0 | 6·6 | 6·4 |
| Length of third walking leg .. | 40·0 | 35·0 | 34·0 |

[1] Henderson, *Trans. Linn. Soc. London (Zool.)* V, pp. 379, 380 (1893).
[2] Laurie, *Ceylon Pearl Oyster Fish. Rept.* V, p. 424 (1906).
[3] Stimpson, *Proc. Acad. Nat. Sci. Philadelphia*, 1858, p. 95 (1858).
[4] Gordon, *Journ. Linn. Soc. London (Zool.)* XXXVII, p. 528 (1931).
[5] Rathbun, *Skrift. K. Dansk. Vidensk. Selsk. Copenhagen* (7) V, p. 344. pl. ii, fig. 2 (1910).

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