XXII NOTES ON CRUSTACEA DECAPODA IN THE INDIAN MUSEUM

XII. SCOPIMERINAE.

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Plates XII, XIII.

This subfamily of Ocypodidae comprises a number of very small crabs found on the sea shore or in estuaries and backwaters. Four genera have hitherto been recognised:—*Scopimera*, de Haan, *Dotilla*, Stimpson (= *Doto*, de Haan), *Ilyoplax*, Stimpson and *Tympanomerus*, Rathbun (= *Dioxippe*, de Man). A fifth is here described under the name *Dotillopsis*.

The range of the subfamily extends from the southern and western coasts of Africa and the Red Sea to the Banda Sea, the Philippine Is. and Japan. Its headquarters appear to be on the Indian coasts on which all the genera except the problematical *Ilyoplax* occur.

Including the new forms here described thirty species of Scopimerinae are now known: of these I have seen twenty-one. Eighteen species are known from the Indian coasts and of these I have seen all but one and the types or paratypes of thirteen.

The Scopimerine crabs are of small size as compared with the Ocypodinae. They are all littoral or estuarine and strictly amphibious in habits. Unlike *Ocypoda* the coastal species live only in sheltered bays on the shores of which surf never breaks. The species of *Dotilla* and *Scopimera* burrow in damp sand between tide-marks and different forms are as a rule restricted to different levels on the beach. For example, both in Mormugao Bay on the west coast of India and at Tuticorin on the south-east coast *Scopimera proxima* and *Dotilla myctiroides* occur, the former inhabiting the zone near high-water mark, while the latter is to be found near low-water mark. *Tympanomerus* burrows in rather stiff clay or muddy sand, while *Dotillopsis* affects estuarine mud of the softest consistency.

All the species construct small oblique burrows, from which they remove the sand or mud in little pellets. This is done as often as the tide sinks and exposes the area in which they are living. In nearly all cases the pellets are disposed with some care, in such a way that one or more pathways are left clear on the surface round the mouth of the burrow. The pathways themselves are smoothed and apparently hollowed out by the crab. The

arrangement of the pellets gives the burrow a very characteristic appearance, enabling it to be distinguished at a glance from that of young *Ocypoda* and other forms of similar habits.

The crabs are gregarious and sometimes occur in very large numbers. Beaches occupied by them can occasionally be recognised at a considerable distance by their freshly raked surface. Little is known as to what occurs in these communities at high tide, but as they are very seldom obtained in nets hauled on suitable ground near the shore it is probable that they remain in their burrows. When the tide is out they may often be seen sitting at the mouths of the burrows or in the pathways leading to them, but seldom if ever wander further afield. Each crab or pair of crabs keeps rigidly to its burrow.

The habits of the Indian species of *Dotillopsis* seem to be somewhat different from those of the other genera because the mud in which it burrows is too soft to retain a definite impression. It is often impossible to distinguish its holes, though it appears to excavate them in the same way. The dense tomentum on the walking legs in this genus and in certain species of *Tympanomerus* is probably an adaptation to life on muddy ground.

Most of the species of *Dotilla* and *Scopimera* live on the sea-shore. A few make their way into backwaters, where the water is brackish or of very variable salinity, but the environment in such situations is as a rule unfavourable. The crabs usually fail to reach their normal size, and in species in which there are marked structural differences between the sexes, the males seem unable to attain their full development.

Most species of *Tympanomerus* are found in estuaries, often near or even beyond the extreme limit of tidal influence. Both species of *Dotillopsis* are essentially estuarine, but the Indian form has been found in a small backwater near the open sea as well as a considerable way up the Gangetic delta. No species has been found at any great distance from the coast, but *T deschampsi* and *T stapletoni* are able to live on the banks of large rivers at places where the water is always fresh. *T stapletoni* is said to have destroyed a dynasty of kings in Eastern Bengal by burrowing through the embankments their people had constructed and so letting brackish water in to the rice-fields.

In examining the Indian species of Scopimerinae I have met with instances of dimorphic forms in the female as well as in the male sex. In *Dotilla intermedia* two perfectly distinct types of adult male exist which differ conspicuously in the structure of the first segment of the abdominal sternum and chela and in the form of the copulatory appendage. *Scopimera proxima* presents still more interesting features, for it exhibits dimorphism of the female—a phenomenon not, I think, hitherto noticed in Decapod Crustacea. The dimorphism in this instance is to be found in the form of the abdomen and is very peculiar in that the scarcer and more aberrant form of female has characters approximating closely to those of the male. The remarkable point is that in this form the sides of

the abdomen are constricted as in the other sex. We have thus a female possessing a male character that can hardly be called secondary, for it can be demonstrated without difficulty that the purpose of the constriction in the male abdomen is that of permitting the copulatory appendages to remain exserted, while the abdomen is folded against the carapace.

This paper was almost completed before I became acquainted with Dr. Tesch's report on the Catometope crabs obtained by the 'Siboga' Expedition, published in 1918. In this report (pp. 40 *et seq.*) will be found a summary of the characters of the genera and species of the Scopimerinae and full descriptions of certain forms. My own work thus to a great extent covers the same ground as that traversed by Tesch, but there are considerable differences in our treatment, and, apart from the new species I have to introduce, an independent consideration of the subfamily will, I believe, have its uses.

Tesch gives to the subfamily the name Mictyrinae and includes in it Latreille's *Mictyris*, usually placed in a separate family. This view is not supported by any discussion and, having examined both the species belonging to Latreille's genus, I am unable to give my adherence to it.

Mictyris differs from the members of all other Catometope families in a number of very important features. Apart from the absence of defined orbits and the extraordinary disposition of the third maxillipeds, the mouth-parts differ widely from those of all genera of Ocypodidae with which I am acquainted, while in the possession of an unpaired accessory branchial orifice at the extreme posterior end of the carapace the genus is unique among Decapoda.[1]

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[1] In nearly all Brachyrhynchous crabs water is normally drawn into the branchial chamber through an aperture at the base of the chelipeds and is expelled through the buccal cavern between the endostome and the distal ends of the outer maxillipeds. In *Mictyris* and in certain Ocypodid genera, all of which are amphibious in habit, accessory passages to the branchial cavity are to be found. The external orifices of these passages are rendered conspicuous by reason of a thick fringe of short hairs which doubtless serves to prevent the intrusion of particles of sand.

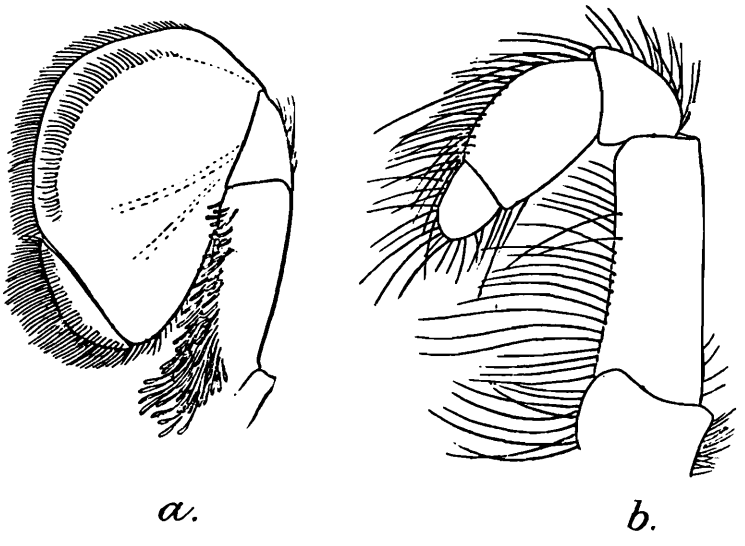
In *Ocypoda* and *Gelasimus* the orifice of the passage takes the form of a hairy-edged pouch situated between the bases of the 2nd and 3rd walking legs. From this pouch a channel passes upwards to the branchial cavity either through a gap between the upturned margins of the coxae (very conspicuous in *O. ceratophthalma*) or through an aperture behind their fused edges. In *Heloecius* similar pouches exist between both the 1st and 2nd and between the 2nd and 3rd walking legs. Of Scopimerine genera *Scopimera* possesses an accessory branchial passage with the orifice placed between the bases of the 1st and 2nd legs, and similar passages also exist in certain species of *Tympanomerus*, the orifices being found between the bases of the 1st and 2nd, 2nd and 3rd and (sometimes) the 3rd and 4th walking legs.

The unusual structure of the branchial opening at the base of the chelipeds in *Mictyris* has been described by Alcock, who does not, however, refer to the accessory passage also found in this genus. The orifice of this passage differs from that of all the Ocypodid genera referred to above in being unpaired. It is situated at the extreme hinder end of the animal and is bounded dorsally by the short posterior margin of the carapace and ventrally by a strong transverse ridge on the first abdominal segment, both upper and lower borders being heavily

I am of the opinion that the resemblances between *Mictyris* and the Scopimerinae are convergent rather than genetic and I cannot believe that the two have had a common origin distinct from that of the Ocypodinae and Macrophthalminae.

Apart from the position of *Mictyris* I differ from Dr. Tesch on a number of points of lesser importance.[1] With more material before me than was at his disposal I believe that I have been able to discover generic characters of more constant value than those utilised by him on p. 41 of his report.

In the possession of tympana, curious membranous areas found on the meral segments of the legs and sometimes on the thoracic sterna, the Scopimerinae differ from all other Decapoda; in some of the genera, however, they are ill-defined and in certain species of *Tympanomerus* they are altogether absent. The sub-family may be distinguished from the Ocypodinae by the presence



TEXT-FIG. 1.

Endopod of second maxilliped.

a. Scopimera globosa, de Haan.

b. Tympanomerus gangeticus, sp. nov.

of a fully formed pleurobranch above the base of the second walking legs and from the Macrophthalminae by the more oblique position and rudimentary character of the antennules and by the greater breadth of the interantennular septum.

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fringed with short hairs. From the slit-like opening thus formed a narrow channel passes forwards on either side to the branchial cavity,

On placing a living specimen of *Gelasimus acutus* in a bowl of water and introducing a little coloured fluid at the base of the chelipeds I found that the fluid was immediately drawn in and expelled in the ordinary way through the upper part of the buccal cavern. I failed, however, to demonstrate that the accessory openings were similarly used in submerged individuals, even though an attempt was made to inject the fluid into the pouch, and think it probable that they are employed only for taking in air. The presence of the fringe of hairs suggests that they are inhalent rather than exhalent.

[1] For instance I regard *Dotilla sigillorum* as a species of *Scopimera*, *D. clepsydrodactylus* as a synonym of *D. intermedia* and *Cleistostoma lingulatum* as a species of *Tympanomerus*.

In recent years a large number of specimens of Scopimerinae have been added to the collection of the Zoological Survey of India. We are indebted to Lt.-Col. C. R. Stevens, I.M.S., for a most valuable series from Karachi, comprising examples of several new and scarce forms. Lt.-Col. H. J Walton, I.M.S., has contributed further specimens of *Dotilla blanfordi*, hitherto known only from the types, and Mr. J Hornell, a small but interesting collection from Tuticorin. I have to thank Dr. F. H. Gravely for a very long series of *Dotilla intermedia* from the Orissa coast, material which has enabled me to demonstrate the existence of dimorphism among the males. Dr. J G. de Man has kindly sent me examples of *Tympanomerus pusillus*, Dr. Nakazawa and Dr. Bruno Parisi specimens of *Scopimera globosa*.

Excluding *Ilyoplax*, which cannot be recognised with certainty until the type species has been rediscovered, the genera of Scopimerinae may be distinguished by the following characters:—

I. Penultimate segment of 2nd maxilliped greatly expanded, with ultimate segment applied to it laterally as a narrow strip (text-fig. 1*a*).
  A. A conspicuous brush of hairs, indicating the position of the accessory branchial orifice, between bases of 1st and 2nd walking legs; 4th segment of abdomen not overlapping 5th, nor with a brush of hair at its distal end; abdomen of male with 4th or 5th segments constricted, the 5th occasionally linear. [Lateral walls of carapace usually without conspicuous sculpture.] ... *Scopimera*, p. 310.
  B. No brush of hairs between bases of walking legs; 4th segment of abdomen overlapping 5th and with a thick brush of hair at its distal end in both sexes; abdomen of male not constricted. [Lateral walls of carapace with deep convolute sculpture.] ... ... *Dotilla*, p. 324.

II. Penultimate segment of 2nd maxilliped not expanded, with ultimate segment attached terminally (text-fig. 1*b*). [4th segment of abdomen not overlapping 5th, nor with a brush of hair at its distal end.]
  A. Lateral walls of carapace with deep convolute sculpture; upper surface strongly sculptured; 4th segment of abdomen of male remarkably expanded, nearly 3 times as broad as fifth ... *Dotillopsis*, p. 334.
  B. Upper surface and lateral walls of carapace not conspicuously sculptured; 4th segment of abdomen of male not remarkably expanded though it may be broader than 5th ... ... *Tympanomerus*, p. 336.

The tympana are well-defined and usually conspicuous in *Scopimera* and *Dotilla*, ill-defined in *Dotillopsis* and ill-defined or absent in *Tympanomerus*. The merus of the third maxilliped is longer than the ischium in *Dotilla* and *Dotillopsis* and longer than or equal to the ischium in *Tympanomerus*; in some but not all the species of *Scopimera* the ischium is longer than the merus. A dense tomentum is found on the first three walking legs in *Dotillopsis* and similar but less extensive patches of hair are found in certain species of *Tympanomerus*.

The genera exhibit rather complex inter-relations. In the form of the abdomen and in the possession of hairy-edged pouches indicating openings into the branchial cavity *Scopimera* is related to *Tympanomerus*, while *Dotilla* and *Dotillopsis* agree in the deep sculpture of the upper surface and side-walls of the carapace. On the other hand *Scopimera* and *Dotilla* resemble each other and differ widely from *Dotillopsis* and *Tympanomerus* in the structure of the ultimate segments of the second maxilliped.

The genus *Ilyoplax*, which was described in 1858,[1] is based on a single species, *I. tenella*, "found at Whampoa, China, along the banks of the Canton River (brackish water), living in holes in the mud, exposed at low water." The fact that the meral segments of the legs possess tympana indicates that the genus must be referred to the Scopimerinae. Stimpson compares it with *Macrophthalmus* and remarks that it forms "a connecting link between the Macrophthalmidae and the Dotillidae." To my mind it is unquestionably a very close ally of *Tympanomerus* and I strongly suspect that it will prove to be synonymous with that genus. This, however, cannot be accurately determined until *I tenella* has been rediscovered.

Genus **Scopimera**, de Haan.

1833. *Ocypode*, subgen. *Scopimera*, de Haan, in Siebold's *Faun. Japon., Crust.*, pp. 5, 24.
1852. *Scopimera*, Milne-Edwards, *Ann. Sci. nat., Zool.*, (3) XVIII, p. 153.
1900. *Scopimera*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 369.
1918. *Scopimera*, Tesch, *Decap. Brachyur. Siboga' Exped.* I, pp. 41, 45.

The species may be distinguished by the following characters:—

I. Ischium of third maxillipeds longer than merus.
  A. Mid-dorsal surface of carapace with large symmetrical puckers or vesicles; chela with strong carina near inferior border; last three segments of abdomen of male racket-shaped, the 5th linear, very much narrower than 6th or 7th ... ... *S. crabricauda.*
  B. Mid-dorsal surface of carapace not conspicuously puckered; chela with inferior border rounded; 5th segment of abdomen of male not linear, little if at all narrower than 6th and 7th.
    1. Tympana on meral segments of walking legs not divided by a ridge.
      a. Lateral border of carapace defined by a crest throughout its length; upper surface strongly granular; chelipeds of adult male little more than twice length of carapace ... ... *S. globosa.*
      b. Lateral border of carapace defined by a crest only in its anterior half; upper surface feebly granular; chelipeds of adult male usually quite three times length of carapace. ... ... *S. pilula.*
    2. Tympana on meral segments of walking legs (except for that on upper surface of last leg) divided longitudinally by a narrow ridge.

[1] Stimpson, *Proc. Acad. Nat. Sci. Philadelphia* X, p. 98 (1858), and *Smithson. Misc. Coll.* XLIX, p. 100 (1907).

a. Antero-lateral portions of carapace much inflated and separated by an abrupt declivity from outer orbital angles; 4th segment of male abdomen anteriorly emarginate, not constricted, 5th longitudinally channelled; abdomen of female with convex lateral margins ... *S. investigatoris.*

b. Antero-lateral portions of carapace not greatly inflated, sloping gently to outer orbital angles; 4th segment of male abdomen much constricted anteriorly, 5th not channelled; abdomen of female with concave lateral margins ... *S. proxima.*

II. Ischium of third maxillipeds shorter than merus. [Chela with strong carina or row of granules near inferior border.]

A. Ischium and merus of outer maxilliped studded with coarse tubercles. [Merus about twice as long as ischium; carpus of male cheliped without tooth at inner angle.] ... ... *S. kochi.*

B. Ischium and merus of outer maxilliped smooth, or nearly so.

1. Upper surface of carapace sculptured; merus of third maxilliped three times as long as ischium; carpus of male cheliped?... ... ... *S. sigillorum.*

2. Upper surface of carapace without evident sculpture; merus of third maxilliped only a little longer than ischium; carpus of male cheliped with a tooth at inner angle .. .. *S. inflata.*

The species fall into four groups. Firstly the very highly specialized *S. crabricauda* which differs widely in the form of the male abdomen from any other species of the genus. Secondly *S. globosa* and *S. pilula* which are normal forms. Thirdly *S. investigatoris* and *S. proxima*, allied to the foregoing but distinguished by the presence of a ridge which bisects the tympana on the walking legs, and fourthly *S. kochi*, *S. sigillorum* and *S. inflata* which, though true Scopimeras, show affinity with *Dotilla* in the proportions of the merus and ischium of the third maxillipeds and in the presence of a certain amount of sculpture on the lateral walls of the carapace.

The brush of hairs between the bases of the first and second walking legs is very conspicuous in all the species of the genus that I have seen. A similar character is sometimes found in *Tympanomerus*, but occurs between the bases of other legs as well and is always much less easily detected.

S. crabricauda, *S. pilula*, *S. investigatoris* and *S. proxima* are Indian species.

Scopimera crabricauda, Alcock.

1900. *Scopimera crabricauda*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 370, and *Illustr. Zool. R.I.M.S. Investigator*,' *Crust.*, pl. lxiii, figs. 5, 5*a*, 5*b*.

In addition to the particulars given by Alcock it may be noted that in both sexes on the inner face of the chela there is a large blunt ridge, dorsally convex, extending from the base of the fixed finger to the carpal articulation. There are three finely serrate carinae on the fixed finger; the outer and inner reach only a short

distance on to the palm, but the median traverses its whole length, running externally a little above the lower border.

Two additional males of this scarce species, recently obtained by Lieut.-Col C. R. Stevens, I.M.S., are considerably smaller than the large male examined by Alcock; the carapace of the larger is only 5 mm. in length and 8·3 mm. in greatest breadth.

$\frac{41.3.3}{4}$	Karachi.	A. O. Hume and F. Day.	Two. TYPES.
$\frac{98.4.9}{10}$	Karachi.	C. R. Stevens.	Two.

Only these four specimens are known.

Scopimera globosa, de Haan.

Plate XII, fig. 2.

1835. *Ocypode* (*Scopimera*) *globosa*, de Haan, in Siebold's *Faun. Japon., Crust.*, p. 53, pl. xi, figs. 3, 3 *a*, *b*.
1852. *Scopimera globosa*, Milne-Edwards, *Ann. Sci. nat., Zool.* (3) XVIII, p. 153.
1858. *Scopimera tuberculata*, Stimpson, *Proc. Acad. Sci. Philadelphia* X, p. 98.
1894. *Scopimera globosa*, Ortmann, *Zool. Jahrb., Syst.*, VII, p. 747.
1898. *Scopimera globosa*, Koelbel, in *Wiss. Ergebn. Reise Grafen Béla, Széchenyi in Ostasien*, p. 572.
1902. *Scopimera globosa*, Doflein, *Abh. K. Bayer. Akad. Wiss.* XXI, p. 668.
1907. *Scopimera tuberculata*, Stimpson, *Smiths. Misc. Coll.* XLIX, p. 102.
1918. *Scopimera globosa*, Tesch, *Decap. Brachyur. Siboga' Exped.* I, p. 46, pl. iii, fig. 3.
1918. *Scopimera globosa*, Parisi, *Atti Soc. Ital. Sci. Nat.* LVII, p. 97, text-fig. 2.

The carapace is more than one and a half times as broad as long and its depth is slightly greater than its length. The upper surface is widest posteriorly, but the lateral walls slope outwards as well as downwards, the widest point being between the bases of the second pair of walking legs. The distance between the outer orbital angles is a little greater than the length.

The upper surface is covered with a very regular microscopic pitting, which gives it a dull appearance, and bears numerous smooth and shiny tubercles. The tubercles are most distinct on the lateral parts of the upper surface and on the branchial regions they tend to form transverse and oblique rugae; above the base of the last leg there is a clearly marked curved and serrulate ridge. On either side of the gastric region there is a conspicuous indentation from which shallow puckers or grooves radiate forwards, outwards and backwards. The gastric and cardiac regions are partially separated from one another by a very inconspicuous transverse furrow; their lateral boundaries are sharply defined.

The front is bluntly pointed and narrow, its breadth between the bases of the eyestalks being little more than a fifth the extra-orbital width. The edges of the front are raised and on each side there is a low granular ridge which curves inwards proximally, the

two almost meeting between the bases of the eyestalks. The central portion is depressed and smooth with a low longitudinal ridge or elevation.

The orbits have a strong dorsal inclination, the greater part of the cavity being visible in dorsal view. The upper border is sinuous and slopes obliquely backwards; it has a smooth raised rim and terminates in a blunt extra-orbital tooth. The lower border is sharply denticulate and strongly curved. On the floor of the orbit there is a fine beaded ridge which runs outwards from the base of the eyestalks and meets the lower border in the outer third of its length.

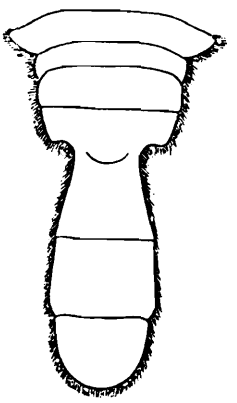
The lateral margin of the carapace is defined as a sharp crest extending from the orbital tooth to the base of the last legs; it is finely crenulate throughout and fringed with short setae. Both above and below the crest there is a smooth longitudinal groove. The side-walls of the carapace are finely granular and setose.

The endostomial margin almost touches the basal segments of the antennules and antennae, the epistome consisting merely of a median triangular plate bearing a sharp transverse carina. The expanded penultimate segment of the second maxilliped (text--fig. 1*a*, p. 308) is not covered with long hairs as in *S. pilula.*

The third maxillipeds bulge strongly. The ischium is longer than the merus and its breadth is a little greater than its length. The merus is nearly twice as broad as long and the suture between it and the ischium is decidedly oblique. The ischium is smooth except for some obscure granules postero-externally and for a raised line fringed with setae near the antero-lateral angle. There is a deep groove on the merus near its lateral border and on the inner side of the groove some low granules. A short blunt ridge runs to the articulation of the carpus. Antero-internally the surface of the merus is smooth and concave, with the margin reflected upwards.

The chelipeds of the male, if straightened, would be rather more than twice the length of the carapace. The merus has a tympanum on its outer side, in breadth about half that of the segment, and another, larger and less well defined on its inner surface; except for the tympana the segment is closely granular. The carpus is also granular and its upper surface is less than twice as long as broad in males. The three edges of the merus and the inner and outer edges of the carpus are rounded, not crested as in *S. pilula.* The chela is a little longer than the carapace and is nearly three times as long as high; its height near the carpal articulation is fully three quarters its greatest height. Both upper and lower borders of the palm are rounded and the entire surface, both within and without, is closely covered with squamiform granulation. The fingers are longer than the upper border of the palm, but shorter than its total length; each is glabrous with four longitudinal, finely serrate carinae. Except near the tip the prehensile edges of the fingers bear small teeth, a group on the dactylus a little behind its middle point being rather larger than the others.

The first and second walking legs are nearly three times the length of the carapace; the fourth pair is little more than two-thirds their length. The meri are expanded and bear very large tympana on both upper and lower surfaces. The dactyli in all four pairs are dorsally flattened; in the first three pairs they are a little longer than, in the last pair nearly one and a half times as long as the propodus. Except for the dactyli all the segments of the walking legs are finely granular and bear long scattered black bristles.



TEXT-FIG. 2.—*Scopimera globosa*, de Haan. Abdomen of male.

In the abdomen of the male (text-fig. 2) the first three segments are short and broad. The fourth and fifth segments, taken together, are about as long as broad at base; in their proximal half they are deeply constricted, the least breadth being about half the length of the two combined. The suture between the fourth and fifth segments is deficient, not meeting the lateral margin on either side; it may be seen as a fine, anteriorly concave groove crossing the narrowest part of the constriction. The sixth and seventh segments are each broader than long.

The carapace of a large male is about 8·7 mm. in length and 14 mm. in greatest breadth. I have not examined any females.

I agree with Koelbel that Stimpson's *S. tuberculata* is synonymous with *S. globosa*. Müller's record from Trincomali[1] is almost certainly erroneous and probably refers to *S. pilula*.

$\frac{97}{10}\frac{91}{0}$	Kisarazu, Tokyo Bay.	K. Nakazawa.	Four.
$\frac{98}{10}\frac{19}{0}$	Yokohama.	Mus. Milano (B. Parisi).	Five.

De Haan gives no precise locality for the specimens he described. Other records are Sagami Bay (Ortmann, Doflein), Nagasaki (Ortmann), Simoda (Stimpson) and Hongkong (Koelbel).

Scopimera pilula, sp. nov.

Plate XII, fig. 1.

? 1887. *Scopimera globosa*, Müller (*nec* de Haan), *Verh. Ges. Basel* VIII, p. 475.

This species is very closely allied to *S. globosa*, differing only in the following particulars.

The carapace is similar in shape to that of *S. globosa* and exhibits a shallow depression on either side of the gastric region. The puckers radiating from this depression are, however, much less

[1] Müller, *Verh, Ges. Basel* VIII, p. 475 (1887).

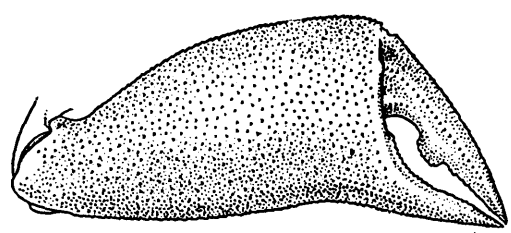
conspicuous and the entire upper surface more smooth. There are tubercles, most evident laterally, but all are smaller than in *S. globosa* and they do not tend to form transverse rugae. There is, however, a granular elevation near the extra-orbital angle and a protuberance near the base of the last pair of legs.

The lateral border, defined in *S. globosa* as a sharp crest running the whole length of the carapace, is deficient. It is visible for a short distance behind the orbital angle and the side-walls beneath it are longitudinally grooved, but further back it is altogether wanting, the side-walls in the posterior half of the carapace meeting the upper surface without interruption.

The front is slightly broader than in the allied species and is minutely nicked at the apex. The distal edge is thickened and behind it there is a large circular and completely circumscribed depression. There is a beaded ridge on the floor of the orbit as in *S. globosa*, but it is shorter and meets the lower orbital border at about its middle point.

The basal segments of the second maxillipeds bear very long woolly hairs which entirely conceal the distal segments when the appendage is normally flexed. The outer maxillipeds closely resemble those of *S. globosa*, but the merus is without granules and its sculpture is much less conspicuous.

The chelipeds of the adult male are very much longer than in *S. globosa*; in adults they are fully three times the length of the carapace. The edges both of the merus and carpus are crested. The carpus is proportionately much longer than in the allied species, the upper surface being more than two and a half times as long as broad. The segment is transversely rugulose above, not simply granular. The length of the chela (text-fig. 3) is distinctly greater than that of the carapace and differs in shape from that of *S. globosa*; the greatest height of the palm is about twice its height at the carpal articulation. The length of the dactylus is only about two-thirds that of the upper border of the palm. On both outer and inner surfaces the palm is covered with very fine granules which are arranged round small interspaces so as to give a reticulated appearance. The ridges on the fingers are similar to those of *S. globosa*, but the cluster of enlarged teeth near the middle of the inner margin of the dactylus is much more conspicuous.

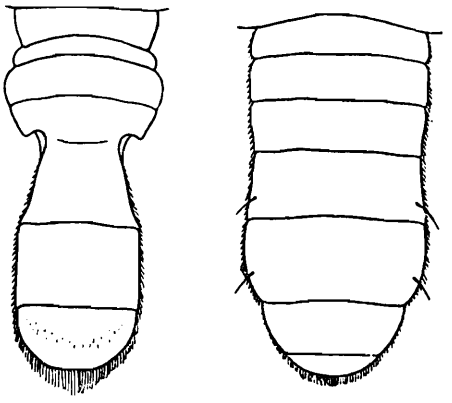


TEXT-FIG. 3.—*Scopimera pilula*, sp. nov. Chela of male.

In the female the cheliped is only about twice the length of the carapace; the carpus is proportionately much shorter and the chela shorter, with fingers longer than the upper border of the palm The limb in consequence bears a close resemblance to that of male *S. globosa*, but the borders of the merus and carpus are crested.

The first and second walking legs are about two and a half times the length of the carapace and are thus a little shorter than in *S. globosa*. In other respects the legs show little difference: the merus is expanded, of similar proportions and bears large tympana.

The abdomen of the male (text-fig. 4*a*) is similar to that of the allied species but the fourth and fifth segments are a little longer than their basal breadth and are less deeply constricted; the breadth at the narrowest point is a little more than half the length. The sixth segment is about two-thirds as long as broad and the seventh nearly twice as broad as long. In the female (text-fig. 4*b*) the segments from the first to the fifth increase regularly in length; the fifth is about twice as broad as long and a shade wider than the fourth. The lateral margins of the abdomen are very slightly concave. In all the females the pleopods are covered with a thick felted growth which under low magnification resembles colonies of small Polyzoa and is usually extruded in bunches between the abdomen and the sternum. The growth in reality consists of stalks and broken shells of eggs from which the young crabs have escaped.



TEXT-FIG. 4.—*Scopimera pilula*, sp. nov.
a. Abdomen of male.
b. Abdomen of female.

In large males the carapace is about 7·0 mm. in length and 10·6 mm. in greatest breadth. The females are a little smaller.

In a young male from the vicinity of Tuticorin with carapace 3·7 mm. in length the chelipeds do not show the characteristic sexual development, though they are normally developed in an individual from the Burma coast with carapace 4·0 mm. in length. The Tuticorin specimen appears to be abnormal and the collection of further specimens in the same locality might prove of interest.

There can be little doubt that Müller's record of *S. globosa* from Trincomali refers to this species.

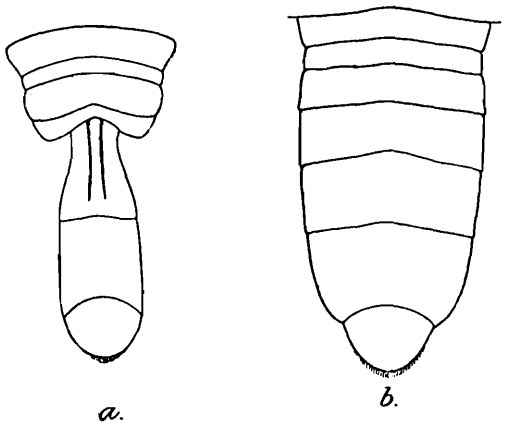
$\frac{9850-2}{10}$	Backwater at Pamban, Ramnad dist., S. India.	S. Kemp, Feb. 1913.	Many.
$\frac{9853}{10}$	Small lagoon near Tuticorin, S. India.	J. Hornell, Feb. 1918.	One.
$\frac{9854}{10}$	Paway (Pawe) I., Mergui Archipelago.	Investigator, Feb., 1914.	Two.

The types are from Pamban and bear the number 9850/10, *Zool. Surv. Ind.*

Scopimera investigatoris, Alcock.

1900. *Scopimera investigatoris*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 369, and *Illustr. Zool. Investigator*,' *Crust.*, pl. lxiii, figs. 4, 4*a*, *b*.

This species and *S. proxima* differ from all other members of the genus by the fact that the tympana on the meral segments of the walking legs, except for that on the upper surface of the last pair, are longitudinally divided by a narrow ridge; the tympana on the merus of the cheliped do not share this character. The two species may be contrasted with *S. inflata* and *S. kochi*, in which the tympana of the walking legs are normal, while that on the inner face of the merus of the cheliped is bisected.



TEXT-FIG. 5.—*Scopimera investigatoris*, Alcock.
a. Abdomen of male.
b. Abdomen of female.

I give a fresh figure of the abdomen in this species for comparison with that of the closely allied *S. proxima*.

The specimens of *S. investigatoris* described by Alcock are from Burma. Additional examples are from the western side of the Bay of Bengal:—

$\frac{2565-74}{7}$	Diamond I., off C. Negrais, Burma.	Investigator.'	Eleven. TYPES.
$\frac{9810}{10}$	False Point, Orissa.	Investigator.'	One (juv.)
$\frac{9811}{10}$	Chandipur, Balasore, Orissa.	F. H. Gravely, May, 1916.	Three.

At Chandipur the species was found in company with *Dotilla intermedia*, de Man.

Scopimera proxima, sp. nov.

Plate XII, fig. 3.

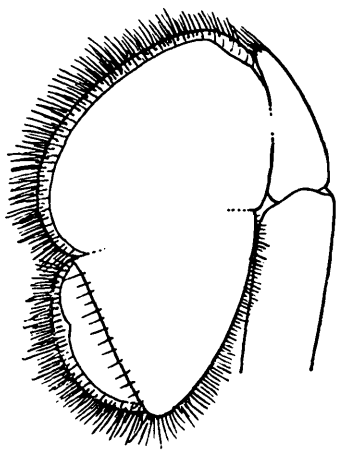
This species is an extremely close ally of *S. investigatoris*, but may be distinguished by its smoother carapace, less inflated antero-laterally and, in particular, by the different form of the abdomen.

The carapace is of similar proportions to that of the allied species and is about one and a half times as broad as long, with its depth about equal to its length.

In *S. investigatoris* a characteristic feature of the upper surface is the presence of an inflated and conspicuously granular area on each side near the antero-lateral angles. This area rises high above the orbital margin and is sharply defined anteriorly and externally by the steep and almost vertical declivity of its frontal and lateral borders, its separation from the outer orbital angle being conspicuous; posteriorly and internally it merges gradually into the general surface of the carapace. The granules of

this elevated area are continued backwards in irregular fashion, terminating in a cluster near the base of the last pair of legs. There are also scattered granules on other parts of the carapace, the gastric and cardiac regions excepted, and a few on either side of the basal part of the front near the insertion of the eye-stalks.

In *S. proxima* the condition is different. The antero-lateral portions of the carapace are only a little swollen, the surface sloping gently upwards and backwards from the orbital border without any indication of the abrupt declivity seen in the allied species. The granules are fewer and much less conspicuous, though they may sometimes be traced backwards to the base of the last pair of legs. The other parts of the carapace are quite smooth and there are no tubercles at the base of the front.



TEXT-FIG. 6.—*Scopimera proxima*, sp. nov. Endopod of second maxilliped.

When the carapace is viewed from in front the lower orbital border appears more strongly sinuous than in the allied species and the facet at its inner end more sharply defined.

The third maxillipeds closely resemble those of *S. investigatoris*; they do not, however, show any trace of the obscure granules often seen in large specimens of the latter species and there is merely a shallow furrow parallel with the outer border of the merus, in place of an incised groove.

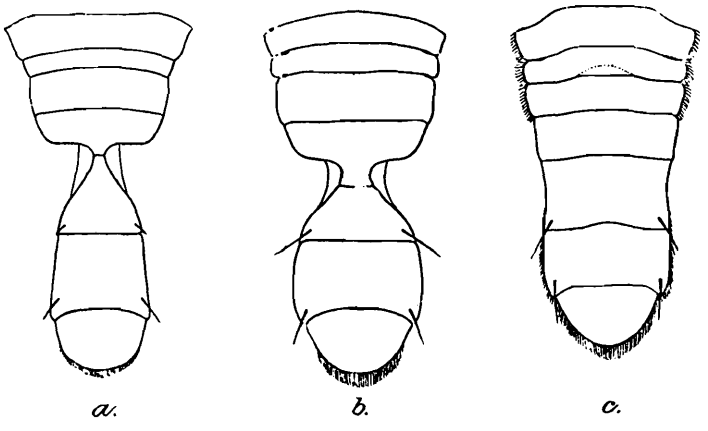
The chelipeds are short in both species and otherwise resemble each other very closely. In *S. proxima* all three edges of the merus are sharp and serrate, whereas in *S. investigatoris* the upper edge, though compressed, is distinctly rounded. In the latter species the inner limit of the upper surface of the carpus is defined proximally by a short crest which is wanting in *S. proxima*. The upper and lower borders of the palm are rounded in both species and there is little difference in the shape of the chela; the granulation is, however, a little coarser in *S. proxima* and the teeth on the prehensile edges of the fingers are larger and sharper. I have not found any distinctions in the walking legs.

The abdomen of the male of *S. investigatoris* has been figured by Alcock, but the form of the fourth segment is not quite correct, the distal angles being a little more produced than he has shown. I give a fresh figure of the male and female abdomen (text-fig. 5) for comparison with those of *S. proxima* (text-fig. 7). In *S. investigatoris* the fourth segment in the male is broad distally with produced outer angles, the fifth narrow, constricted at the base and deeply channelled, the sixth longer than broad with parallel sides. In *S. proxima* there is a very deep constriction at the junction of the fourth and fifth segments, the anterior end of the

former being exceedingly narrow[1]; the fifth segment is not channelled and the sixth is a little broader than long with straight, slightly divergent sides.

In the abdomen of the female the differences are less marked. In *S. investigatoris* (text-fig. 5*b*) it is rather broad, with slightly convex sides and with the seventh segment narrow; in *S. proxima* (text-fig. 7*c*) it is proportionately narrower, with the sides a trifle concave and the seventh segment broader.

Among a large number of specimens of *S. proxima* I have found ten in which the abdomen does not correspond with the normal type of either sex. In general outline (text-fig. 7*b*) the abdomen is similar to that of the normal male, but the constriction at the junction of the fourth and fifth segments is less deep, the fifth segment is proportionately broader and shorter and the sixth broader with convex lateral margins. On raising the abdomen four pairs of pleopods are found as in normal females.



TEXT-FIG. 7.—*Scopimera proxima*, sp. nov.

a. Abdomen of male.
b. Abdomen of abnormal female.
c. Abdomen of normal female.

At first it seemed probable that these specimens were males, infected by some parasite which had castrated them and rendered abortive the normal development of the secondary male characters. No parasite could, however, be discovered and on dissection ovarian eggs were found which differed in no respect from those obtained by the same method from normal females. There is, in consequence, very little doubt that the specimens are females and capable of breeding.

That very aged females occasionally assume some of the secondary sexual characters of the male is well known, but it does not seem probable that this will afford an explanation of the abnormal females in *S. proxima*. None of them is at all excep-

[1] The sides of the constricted portion are bevelled, so that the segments would appear broader if viewed from beneath.

tional in size and the presence of ovarian eggs indicates that they are capable of breeding and not, therefore, senile. The instance appears to be one of female sexual dimorphism, a phenomenon not, I believe, hitherto noticed among Decapod Crustacea.

It is very remarkable that the abdomen should be constricted in the abnormal females. In males the copulatory appendages can be exserted through the notches formed by the constriction and can remain in this position with the abdomen folded against the sternum: at the time of their capture many males of *S. proxima* were found with the appendages exposed. The modification of the abdomen seems thus to have a definite function in the male; in the female it is difficult to see how it can serve any useful purpose.

Of 87 specimens of *S. proxima* collected in Mormugao Bay in Portuguese India 50 are males, 31 normal females (2 ovigerous) and 6 abnormal females. Of 14 specimens from the neighbourhood of Tuticorin in S. India 9 are males, 4 normal females (1 ovigerous) and 1 an abnormal female. Of 16 specimeus from Ennur backwater, near Madras, 6 are males, 7 normal females and 3 abnormal females.

In large males the carapace is about 4·4 mm. in length and 7 mm. in breadth.

$\frac{9812\text{-}4}{10}$	Vasco da Gama Bay, Mormugao Bay, Portuguese India.	S. Kemp; Aug., Sept., 1916.	Seventy-one.
$\frac{9815\text{-}6}{10}$	Donna Paula Bay, Mormugao Bay.	*do.*	Eleven.
$\frac{9817\text{-}8}{10}$	Bay N.W. of Nazareth Point, Mormugao Bay.	*do.*	Five.
$\frac{9855}{10}$	Silavathurai lagoon, nr. Tuticorin, S. India.	J. Hornell; Feb., May, 1918.	Fourteen.
$\frac{9867}{10}$	Ennur backwater, near Madras.	S. Kemp; May, 1918.	Sixteen.

Both in Mormugao Bay and near Tuticorin the species was found associated with *Dotilla myctiroides*, but the colonies of the latter were situated close to low-water mark, whereas those of *S. proxima* were higher up the beach, near high-water mark. In Mormugao Bay the species was found on ground that was sandy with a small admixture of mud. The burrows were widely separated, with pellets of sand neatly arranged in the customary manner. In many cases two, three or four 'runs' led to the mouth of the burrow, in place of the single one usually found in *Dotilla*. The 'runs' are long, sometimes as much as 1 ft.

The salinity of the water in Mormugao Bay varies with the state of the tide and doubtless also according to the season of the year; at the time of my visit, towards the end of the monsoon, it was everywhere brackish. The specific gravity in Vasco da Gama Bay was on one occasion 1·0165 (corrected).

The types are from Vasco da Gama Bay and bear the number 9812/10, *Zool. Surv. Ind.*

Scopimera inflata, A. Milne-Edwards.

1873. *Scopimera inflata*, A. Milne-Edwards, *Journ. Mus. Godeffroy*, Heft IV, p. 83.

In the collection of the Zoological Survey is preserved a single individual bearing the label "1423. *Scopimera inflata*, A. M.-Edw. Indian Ocean. Purchased." This specimen is one of very considerable interest and, though its history is not altogether free from doubt, there is every reason to believe that it is one of the original examples determined by A. Milne-Edwards.

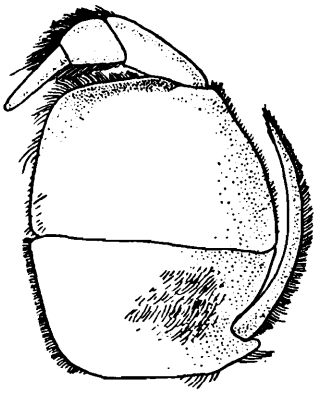
The register of the Crustacean collections contains under No. 1423 no information additional to that on the label, except that it is noted that only one specimen of the species was obtained. On the same page, however, are entries of a number of other Crustacea, also acquired by purchase and all apparently forming a single consignment, from Upolu, Samoa and the Viti Is. The entries were evidently made in 1875 or 1876. In the Annual Report of the Trustees of the Indian Museum for 1874-75 there is a statement that a collection of Crustacea "mostly from Southern Seas" was purchased from the Godeffroy Museum, while in the issue for 1875-76 it is noted that over 100 species of Crustacea (evidently a second consignment) were obtained from the same source. Mr. J Wood-Mason, who came to Calcutta in 1869 as assistant Curator of the Indian Museum, devoted a great deal of time to the acquisition of a representative collection of named Crustacea—of this the registers and annual reports from 1873 and onwards contain abundant proof. He evidently took steps to obtain a set of duplicates from the Godeffroy Museum as soon as Milne-Edwards' paper appeared, and there can hardly be a doubt that the example of *S. inflata* was one of the specimens then acquired. It will be observed that in the original description the only note regarding locality is "Habite la mer des Indes."

The specimen is an adult female and is unfortunately in poor condition; the carapace is partially detached and the only legs remaining are those of the first two pairs. It is not possible to measure the carapace satisfactorily, but there can be no doubt that it is proportionately much broader than in other species of the genus. The length appears to have been 6·5 mm. or a little more, and the breadth at the orbital angles nearly 10 mm., the greatest breadth apparently exceeding 12 mm. These figures do not agree with those given by Milne-Edwards, who gives the length as 10 mm. and the breadth as 13 mm.; the former measurement perhaps represents the total length and not, as stated, that of the carapace only.

The upper surface of the carapace is very strongly convex antero-posteriorly, but in transverse direction is almost flat over the greater part of its breadth, sloping abruptly downwards on either side. Antero-laterally the surface is very greatly inflated, bulging upwards and forwards to such an extent that in a true dorsal view the upper orbital border is, in the middle of its length,

altogether concealed. The gastric and cardiac regions are smooth, but laterally the tubercles mentioned in the original description can be made out; apart from these the upper surface appears to be without evident sculpture. The side-walls are finely granular and seem to show traces of a rather deep sculpture, the grooves apparently forming a pattern somewhat similar to those found in *Dotilla myctiroides*; it is, however, difficult to be certain about this point owing to the poor condition of the specimen.

The epistome is very broad and exceptionally short. The penultimate segment of the second maxilliped is broader and the last segment more parallel-sided and proportionately longer and narrower than in other species of *Scopimera*. The third maxillipeds are also unusually broad and differ from normal species of the genus in having the ischium shorter than the merus (text-fig. 8). The ischium has a rather thick patch of hairs near its postero-lateral angle and the suture between it and the merus is nearly transverse. The merus is one third broader than long and decidedly longer than the ischium; it is very little narrowed distally and is angled antero-internally. The anterior margin is reflected upwards, a short ridge runs backwards from the carpal articulation and there is a deep groove parallel with the lateral margin.



TEXT-FIG. 8.—*Scopimera inflata*, A. Milne-Edwards. Third maxilliped.

The chelipeds are about 15 mm. in length. There is a large tympanum on the inner face of the merus, subdivided longitudinally by a ridge as in Roux's *S. kochi*. The tympanum on the outer face is without this ridge and is a little smaller, though broad and in length about half that of the segment. Except for the tympana the entire segment is finely granular. A. Milne-Edwards in his description says " avant-bras allongé et armé d'une épine à son angle interne." This statement refers to the male. In the female there is no tooth, but the inner margin is concave and sharp-edged anteriorly and is obtusely angled in front of its middle point: in this respect there is a great difference between *S. inflata* and *S. globosa*. The carpus of the female is not elongate; its upper surface is about one and a half times as long as broad and is closely covered with granules. The chela is about 8 mm. in length and its greatest height, which is about twice that at the articulation of the carpus, is 3·7 mm. The whole palm is strongly compressed and the entire outer surface is conspicuously granular. The upper border is not carinate. On the outer side near the lower border there is a sharply defined beaded carina which extends from the proximal end to the distal third of the fixed finger; on the inner side a similar, but even more strongly marked, carina reaches from the carpal articulation to the middle of the inner side of the fixed finger.

The lower surface of the palm, bounded by these two crests, is only slightly convex; it bears rather large scattered granules, some of which towards the distal end are arranged in a single row and thus form a low ridge which extends to the middle of the finger. The fingers themselves are nearly twice the length of the upper border of the palm. On the prehensile edge of the fixed finger there is, in the basal two thirds, a series of small inconspicuous teeth; the same margin of the dactylus is similarly armed, but some of the teeth at the proximal end are situated on a low convex crest, the counterpart it would seem of the large triangular tooth found in this position in the male. On the upper and outer borders of the dactylus are longitudinal rows of granules.

In the first pair of walking legs, which alone remains in the specimen examined, the merus is a little more than twice as long as broad; it bears large tympana on both sides, not divided by a longitudinal ridge. The propodus is stout, a trifle more than twice as long as broad, and bears on its anterior face a strong longitudinal ridge. The dactylus is one and a half times as long as the propodus. The abdomen is very broad covering practically the whole of the sternum.

Scopimera inflata is allied to *S. kochi*, Roux, and *S. sigillorum* (Rathbun). The three species resemble *Dotilla* and differ from normal members of the genus in two points,—(i) the merus of the outer maxillipeds is longer than the ischium and (ii) the side-walls of the carapace are to some extent sculptured. In *S. inflata* and *S. kochi* the tympanum on the inner face of the merus of the cheliped is divided longitudinally by a narrow ridge and the same character, though not mentioned in the description, is perhaps also to be found in *S. sigillorum*. In other species of *Scopimera* the tympana on the chelipeds are not bisected; but those on the walking legs are divided in an exactly similar manner in *S. investigatoris* and *S. proxima*.

There can be little doubt that *S. inflata* is correctly referred to the genus *Scopimera*. In the female I have examined the accessory branchial orifice is situated between the bases of the first and second walking legs and is thickly fringed with hair, while the abdomen does not possess the peculiar form invariably met with in *Dotilla*. The abdomen of the male, as described by Milne-Edwards, is similar to that of *S. globosa*.

Scopimera kochi, judging from Roux's excellent description, is a closely related form, differring in the sculpture of the upper surface of the carapace, in the form and coarse tuberculation of the outer maxillipeds and in the absence of a tooth at the inner angle of the carpus of the cheliped in the male.

S. sigillorum, described by Miss Rathbun as a species of *Dotilla*, is unfortunately known only from a single female specimen. The statement that the abdomen is subcircular indicates that it cannot be included in the genus *Dotilla* as here defined. In most respects the species appears to be very closely related to *S. inflata*, but the carapace is more distinctly areolated and

the merus of the outer maxilliped is proportionately much longer, being three times the length of the ischium. The brush of hair between the bases of the first two walking legs is not mentioned either by Roux or by Miss Rathbun.

Scopimera kochi, Roux.

1917. *Scopimera kochi*, Roux, in *Nova Guinea*: *Résultats Expéd. Sci. Néerl. Nouvelle-Guinea* V Zool., p. 610, pl. xxvii, figs. 21-24.

Merauke, New Guinea.

Scopimera sigillorum (Rathbun).

1914. *Dotilla sigillorum*, Rathbun, *Proc. U.S. Nat. Mus.* XLVII, p. 83.

Sandakan Bay, Borneo.

I have not seen examples of either of these species. As noted above they appear to be related to *S. inflata*.

Genus **Dotilla**, Stimpson.

1835. *Doto*, de Haan, in Siebold's *Faun. Japon., Crust.*, p. 24.
1852. *Doto*, Milne-Edwards, *Ann. Sci. nat., Zool.*, (3) XVIII, p. 152 (*nom. praeocc.*).
1858. *Dotilla*, Stimpson, *Proc. Acad. Sci. Philadelphia*, p. 98.
1900. *Dotilla*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 363 (*in part*).
1918. *Dotilla*, Tesch, *Decap. Brachyur. Siboga Exped.* I, pp. 41, 43 (*in part*).

From this genus I have separated two species, *D. brevitarsis*, de Man and *D. profuga*, Nobili, and have placed them in a new genus to which I have given the name *Dotillopsis*. The remaining species—in my opinion only eight in number—form a very homogeneous group, distinguishable at a glance from any other genus of crabs by the curious formation of the abdomen. The fourth segment overlaps the fifth and is furnished at its distal end with a conspicuous brush of hair.

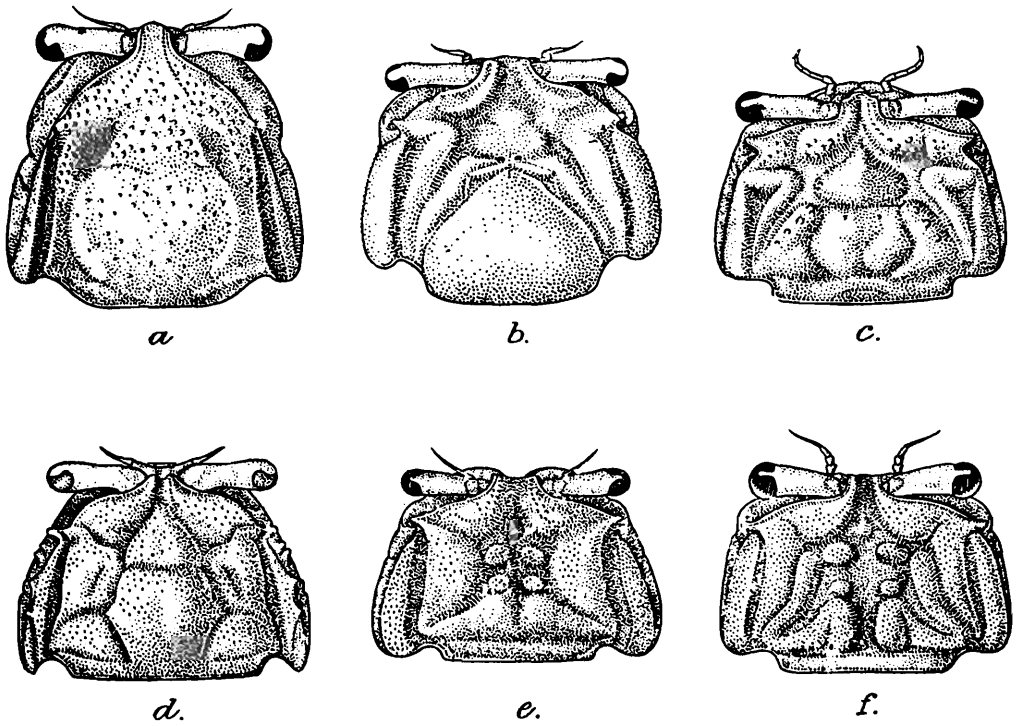
Many authors have remarked that they have seen no female *Dotilla*, but it does not appear that females are really scarce. The sexes, however, resemble each other so closely in the form of the abdomen that it is next to impossible to distinguish them without examination of the pleopods.

The genus shows affinity with *Scopimera* in the form of the distal segments of the second maxilliped, but lacks the accessory branchial passage found in that genus. In the deep convolute sculpture of the side-walls of the carapace it resembles *Dotillopsis* and, less markedly perhaps, the species of the *inflata*-group of *Scopimera*.

As regards the species, I have already referred Miss Rathbun's *D. sigillorum* to the genus *Scopimera* and, as noted above, two other species are placed in *Dotillopsis*. I agree with Nobili and Laurie that Alcock's *D. affinis* is synonymous with *D. sulcata*,

Forskål. *D. clepsydrodactylus*, Alcock, appears to me to be nothing more than a fully developed form of *D. intermedia*, de Man, while Stebbing's *D. clepsydra* does not seem to be distinguishable from Hilgendorf's *D. fenestrata*.

The mutual affinities of the species are best understood by a study of the grooves of the carapace. In text-fig. 9 will be found illustrations of the carapace of six species, the figures representing all the known types of sculpture. Two species I have not seen,—*D. fenestrata*, in which the sculpture is almost identical with that of *D. sulcata*, and *D. malabarica*, which in this respect bears a close resemblance to *D. pertinax*.



TEXT-FIG. 9.—Carapace sculpture in *Dotilla*.

a. *D. myctiroides* (Milne-Edwards).
b. *D. sulcata* (Forskål).
c. *D. pertinax*, Kemp.
d. *D. wichmanni*, de Man.
e. *D. blanfordi*, Alcock.
f. *D. intermedia*, de Man.

The species are often difficult to determine, partly owing to the fact that the grooves of the carapace are not easy to observe and partly because samples from a particular locality frequently consist only of comparatively small individuals, to the exclusion of large males with well developed secondary sexual characters. I have already remarked (p. 306) that the absence of full grown males is, in certain cases at any rate, to be attributed to an unfavourable environment. Males of *D. intermedia* are subject to a well-marked dimorphism.

With the exception of *D. fenestrata* all the known species of *Dotilla* have been found on the Indian coast. They may be distinguished thus :—

I. Carapace as long as broad, except for the lateral grooves practically devoid of sculpture; chelipeds at least three times length of carapace. [Tympana on all segments of sternum][1] ... ... *D. myctiroides.*

II. Carapace broader than long, its surface strongly sculptured; chelipedes at most little more than twice length of carapace.

A. Groove parallel to lateral margin of carapace anteriorly bifurcated or Y-shaped.

1. Two long parallel ∧-shaped grooves on dorsum of carapace, the lower enclosing a large triangular plane area with base occupying the whole of the posterior margin.

a. Tympana present on 2nd and 3rd segments of sternum; fingers of chela longer than palm, each in the adult male with a large tooth on its inner edge ... ... *D. fenestrata.*

b. No tympana on sternum; fingers of chela not longer than palm and without large teeth ... *D. sulcata.*

2. No parallel ∧-shaped grooves on dorsum of carapace; a cardio-intestinal area (much narrower than posterior margin) defined by lateral grooves.

a. Gastric area triangular; a faint transverse groove near posterior margin; dactylus of last leg not $1\frac{1}{2}$ times as long as propodus ... *D. pertinax.*

b. Gastric area pentagonal; no posterior transverse groove; dactylus of last leg 2^{ce} as long as propodus ... ... *D. malabarica.*

B. Groove parallel to lateral margin of carapace simple, not bifurcated anteriorly.

1. Gastric and cardiac areas entire, not divided by a median longitudinal groove; transverse groove near posterior margin incomplete in the middle; no lobules isolated by grooves on gastric region; adult male with a tooth below orbital angle and a strong compressed tubercle on inner and proximal aspect of carpus of cheliped; tympana on all segments of sternum ... ... *D. wichmanni.*

2. A deep mid-dorsal groove extending from front to posterior margin; transverse posterior groove complete; 4 (or 5) small lobules on gastric region isolated by grooves; no tooth below orbital angle and no tubercle on carpus of cheliped; no tympana on sternum.

a. Only a single oblique groove running from side of cardiac region towards postero-lateral angle; lower surface of palm not carinate ... *D. blanfordi.*

b. Two oblique grooves running from side of cardiac region towards postero-lateral angle; lower surface of palm strongly carinate ... *D. intermedia.*

Dotilla myctiroides (Milne-Edwards).

1900. *Dotilla myctiroides*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 368.
1900. *Scopimera myctiroides*, Lanchester, *Proc. Zool. Soc. London*, p. 760, pl. xlvii, fig. 14.
1907. *Dotilla myctiroides*, Stimpson, *Smithson. Misc. Coll.* XLIX, p. 101.
1907. *Dotilla myctiroides*, Willey, *Spolia Zeylanica* V, p. 38.
1915. *Dotilla myctiroides*, Kemp, *Mem. Ind. Mus.* V, p. 227, fig. 8.

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[1] Sternal tympana otherwise occur only in *D. fenestrata* and *D. wichmanni*.

References prior to 1900 are given by Alcock, who records the species from the Andamans and the Coromandel coast. Additional specimens are from the following localities:—

$\frac{9804}{10}$	Vasco da Gama Bay, Mormugao Bay, Portuguese India.	S. Kemp; Aug., Sept., 1916.	Thirty.
$\frac{9805}{10}$	Bay N. W. of Nazareth Pt., Mormugao Bay, Portuguese India.	*do.*	Six.
$\frac{9806}{10}$	Tuticorin, S. India.	J. Hornell; Feb., 1918.	Twenty-four.
$\frac{8935}{10}$	Pamban backwater, Ramnad dist., S. India.	S. Kemp; Feb 1913.	Seven.
$\frac{6934}{10}$	Ennur backwater, nr. Madras.	N. Annandale; Oct., 1913.	One (ovig.).
$\frac{8933}{10}$	Outer channel of Chilka Lake, Orissa.	Chilka Survey, March, 1914.	One.
$\frac{9856}{10}$	Maungma-gan, Tavoy, Burma.	J. Coggin Brown.	Five.
$\frac{8936}{10}$	Paway (Pawei) I., Mergui Archipelago.	Investigator, Feb., 1914.	Four.
$\frac{9857}{10}$	Port Blair, Andamans.	R. P. Mullins; June, 1918.	Seven.

In the first of these localities the species was exceedingly abundant on sandy ground with a small admixture of mud. The colonies occupied extensive tracts near low-water mark; the burrows were very closely packed together and the whole surface of the sand was covered with pellets to a depth of nearly an inch. It is perhaps due to this overcrowding that the specimens are decidedly smaller than usual, none exceeding 6·5 mm. in length of carapace. With the species, but in isolated burrows near high-water mark, was found *Scopimera proxima* and Mr. Hornell found the two forms associated in the same way at Tuticorin

Dotilla myctiroides is frequently found in places where the water is brackish. Dr. Annandale found an ovigerous female in such a situation at Ennur and, at the time specimens were taken, the specific gravity of the water in Vasco da Gama Bay was 1·0165 (corrected).

The species has been recorded from Mahé (Milne-Edwards),[1] Rameswaram I., Tuticorin and Ennur (Henderson), Singapore (Walker, Lanchester), Java (Brit. Mus., *fide* Henderson), Gaspar Straits (Stimpson) and Billiton I. and Mindanao (Aurivillius). Henderson gives "Seychelles (Miers)," but I have not succeeded in tracing the record.

Dotilla fenestrata, Hilgendorf.

1843. *Doto sulcatus*, Krauss, *Sudafrik.-Crust.*, p. 39 (Stuttgart).
1869. *Dotilla fenestrata*, Hilgendorf, in von der Decken's *Reisen Ost.-Afrika* III, p. 85, pl. iii, figs. 5, 5*b*,*c*.
1879. *Dotilla fenestrata*, Hilgendorf, *Monatsb. K. Preuss. Akad. Wiss.*, 1878, p. 806.
1884. *Dotilla fenestrata*, Miers, *Zool. H.M.S. Alert*, p. 543.
1893. *Dotilla fenestrata*, Aurivillius, *Nov. Act. Reg. Soc. Sci. Upsala*, ser. III, p. 12, pl. i, figs. 14, 15.

[1] Presumably the Mahé on the Malabar coast.

1894. *Dotilla fenestrata*, Ortmann, *Zool. Jahrb., Cyst.*, VII, p. 748.
1905. *Dotilla fenestrata*, Lenz, *Abh. Senck. Naturf. Ges. Frankfurt* XXVII, p. 367.
1917. *Dotilla clepsydra*, Stebbing, *Ann. Durban Mus.* II, p. 18, pl. v.

Stebbing records *D. clepsydra* from Durban Bay and compares it with Alcock's *D. clepsydrodactylus* (=*D. intermedia*, de Man), which it resembles in the structure of the chela of the adult male. Apparently, however, he has failed to notice that *D. fenestrata*, which also inhabits the S. African coast, possesses a chela of precisely this type.

I have little doubt that the two are synonymous. Judging from the very rough figure the sculpture of the carapace is of the type found in *D. fenestrata* and in the figure of the under surface there appears to be an indication of a tympanum on the second segment of the abdominal sternum, the third segment not being represented.

The only discrepancy is that *D. clepsydra* possesses a tooth at the proximal end of the lower surface of the merus of the cheliped. In males of *D sulcata* this tooth may be present or absent, but its existence is not mentioned in any description of *D. fenestrata.*

Of this species, which is restricted to the southern and eastern coasts of Africa, I have seen no specimens. It has been recorded from Zanzibar (Aurivillius, Lenz), Ibo (Hilgendorf), Mozambique (Hilgendorf, Miers), Inhambane (Hilgendorf), Durban Bay (Stebbing) and the Cape of Good Hope (Ortmann).

Dotilla sulcata (Forskål).

1775. *Cancer sulcatus*, Forskål, *Descript Anim.*, p. 92 (Hauniae).
1809. *Myctiris sulcatus*, Audouin, *Descript. de l'Egypte, Hist. Nat.*, I, *Explic. sommaire des planches.* p. 81 ; Savigny, *ibid.*, *Planches, Crust.*, pl. 1, figs. 3, i-iv (1817).
1829-44. *Myctiris sulcatus*, Guérin, *Icon. Regne Anim., Crust.*, pl. iv, figs. 5, 5*a-b*.
? *Myctiris sulcatus*, Milne-Edwards, in Cuvier's *Regne Anim., Atlas.* pl. xviii, figs. 3, 3*a*, *b*.
1833. *Ocypode* (*Doto*) *sulcata*, de Haan, in Siebold's *Faun. Japon., Crust.*, p. 24.
1837. *Doto sulcatus*, Milne-Edwards, *Hist. nat. Crust.* II, p. 92.
1850. *Doto sulcatus*, Lucas, *Hist. Nat. Anim. Artic., Crust.*, p. 61, pl. ii, fig. 1.
1861. *Doto sulcatus*, Heller, *Fitz. Kais. Akad. Wiss. Wien* XLIII, p. 361.
1888. *Dotilla sulcata*, de Man, *Journ. Linn. Soc , Zool.* XXII, p. 130.
1889. *Doto sulcatus*, Cano, *Boll. Soc. Nat. Napoli* III, p. 249.
1892. *Dotilla sulcata*, de Man, in Weber's *Zool. Ergebn. Reise Nied. Ost-Ind.* II, pp. 309-13.
1900. *Dotilla affinis*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 365, and *Illustr. Zool. Investigator,' Crust.*, pl. lxiii, figs, 1, 1*a*, *b*.
1906. *Dotilla sulcata*, Nobili, *Ann. Sci. nat., Zool* , (9) IV, p. 315.
1915. *Dotilla sulcata*, Laurie, *Journ. Linn. Soc., Zool.* XXXI, p. 467.

I agree with Nobili and Laurie that *D. affinis* is synonymous with *D. sulcata*. The tooth at the proximal end of the lower surface of the male cheliped is well developed only in large individuals ; the types of Alcock's species are all small, but the tooth

is present in a rudimentary condition in the two largest males. In a series of five specimens recently obtained by Capt. R. B. Seymour Sewell, I.M.S., in the Gulf of Suez, the tympanum on the upper surface of the last leg is present in two very small specimens and in a female of medium size; in a small male and large female it is altogether absent.

The specimens examined are:—

$\frac{1135}{4}$	Red Sea.	Berlin Mus.	Three.
$\frac{1173}{4}$	Aden and Mekran coast.	Investigator. TYPES of *D. affinis*, Alc.	Four.
$\frac{9807}{10}$	Ain Musa, Gulf of Suez.	R. B. Seymour Sewell.	Five.

Other precisely localized records of *D. sulcata* are,—Suez (Forskål, Laurie), Tor (Heller), Aden (Nobili) and Djibouti (Nobili).

Dotilla pertinax, Kemp.

1915. *Dotilla pertinax*, Kemp, *Mem. Ind. Mus.* V, p. 222, pl. xii, fig. 4.

Examination of further specimens shows that, as in *D. sulcata*, the tympanum on the upper surface of the last pair of legs may be present or absent. This character, therefore, will not serve to distinguish the species from Nobili's *D. malabarica*, to which in the pattern of the grooves on the carapace it is clearly related.

$\frac{8937-8}{10}$	Outer channel of Chilka Lake, Orissa.	Chilka Survey, March, Oct., 1914.	Many (including TYPES).
$\frac{9133}{10}$	Puri, Orissa.	S. Kemp; March, 1916.	Seventeen.

The specimens obtained at Puri were found at the edge of a small pool of brackish water separated by a sandbank from the open sea. At exceptional tides sea-water made its way into the pool.

Dotilla malabarica, Nobili.

1903. *Dotilla malabarica*, Nobili, *Boll. Mus. Torino* XVIII, No. 452, p. 20, fig. 6.

I have not seen this species, which is evidently closely related to *D. pertinax*. It differs in the sharply pentagonal form of the gastric area—clearly shown in Nobili's figures, in the generally deeper sculpture of the carapace and in the absence of a transverse groove near the posterior border. The fingers also appear to be much shorter in relation to the palm and the dactylus of the last leg longer, twice the length of the propodus. On actual comparison of specimens other distinctions will probably be discovered.

Dotilla malabarica is known only from the original examples obtained at Mahé on the Malabar Coast (E. Deschamps coll.). I have endeavoured without success to obtain further specimens.

Dotilla wichmanni, de Man.

1892. *Dotilla wichmanni*, de Man, in Weber's *Zool. Ergebn. Reise Ned. Ost.-Ind.* II, p. 308, pl. xviii, fig. 8.

1895. *Dotilla wichmanni*, de Man, *Zool. Jahrb., Syst.*, VIII, p. 577.

1910. *Dotilla wichmanni*, Rathbun, *Dansk. Vid. Selsk. Skrift.* (7), *naturvid. og math.*, V, p. 324.
1918. *Dotilla wichmanni*, Tesch, *Decap. Brachyur. 'Siboga Exped.* I, p. 45.
1918. *Dotilla wichmanni*, Kemp, *Mem. Asiat. Soc. Bengal* VI, p. 227, text-fig. 1.

In the last-quoted paper I have given an account of a series of very large specimens obtained by Dr. Annandale in Lower Siam. Large males from this locality exhibit strong secondary sexual characters in the presence of certain angular projections on the sides of the carapace, the most conspicuous being spinose in character and situated beneath the outer orbital angle. There is also in the fully developed male a prominent compressed tubercle on the inner face of the carpus close to the meral articulation.

Tesch notes the presence of two tympana on the outer face of the merus of the chelipeds; both are distinct in the specimens I have seen and a similar character is frequently, but not always, met with in *D. intermedia*.

In the conformation of the grooves on the carapace *D. wichmanni* differs markedly from any other species of the genus. In the form of the lateral grooves it shows affinity with *D. blanfordi* and *D. intermedia* but otherwise there are few points of resemblance. Apart from *D. myctiroides* it is the only species which possesses tympana on all the segments of the abdominal sternum.[1]

$\frac{9+30}{10}$	Kaw Deng, near Singgora, Gulf of Siam.	N. Annandale; Jan., 1916.	Thirty-one.
$\frac{9+31}{10}$	Corbyn's Cove South, Port Blair, Andamans.	S. Kemp; March, 1915.	Sixty-five.

The specimens from Port Blair are all small and the secondary sexual characters of the males are not developed. One of Dr. Annandale's specimens is ovigerous.

The species has been recorded from Celebes, Makassar and Atjeh in Sumatra (de Man), the Talaut Is. (Tesch) and from Koh Kong in the Gulf of Siam (Rathbun).

Dotilla blanfordi, Alcock.

1900. *Dotilla blanfordi*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 366, and *Illustr. Zool. Investigator*,' *Crust.*, pl. lxiii, figs. 3, 3*a*.

We are indebted to Lieut.-Col. H. J Walton, I.M.S., for further examples of this species, which like most other Scopimerinae appears to be local rather than rare. The additional specimens are considerably smaller than the types; the carapace of the largest male is only 4·2 mm. in length and that of the single ovigerous female only 3·0 mm.

In the sculpture of the carapace this species shows affinity with *D. intermedia*, a form which appears to be restricted to the Bay of Bengal.

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[1] For my observations on this point see the paper cited above.

$\frac{4132}{4}$ $\frac{3709}{10}$	Bombay and Karachi.	A. O. Hume, F. Day and W. T. Blanford.	Four. TYPES.
$\frac{9859}{10}$	Oran I., Bombay.	H. J. Walton; April, May, 1918.	Thirty-eight.

Not known from any other locality.

Dotilla intermedia, de Man.

1888. *Dotilla intermedia*, de Man, *Journ. Linn. Soc. Zool.*, XXII, p. 135, pl. ix, figs. 4-6.
1900. *Dotilla clepsydrodactylus*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 367, and *Illustr. Zool. Investigator, Crust.*, pl. lxiii, figs. 2, 2*a*.
1915. *Dotilla clepsydrodactylus*, Kemp, *Mem. Ind. Mus.* V, p. 226.

Examination of a very fine series of specimens, recently collected by Dr. F. H. Gravely at Chandipur in Orissa, has convinced me that *D. clepsydrodactylus* is synonymous with *D. intermedia*. I have seen the types of both forms and find that the configuration of the grooves of the carapace is identical. *D. intermedia* was described by de Man from a number of small specimens [1] in which the characters of the adult male chela were not developed.

Altogether I have examined 316 specimens of this species, of which 235 (148 males and 87 females) were obtained by Dr. Gravely at Chandipur on the Orissa coast. Among the males from this locality two very distinct dimorphic forms occur, which may be termed "high" and "low."

In the "high" male, which is the type described by Alcock, the first abdominal sternum bears a sharp transverse ridge on either side of the trough formed to receive the terminal segment of the abdomen and well behind its anterior limit. The fingers of the chela each bear a large lobe or tooth near the middle of their prehensile edge. The copulatory appendage is blunt at the tip and furnished with numerous setae.

In the "low" male the first abdominal sternum bears anteriorly a pair of large outstanding triangular teeth; these are in advance of the anterior limit of the abdominal trough and are thus placed considerably further forwards than the ridges in the "high" male. The dactylus of the chela bears a low rounded lobe near the base of its prehensile edge (further back than in the "high" male) and there is no lobe or large tooth on the fixed finger. The copulatory appendage is more slender, strongly sinuous, and terminates in a fine point which is turned inwards and does not bear conspicuous setae.

That these two types of male belong to the same species is, I believe, incontestable. In the form and areolation of the carapace they resemble each other exactly and they were, moreover, all found in the same locality.

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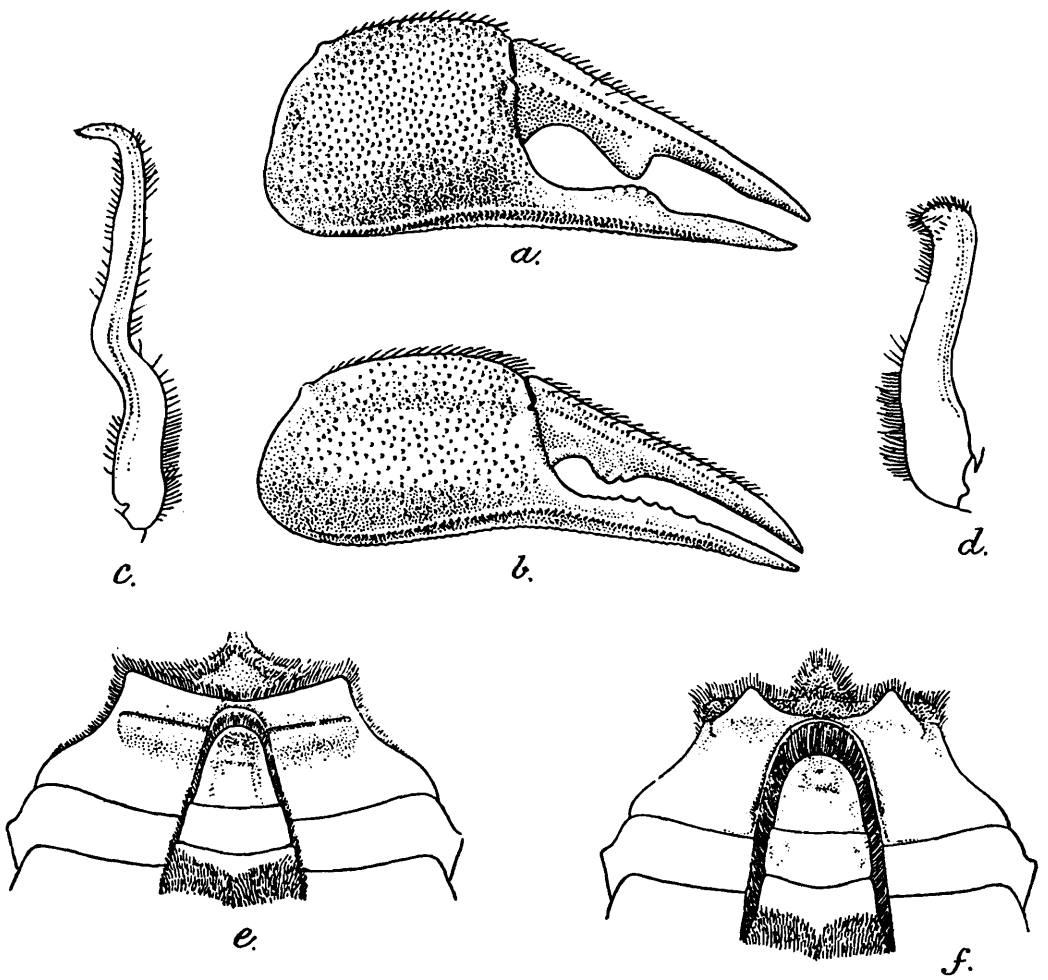
[1] De Man described the species from 32 specimens, "all males." Of these 14 are in the collection of the Zoological Survey of India, labelled "types" in de Man's handwriting. De Man was mistaken as to the sex of his specimens, for 7 of those examined are females.

All well-grown males can be referred without the least hesitation to one or other dimorphic form; the "high" males reach a larger size, the carapace being sometimes as much as 5·5 mm. in length, whereas the "low" males rarely exceed 4·5 mm. In specimens of medium size the characters of the sternum and chela are less well developed, though as a rule perceptible, but in very small individuals, from 2·0 to 3·0 mm. in length, it is usually not possible to detect them. The form of the copulatory appendage appears,



TEXT-FIG. 10.—*Dotilla intermedia*, de Man.

a. Chela of "high" male.
b. Chela of "low" male.
c. Copulatory appendage of "low" male.
d. Copulatory appendage of "high" male.
e. Abdominal sternum of "high" male.
f. Abdominal sternum of "low" male.

however, to be quite constant; I have examined it in all the specimens and have never once been in doubt.

At Chandipur Dr. Gravely collected specimens on three occasions, the numbers being as follows:—

	"High" males.	"Low" males.	Females.
June, 1915.	17	6	15 (1 ovig.)
May, 1916.	46	18	39 (17 ovig.)
May, 1917.	41	20	33 (3 ovig.)
	104	44	87

It seems therefore that "high" males are very much commoner than "low" males, and that males (both forms included) are nearly twice as abundant as females.[1]

I am not at all certain as to the meaning of the dimorphism in this species. Of both types of male there is a series ranging from very small to full-grown specimens, a fact which perhaps discounts the possibility that they represent breeding and non-breeding phases. On the other hand it is very improbable that more than one type of copulatory appendage can be employed in the sexual process. In other species of *Dotilla* the appendage is generally blunt at the tip, resembling that of the "high" male, a circumstance which points to the conclusion that the "low" males do not breed.

The examples of *D intermedia* that I have seen from other localities are mostly of small size and (determined mainly by the form of the copulatory appendage) consist entirely of "high" males and females.

Several observations indicate that environment has a great influence on species of *Dotilla*, its effects being shown both in the size of the specimens and in the degree of development of the secondary sexual characters of the male. Thus the individuals of *D. intermedia* that we obtained in the outer channel of the Chilka Lake in Orissa were all small and it was only with difficulty that a few specimens were obtained which showed in an imperfect degree the peculiar character of the "high" male chela. In this locality with its extreme seasonal changes in salinity, there can be little doubt that the environment is unfavourable. A somewhat similar instance has been noticed in *D. wichmanni* (see p. 330).

At Chandipur it is clear that the environment is peculiarly favourable for *D. intermedia* and that "low" males were found here and not in any other place in which the species has been collected, is perhaps in some way correlated with this fact.

The following specimens have been examined:—

$\frac{8236}{6}$	Sullivan I., Mergui Archipelago.	Mus. Collr.	Fourteen. TYPES.
$\frac{436-45}{7}$	False Point, Orissa.	Investigator. TYPES of *D. clepsydrodactylus*, Alc.	Seven.
$\frac{8939}{10}$	Outer Channel, Chilka Lake, Orissa.	Chilka Survey; March, 1914.	Thirty-five.
$\frac{9104}{10}$	Ennur backwater, nr. Madras.	N. Annandale.	Twenty (juv.).
$\frac{9102-3}{10}$	Chandipur, Balasore, Orissa.	F. H. Gravely; June, 1915; May, 1916; May, 1917.	Two hundred and thirty-five.
$\frac{9860}{10}$	Maungma-gan, Tavoy, Burma.	J. Coggin Brown.	Five.

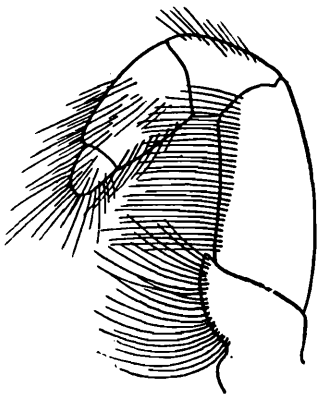
The species has not been recorded from any other locality.

[1] The abdomen in the genus *Dotilla* shows little difference in outline in males and females. In determining the sex it is therefore necessary to examine the pleopods, unless the specimens are ovigerous or with the male secondary characters strongly developed.

Genus **Dotillopsis**, nov.

This genus, which is established for *Dotilla brevitarsis*, de Man and *D. profuga*, Nobili, may be recognised by the following combination of characters :—

The carapace is cuboidal rather than globose and deeply grooved above. The side-walls possess the deep convolute sculpture seen in *Dotilla*. The penultimate segment of the second maxilliped is but little expanded and the ultimate segment is terminal in position. The merus of the outer maxilliped is longer than the ischium and is gyrous-sulcate. The meral segments of the legs bear ill-defined tympana. In the first three pairs of walking legs the merus, carpus and propodus are densely tomentose inferiorly. The abdomen consists of seven distinct segments; the fourth segment does not overlap the fifth and does not bear a brush of hairs at its distal end. In the male the fifth, sixth and seventh segments are narrow, the fifth not deeply constricted; the fourth segment is greatly expanded and produced on either side, its breadth being nearly three times that of the fifth. In the female the abdomen is broadly oval.



TEXT-FIG. 11.—*Dotillopsis brevitarsis* (de Man).
Endopod of second maxilliped.

Type.—Dotilla brevitarsis, de Man.

The genus is in some respects intermediate between *Dotilla* and *Tympanomerus*; it agrees with the former in the deep sculpture of the upper surface and lateral walls of the carapace and with the latter in the structure of the ultimate segments of the second maxilliped. The abdomen differs altogether from the very characteristic type found in *Dotilla*; in the male it shows signs of considerable specialization and has little resemblance to that found in any other genus of the subfamily.

The presence of a dense tomentum on the first three walking legs, a character also found in a few species of *Tympanomerus*, is almost certainly an adaptation to environment; the species of *Dotilla* are in my experience always found burrowing in clean firm sand, whereas *Dotillopsis brevitarsis* lives in the softest mud. Nobili's *D. profuga*, which I have not seen, probably also lives in mud, being described from the Upper Sadong River in Borneo.

The two species of the genus may be distinguished thus :—

I. Sculpture of carapace sharp; frontal groove continued almost to posterior margin; palm with conspicuous longitudinal carinae on its lower and inner aspects ... *D. brevitarsis.*

II. Sculpture of carapace indistinct; frontal groove reaching only to gastric region; palm without longitudinal carinae. ... ... *D. profuga.*

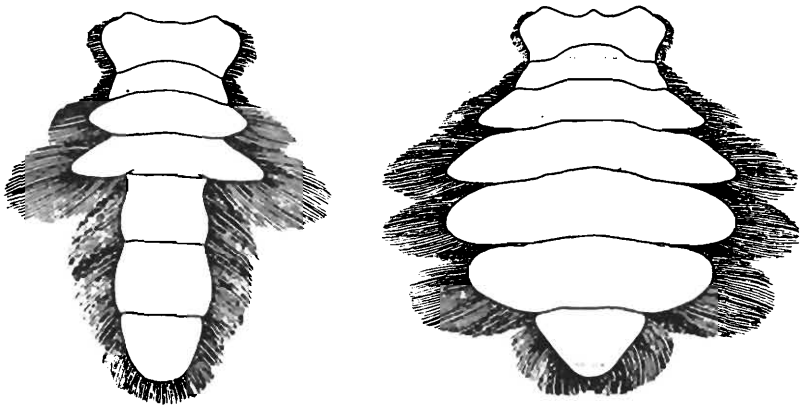
Dotillopsis brevitarsis (de Man).

1888. *Dotilla brevitarsis*, de Man, *Journ. Linn. Soc., Zool.*, XXII, p. 130, pl. ix, figs. 1-3.
1900. *Dotilla brevitarsis*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 367.

Plate XIII, fig. 1.

A number of additional specimens of this species have recently been obtained in the Gangetic Delta. The species was found at Port Canning and near the junction of the Matlah and Biddah rivers, living between tide-marks on a bank of exceedingly soft mud. The crab appears to have habits similar to those of the species of *Dotilla*; but, owing to the semiliquid consistency of the mud, the burrows do not retain their form and the pellets brought to the surface rapidly disappear. On one of the occasions on which specimens were obtained, in December 1916, the water was brackish, its specific gravity (corrected) being about 1·0105.

I have nothing to add to de Man's excellent description, but



TEXT-FIG. 12.—*Dotillopsis brevitarsis* (de Man).
Abdomen of male (left), of female (right).

give a fresh figure of the animal (pl. xiii, fig. 1) and outline drawings of the second maxilliped (text-fig. 11) and of the abdomen in each sex (text-fig. 12).

In adult males the carapace is grey, white above the bases of the legs and on the outer maxillipeds. The chelipeds are entirely bright orange red except for the upper surface of the carpus, which is grey. The walking legs are grey at the base, with the two terminal segments pure white. In the first three pairs there is a large red or orange-red patch on the anterior surface of the merus and, in the first two pairs, a similar patch on the posterior surface of the same segment. Adult females are similarly coloured, but frequently with orange instead of red or orange-red pigment and with the colour less pronounced on the walking legs. The eggs are deep reddish-purple, turning yellow in spirit.

In the largest specimen obtained the carapace is about 8 mm. in length and 10·5 mm. in breadth.

$\frac{8255}{6}$	Mergui Archipelago.	Mus. Collr.	Three (fragmentary).
$\frac{2575}{7}$	Diamond I., off C. Negrais, Burma.	Investigator.'	One.
$\frac{9801\cdot3}{10}$	Kaikal Maree, nr. junction of Matlah and Biddah Rs., Gangetic Delta.	S. Kemp; Dec., 1916.	Eighty.
$\frac{9809}{10}$	Matlah R., opposite Port Canning, Gangetic Delta.	Bengal Fish. Dept. (B. Prashad); March, 1918.	Seven.

The species is not known from any other locality. The fragmentary specimens from the Mergui Archipelago appear to be paratypes.

Dotillopsis profuga (Nobili).

1903. *Dotilla profuga*, Nobili, *Boll. Mus. Torino* XVIII, No. 447, p. 22.

Upper Sadong R., Borneo.

Genus Tympanomerus, Rathbun.

1835. *Cleistostoma*, de Haan, in Siebold's *Faun. Japon., Crust.*, p. 26.
1888. *Dioxippe*, de Man, *Journ. Linn. Soc., Zool.*, XXII, p. 137 (*nom. praeocc.*).
1897. *Tympanomerus*, Rathbun, *Proc. Biol. Soc. Washington* XI, p. 164.
1900. *Tympanomerus*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 371.
1918. *Tympanomerus*, Tesch, *Decap. Brachyur. Siboga' Exped.* I, p. 48.

This genus shows signs of affinity with *Scopimera* in the form of the abdomen and in the presence of accessory branchial passages between the bases of the walking legs. It differs, however, from both *Scopimera* and *Dotilla* and resembles *Dotillopsis* in the form of the ultimate segments of the second maxilliped From *Dotillopsis* it is readily distinguished by the absence of convolute grooves on the side-walls of the carapace, by the much less strongly sculptured dorsal surface and by the less broadly expanded fourth segment of the male abdomen.

Tympana, which are uniformly found in all other Scopimerinae, are sometimes absent in species of this genus; when present, they are usually ill-defined and difficult to observe.

Tesch has drawn attention to the presence of hairy-edged pouches or orifices of accessory branchial passages in species of this genus. In both *T ceratophora* and *T integer* he found two pairs, situated between the bases of the first and second and the second and third walking legs. I have found these pouches in *T pusillus*, *T lingulatus* and *T stapletoni*,—in the last-named species they occur between the third and fourth legs also. In five other forms that I have examined the tufts of hair are absent or very poorly developed and I am not satisfied that accessory branchial passages exist.

Stimpson's genus *Ilyoplax*, which cannot be identified with certainty until the type species has been rediscovered (see p. 310), is evidently related to *Tympanomerus* and it seems very probable that the two will prove to be synonymous. Should this happen

the unfortunate term *Tympanomerus* will disappear from nomenclature, for *Ilyoplax* has long priority.

The species may be distinguished thus:—

I. Eyestalk without projecting terminal style.

A. Carpus of cheliped without a tooth on its inner aspect. [Carpus short, its upper surface about 1½ times as long as broad.]

1. Carapace pentagonal, the orbits being decidedly oblique; outer surface of palm granular or with squamiform rugosities.

a. Lateral border of carapace notched behind outer orbital angle; male abdomen with all segments distinct, distal angles of 4th segment not produced.

i. Granules on outer surface of palm arranged in a reticulate manner; a strong crenulate carina on outer side of both fingers; fixed finger horizontal in relation to palm; meri of walking legs with large tympana on underside ... ... *T. pusillus.*

ii. Granules on outer surface of palm not arranged in a reticulate manner; no carinae on outer sides of fingers; fixed finger bent downwards in relation to palm; meri of walking legs without tympana ... *T. philippinensis.*

b. No notch on lateral border of carapace behind outer orbital angles; 4th and 5th segments of male abdomen fused, distal angles of 4th segment produced and acute. [No carinae on outer sides of fingers; meri of walking legs with conspicuous tympana] ... ... *T. integer.*

2. Carapace quadrilateral, the orbits being almost or quite transverse; outer surface of palm quite smooth or with very inconspicuous microscopic granules near lower border.

a. Front narrow, less than one fifth anterior breadth of carapace; a well-defined groove on side-walls of carapace extending from anterior angles of buccal cavern to base of penultimate legs; abdomen of male with 5th segment only a little constricted, 7th broader than long. [Lower surface of palm flattened and bordered by carinae.]

i. Front not more than one eleventh anterior breadth of carapace; upper surface of carapace not wider at the middle than anteriorly; chela of adult male weak, similar to that of female; male with a patch of tomentum on carpus and propodus of 2nd walking legs *T. stevensi.*

ii. Front not less than one seventh anterior breadth of carapace; upper surface of carapace wider at the middle than anteriorly; chela of adult male strong, dissimilar to that of female; male without tomentum on 2nd walking legs ... ... *T. frater.*

b. Front broader, more than one quarter anterior breadth of carapace; groove on side-walls of carapace visible only near angles of buccal cavern; abdomen of male with 5th segment deeply constricted, 7th at least as long as broad.

i. Anterior breadth of carapace less than 1½ times its length; front angular at sides; crest defining lateral border of carapace discon-

tinuous posteriorly; outer surface of palm without a carina, its upper border rounded *T. stapletoni.*

ii. Anterior breadth of carapace more than 1½ times its length; front rounded; crest defining lateral border of carapace continuous throughout its length; outer surface of palm with a fine carina running to tip of fixed finger, its upper border crested ... *T deschampsi.*

B. Carpus of cheliped with a tooth on its inner aspect. [Front not less than one quarter anterior breadth of carapace; male abdomen with 5th segment very slightly constricted.]

1. Surface of carapace with numerous small furry patches; carpus of cheliped short, its upper surface about 1½ times as long as broad; palm without carinae on lower surface; fingers with large teeth in male ... . *T lingulatus.*

2. Surface of carapace without furry patches; carpus of cheliped elongate, its upper surface twice as long as broad; lower surface of palm bounded by fine carinae; fingers without large teeth.

a. Lower border of orbit with a large projecting lobe near its outer end; lateral margin of carapace sinuous ... ... *T orientalis.*

b. Lower border of orbit without a projecting lobe; lateral margin of carapace regularly convex ... *T gangeticus.*

II. Eyestalk with a long terminal style projecting far beyond cornea. [Front about one fifth anterior breadth of carapace; orbits oblique; lateral border concave; carpus of cheliped elongate] ... ... *T. ceratophora.*

Koelbel has suggested that *T ceratophora* should be placed in a separate subgenus, *T methypocoelis*, but I do not think this necessary.

Of the eleven species I have seen all but *T philippinensis*, *T integer* and *T ceratophora*. *T stevensi*, *T frater*, *T stapletoni*, *T orientalis*, *T gangeticus* and *T lingulatus* are Indian species.

Tympanomerus pusillus (de Haan).

1835. *Ocypode* (*Cleistostoma*) *pusilla*, de Haan, in Siebold's *Faun. Japon., Crust.*, p. 56, pl. xvi, fig. 1.

1852. *Cleistostoma pusilla*, Milne-Edwards, *Ann. Sci. nat., Zool.*, (3) XVIII, p. 160.

1888. *Dioxippe pusilla*, de Man, *Journ. Linn. Soc., Zool.*, XXII, p. 137.

1889. *Dioxippe pusilla*, de Man, *Zool. Jahrb., Syst.*, IV, p. 447.

1902. *Cleistostoma pusillum*, Doflein, *Abh. math.-phys. Classe K. Bayer Akad.* Wiss. XXI, p. 667.

$\frac{97.9.5}{10}$ Japan. J. Anderson (*per* J. G. de Man). Two.

Tympanomerus philippinensis, Rathbun.

1914. *Tympanomerus philippinensis*, Rathbun, *Proc. U.S. Nat. Mus.*, XLVII, p. 84.

Guijulugan, Negros, Philippine Is.

Tympanomerus integer, Tesch.

1918. *Tympanomerus integer*, Tesch, *Decap. Brachyur. Siboga' Exped.* I, p. 54, pl. iii, fig. 1.

Kur I., west of Kei Is., Banda Sea.

Tympanomerus stevensi, sp. nov.

Plate XIII, fig. 2.

The carapace is transversely oblong; the anterior breadth is about one and a half times the length and the depth about half the breadth. The upper surface is slightly convex in both directions and is very feebly sculptured. A broad and inconspicuous median furrow extends backwards from the base of the rostrum, disappearing before it reaches the middle of the gastric region and there is a shallow transverse depression on either side some distance behind the orbital border. The posterior limit of the gastric region is defined by a well-marked transverse groove about one third the breadth of the carapace. On the branchial regions there are a few minute tubercles, bearing short setae, arranged in three oblique rows. The two anterior rows are exceedingly short and indistinct and frequently consist of only one or two tubercles each. The most posterior of them is longer and more conspicuous; in direction the row is as much longitudinal as transverse, and if it were continued forwards the line so formed would pass through the front. In this respect a marked difference exists between *T stevensi* and the closely allied *T frater*. Posteriorly the carapace is traversed by a sharp and perfectly straight transverse ridge, situated nearer the hinder margin than in *T stapletoni* and *T deschampsi*.

The front is obliquely deflexed and at the apex is broadly rounded or with a very obtuse median point; its lateral borders are slightly but distinctly constricted near the base. The breadth of the front is only one eleventh or one twelfth the breadth of the anterior border of the carapace and is thus much narrower than in any other species of the genus.

The orbits are very slightly oblique, much less so than in *T pusillus*, but not strictly transverse as in *T stapletoni*. The upper orbital border is microscopically beaded; it is excavate near the base of the front, but in its outer half is almost perfectly straight. The lower border is a little sinuous in dorsal view and is finely crenulate. On the floor of the orbit there is a crest that extends throughout nearly the whole of its length; it runs close to the lower border and the space between the two is hollowed. The outer orbital angle consists of a small acute tooth directed outwards.

The lateral margins of the carapace are very slightly convergent posteriorly and are straight, not convex; the breadth of the upper surface in the middle is thus a little less than its anterior breadth. There is a small emargination or notch behind the outer orbital angles and further back a series of minute denticles. Throughout its length the margin is defined as a sharp crest bearing short setae. At the extreme posterior end, as in *T pusillus*, it is bifurcated, one branch running to the margin at the base of the penultimate legs, while the other—the more conspicuous of

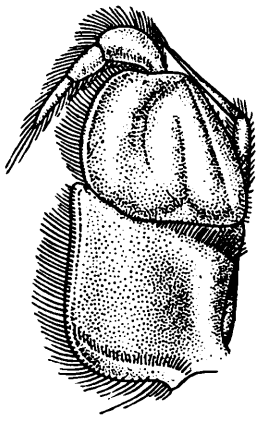
the two—trends inwards in a sinuous curve and terminates in a small angular lobule bearing a tuft of setae, immediately above the base of the last pair of legs.

There are minute tubercles, sparsely distributed, on the anterior part of the side-walls of the carapace. A conspicuous groove runs from the anterior angles of the buccal cavern to the base of the penultimate legs.[1]

The antennules and antennae do not differ appreciably from those of *T pusillus*, but the epistome is shorter and the broadly triangular median tooth that separates the distal ends of the outer maxillipeds in other species is here exceedingly narrow.

The buccal cavern is nearly one and a half times as broad as long and is completely closed by the external maxillipeds (text-fig. 13). The ischium of the latter appendages is subquadrate with a setose line extending obliquely across it near the anterior border. The merus is a trifle shorter than the ischium and is broader than long. It bears a ∧-shaped furrow anteriorly as in *T stapletoni*; it is, however, grooved near its inner edge, with the margin reflected upwards and in the proximal half there is a shallow median furrow which runs forward between the terminations of the ∧ The surface of the merus is smooth and shining. The exopod is entirely concealed and is furnished with a long slender flagellum.

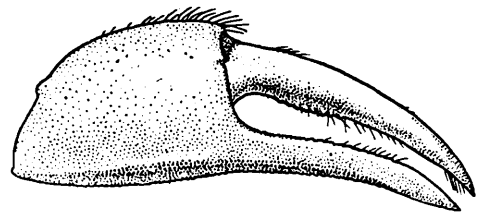
The chelipeds of the male are weak, very little stouter than those of the female, and decidedly less than twice the length of the carapace. The merus is trigonal with microscopically beaded edges; it bears a tympanum internally and sometimes, but not always, another of larger size externally. The carpus is short and smooth without a tooth on its inner aspect; the inner margin of the upper surface is crested and beneath it there is a tuft of very long hairs. The chela (text-fig. 14) is slender, nearly three times as long as the greatest height of the palm and the fingers are more than one and a half times the length of the upper border of the palm. The latter border is crested and microscopically crenulate; parallel with it on the inner face there is a longitudinal row of setae. From the tip of the fixed finger four finely beaded carinae run backwards on to the palm. The two median ridges are parallel and disappear before reaching the middle of the lower surface; the innermost curves obliquely upwards



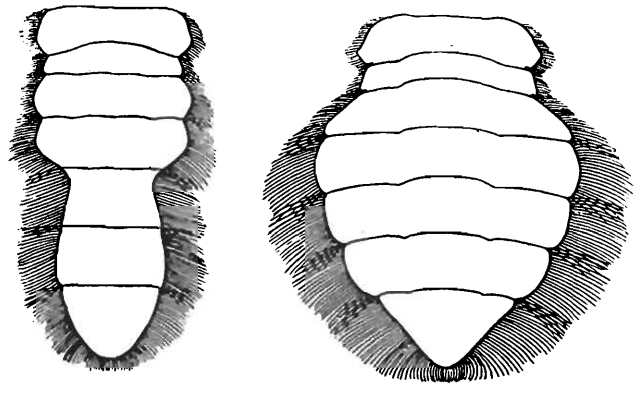
TEXT-FIG. 13.—*Tympanomerus stevensi*, sp. nov. Third maxilliped.

[1] In this respect the species resembles *T. frater*. In *T. pusillus*, *T. stapletoni*, *T. deschampsi*, *T. gangeticus* and *T orientalis* the groove is inconspicuous and is visible only in the anterior part of its course.

across the inner face, while the outermost runs along the lower part of the outer surface and extends to the proximal end of the palm. Between these ridges there are a few extremely minute tubercles; the remaining portions of the palm, including almost the whole of the outer surface, are quite smooth. The fingers meet only in their distal third when the claw is closed; their tips are curved a little inwards and are slightly spatulate. The fixed finger is without teeth; the dactylus is ridged above and bears a low crest of minute teeth in the proximal half of its prehensile edge.



TEXT-FIG. 14.—*Tympanomerus stevensi*, sp. nov.
Chela of male.



TEXT-FIG. 15.—*Tympanomerus stevensi*, sp. nov.
Abdomen of male (left), of female (right).

In females the chelipeds are a little more slender and the fingers are fully twice the length of the upper border of the palm. The palm is crested above with the row of setae on the inner face as in the male; but on the lower side there are only two carinae, enclosing a flattened lower surface, and each of these carinae bears long setae. The fingers are more distinctly spatulate than in the male; they gape widely at the base and there is no denticulate crest on the dactylus.

The third or penultimate pair of walking legs is the longest, nearly two and a half times the length of the carapace. There are well defined tympana on the upper and lower surfaces of the meri of the first two pairs and on the lower surface of the last two. In the proximal half of the merus of the two intermediate pairs, on the dorsal surface, there is a finely crenulate ridge running parallel to the upper border. The edges of the meri are finely spinulose, a feature specially well marked on the posterior borders of the second and third pairs. In these two pairs the carpus

and propodus each bear two carinae on their superior faces; the dactyli are flattened and in every instance shorter than the propodi. In large males there is a dense patch of tomentum on the second walking legs, extending from the middle of the carpus to the distal third of the propodus; in young males and females no trace of this tomentum can be found. The basal segments of the legs bear long plumose setae which retain fine particles of mud.

The second segment of the abdomen of the male (text-fig. 15) is narrower than the first. The third and fourth are separately rounded at the sides and about as broad as the first, the fourth being a little the longer. The fifth segment is rather more than half the breadth of the fourth and is only slightly constricted near its proximal end; at its narrowest point it is broader than long. The sixth segment is twice as broad as long and is a little wider than the fifth; the seventh is triangular, broader than long and rounded distally. The abdomen of the female (text-fig. 15) is much broader than that of the male but is comparatively narrow at the base; the fourth segment is the broadest; the seventh is triangular in shape and variable in its dimensions.

In the largest male the anterior breadth of the carapace is 7·7 mm., its breadth 5·1 mm. and the breadth of the front about 0·65 mm. In a large female these measurements are respectively 7·0, 4·7 and 0·6 mm.

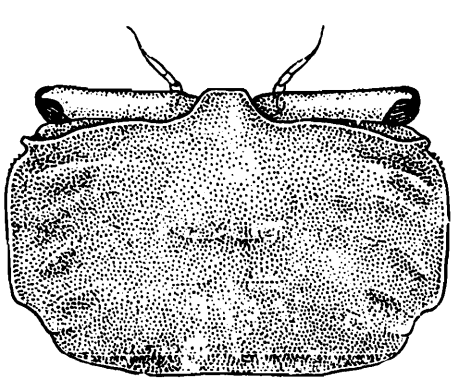
The specimens are of a bluish-grey colour in spirit.

$\frac{9796-7}{10}$ Karachi. C. R. Stevens; March, May, 1917. Twenty-eight.

One of the females is ovigerous. The types bear the number 9796/10, *Zool. Surv. Ind.*

Tympanomerus frater, sp. nov.

This species is very closely allied to the preceding and differs from it only in the following particulars:—



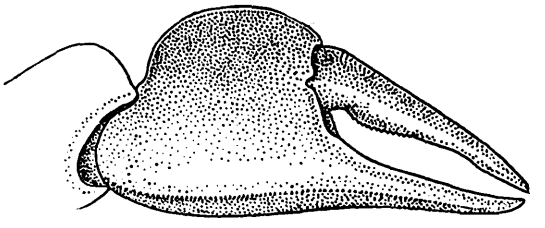
TEXT-FIG. 16.—*Tympanomerus frater*, sp. nov. Carapace.

(i) The carapace (text-fig. 16) is in most respects closely similar to that of *T stevensi*; but the lateral borders are slightly and evenly convex, with the result that the breadth across the middle is decidedly greater than that between the outer orbital angles.

(ii) The front is very much broader, between one sixth and one seventh the anterior breadth; its lateral borders are a little convergent anteriorly, not constricted as in *T stevensi*.

(iii) The upper orbital border is decidedly sinuous and is conspicuously concave in its outer half.

(iv) The oblique rows of tubercles on the branchial region are better developed than in the allied form and the most posterior of them is more transverse than longitudinal; if the line formed by this row were continued forwards it would cut the outer end of the orbital border on the opposite side.



TEXT-FIG. 17.—*Tympanomerus frater*, sp. nov. Chela of male.

(v) The chelae of the male (text-fig. 17) are strongly developed, much deeper and longer than those of the female.

(vi) In addition to those mentioned in the description of *T stevensi* there is a large tympanum on the upper surface of the merus of the penultimate walking legs.

(vii) The borders of the meral segments of the walking legs are microscopically beaded, not spinulose as in the allied species.

(viii) There is no tomentum on the carpus and propodus of the second walking legs of the male.

(ix) A fringe of dark brown bristles, not found in the preceding species, occurs on the edge of the sternum between each pair of walking legs.

(x) The abdomen of the male closely resembles that of *T stevensi*, but the fifth segment is proportionately a little longer and its sides are more sinuous.

In all other respects the species are in the closest agreement; notably in the presence of a groove extending from the edges of the buccal cavern to the base of the penultimate legs, in the carination of the palm and subspatulate form of the fingers, and in the dorsal carinae on the two intermediate pairs of legs. The two species were, moreover, found together.

I was at first of the opinion that two forms of a single species were represented; but the differences, though many of them are small, are too numerous to admit of this possibility. I have been able to separate even the youngest specimens without any great difficulty and have seen adult males and females of both species.

In an adult male of *T frater* the anterior breadth of the carapace is 5·6 mm., its length 4·0 mm. and the breadth of the front about 0·9 mm. In a female these measurements are respectively 5·0, 3·6 and 0·8 mm. and in another female, which is ovigerous, 5·0, 3·5 and 0·75 mm.

The specimens are of a bluish-grey colour in spirit, sometimes rather darker than *T stevensi*.

$\frac{9861-2}{10}$ Karachi. C. R. Stevens; March, May, 1917. Twenty-six.

Four of the females are ovigerous. The types bear the number 9861/10, *Zool. Surv. Ind.*

Tympanomerus stapletoni, de Man.

1908. *Tympanomerus stapletoni*, de Man, *Rec. Ind. Mus.* II, p. 212, pl. xviii, figs. 1, 1*a-e*.

This species has been found at a number of additional localities in Bengal and is quite common on the banks of the Hughli river at Calcutta. It is evidently an estuarine form and seems to occur only in places near or a little beyond the limit of tidal influence. At Calcutta the water of the Hughli is frequently quite fresh, but under favourable conditions a slight admixture of salt is to be found up to a point some little distance above the town.

The colour of living specimens agrees in general with de Man's description, but the carapace is frequently of a grey or dull grey-green colour and in the male the fingers of the chelae are orange and the last abdominal segment white.

The species is known only from the Gangetic delta:—

$\frac{5137}{10}$ } $\frac{5851}{10}$	Jhalakati, Backergunj dist., Bengal.	H. E. Stapleton.	Many, including TYPES.[1]
$\frac{9798}{10}$	Kanaigunj, Backergunj dist., Bengal.	,,	Six.
$\frac{9792}{10}$	Banks of Passur R., Khulna, Bengal.	Bengal Fish. Dept. (B. Prashad) and S. Kemp; Oct., 1917; July, 1918.	Forty.
$\frac{9793}{10}$	Banks of Hughli R., near Calcutta. (Sibpur, Shalimar, Budge-Budge and Takta Ghat.)	S. Kemp.	Many.

All the specimens are from small burrows in the mud between tide-marks.

Tympanomerus deschampsi, Rathbun.

1913. *Tympanomerus deschampsi*, Ratbbun, *Proc. U.S. Nat. Mus.* XLVI, p. 356, pl. xxxii, pl. xxxiii, fig. 1.

1918. *Tympanomerus deschampsi*, Kemp, *Mem. Asiat. Soc. Bengal* V p. 228.

$\frac{9432}{10}$	Banks of Whangpoo R., 5-10 miles below Shanghai.	N. Annandale.	One.

Described by Miss Rathbun from Shanghai.

Tympanomerus lingulatus (Rathbun).

1909. *Cleistostoma lingulatum*, Rathbun, *Proc. Biol. Soc. Washington* XXII, p. 108.

1910. *Cleistostoma lingulatum*, Rathbun, *K. Danske Vidensk. Selsk. Skrift.* (7), *naturvid. og math.*, V p. 323, text-figs. 7, 8.

This species was described by Miss Rathbun from an immature female found in the Gulf of Siam; two adult males and an ovigerous female have since been obtained by the R.I.M.S. 'Investigator' in the Mergui Archipelago.

There is, I think, no doubt that the species must be transferred to the genus *Tympanomerus*. The antennular flagella are minute

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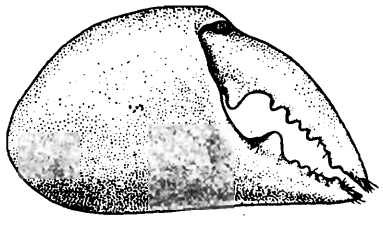
[1] There seems to have been a mistake about the precise locality of these specimens; on the label sent with them to de Man "Dacca" was certainly written, but information subsequently supplied by the collector showed this to be incorrect.

and rudimentary, lying in small oblique pits close to the edge of the front and separated by a comparatively broad septum, as in *Tympanomerus pusillus* and other Scopimerinae. In the Macrophthalminae, to which the genus *Cleistostoma* belongs, the antennules are well developed, fold quite transversely, and the septum between them is very narrow. These characters constitute, so far as I am aware, the only really valid distinction between the subfamilies Macrophthalminae and Scopimerinae, for the tympana found in most species of the latter subfamily are ill-defined and occasionally absent in *Tympanomerus*. On comparing *T lingulatus* with Alcock's *Cleistostoma dotilliforme* the differences in the antennules are quite evident.

The Mergui specimens of *T lingulatus* agree very closely with Miss Rathbun's description, but her figure does not altogether succeed in conveying the characteristic appearance of the upper surface of the carapace. In the individuals I have seen the majority of the fine granules are aggregated into small clusters, varying a little in size and arrangement and each set with short dark brown bristles retaining mud. The carapace in specimens which have not been cleaned overmuch is, in consequence, seen to be covered with small furry patches, rather than with isolated granules as in Miss Rathbun's figure. The angle on the lateral margin of the carapace in front of its middle point is in reality more obtuse than in the figure, but it bears a setiferous patch which makes it look more prominent. The oval cavities above the edge of the front are very evident, the species differing in this character from any other known species of *Tympanomerus*. The prominent median tooth on the epistome is paralleled in *T stevensi* and *T frater*.

The chelipeds of the male are short. The carpus bears a strong tooth on its inner side as in *T gangeticus* and *T orientalis*; it is, however, much shorter than in those species, its upper surface being only about one and a half times as long as broad. Above the tooth on the inner side there are some long setae, while on the upper surface there are some short brown bristles. The palm is swollen and its height is fully as great as the length of the upper border (text-fig. 18). The outer side is smooth and convex; inferiorly it is rounded, without any traces of the longitudinal keels found in many species of the genus. The upper surface is finely granular with scattered setae. On the inner side there is a huge blunt ridge which commences near the posterior end of the upper border and curves downwards and forwards to the base of the fixed finger. The summit of the ridge is irregularly tuberculate and, in the area between it and the finger-cleft, there is a patch of long hairs.

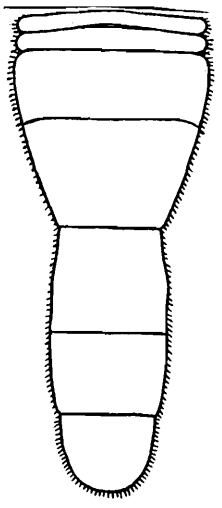


TEXT-FIG. 18.—*Tympanomerus lingulatus* (Rathbun). Chela of male.

The fingers are longer than the upper border of the palm and meet only at the apices where they are provided with corneous tips and some setae. The dactylus is strongly curved; it bears a large tooth close to the base and another, not quite so large, near the apex; between the two there are some smaller teeth. The dentition of the fixed finger is similar, the teeth being in advance of those on the dactylus; the proximal tooth is very large and conical. In the ovigerous female the chelipeds are as shown in Miss Rathbun's figure; the carpus, however, bears a small acute tooth on its inner side.

The meral segments of the walking legs bear thickly setose patches, resembling tubercles, as described by Miss Rathbun. In addition, the upper surfaces of the meri, carpi and propodi are rather closely covered with brownish hair in males, while in the same sex on the underside of each merus there is a thickly felted patch.

In the abdomen of the male (text-fig. 19) the suture between the third and fourth segments is exceedingly fine and inconspicuous, suggesting that the segments are not separably movable. The first and second segments are very short, and, though broad, do not nearly fill all the space between the last two pairs of legs. The second and third segments taken together are a little longer than broad with gently curved sides that converge strongly anteriorly. The fifth segment is about as long as its distal breadth, much narrower than the base of the third, and is very inconspicuously contracted at its proximal end. The sixth is broader than long and the seventh about as long as broad, with a broadly rounded apex.



TEXT-FIG. 10.—*Tympanomerus lingulatus* (Rathbun). Abdomen of male.

In the larger of the two males the greatest breadth of the carapace is 5·4 mm., its anterior breadth 4·8 mm. and its length about 4·0 mm. In the ovigerous female the greatest breadth is 5·2 mm.

T lingulatus appears to find its nearest allies in *T orientalis* (de Man) and *T gangeticus*, sp. nov., agreeing with these species in the possession of a strong tooth at the inner angle of the wrist.

$\frac{9799}{10}$	Trotter I., Mergui Archipelago.	'Investigator.	Two males.
$\frac{9800}{10}$	Jack and Una Is., Mergui Archipelago.	,,	One female.

The specimens were found in November 1913 on a shore composed of mud and sand with larger boulders. That described

by Miss Rathbun is from a mangrove swamp at Lem Ngob in the Gulf of Siam.

Tympanomerus orientalis (de Man).

1888. *Dioxippe orientalis*, de Man, *Journ. Linn. Soc., Zool.*, XXII, p. 138, pl. ix, figs. 8-10.

1900. *Tympanomerus orientalis*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 371.

$\frac{8\,1\,1\,0}{6}$ Mergui Archipelago. Mus. Collr. Seven. PARATYPES.

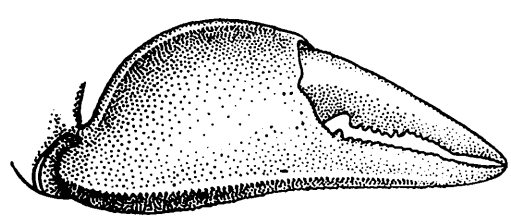
Not known from any other locality.

Tympanomerus gangeticus, sp. nov.

Plate XIII, fig. 3.

This species, which is represented only by two specimens one of which is imperfect, is very closely allied to de Man's *Tympanomerus orientalis*, resembling that species in the possession of a strong tooth on the inner face of the carpus of the chelipedes.

T gangeticus differs from *T orientalis* in only two conspicuous features:—(i) the lower border of the orbit shows no trace of the large obtuse lobe found near the outer end in de Man's species; (ii) the crest defining the lateral borders of the upper surface of the carapace is regularly convex behind the small anterior excavation, the upper surface being widest in front of the middle point. In *T orientalis* the crest takes a sinuous course; it is distinctly concave anteriorly and is obtusely angled behind the middle, the upper surface being widest at this point.

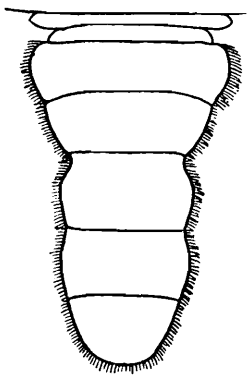


TEXT-FIG. 20.—*Tympanomerus gangeticus*, sp. nov.
Chela of male.

In other respects the differences are small. The front is a little broader, with its lateral angles more broadly rounded and its sides more oblique; its apex does not possess a median point. The median groove on the upper surface is deeper and the front when viewed from above is more conspicuously emarginate distally. There are numerous scattered setae on the lateral parts of the upper surface of the carapace. The buccal cavern is broader and the merus of the external maxillipeds is as broad as long (in *T orientalis* it is longer than broad). The surface of the merus bears numerous very short setae.

The chelipeds are a little shorter: the length of the chela is considerably less than the anterior breadth of the carapace. The upper surface of the carpus is finely roughened and bears numerous minute granules antero-externally. The walking legs are a little shorter and stouter; the merus of the penultimate pair is less than two and three quarter times as long as wide, whereas in specimens

of *T orientalis* of similar size it is rather more than three times. The carpi and propodi of the first two walking legs are thickly coated with short woolly hair.



TEXT-FIG. 21.—*Tympanomerus gangeticus*, sp. nov. Abdomen of male.

The excavation in the lateral margin of the fifth abdominal segment of the male (text-fig. 21) is a little shallower and the distal parts of the same margin are less convergent anteriorly than in *T orientalis*.

The carapace of the type male is 4·0 mm. in length and 5·3 mm. in anterior breadth. In life it was uniformly grey in colour, with white fingers to the chelae and with dark spots on the merus, carpus and propodus of the walking legs.

$\frac{9794}{10}$	Kaikal Maree, near junction of Matlah and Biddah Rs., Gangetic delta.	S. Kemp; Dec., 1916.	One. TYPE.
$\frac{9808}{10}$	Matlah R., opposite Port Canning, Gangetic delta.	Bengal Fish. Dept. (B. Prashad); March, 1918.	One.

The water in both these localities probably contains some admixture of salt at all seasons. The specimens were found on banks of soft mud between tide-marks and the specific gravity of the water in the locality where the type specimen was taken was 1·0105 (corrected).

Tympanomerus ceratophora (Koelbel).

1898. *Dioxippe ceratophora*, Koelbel, in *Wiss. Ergebn. Reise Grafen Béla Széchenyi in Ostasien* II, p. 573, pl. i, figs. 8-12.

1918. *Tympanomerus ceratophora*, Tesch, *Decap. Brachyur. Siboga Exped.* I, p. 50, pl. 2, fig. 2.

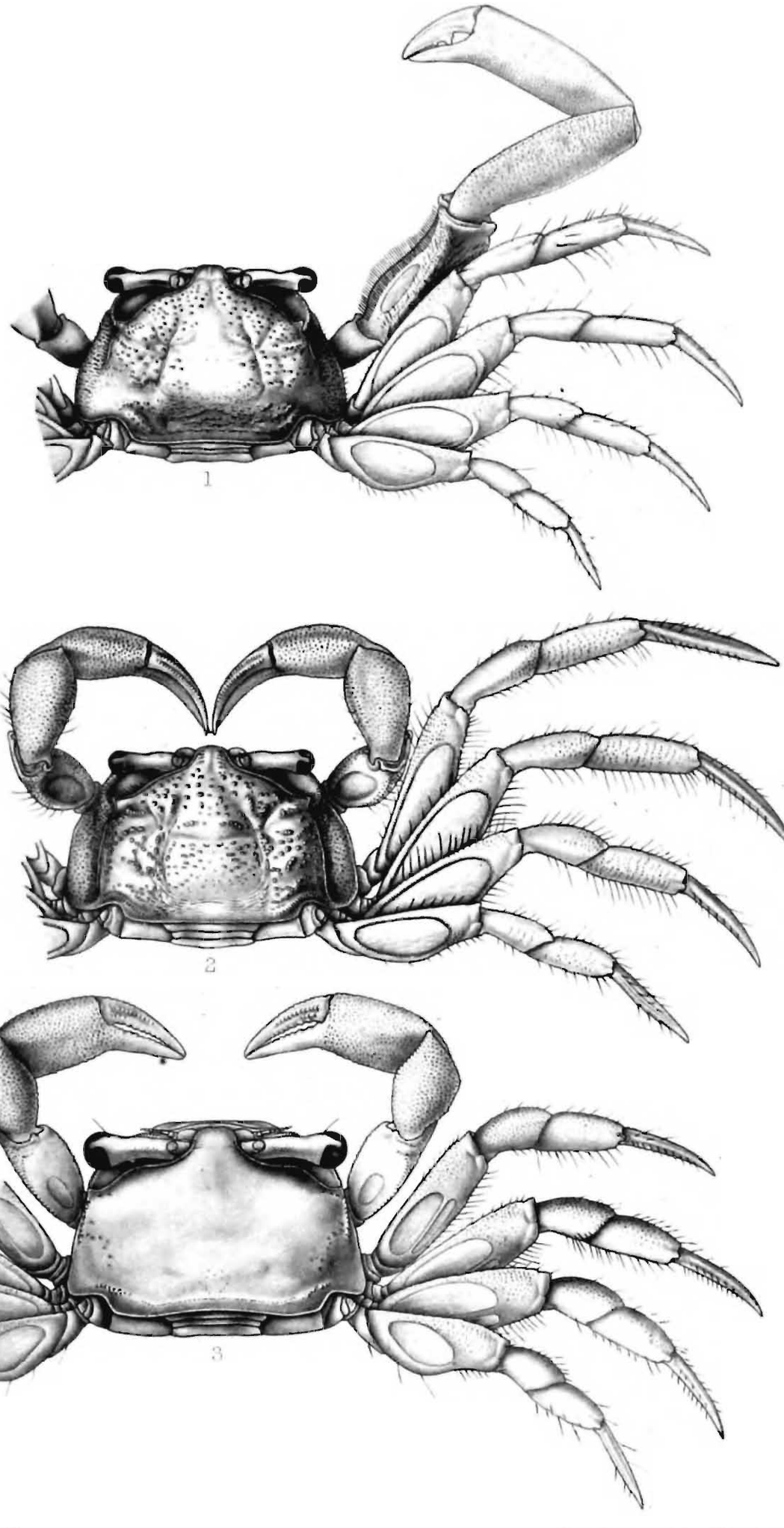
Hongkong (Koelbel); River near Pidjot, Lombok (Tesch).

EXPLANATION OF PLATE XII.

FIG. 1.—*Scopimera pilula*, sp. nov. Dorsal view of a male with carapace about 10½ mm. in breadth.

,, 2.—*Scopimera globosa*, de Haan. Dorsal view of a male with carapace about 14 mm. in breadth.

,, 3.—*Scopimera proxima*, sp. nov. Dorsal view of a male with carapace about 7 mm. in breadth.



S. C. Mandal del.

Photogravure Survey of India Offices Calcutta 1919

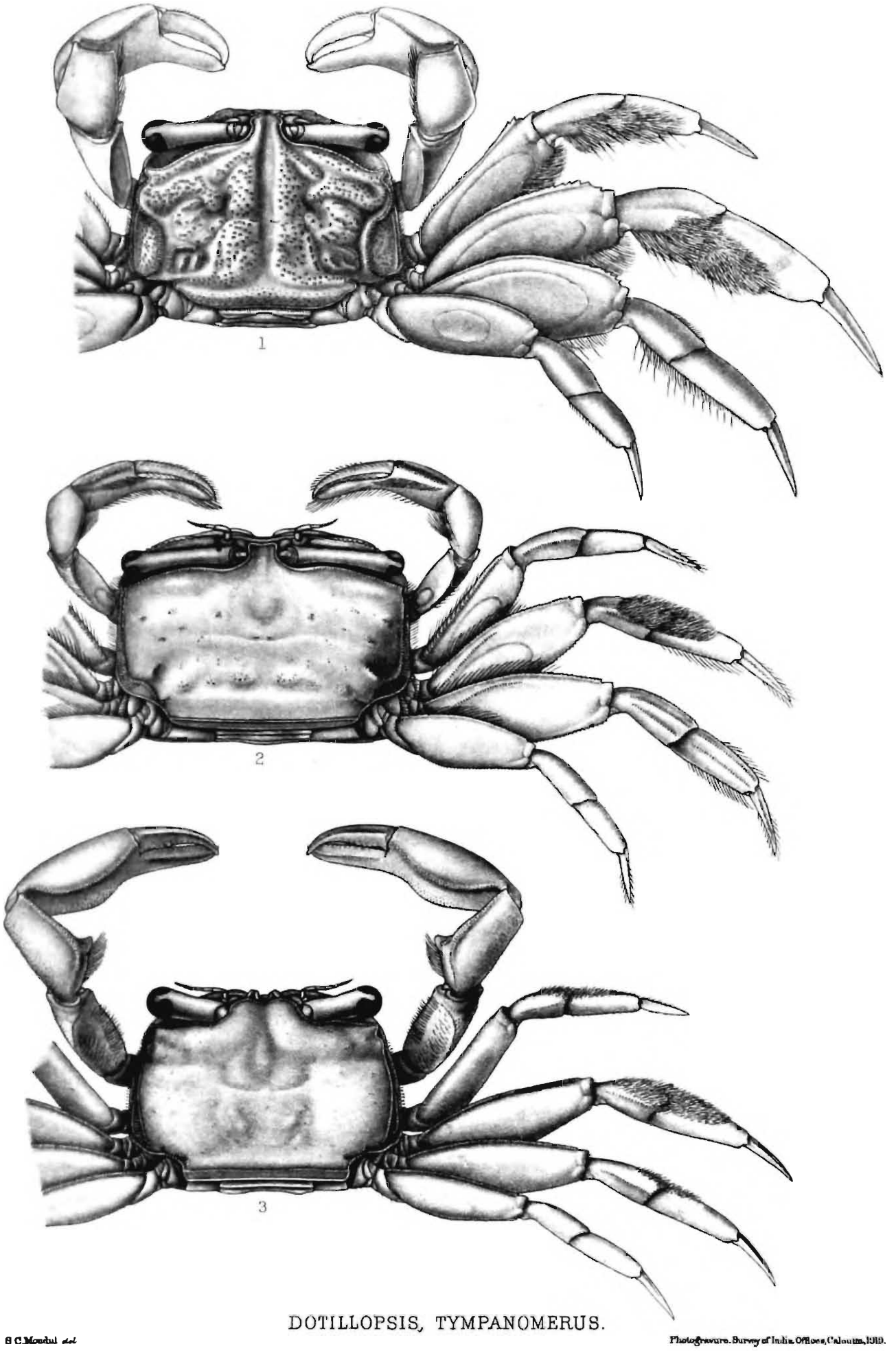
SCOPIMERA.

EXPLANATION OF PLATE XIII.

Fig. 1.—*Dotillopsis brevitarsis* (de Man). Dorsal view of a male with carapace about 10½ mm. in breadth.

,, 2.—*Tympanomerus stevensi*, sp. nov. Dorsal view of a male with carapace about 7½ mm. in breadth.

,, 3.—*Tympanomerus gangeticus*, sp. nov. Dorsal view of a male with carapace about 5¼ mm. in breadth.



DOTILLOPSIS, TYMPANOMERUS.

S. C. Mondal del. Photogravure. Survey of India Offices, Calcutta, 1919.

XXIII RHYNCHOTA FROM THE GARO HILLS, ASSAM

By C. A. PAIVA, *Assistant, Zoological Survey of India.*

(Plates XXXIV–XXXVI).

[In this paper Mr. Paiva gives an account of a collection of Rhynchota (excluding the smaller Homoptera) made in the Garo Hills between June and October, 1917, by Mrs. Kemp and myself. The specimens were for the most part obtained in two localities: at Tura, the headquarters of the Garo Hills district, at an altitude of 1,200 to 1,500 ft., and on the summit of the ridge immediately above Tura at altitudes varying from 3,500 to 4,000 ft. Although these two localities are less than five miles distant from each other there are marked differences in the fauna. The differences are no doubt due mainly to the change in altitude, but may to some extent owe their origin to the different nature of the country in the two localities. In the neighbourhood of Tura the Garos have made extensive clearings for cultivation and the country consists of open land and low scrub interspersed by patches of ancient forest. On the range above Tura no cultivation has ever been attempted and the hills are entirely covered with high tree-jungle, often almost impenetrable in its density. As might be expected, it is from the latter region that the more interesting forms were obtained. Mr. Paiva has found in the collection a considerable number of forms hitherto known only from the Eastern Himalayas and has described as new two genera and eighteen species. Among the latter is a very curious cavernicolous Reduviid recently obtained by Mr. R. Friel, I.C.S., in the Siju Cave on the borders of the Garo Hills and Mymensingh districts.—*S. W Kemp.*]

Family PENTATOMIDAE.

Cantao ocellatus (Thunb.).

Five specimens from above Tura, 15.vii–31.viii.1917; three specimens from Tura, 1,400 ft., x.1917.

Those collected in July and August are dark reddish ochraceous, while those collected in October are pale yellowish ochraceous in colour.

Found all over India.

Poecilocoris hardwickii (West.).

Two specimens from above Tura.
Common in the Hills of Assam.

Chrysocoris grandis (Thunb.) var. **baro** (Fab.).

One specimen from Tura, 1,200-1,500 ft., 15.vi–15.vii.1917; two specimens from above Tura.
Recorded from Skkim, Assam, Burma, extending to Java.

Chrysocoris stollii (Wolff).

One specimen from Tura, 1,400 ft., x.1917.
Universally distributed.

Chrysocoris pulchellus (Dall.).

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917.
This evidently rare species was originally described from Sylhet, Assam. A larger, but similarly marked, form comes from Ceylon. Hitherto the only specimen in the collection of the Zoological Survey of India was one from Trincomalee, Ceylon, collected, probably by Mr. E. E. Green, in November, 1906.

Chrysocoris garoensis, sp. nov.

Described from two specimens, one from Tura, 1,400 ft., x.1917 and one from above Tura.
Closely resembling *C. ornatus* (Dall.) from which it differs in the number and position of the spots on the scutellum and in the colour of the abdomen.
Head dark purplish with the apices of the lateral lobes bluish-green and in one specimen slightly purplish-red; antennae and rostrum black; pronotum purplish-red with the anterior margin shining green in the centre, eight bluish-black spots arranged three near anterior margin, three largest on disk of posterior area, and one at each posterior lateral angle; scutellum purplish-red with a spot at the centre of basal margin, one large, central, almost rounded spot on disk and six spots arranged in pairs, bluish-black, a distinct callosity at base of scutellum; pronotum with a fine, short, central, longitudinal carina on disk, extending from the centre of the middle anterior spot to about the middle of the central posterior spot; scutellum with a distinct, central, longitudinal carina extending through the centre of the large discal spot, this carina is connected with the basal spot of the scutellum by a fine bluish-black line; underside of head purplish, appearing bright green in certain lights; sternum bluish-black; abdomen beneath pale ochraceous with a small basal and a large apical spot black, stigmatal spots rounded, bluish, lateral margins bright orange; legs purplish.

Length 15 millim., breadth between pronotal angles 8·9 millim.

Type No. 8368/HEM. in the collection of the Zoological Survey of India.

Lamprocoris lateralis (Guer.).

Three specimens from above Tura.
Not uncommon in the hills of Assam and Burma.

Lamprocoris roylii (West.).

Five specimens from above Tura.
Recorded from Nepal, E. Himalayas and hills of Assam.

Hotea curculionoides (Herr.-Sch.).

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917.
India, Burma and Ceylon.

Aspidestrophus morio, Stål.

One specimen from above Tura.
The genus *Aspidestrophus* was not hitherto represented in the collection of the Zoological Survey of India and was recorded only from the Naga Hills, Assam and Java.

Cydnus varians, Fab.

One specimen from above Tura.
A fairly common species.

Macroscytus subaeneus (Dall.).

One specimen from Tura, 1,400 ft., x.1917.
Found all over India and Burma.

Dalpada oculata (Fabr.).

One specimen from Tura, 1,400 ft., x.1917 and two from above Tura.
Common in Assam.

Dalpada jugatoria, Leth.

One specimen from Tura, 1,200-1,500 ft., 15.vi–15.vii.1917.
Recorded from Sikkim, Assam and Burma.

Dalpada varia, Dall.

One specimen from above Tura.
Found in Bhutan and Assam.

Nevisanus nagaensis, Dist.

Four specimens from above Tura, "common on tree-trunks. *S. W K.*"

This species was not previously represented in the collection of the Zoological Survey of India and was known only from the Naga Hills.

Ochrophara montana, Dist.

Two specimens from above Tura.

The only other specimens in the collection of the Zoological Survey of India are those from Chanda, Central Provinces, about which there is an interesting note on the damage they do to bamboo seed crops, in Vol. I, p. 147 of the "Fauna of British India, Rhynchota."

Recorded also from the Naga Hills and Burma.

Cappaea taprobanensis (Dall.).

Three specimens from above Tura.

Recorded from Sikkim, N. Khasi Hills, Assam, S. India and Ceylon.

Tolumnia latipes (Dall.).

One specimen from Tura, 1,200-1,500 ft., x.1917.

Found in Sikkim, Hills of Assam, Trivandrum and Burma.

Aeschrocoris obscurus (Dall.).

Seven specimens from above Tura.

As widely distributed as the preceding species.

Eusarcocoris montivagus, Dist.

Five specimens from above Tura, 15.vii–31.viii and ix.1917.

Same distribution as the two preceding species.

Carbula crassiventris (Dall.).

Three specimens from above Tura.

This species was not previously represented in the collection of the Zoological Survey of India.

Bhutan, Naga Hills, Assam and Burma.

Hoplistodera virescens, Dall.

One specimen from above Tura.

Recorded from Sikkim, Naga Hills and Burma.

Antestia pulchra (Dall.).

Five specimens from above Tura, 15.vii–31.viii and ix.1917.

Found in Sikkim and Burma.

Exithemus similis, sp. nov.

One specimen from above Tura, IX.1917.

Resembling *E. assamensis* but differing from it in the absence of the linear, levigate fascia on the anterior area of the pronotum and head ; the scutellum is not paler in hue on its central disk, but is concolourous and evenly punctured throughout and has two small, almost contiguous, black spots near the centre of disk ; the abdomen is pale yellowish ochraceous and the black fascia on the lateral area is less distinct, and extends to the apex of the fifth abdominal segment, a large, longitudinal, black fascia occupies the centre of the remaining apical segments ; there is no large, black spot on the femora beneath a little before the apex, the apices of the tibiae and tarsi are brownish ochraceous ; the antennae are pale ochraceous with the apices of the second and third joints narrowly, and the apical halves of the fourth and fifth joints brownish-black.

Length 12 millim.; breadth between pronotal angles 7·5 millim.

Type No. 8369/H1 in the collection of the Zoological Survey of India.

Compastes bhutanicus (Dall.).

Four specimens from above Tura.

Recorded from Bhutan, Sikkim, Assam and Burma.

Priassus exemptus (Walk.).

One specimen from above Tura.

Known from the Naga Hills and Tenasserim.

Rhynchocoris humeralis (Thunb.).

One specimen from Tura, 1,400 ft., x.1917 and one specimen from above Tura.

Recorded from Sikkim, Assam and Burma.

Catacanthus incarnatus (Dru.).

One specimen from Tura, 1,200-1,500ft., 15.vi–15.vii.1917.

Almost universally distributed.

Nezara viridula (Linn.).

One specimen from above Tura.

Common all over India, Burma and Ceylon.

Menida varipennis (West.).

Three specimens from above Tura, 15.vii–31.viii and ix.1917 ; occurring in Sikkim, Khasi Hills and Tenasserim.

Menida histrio (Fabr.).

One specimen from above Tura.

At present recorded only from Calcutta, Bangalore and Burma.

Cecyrina platyrhinoides, Walk.

Three specimens from above Tura.

In these specimens the dark brown ochraceous colour given by Walker in his description of the species is replaced by shining black, the pale ochraceous and pale luteous markings on the various parts of the body are present but are less distinct; in one specimen, probably a male, the femora of all the legs and the intermediate and posterior tibiae are medially banded with red; the second and third joints of the rostrum are also red.

This species is apparently confined to Assam. It was not previously represented in the collection of the Zoological Survey of India.

Cazira verrucosa (Westw.).

Two specimens from above Tura, ix.17, and one from Tura, 1,400 ft., x.1917.

Found all over India and Burma.

Picromerus obtusus, Walk.

Four specimens from above Tura.

Recorded from Sikkim, Naga Hills, Assam and Burma.

Eusthenes rubefactus, Dist.

Two males and two females from Tura, 1,200-1,500 ft., 15.vi–15.vii.1917; also one specimen from above Tura.

The latter is dark brown above and pale ochraceous on the underside and legs. It is partly deformed, the lateral margins of the pronotum being asymmetrical. This is evidently an immature male.

A common Assamese species.

Pycanum ochraceum, Dist.

Two specimens from above Tura.

Recorded from Sikkim, Assam and Burma.

Dalcantha dilatata, Amy. and Serv.

Three specimens from above Tura.

Probably only known from Assam.

Cyclopelta siccifolia (Westw.).

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917.

Found all over India, Burma and Ceylon.

Aspongopus chinensis, Dall.

Three specimens from above Tura.
Common in Sikkim and Assam.

Megymenum parallelum, Voll.

One specimen from above Tura.
Recorded from Sikkim, Assam and the Andamans.

Eumenotes obscura, West.

One specimen from above Tura.
Previously recorded from Sikkim and Burma.

Gonopsis coccinea (Walk.).

One specimen from above Tura, ix.1917.
Recorded from Sikkim, Assam and Burma.

Sastragala heterospila (Walk.).

One specimen from above Tura, ix.1917.
This species was not previously represented in the collection of the Zoological Survey of India.
Recorded from the Western Himalayas and the Nilgiris. Apparently very widely distributed.

Sastragala trilineata, sp. nov.

Pl. xxxiv, fig. 1.

Described from a single specimen from above Tura.
Head ochraceous with four longitudinal series of punctures, two discal and two marginal, two small, triangular, black spots on basal margin, antennae pale ochraceous with the fourth and fifth joints slightly fuscous; rostrum luteous, its apex black; pronotum ochraceous, coarsely but sparingly punctured, anterior area levigate a little behind the anterior margin, posterior lateral angles spinously produced, acute, the spines dark castaneous, between the posterior lateral angles a broad castaneous fascia occupies the basal portion of the pronotum, and on the middle of the fascia there are three pale ochraceous, longitudinal fasciae, giving the central area a paler appearance; sternum pale ochraceous; scutellum light brownish on the basal area, the apical half luteous with a pale fuscous transverse band just before the apex; extreme basal angles black, the basal area and the apical half sparingly but strongly punctured; corium luteous, irregularly punctured with a few dark castaneous punctures which are most dense on the disk and at the apical angle; connexivum ochraceous, marked with black at the segmental angles; the apex of

the sixth abdominal segment broadly black; underside of abdomen and the legs pale ochraceous, the latter with the apices of the femora, tibiae and tarsi pale fuscous.

Length 7 millim., breadth between pronotal angles 4·5 millim.

Type No. 8370/H1 in the collection of the Zoological Survey of India.

Elasmostethus nebulosum, Dist.

Two specimens from above Tura.

Hitherto known only from the Naga Hills.

Elasmostethus truncatulum (Wa'k.).

Two specimens from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917, and two from above Tura.

This and the preceding species were not previously represented in the collection of the Zoological Survey of India.

Recorded from Darjiling and Sibsagar, Assam.

Family COREIDAE.

Helcomeria spinosa (Sign.).

One mature and one immature specimen from above Tura, 2,500 and 3,900 ft., respectively, 15.vii–31.viii.1917.

Recorded from Sikkim and Assam.

Elasmomia granulipes (Westw.).

One specimen from above Tura.

Recorded from Sikkim.

Mictis tenebrosa (Fabr.).

Two specimens from above Tura.

Occurring in Sikkim, the Khasi Hills, Assam and Burma.

Mictis gallina, Dall.

Two specimens from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917.

Recorded from Burma.

Homoeocerus subjectus, Walk.

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917 and one specimen from above Tura.

Within our limits, known only from Assam.

Homoeocerus simiolus, Dist.

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917.

Recorded from Sikkim, Assam and Burma.

Homoeocerus concisus, Walk., var. *a.*

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917.
Recorded from Sikkim and Burma.

Cloresmus antennatus, Dist.

One specimen from above Tura, 3,500–3,900 ft., ix.1917.
This specimen agrees in every respect with Distant's description of the species, but it is much larger, being 16 millim. in length.
Hitherto known only from Sikkim.

Colpura erebus, Dist.

Three specimens from above Tura
Recorded from Sikkim and the Naga Hills.

Colpura funebris, Dist.

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917.
Recorded from Sikkim and Assam.

Colpura sulcata, sp. nov.

Pl. xxxvi, fig. 1.

Described from one specimen from above Tura.
Black with ochraceous and reddish ochraceous markings, and some very fine, short, golden hairs above and beneath; extreme base of first joint and the apical joint of the antennae (excluding base), the ocelli, tubercles behind eyes, two lateral spots on basal margin of head, anterior, lateral and posterior margins of pronotum, two irregularly shaped marks on disk and a short longitudinal line on posterior margin of pronotum, apex of scutellum and costal margin of corium, reddish ochraceous; annulations to femora and tibiae of all the legs, those on the posterior femora very broad, veins on the basal area of membrane, transverse linear fasciae at incisures of connexivum, the apex of the first joint and the bases of the second, third and fourth joints of the rostrum ochraceous; some black spots on the pale areas of the femora; a lateral series of segmental spots and four spots at base of abdomen beneath dull black, those on the fifth, sixth and seventh segments larger and more distinct; membrane with a few irregular greyish marks; corium brownish ochraceous with a large dull black spot near inner angle followed by a small, indistinct ochraceous spot; pronotum with its margins slightly reflexed, two short, oblique pits or depressions on centre of anterior area and a shallow longitudinal discal sulcation which extends to the basal area; rostrum very long, extending to the apical margin of the fourth abdominal segment, first joint passing base of head,

shorter than any of the remaining joints, which are subequal, a somewhat deep, longitudinal sulcation on disk of abdomen beneath extending to the apical margin of the sixth segment.

Length 16·5 millim., breadth between pronotal angles 5 millim.

Type No. 8371/H1 in the collection of the Zoological Survey of India.

Hygia touchei (Dist.) var.

Three specimens from above Tura.

These specimens differ from the typical form in being black instead of piceous brown; the legs are entirely black with no ochraceous markings.

Recorded from Sikkim.

Dasynus relatus, sp. nov.

Described from three specimens from above Tura.

Brownish ochraceous, thickly and darkly punctate; corium purplish; membrane fuscous brown, its basal angle darker; antennae black, the apical joint ochraceous with the base narrowly black; legs and underside ochraceous; antennae with the first joint slightly incrassated towards apex, first and second joints equally long, longer than the third and fourth, which are subequal; head a little longer than breadth between eyes, with a few minute scattered black punctures, which are most dense in a central longitudinal groove situated between the ocelli; apex of head broad, pale ochraceous; rostrum ochraceous, its extreme apex black, extending to base of mesosternum; pronotum densely punctate, the lateral margins narrowly black, posterior pronotal angles prominent, obtusely angulate and slightly recurved, disk of pronotum with a pale, faint, central, longitudinal carina, posterior marginal area of pronotum with a somewhat deep, transverse sulcation; scutellum brownish ochraceous, its apex pale and impunctate, the anterior area deeply punctured, transversely rugulose; coriaceous portion of hemelytra blackly punctate, outer portion of corium purplish, remainder brownish ochraceous, costal margin of corium ochraceous; abdomen above reddish ochraceous, the lateral margins of the sixth and the greater part of the apical two segments dull black; connexivum ochraceous; a small black spot on the lateral areas of the meso- and metasterna and a similar spot near the middle of the lateral areas of the second, third, fourth and fifth abdominal segments below.

Length 17-21 millim., breadth between pronotal angles 6-8 millim.

Type No. 8372/H1 in the collection of the Zoological Survey of India.

Cletus punctulatus (Westw.).

One specimen from above Tura.

Recorded from Sikkim and the hills of Assam.

Cletus bipunctatus (West.).

One specimen from above Tura.
Common throughout India, Burma and Ceylon.

Cletus punctiger (Dall.).

One specimen from Tura, 1,200–1,500 ft., vii–viii.1917 and two from above Tura.
Recorded from Murree; Bengal and Burma.

Cletomorpha raja, Dist.

Two specimens from above Tura.
Recorded from Sikkim, Assam and Burma.

Riptortus linearis (Fab.).

Three specimens from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917.
Distributed throughout India, Burma and Ceylon.

Serinetha abdominalis (Fab.).

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917.
Apparently a common Indian species.

Family LYGAEIDAE.

Graptostethus trisignatus, Dist.

Two specimens from Tura, 1,400 ft., x.1917 and five from above Tura.
Recorded from the Assam Hills and Burma.

Nysius ceylanicus (Motsch.).

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917.
A very common and widely distributed species.

Ninus turaensis, sp. nov.

Described from a single carded specimen from above Tura.

Head dark, clothed with fine white pubescence; eyes very dark purplish-red; antennae ochraceous, the basal and apical joints darker in hue, first joint stout, shortest, second longest, third and fourth joints much shorter than second, subequal, fourth incrassated; pronotum brownish, densely pubescent on anterior area, the brown colouration on the posterior area in the shape of the letter **M**; scutellum, clavus and base of corium clothed with white pubescence, a spot at the apex of clavus near the inner angle of corium, a small linear mark near outer margin of corium a

little beyond base and the apex dark castaneous, a small impunctate, hyaline depression near apical area of clavus and a larger similar depression on disk of corium near the inner angle; membrane hyaline; legs ochraceous, claws of tarsi black.

Length excluding membrane 2·5 millim.

Type No. 8375/H1 in the collection of the Zoological Survey of India.

Macropes excavatus, Dist.

Four specimens from above Tura.

Known only from Shillong, Assam.

Malcus scutellatus, Dist.

Three specimens from above Tura.

Recorded from Assam, Sikkim and Ceylon.

Nerthus kempi, sp. nov.

Pl. xxxvi, fig. 2.

Described from one carded specimen from above Tura.

Shining black, elongate. Base of first joint of antennae, basal margin of pronotum, central longitudinal fascia on apical area of scutellum not extending to base, basal marginal area of first and third segments of connexivum, basal third of intermediate and posterior femora, and a more or less distinct central annulation to posterior tibiae, yellowish ochraceous; clavus brownish ochraceous, with the scutellar margin black, and two longitudinal series of black punctures on marginal areas; basal half of corium semi-hyaline, its veins, costal margin and the apical area broadly black; membrane shining, bronzy; head, pronotum, scutellum and sternum densely punctured, the pale areas on the pronotum and scutellum almost impunctate, a small, foveate depression at the centre of the basal margin of scutellum; femora slightly incrassate, antennae with the first joint very short, second joint longest, third longer than fourth.

Length 11 millim., breadth between pronotal angles 3 millim.

The colour of the corium, connexivum and legs distinguishes this species from *N. dudgeoni,* Dist.

Type No. 8376/H1 in the collection of the Zoological Survey of India.

Vertomannus capitatus, Dist.

Four specimens from above Tura.

Recorded from Assam and Burma and represented in the collection of the Zoological Survey of India from the Darjiling district.

Paromius exiguus (Dist.).

One specimen from above Tura.

Apparently widely distributed.

Pamera pallicornis (Dall.).

Two specimens from Tura, 1,200–1,500 ft., 15.vi–15.viii.1917.
Recorded from Assam, Sikkim, Burma and Shillong.

Pamera vincta, Say.

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.viii.1917.
Universally distributed.

Dieuches uniguttatus (Thunb.).

One specimen from Tura.
A very common and widely distributed species.

Family PYRRHOCORIDAE.

Lohita grandis (Gray).

Four specimens from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917, and two from above Tura.
A fairly common species, also found in the plains.

Physopelta gutta (Burm.).

Four specimens from above Tura.
Common in the Darjiling district. Recorded from Assam, Burma and Ceylon.

Ectatops gelanor, Kirk. and Edw.

One specimen from Tura, 1400 ft., x.1917.
This species was not previously represented in the collection of the Zoological Survey of India.
Recorded only from Karenee, Burma.

Dindymus lanius, Stål.

Five specimens from above Tura.
Recorded from the Naga and Khasi Hills, Assam, and Burma.

Dindymus rubiginosus (Fabr.).

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917.
A common species in Assam. Occurring also in Malabar and Burma.

Pyrrhopeplus posthumus, Horv.

One specimen from above Tura,
Recorded from Sikkim, Assam and Burma.

Family ARADIDAE.

Mezira membranacea (Fabr.).

Three specimens from above Tura.
An abundant species.

Neuroctenus affinis, Dist.

Two specimens from above Tura.
Not previously known to occur in Assam.

Family HYDROMETRIDAE.

Rhagovelia nigricans (Burm.).

Two specimens in alcohol, one from Tura, 1,200–1,500 ft., vi–vii.17 and another from the Ganool R., Damalgiri, Garo Hills, viii.17.

Recorded from the Southern Palaearctic Region and the Mascarene Is.

Microvelia lineatipes, sp. nov.

Pl. xxxiv, fig. 2.

Described from four carded specimens from Damalgiri, Garo Hills, ix.1917.

Head and pronotum piceous; lateral margins of head and greater part of pronotum with silvery grey pubescence; a fine, central, longitudinal sulcation extending from near base of head to apex; antennae castaneous, second joint longest, remaining joints subequal; a short, pale reddish ochraceous fascia near anterior margin of pronotum medially interrupted with black, some long black hairs near anterior lateral pronotal margins, lateral angles prominent; hemelytra fuscous, a long streak sometimes broken near inner margin of clavus, another on basal area of corium, three spots inconstant in size placed transversely across the middle of membrane, a long streak, sometimes broken up into spots, near inner margin and a somewhat elongate spot at the middle of apical area of membrane greyish-white; legs ochraceous, apical half of claw joint of all the tarsi, apices of fore tibiae and a longitudinal streak on the anterior part of all the femora, inwardly black, femora and tibiae of the legs hairy; underside dull black, densely pubescent, a spot beneath lateral pronotal angles and the connexivum beneath dark reddish ochraceous.

Length 2·3 to 2·5 millim.

Type No. 8377/H1 in the collection of the Zoological Survey of India.

Microvelia atromaculata, sp. nov.

Pl. xxxiv, fig. 3.

Described from five carded specimens from Damalgiri, Garo Hills, ix.1917.

Head and pronotum dull black; apex of head, anterior margin and posterior portion of lateral angles of pronotum, reddish ochraceous; lateral margins of head and anterior area of pronotum greyishly pubescent; antennae ochraceous, apices of first and second joints and the whole of the fourth joint fuscous, second joint shortest, fourth longest, first and third subequal in length, third joint very slender; pronotum with a transverse patch produced narrowly backwards but not reaching basal margin, situated immediately behind the ochraceous fascia on anterior margin and two almost contiguous spots at basal angle jet black; hemelytra pale brownish, a longitudinal streak on clavus connected with a small spot at basal angle of corium, a large spot on disk of corium, a large, furcate mark near base of membrane, a rounded spot near apical angle of corium, a series of linear spots on inner margin and a large subrectangular spot on apical area of membrane greyish white; legs pale ochraceous, apices of tibiae and tarsi infuscate; underside black, greyishly pubescent.

Length 1·75 millim

Type No. 8378/H1 in the collection of the Zoological Survey of India.

Perittopus maculatus, sp. nov.

Pl. xxxiv, fig. 4.

Described from six carded specimens from above Tura, Garo Hills, 3,500–3,900 ft., 15.vii–31.viii.1917. Also found in a well in dense jungle above Tura, 3,800 ft., 15.vii–31.viii.17.

Macropterous form —Bright reddish ochraceous, with a large patch on each antero-lateral margin of pronotum black; the entire insect covered with erect hairs, those on the disk of the pronotum very short; head globosely arched, almost perpendicularly deflected anteriorly, a short longitudinal sulcation between eyes; antennae shining black, inserted below the eyes on a level with the clypeus, first joint stout, curved outwards, longer than any of the remaining joints, second and fourth subequal, slightly longer than the third, first three joints with long black hairs on inner margins; pronotum about as long as broad, lateral margins strongly sinuate, lateral angles broadly prominent, basal angle subangulate, disk moderately raised, minutely punctured, anterior margin depressed behind head, the whole surface covered with hairs which are most conspicuous on the lateral areas; hemelytra reddish-brown, with the claval margins and the basal and apical margins of corium black, clothed with short greyish hairs; membrane dusky grey, body beneath bright ochraceous, an irregular lateral fascia extending from the metasternum to the sixth abdominal segment black; legs bronzy black, coxae, trochanters, anterior femora and the bases of the intermediate and posterior femora pale ochraceous.

Apterous form.—Similar in colour to the macropterous form; lateral and basal angles of pronotum rounded; a slight transverse impression between the anterior and posterior lobes of the pro-

notum; the black patch on the antero-lateral area more distinct and rounded; pronotum not so long as in the macropterous form; abdomen above black as far as the sixth visible segment, remaining segments bright reddish ochraceous, the entire surface very hairy.

Length 2 millim.

Type No. 8379/H1 in the collection of the Zoological Survey of India.

Gerris (Limnogonus) tristan, Kirk.

A single specimen from a stream in dense jungle above Tura, 3,800 ft., 15.vii–31.viii.1917.

A very common and widely distributed species.

Chimarrhometra orientalis (Distant).

1879. *Halobates? orientalis*, Distant, *Trans. Ent. Soc. Lond.*, p. 126.
1879. ,, ,, *Id.* (gen.?) *Sec. Yark. Miss., Rhyn.*, p. 12, ff. 11, 12.
1896. *Chimarrhometra orientalis*, Bianchi, *Annuaire Mus. St. Pétersb.*, p. 71.
1904. ,, ,, Distant, *Fauna Brit. Ind. Rhy.*, II, p. 190.
1908. *Rheumatotrechus himalayanus*, Kirkaldy, *Canad. Ent.*, XL, p. 452.
1910. *Gerris monticola*, Distant, *Ann. Mag. Nat. Hist.* (8) V, p. 141.
1910. ,, ,, *Id.*, *Fauna Brit. Ind. Rhy.*, V (Appendix), p. 142.
1910. *Rheumatotrechus himalayanus*, Kirk., Distant, *Fauna Brit. Ind. Rhy.*, V (Appendix), p. 151.

One winged and five apterous females from the same locality as the preceding species.

The generic position of this species is doubtful. It has evidently been described under various generic and specific names by different authors. Distant himself has described it under two different genera. He based his original description on the structural character of the basal joint of the anterior tarsi but there appears to be a misunderstanding on this point. The male genitalia form a very good character for distinguishing the genus. Distant's description of *Gerris monticola* was taken from a macropterous female, while that of *Halobates? orientalis* was taken from an apterous male. We have in the collection of the Zoological Survey of India the type of *Halobates? orientalis* as well as the co-types of *Gerris monticola*. There is no doubt that Kirkaldy's species is the same as *G. orientalis*. It is common in Himalayan streams.

Eotrechus kalidasa, Kirk.

One apterous specimen from above Tura.

This species was not hitherto represented in the collection of the Zoological Survey of India. I have no doubt that the specimen is specifically identical with the winged form described from Karenee, Burma, by Distant.

Ptilomera laticaudata (Hardw.).

Four apterous specimens from Tura, 1,200-1,500 ft., 15.vi—15.vii.1917.

Genus **Metrocoropsis**, nov.

Type: *Metrocoropsis femorata*, Paiva.

Distribution: Assam, Garo Hills.

Head subquadrate, as long as broad at base; lateral margins strongly concavely sinuate at junction of eyes, apical and basal margins convex; antennae four-jointed, first joint longest, almost as long as the remaining three together, third joint shortest; eyes large, posteriorly extending over the lateral angles of the pronotum; pronotum much longer than broad; hemelytra passing abdominal apex; anterior legs very robust in male, anterior femora much incrassated with two distinct teeth situated on the underside, one a little beyond middle and the other near apex, anterior tibiae almost as long as anterior femora, much stouter than the tibiae of the other legs, anterior tarsi with the basal joint much smaller than the second joint; intermediate and posterior legs very long; in the female the anterior femora are simple.

Allied to *Metrocoris*, but differing in the presence of the teeth on the anterior femora.

Metrocoropsis femorata, sp. nov.

Pl. xxxiv, fig. 5.

Described from five specimens from a stream in dense jungle, above Tura, 3,800 ft., 15.vii–31.viii.1917.

Head, pronotum, underside and legs ochraceous; antennae (excluding base of the first joint), a large patch on head between eyes, anterior and lateral margins of pronotum (excluding anterior angles), a central longitudinal fascia to pronotum extending from anterior margin to a little before basal angle, a broad curved fascia on each side of the central one, in some cases united anteriorly a little before middle, but not reaching basal angle, a few linear marks on intermediate and posterior acetabula, four longitudinal fasciae on anterior femora, the uppermost widest, the anterior tibiae and tarsi and two small rounded spots at the bases of the intermediate and posterior femora black; intermediate and posterior legs fuscous brown.

Length including membrane 8·5 millim.

This species resembles *Metrocoris nigrofasciatus* very closely but is easily separated from it by the markings on the pronotum and the anterior femora, etc.

Type No. 8381/H1 in the collection of the Zoological Survey of India.

Family REDUVIIDAE.

Myiophanes greeni, Dist.

One specimen from Tura, 1,400 ft., x.1917.

Not previously represented in the collection of the Zoological Survey of India.

Recorded only from Ceylon.

Bagauda cavernicola, sp. nov.

Pl. xxxvi, fig. 3.

Six specimens in alcohol from the Siju Cave, Garo Hills, Assam, xi.1917 (*R. Friel*).

Castaneous brown; constricted area of pronotum extending to the anterior half of the posterior lobe, a large rounded spot on corium at base of membrane, bases of anterior coxae, apical halves of anterior femora, the anterior tibiae (excluding base and apex), prosternum, a spot on the disks of meso- and metasterna, intermediate and posterior coxae, apices of intermediate and posterior femora, bases of intermediate and posterior tibiae creamy white; abdomen beneath paler than above; membrane pale fuliginous; other structural characters as in *B. splendens,* Dist. Antennae mutilated in type specimen.

Length excluding membrane 16 millim.

Type No. 8547/H1 in the collection of the Zoological Survey of India.

Apocaucus laneus, Dist.

One specimen from above Tura.

Hitherto known only from Kurseong, Darjiling district, E. Himalayas.

Canthesancus gulo, Stål.

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917 and two from above Tura.

Recorded from Sikkim, Assam and Burma.

Valentia apetala (de Vuill.).

Three specimens from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917

Known only from Sylhet, Assam.

Valentia compressipes, Stål.

Two specimens from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917.

Recorded from Burma.

Psophis erythraea, Stål.

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917 and two from above Tura.

Not previously represented in the collection of the Zoological Survey of India. Recorded from North India.

Centrocnemis ståli, Reut.

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917 and three found on a dead tree above Tura, 3,000 ft.

Recorded from Darjiling district, E. Himalayas and Assam.

Epirodera impexa, Dist.

Two specimens from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917.

Not previously represented in the collection of the Zoological Survey of India.

Hitherto known only from Burma.

Acanthaspis helluo, Stål.

Three specimens from above Tura.

Apparently confined to Assam.

Scadra fuscicrus, Stål.

Three specimens from above Tura.

Recorded from Burma and Ceylon.

Scadra castanea, sp. nov.

Pl. xxxv, fig. 1.

Described from two specimens from above Tura.

Head light brown, collar, pronotum, scutellum and legs castaneous; antennae black, longly pilose, the base of the first joint pale ochraceous; pronotum shining, glabrous, constricted a little before the middle, a deep, central longitudinal furrow extending from the anterior margin to a little beyond the middle of the posterior lobe, a longitudinal depression on each lateral area of the posterior lobe extending from the impression at the constriction to the posterior basal margin, with the exception of the central longitudinal furrow, the other furrows on the pronotum are transversely impressed; scutellum strongly depressed on disk, the apical spines curved inwards; hemelytra dull black, the basal angle of the corium and a small triangular patch on its apical margin ochraceous, sometimes tinged with red; connexivum dilated, obliquely reflexed, marked alternately with orange yellow and black; sternum black; abdomen beneath black, centrally carinate, a pale ochraceous line on the middle of the apical margins of the first three basal segments, and a greenish-yellow patch on the basal lateral angles of the second, third, fourth and fifth segments; legs with the coxae, trochanters, apices of the femora broadly, bases and apices of the tibiae and the tarsi ochraceous.

Length 13·5 millim.

Type No. 8382/H1 in the collection of the Zoological Survey of India.

Genus **Paralibavius**, nov.

Type: *P. singularis*, Paiva.

Distribution: Assam, Garo Hills,

Head deflected in front of eyes, its apex acuminate, central lobe tuberculous, eyes large, postocular area tumid, distinctly narrowed behind, forming a short cylindrical collar; antennae 7-jointed, inserted nearer the eyes than the apex, first joint long, passing apex of head, about as long as head, its apex incrassated, second joint longer than first, the remainder smaller and slender; pronotum slightly, transversely constricted before middle, centrally, longitudinally impressed, the impression not reaching the basal margin, anterior lobe tumid, faintly sculptured on disk, minutely tuberculous on lateral areas, posterior lobe with a shallow impression on each lateral area, where it is transversely striate; scutellum with three spinous angulations, the outer ones curved inwards, the central about two-thirds as long as the outer, disk with a large depression; hemelytra about reaching apex of abdomen; abdomen a little broader than hemelytra; a strong, acute spine at the posterior angle of each segment of the connexivum; femora slightly incrassated towards apex, two rows of minute, tuberculous spines on the underside of the femora and tibiae of all the legs, anterior tibia with a short spongy furrow at apex.

Readily distinguished from the other genera of the Ectrichodiinae by the spinous projections of the connexivum.

Paralibavius singularis, sp. nov.

Pl. xxxv, fig. 2.

Described from a perfect specimen from above Tura.

Head, anterior lobe and lateral margins of posterior lobe of pronotum, base and lateral margin of corium and connexivum pale reddish ochraceous; antennae black, extreme base of first joint ochraceous; disk of posterior lobe of pronotum, scutellum and legs castaneous; membrane dull black;

Length 8 millim.

Type No. 8384/H1 in the collection of the Zoological Survey of India.

Ectrychotes relatus, sp. nov.

Pl. xxxv, fig. 3.

Three specimens from Tura, 1,200–1,500 ft. 15.vi–15.vii.1917 and three from above Tura.

Head, lateral margins of posterior pronotal lobe, scutellum, bases of clavus and corium, connexivum and legs reddish testa-

ceous; antennae longly pilose, black, first joint brown, its extreme base pale ochraceous; pronotum, excluding the posterior lateral margins, and base of scutellum cupreous; hemelytra black, a very deep black patch on clavus and disk of corium, the lateral margins and the apical area of corium reddish-black; connexivum marked with black on the third, fourth, fifth and sixth segments; sternum blackish; abdomen beneath reddish ochraceous, with the segmental sutures and large, lateral patches on each segment united to form a broad band, black; apices of the anterior and intermediate tibiae black; anterior and intermediate femora very faintly, and the posterior femora very distinctly, annulated with black at about middle; a narrow black annulation near base of posterior tibiae.

Length 13 millim.

Type No. 8385/H1 in the collection of the Zoological Survey of India.

Closely resembling *E. cupreus*.

Vilius melanopterus, Stål.

Two specimens from Tura, 1,200-1,500 ft., 15.vi–15.vii.1917.
Recorded from Assam and Burma.

Harpactor marginellus (Fabr.).

Two specimens from Tura, 1,200-1,500 ft., 15.vi–15.vii.1917 and two from above Tura.

Recorded from Assam, Burma and Aden.

Harpactor nigricollis (Dall.).

Four specimens from above Tura.
Found in Bhutan, Sikkim and Burma.

Sphedanolestes mendicus (Stål) var.

One specimen from Tura, 1,200-1,500 ft., 15.vi–15.vii.1917.
Recorded from Assam and Burma.

Sycanus ? dubius, sp. nov.

Described from a single specimen from above Tura, 2,500 ft. viii.1917.

Head, antennae, anterior lobe of pronotum, scutellum, membrane, body beneath, legs, and large rounded spots on the dilated connexivum shining black; antennae with the fourth joint very dark brown, the first joint longest, about as long as the anterior tibiae; head a little longer than pronotum; rostrum with the second joint longest; anterior lobe of pronotum small, centrally impressed near base, posterior lobe luteous, smooth, the lateral angles nodulosely subprominent; scutellum without a raised

tubercle or spine; clavus and corium dull black, margins of the dilated connexivum broadly brownish ochraceous, anterior tibiae outwardly spined before apex, coxae and trochanters of the anterior legs and the coxae of the intermediate and posterior legs dull reddish.

Length 28·5 millim.

Type No. 8386/H1 in the collection of the Zoological Survey of India.

I am not sure of the generic position of this species. It appears to belong to *Sycanus*, but the posterior lobe of the pronotum is not rugosely punctate and the anterior tibiae are outwardly spined before the apex.

Villanovanus dichrous (Stål.).

Two specimens from above Tura.
Known only from Assam.

Rihirbus trochantericus, Stål.

One male and one female from Tura, 1,500 ft., viii.1917.
A very variable species with a wide distribution.

Panthous excellens, Stål.

Six specimens from above Tura.
Recorded only from Assam.

Gorpis annulatus, sp. nov.

Pl. xxxvi, fig. 4.

Described from a single carded specimen from above Tura.

Head, pronotum, scutellum, and legs pale luteous; some light brown linear marks on vertex of head; antennae ochraceous, the apex of the second joint black; disk of anterior lobe of pronotum variegated with brown, its anterior and lateral margins and two indistinct patches on the posterior lobe brown, the latter rugosely punctured; scutellum with a black spot at centre of basal margin; hemelytra fuscous brown, the lateral margins of the clavus, the costal margin of the corium, medially interrupted, and all the veins luteous, a transverse patch a little beyond middle and the apex of the corium blackish, apical half of membrane hyaline; legs with two large black patches on the outerside of the anterior femora, two indistinct annulations to intermediate and posterior femora and a slight annulation to intermediate and posterior tibiae near base fuscous; membrane passing abdominal apex.

Length including membrane 10 millim.

Type No. 8387/H1 in the collection of the Zoological Survey of India.

Nabis assamensis, sp. nov.

Pl. xxxiv, fig. 6.

Described from one carded specimen from above Tura.

Head fuscous brown, a black **V**-shaped mark on disk extending from anterior margin of eyes to base of head; antennae black, extreme bases and apices of first and second joints, two annulations to second joint, third joint (excluding base) and fourth joint (excluding apex) ochraceous; pronotum with a greyish sericeous patch on disk of anterior lobe, widening posteriorly and extending from anterior margin to the transverse impression, the lateral margins and an elongate spot on the central area of the anterior lobe just before the transverse impression black; posterior lobe brownish mottled with ochraceous; scutellum black; hemelytra fuscous brown, thickly mottled with ochraceous; a large patch at apex of corium, and a linear mark at base of inner margin of membrane creamy white, a small black spot on disk of corium, some small spots on apical margin of membrane ochraceous; connexivum black with transverse ochraceous spots; legs brownish, mottled and annulated with ochraceous, some small, round, black spots on the femora; anterior and intermediate tibiae with a distinct row of small spines on the underside; tarsi brownish annulated with ochraceous; underside black; first joint of antennae longer than head, second joint longest, third slightly shorter than second, fourth shortest.

Length 9·25 millim.

Type No. 8388/H1 in the collection of the Zoological Survey of India.

Closely allied to *N mussooriensis*, Dist.

Velocipeda aliena (Dist.).

Four specimens from above Tura.

Recorded only from Burma.

Family CAPSIDAE.

Owing to the war it has not been possible to consult descriptions of various new species. It is, therefore, not advisable to describe specimens which do not agree with any of the described forms in the Fauna volumes of Rhynchota. The remainder of this paper will therefore consist only of those species which have already been recorded by Distant.

Onomaus pompeus, Dist.

Two specimens from above Tura.

Recorded from Assam and Burma.

Lasiomiris albopilosus (Leth.) var.

Two specimens from above Tura.
Recorded from Burma and Ceylon.

Helopeltis cinchonae, Mann.

Three specimens from above Tura.
Recorded from the Darjiling district and British Bhutan.

Poeciloscytus longicornis (Reut.).

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917.
A widely distributed species.

Family PELOGONIDAE.

Pelogonus marginatus (Latr.).

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917.
Found nearly all over India, Burma and Ceylon.

Mononyx indicus, Atkins.

One specimen from Tura, 1,200–1,500 ft , 15.vi–15.vii.1917, and two specimens from above Tura.
A common E. Himalayan species.

Family CICADIDAE.

Tosena melanoptera (White).

Two specimens from above Tura.
Common in the Himalayas and U. Burma.

Cryptotympana corvus (Walk.).

One specimen from above Tura, "common with *Tosena melanoptera*. *S. W K.*"
Recorded from the E. Himalayas and the Nilgiris.

Leptopsaltria samia (Walk.).

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917, and three from above Tura.
Recorded from N. India and Sikkim.

Platylomia similis (Dist.).

Two specimens from Tura, 1,400 ft., x.1917.
Recorded only from Sikkim and Assam.

Platylomia umbrata (Dist.).

Two specimens from Tura, 1,400 ft., x·1917.
Found in Sikkim, Assam and Burma,

Pomponia fusca (Oliv.).

Four specimens from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917 and six from above Tura. " This species differs in note from very closely allied form from Tura, 1,300 ft. Its call is a harsh monotonous drone, whereas the species at 1,300 ft., though it begins in similar style, after a short period changes to an ear-splitting screech, 3,900 ft., vii.1917. *S. W K* "
Occurring in Assam and the Nilgiris.

Family FULGORIDAE.

Fulgora viridirostris (Westw.).

Two specimens from Tura, 1,200–1,500 ft., 15.vi–15.vii.1917.
Recorded from Assam, Jumna Valley and Burma.

Fulgora spinolae (Westw.).

Three specimens from above Tura. " Not uncommon at 3,000 ft. with *F. clavata*, often found on the same tree. *S. W K.*"
Recorded from Sikkim, Assam and Mysore.

Fulgora clavata, Westw.

Five specimens from above Tura. " Not uncommon at 3,000 ft. Several specimens sometimes found on single trees to which they return after disturbance. *S. W K.*"
Fairly common in Sikkim and Assam.

Saiva gemmata (Westw.).

One specimen from Tura, 1,400 ft., x.1917.
Distributed throughout the E. Himalayas, extending to Assam.

Saiva cardinalis (Butl.).

Four specimens from above Tura, 2,500 ft., 1–10.viii.17. " On mossy tree-trunks, very inconspicuous. Only seen at 2,500 ft. *S. W K.*"
Recorded from Nepal and the Darjiling district.

Aphana pulchella (Guer.).

Two specimens from Tura, 1,400 ft., x.17.
Recorded from Sikkim, Assam and the Andamans.

Aphana variegata (Guer.).

One specimen from above Tura, 2,500 ft., viii.17.
Very widely distributed, extending from the Darjiling district through Assam and Burma to Cochin China.

Lycorma punicea (Hope).

Two specimens from above Tura.
Apparently confined to Assam and China.

Euphria submaculata (Westw.).

One specimen from above Tura, ix.17.
Recorded only from the Darjiling district, E. Himalayas.

Loxocephala aeruginosa (Hope).

One specimen from above Tura.
Extending from Garhwal in the Kumaon Hills to the hills of Assam.

Centromeria simulata, Dist.

Two specimens from above Tura, ix.17.
Known only from Assam.

Borysthenes suknanicus, Dist.

Two specimens from Tura, 1,200–1,500 ft., vii–viii.17.
Recorded only from Sukna, 500 ft., E. Himalayas.

Melandeva ocellata, Dist.

One specimen from above Tura.
Recorded from the Khasi Hills in Assam and from Momeit, Burma.

Pochazia guttifera, Walk.

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.17.
Extending from the Darjiling district through Assam to Burma and Tenasserim.

Euricania ocellus (Walk.).

Six specimens from above Tura.
Recorded from Sikkim and Assam; also found in China and Japan.

Family MEMBRACIDAE.

Hypsauchenia hardwicki (Kirby).

One specimen from above Tura.
A common East Himalayan species; recorded also from Nepal, Assam and Burma.

Nilautama typica, Dist.

Four specimens from Tura, 1,200–1,500 ft., 15.vi–15.vii.17.
Recorded from "India" and Tenasserim.

Centrotypus assamensis (Fairm.).

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.17.
Found in Sikkim, Assam, Burma and Tenasserim.

Darthula hardwicki (Gray).

Three specimens from above Tura. "On twigs, 3,900 ft. Each specimen found sitting on clutch of eggs. Tail raised to perpendicular position when irritated. *S. W K.*"
Recorded from Nepal, Sikkim, Assam and Burma.

Family CERCOPIDAE.

Callitettix versicolor (Fab.).

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.17.
Extending from Kashmir to Sikkim and Assam as far as Burma.

Eoscarta semirosea (Walk.).

One specimen from above Tura.
Found in the E. Himalayas and Assam.

Cosmoscarta egens (Walk.).

Twelve specimens from above Tura.
Common in the Darjiling district and Assam. Also recorded from Karenee, Burma.

Cosmoscarta dimidiata (Dallas).

Three specimens from Tura, 1,200–1,500 ft., 15.vi–15.vii.17.
Recorded from Sikkim, the Bhutan Duars and Assam.

Cosmoscarta dorsimacula (Walk.).

One specimen from Tura, 1,400 ft., x.17.
Widely distributed, extending from the Kangra Valley to Assam.

Cosmoscarta septempunctata (Walk.).

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.17, and one from above Tura.
Not uncommon in the Darjiling district and Assam; also found in Burma.

Cosmoscarta funeralis, Butl.

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.17.
Recorded from the Khasi Hills, Assam.

Leptataspis fulviceps (Dallas).

Two specimens from Tura, 1,200–1,500 ft., 15.vi–15.vii.17. and three from above Tura.
Recorded from Sikkim, Bhutan, Assam and Burma.

Family JASSIDAE.

Tituria planata (Fab.).

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.17.
Recorded from Calcutta, Nepal, Darjiling district and Tenasserim.

Petalocephala latifrons (Walk.).

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.17.
Widely distributed. Recorded from the Bombay Presidency, the Darjiling district and Assam.

Ledra dorsalis (Walk.).

One specimen from above Tura.
Occurring in Sikkim and Assam.

Tettigoniella ferruginea (Fab.).

Two specimens from Tura, 1,200–1,500 ft., 15.vi–15.vii.17.
A very common and widely distributed species.

Tettigoniella leopardina, Dist.

One from Tura, at light, 1,200–1,500 ft., 15.vi–15.vii.17.
Recorded from Upper Assam and Tenasserim.

Tettigoniella inflammata, Dist.

One from above Tura.
Only known from Margherita, Assam.

Tettigoniella sikhimensis, Dist.

Two specimens from above Tura.
Recorded from Sikkim.

Hylica paradoxa, Stål.

One specimen from Tura, 1,200–1,500 ft., 15.vi–15.vii.17.
Recorded from the Darjiling district, Burma and Tenasserim.

Vangama steneosaura, Dist.

One specimen from Tura.

Recorded from Bhim Tal, Kumaon Hills, Dehra Dun and the Darjiling district.

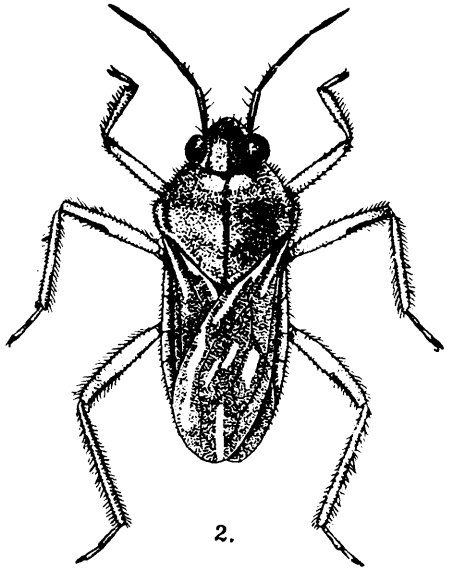
Krisna strigicollis (Spin.).

Two specimens from above Tura.

A very widely distributed species.

EXPLANATION OF PLATE XXXIV.

FIG. 1.—*Sastragala trilineata*, sp. nov.
,, 2.—*Microvelia lineatipes*, sp. nov.
,, 3.— ,, *atromaculata*, sp. nov.
,, 4.—*Perittopus maculatus*, sp. nov.
,, 5.—*Metrocoropsis femorata*, gen. et sp. nov.
,, 6.—*Nabis assamensis*, sp. nov.



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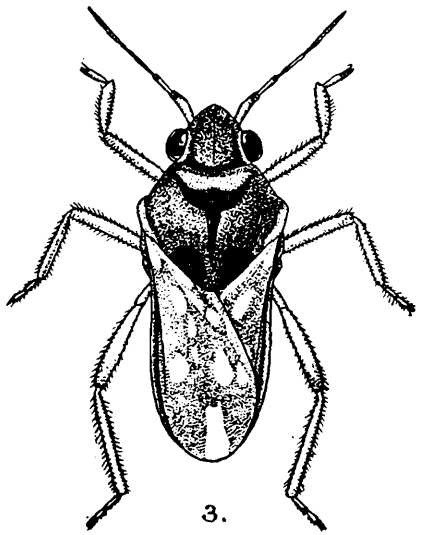

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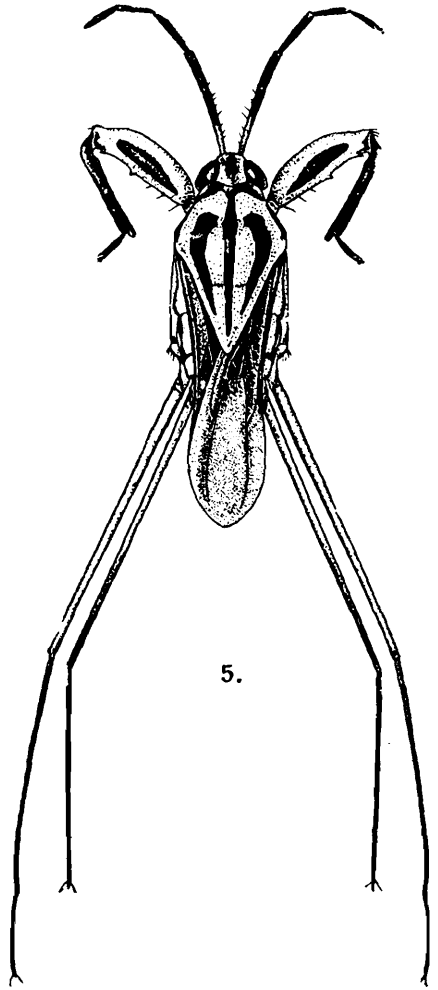

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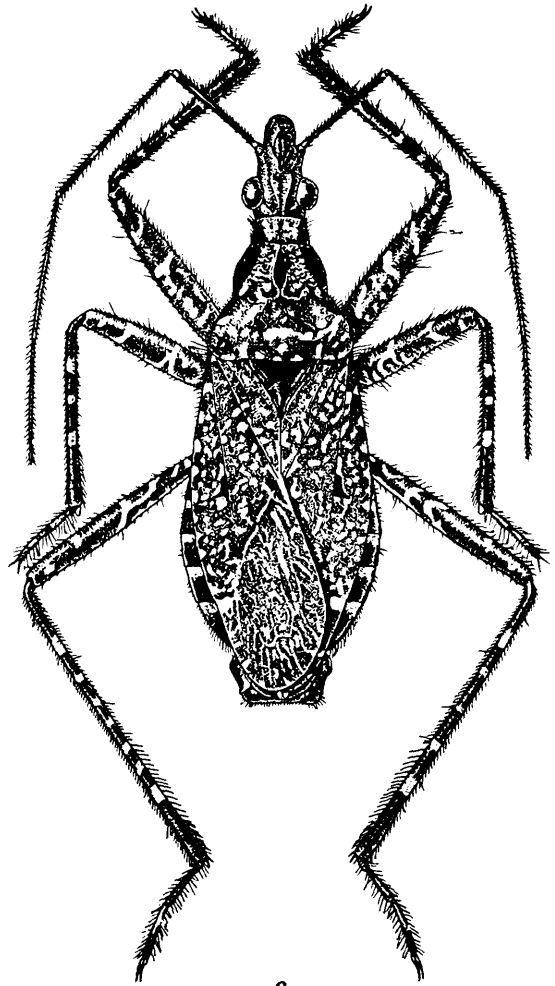

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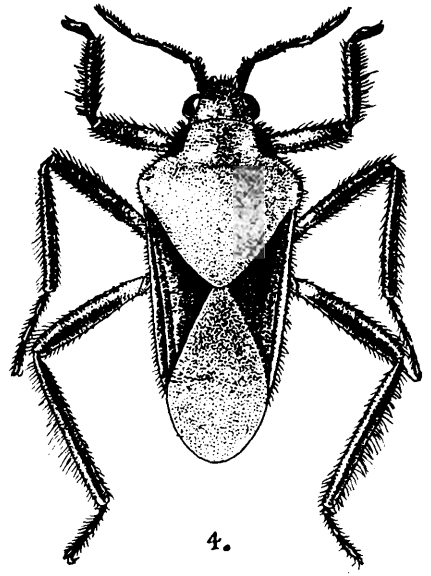

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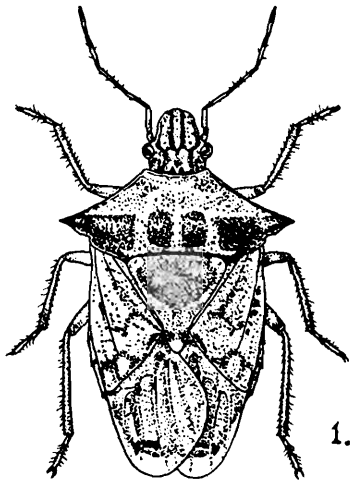


1.

D. Bagchi del.

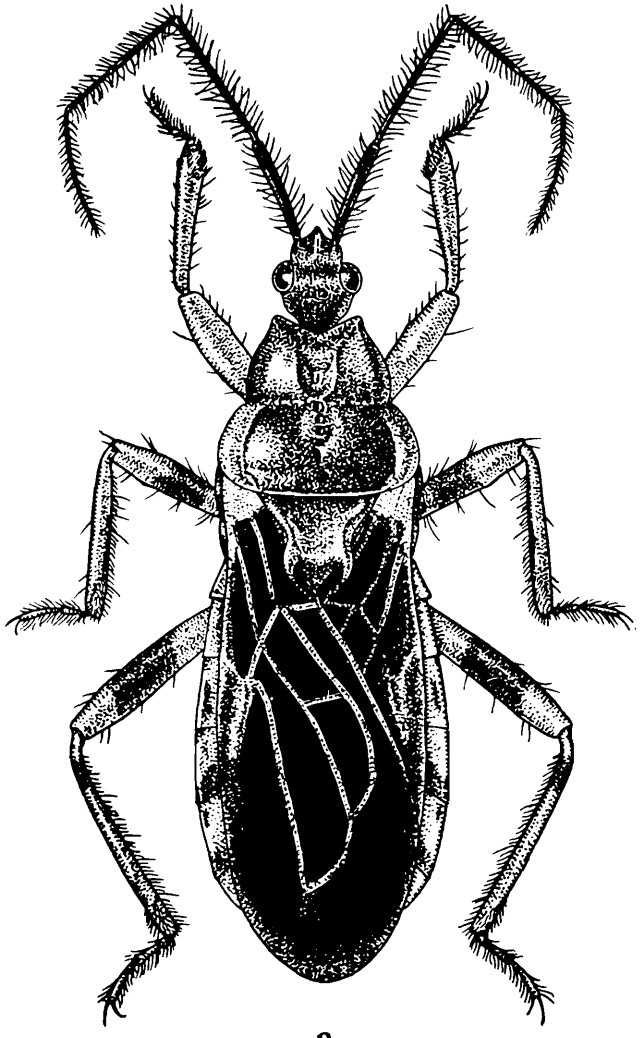
RHYNCHOTA OF THE GARO HILLS.

EXPLANATION OF PLATE XXXV.

FIG. 1.—*Scadra castanea*, sp. nov.

,, 2.—*Paralibavius singularis*, gen. et sp. nov.

,, 3.—*Ectrychotes relatus*, sp. nov.



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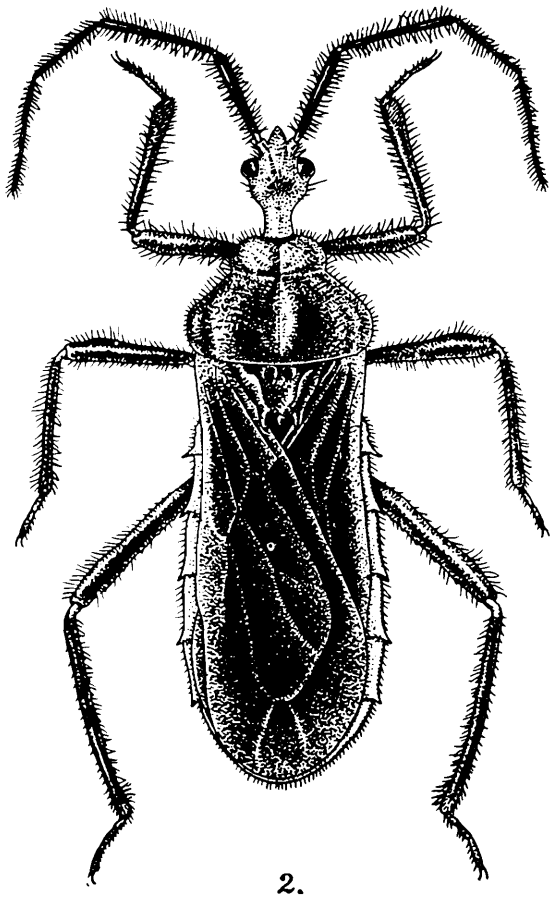

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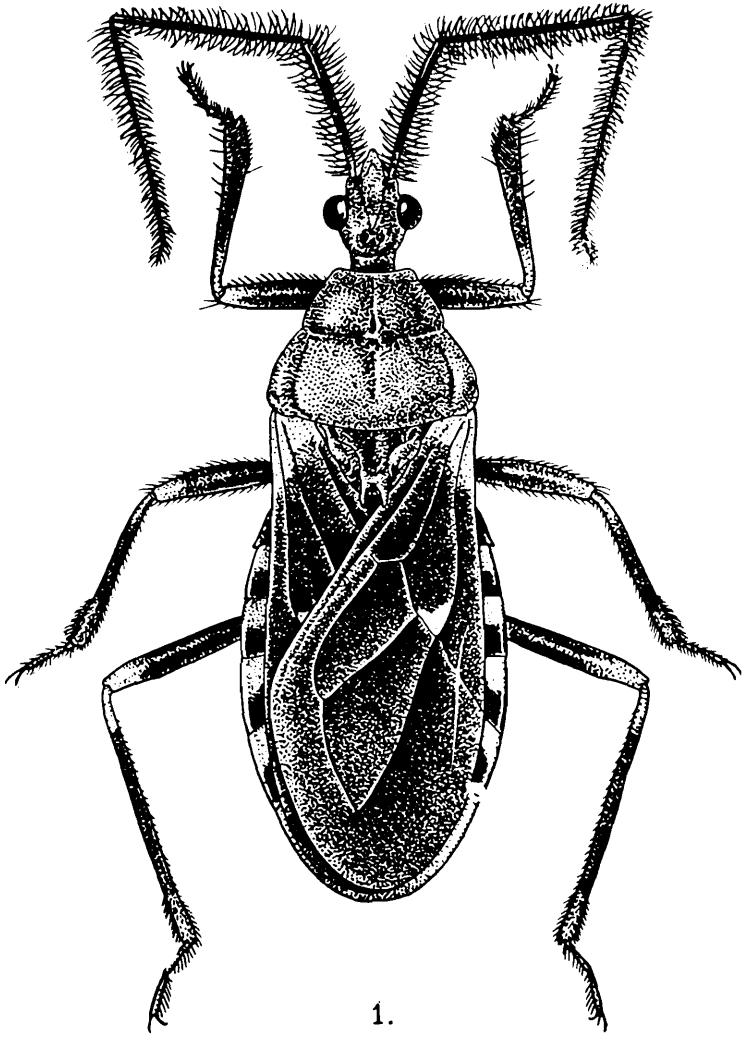


1.

D. Bagchi del.

RHYNCHOTA OF THE GARO HILLS.

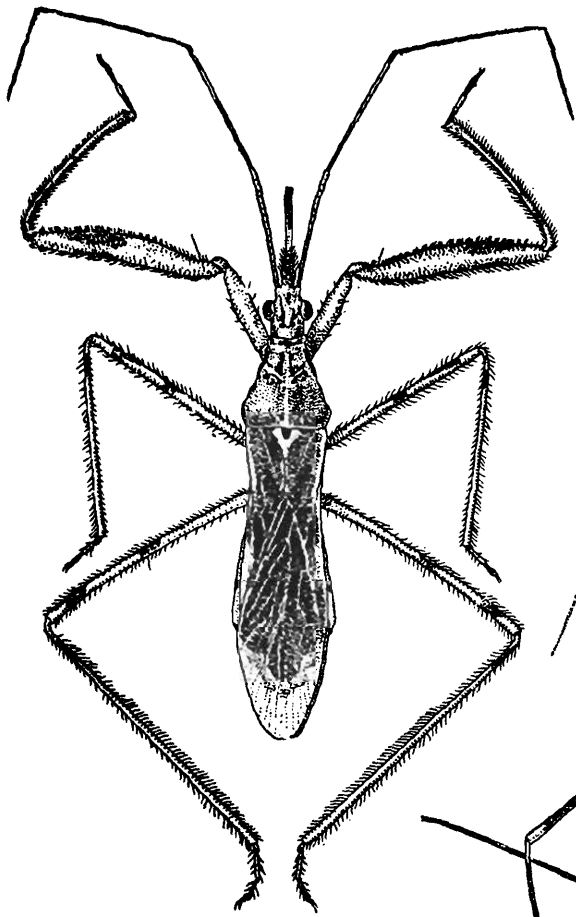
EXPLANATION OF PLATE XXXVI.

FIG. 1.—*Colpura sulcata*, sp. nov.

,, 2.—*Nerthus kempi*, sp. nov.

,, 3.—*Bagauda cavernicola*, sp. nov.

,, 4.—*Gorpis annulatus*, sp. nov.



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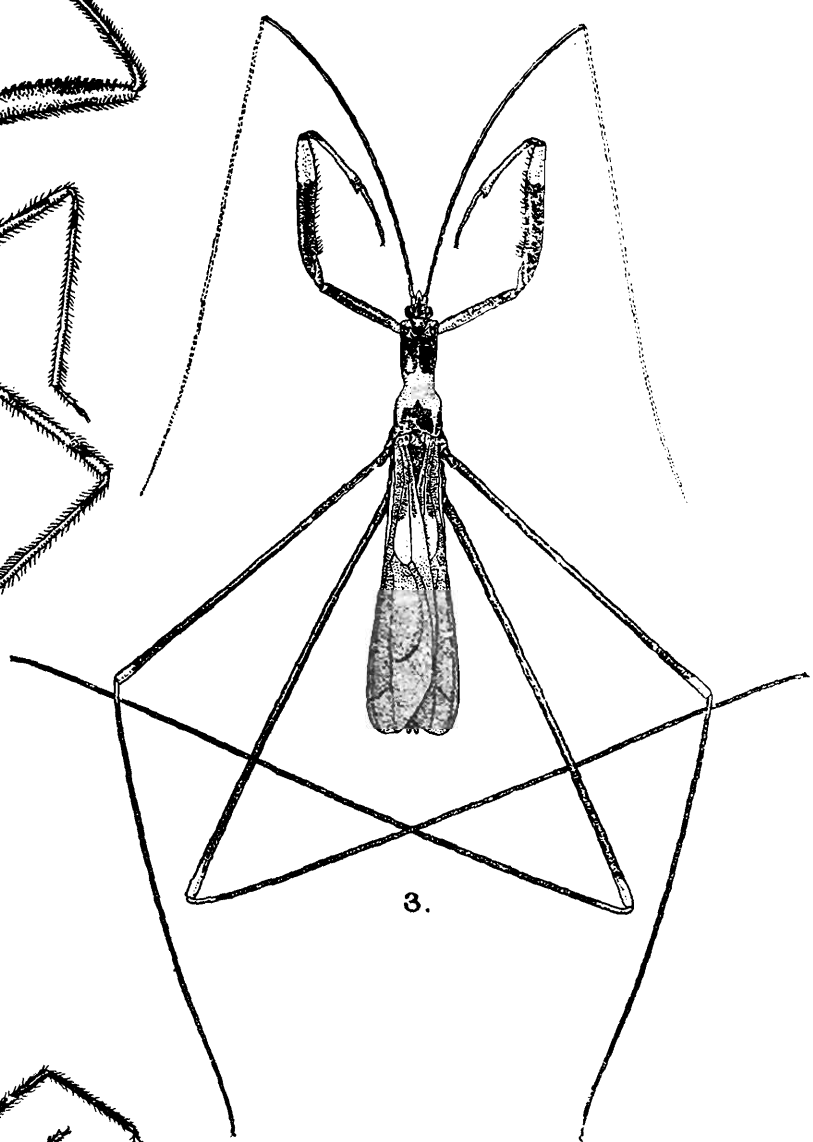

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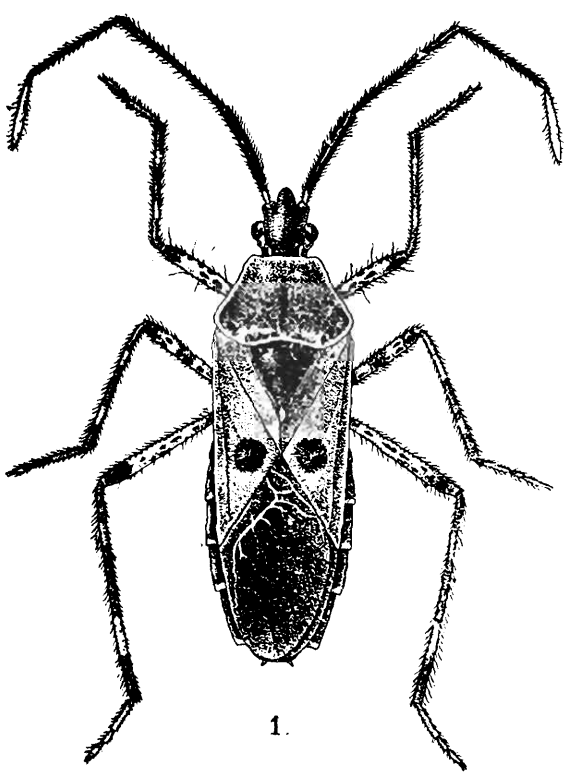

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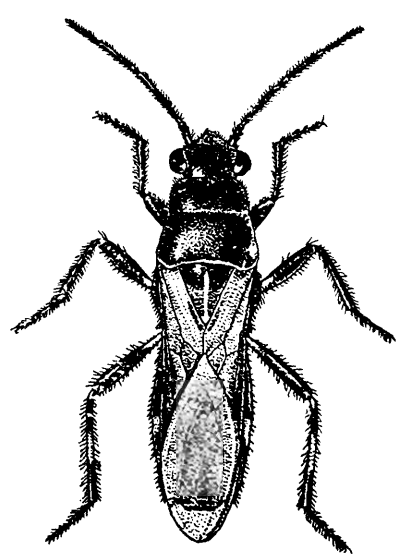


2.

D. Bagchi del.

RHYNCHOTA OF THE GARO HILLS.

XXIV TWO NEW SCORPIONS FROM SOUTHERN INDIA

By J R. HENDERSON, *M.B., C.M., C.I.E., Formerly Superintendent, Madras Government Museum.*

Plate XXI.

The scorpions which form the subject of this note were exhibited at the meeting of the Indian Science Congress held at Madras in January, 1915, but have not been described till now.

Lychas albimanus, n. sp.

Plate XXI, figs. 1, 2.

Habitat.—Three specimens found under logs, at an elevation of about 1,500 feet in the Teak Forests, Cochin State, by Dr. F. H. Gravely and Mr. B. Sundara Raj, M.A., in September, 1914. The following description has been drawn up from only one of these specimens, an apparently adult female.

Colour black with brownish mottlings, the last three terga with yellowish spots and mottlings. Tail paler especially towards its distal end, the vesicle yellowish. Chela black with the exception of the band which is white (becoming yellow in spirit); the fingers black. Legs pale brownish, with the femora and patellae black.

Carapace finely granular, the granules being most strongly developed towards the anterior margin.

Terga finely granular, with a single median keel on each, which, however, is poorly developed on the last tergum and the latter carries two well-developed lateral keels in addition.

Sterna smooth, except the last which is faintly granular and carries two indistinct keels on either side of the middle line.

Tail about five times as long as the carapace, faintly granular; keels well-developed, granular; vesicle faintly granular below; spine beneath the aculeus triangular, pointed, and placed at the end of a median granulated ridge which traverses the undersurface of the vesicle.

Chelae practically smooth, but with granular crests on the humerus and brachium; hand smooth, about the same width as the brachium; digits in contact, not sinuate, the movable one slightly longer than the carapace; outer series of teeth on the movable finger 6, inner series 5.

Legs faintly granular ; the tibial spurs much longer than the neighbouring hairs.

Pectinal teeth 21.

Measurements.— ♀ Total length 41 mm., carapace 4·5 mm., tail 21 mm., underhand 3 mm., movable finger 5 mm., width of hand 2 mm.

Type-specimen : No. $\frac{2+2}{17}$ in the collection of the Zoological Survey of India.

This species, which is chiefly characterised by its white hand and the pronounced granulation of the anterior portion of the carapace, appears to be related to *L. tricarinatus*, Simon, and *L. hendersoni*, Pocock. From the former it is distinguished by the fact that all its terga except the last have only a single carina ; in the latter species the colouration is entirely different, the hand and fingers both being yellow.

Palamnaeus tristis, n. sp.

Plate XXI, figs. 3, 4.

Habitat.—Tirupati Hills, North Arcot District, two males.

Venkatagiri Hills, Nellore District, two females and one young male.

This species was discovered in September, 1904 by my former pupil and assistant at the Madras Christian College, Mr. S. K. Sundara Charlu, M.A., who made a large collection of scorpions from the Eastern Ghats and other parts of the Madras Presidency. The specimens recorded above were found at elevations of between 2,000 and 3,000 feet, inhabiting short burrows, the entrance to which were, as is usually the case in the species of *Palamnaeus*, covered by a large stone. Mr. Sundara Charlu informed me that in some cases the burrow also afforded shelter to a small frog—*Callula variegata*, Stol.

Colour greenish-black, the legs sometimes paler than the rest of the body ; vesicle reddish-yellow.

Carapace on the whole smooth and polished, slightly granular towards the sides.

Terga smooth and polished, slightly granular towards the sides.

Sterna smooth and polished, the last one without a crest.

Tail about three times as long as the carapace ; all the segments polished, particularly above, and slightly granulated ; keels of the first three segments smooth, of the fourth and fifth segments slightly denticulate.

Vesicle wider than high, about as wide as the fifth segment, with four tuberculate crests below ; a well-defined groove on each lateral surface.

Chelae with the humerus and brachium both slightly longer than the carapace; humerus coarsely granular above and at the base below, with the anterior margin rather strongly denticulate ; brachium strongly ridged above and very slightly granulated ;

hand with the outer portion of its upper surface vertical and crested, the upper crest or finger-keel forming the outer border of the hand as seen from above and stopping opposite the articulation of the mobile finger; hand covered above with large smooth tubercles of varying size and shape, which are specially aggregated to form three well-defined hand ridges in addition to the finger-keel, *viz.* an inner and an outer ridge continued on to the immobile finger where the tubercles disappear, and a third intermediate shorter ridge which stops short of the immobile finger ; the three ridges all commence at the posterior margin of the hand; in addition to the keel of the underhand, which is smooth, there are three slightly tuberculate ridges on the undersurface of the hand, and this surface is rather coarsely tuberculate towards the inner margin ; the fingers are faintly granular particularly below.

Legs practically smooth.

Pectinal teeth 17-18.

Measurements.— ♂ Total length 116 mm., carapace 19 mm., tail 60 mm., humerus 21 mm., brachium 21·5 mm., underhand 18·5 mm., movable finger 21 mm., width of hand 13 mm.

Type-specimen: No. $\frac{2422}{17}$ in the collection of the Zoological Survey of India.

The above description is taken from an adult male. In the female the hand is much broader, more finely granulated, and the three ridges on the upper surface of the hand are much fainter. The length of the tail as compared with that of the carapace is practically the same in both sexes.

This species resembles *P. gravimanus*, Pocock, in the presence of longitudinal ridges or crests on the upper surface of the hand, but in other respects is very different. It appears to be most nearly related to *P. fulvipes*, Koch, and *P. wroughtoni*, Pocock, which both have the outer portion of the upper surface of the hand defined above by a distinct ridge. I had the opportunity some years ago of comparing specimens of the species just described with the types of *P. wroughtoni* from Belgaum, Bombay Presidency, preserved in the British Museum. This last species, which is of smaller size, has a much wider hand and the crest on the outer border of this joint is not so well-defined. The part external to this crest is flatter and more vertical in the new species, which is also characterised by the well-marked longitudinal ridges on the upper surface of its hand ; the underhand is granular in the new species, while it is smooth in *P. wroughtoni*.

EXPLANATION OF PLATE XXI.

Lychas albimanus, n. sp.

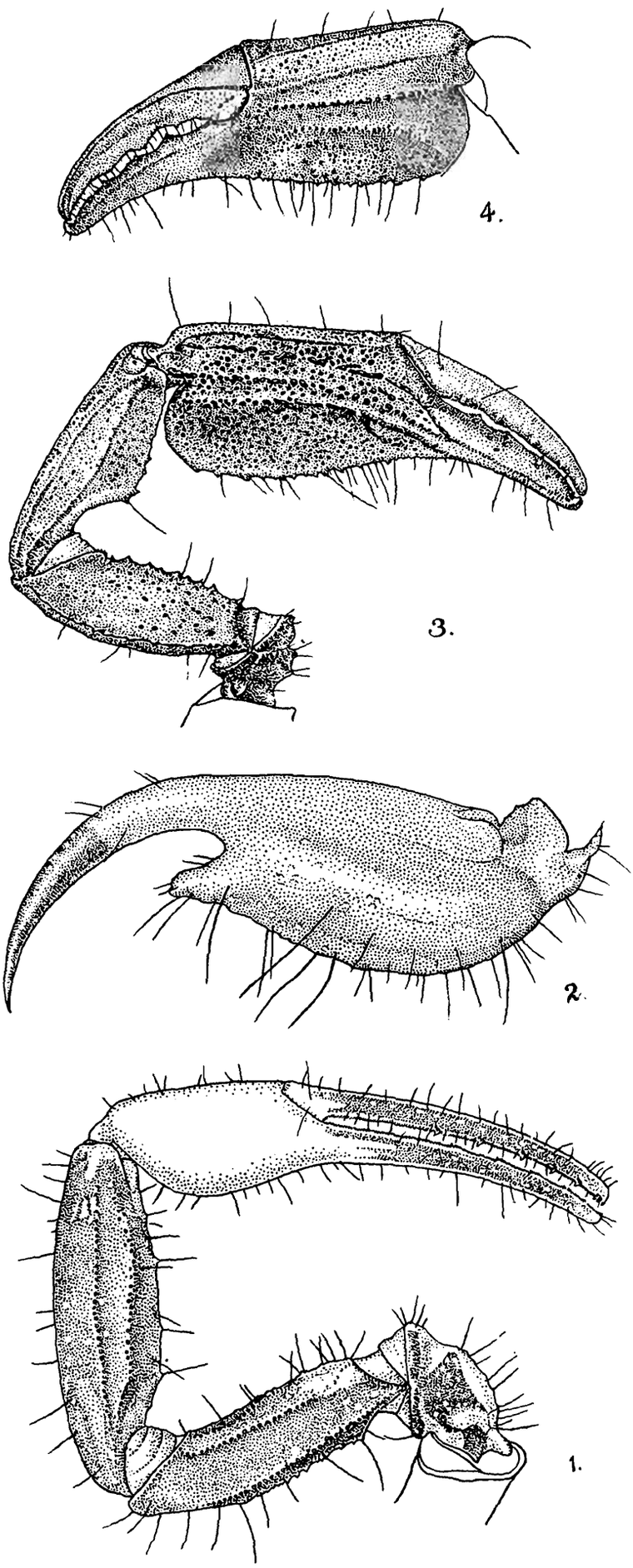
FIG. 1.—Arm and hand from above.

,, 2.—Vesicle and aculeus from side.

Palamnaeus tristis, n. sp.

FIG. 3.—Arm and hand from above.

,, 4.—Hand and fingers from below.



D. Bagchi del.

SOUTH INDIAN SCORPIONS.

XXV NOTES ON CRUSTACEA DECAPODA IN THE INDIAN MUSEUM.

XIII. THE INDIAN SPECIES OF *MACROPHTHALMUS*.

By STANLEY KEMP, *B.A., Superintendent, Zoological Survey of India.*

Plate XXIV

Since Alcock published his account of the Indian species of *Macrophthalmus* in 1900[1] a considerable amount of additional material has been obtained from various sources. A number of species not hitherto known from Indian waters have been added to the list, while several which were known to Alcock only by name have been rediscovered.

In determining the species I have derived great assistance from Dr. Tesch's recent monograph of the genus.[2] This work contains a most valuable key to twenty-five species, critical notes on their characters and synonymy and a great number of figures. I have found myself in complete agreement with Tesch as regards the species recognised by him, but I differ from him, and from other recent authorities also, in my views on the position of the species usually termed *Euplax bosci*.

The genus *Euplax* was established by Milne-Edwards for the reception of certain species which he found to differ from typical *Macrophthalmus* in the squarer outline of their carapace, in their shorter eyestalks and in the shortness of the chelipeds in both sexes. During the sixty years that have intervened since Milne-Edwards wrote, numbers of additional species have been described, referred for the most part to *Macrophthalmus*, and nowadays it is no longer possible to form two distinct groups on the characters on which he based his generic distinction.

Tesch, in his account of the Grapsoid crabs collected by the 'Siboga' expedition[3], distinguishes *Euplax* from *Macrophthalmus* by other characters: by the extent of the gape between the external maxillipeds and by the proportions of the merus of those appendages. In these respects, however, the difference is sometimes so very slight that it is clear that they do not afford a basis for generic differentiation.

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[1] Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 375 (1900).

[2] Tesch, *Zool. Meded. Rijks Mus. Nat. Hist. Leiden*, I, pp. 149-204, pls. v-ix (1915).

[3] Tesch, *Decap. Brachyur, 'Siboga' Exped.*, XXXIXc, p. 57 (1918).

Unfortunately it is not at present possible to include ***Euplax*** definitely in the synonymy of *Macrophthalmus*, for *E. leptophthalma* from Chili, the type species of the former genus, has never been re-examined since Milne-Edwards described it; there is thus a possibility that it may possess characters, hitherto overlooked, which entitle it to generic recognition. There is, however, very little doubt that *E. bosci* must be regarded as a species of *Macrophthalmus*, to which genus both Audouin and Krauss referred it. In his notes on the species Tesch remarks [1] that the proportional length of the merus of the outer maxillipeds in relation to the ischium is variable. This variation also extends to the relative length and breadth of the merus; the segment is sometimes nearly as long as broad, sometimes as much as one sixth broader than long. In this respect it is not possible to draw a distinction between *E. bosci* and such species as *Macrophthalmus erato* and *M pacificus*.

E. bosci, moreover, as Tesch has noted [2], is so very closely related to *Macrophthalmus crinitus*, Rathbun, that the two forms can only with difficulty be distinguished from one another (see p. 391). There can be no possible doubt that the two species are congeneric, yet no one has suggested that *M. crinitus* should be referred to *Euplax*. In both species the gape of the outer maxillipeds is a little wider than in normal *Macrophthalmus* and the front proportionately broader. But the former distinction is a trivial one and the difference, on comparison with *M pacificus*, is very small; in the latter the species merely takes a place at one end of an evenly graded series.

The position of the Australian species, described by Milne-Edwards as *Cleistostoma tridentatum* and recently referred to the genus *Euplax* by Miss Rathbun and Tesch, seems to require further investigation. On comparison with *Hemiplax hirtipes* from New Zealand I find many points of resemblance. The two species agree with one another and differ from all *normal* species of *Macrophthalmus* in three characters:—(i) the front is extremely broad, its breadth between the eyestalks being considerably more than one third that of the carapace, (ii) the sides of the front are strongly convergent anteriorly, and (iii) there are no enlarged teeth on the fingers of the male cheliped. It appears to me therefore that *C. tridentatum* should be referred to Heller's *Hemiplax*; but the distinctions between this genus and *Macrophthalmus* are by no means convincing and it will perhaps be better to regard the former merely as a subgenus of the latter.

At the present moment two broad-fronted Australian species of *Macrophthalmus*, *M punctulatus*, Miers and *M. latifrons*, Haswell, are known to us only from the original descriptions. When these have been rediscovered we shall probably be better able to decide on the position of *C. tridentatum* and on the validity of *Hemiplax*.

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[1] Tesch, *loc. cit.*, 1918, p. 60.

[2] Tesch, *loc. cit.*, 1915, p. 192.

Excluding three species altogether unrecognisable from the published descriptions, Tesch recognised twenty-six species of *Macrophthalmus* in his monograph ; to these may be added *M bosci*, Sav. & Aud., *M sandakani*, Rathbun, *M gastrodes*, Kemp and *M teschi* described in this paper. The total number of species, including the somewhat doubtful *M latifrons*, Haswell and *M. punctulatus*, Miers, is consequently thirty.

Alcock in his account of the Indian Catometopes described seven species of the genus and mentioned the names of four others which were said to occur in Indian seas. The total number of Indian forms now stands at fifteen. The species are :—

SPECIES.	SYNONYMS.
M pectinipes, Guérin.	*M. simplicipes*, Guérin.
M. transversus (Latreille).	
M. telescopicus (Owen).	*M. compressipes*, Randall. *M. podophthalmus*, Souleyet. *M. verrauxi*, Milne-Edwards.
M latipes, Borradaile.	
M. sulcatus, Milne-Edwards.	
M brevis (Herbst).	*M. carinimanus*, Milne-Edwards.
M. convexus, Stimpson.	*M inermis*, A. Milne-Edwards.
M. erato, de Man.	
M latreillei, Desmarest.	*M desmaresti*, Lucas. *M serratus*, Gray. *M polleni*, Hofmann. *M. laniger*, Ortmann.
M. pacificus, Dana.	*M bicarinatus*, Heller.
M tomentosus, Souleyet.	
M depressus, Rüppell.	*M affinis*, Guérin.
M. teschi, sp. nov.	
M gastrodes, Kemp.	
M. crinitus, Rathbun.	

Of these I have seen all but *M latipes* and *M. latreillei*.

Macrophthalmus pectinipes, Guérin.

1900. *Macrophthalmus pectinipes*, Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 377.
1915. *Macrophthalmus pectinipes*, Tesch, *Zool. Meded. Mus. Leiden*, I. p. 156.

I agree with Tesch that Guérin's *M. simplicipes* is probably founded on a young varietal form of this species.

No additions have been made to the specimens examined by Alcock. The record from Orissa is based on a large male labelled "Cuttack. Dr. F. Stoliczka." This appears to be an error, for the original label, also found with the specimen, clearly reads "Kutch."

M. pectinipes is otherwise known only from Sind (Henderson), Karachi (Alcock), Bombay (Guérin) and Penang (Henderson).

Macrophthalmus transversus (Latreille).

(Plate xxiv, fig. 1.)

1915. *Macrophthalmus transversus*, Tesch, *Zool. Meded. Mus. Leiden*, I, p. 158, pl. v, fig. 1 (*ubi lit.*).

This species is not mentioned by Alcock in his account of the Indian species; it was, however, recorded from Pondicherry by Milne-Edwards and has recently been found in great abundance by Dr. F. H. Gravely on the coast of Orissa

The specimens agree well with the excellent figures published by Milne-Edwards in Cuvier's *Règne Animal*[1] and also, in most respects, with Tesch's figures and detailed description. The eyes are variable in length; sometimes they reach beyond the tip of the orbital tooth by only half the length of the cornea, sometimes by fully twice its length. In none of the specimens I have seen are they quite so long as shown in Tesch's figure. The differences noted by Tesch in the granulation of the carapace are undoubtedly sexual; in females the greater part of the surface is smooth and glossy, whereas in males it is closely covered with small granules.

In his description of the male cheliped Tesch notes that the lower surface of the palm is bordered by two parallel serrated crests, but only one is visible in the specimens I have seen. The palm as a whole (fig. 1) is more slender than in the figure and the fingers more strongly deflexed: when the claw is closed the dactylus is at right angles to the main axis of the palm. Tesch remarks that a part of the palm at the insertion of the movable finger 'seems to be detached, so as to form a separate joint, but the suture separating this part from the rest of the palm is not continued on the inner surface.'' I think the appearance of a separate segment must be due to a partial fracture, I can find nothing resembling it in any of the specimens I have examined. The dactylus differs from the description in bearing a large molar tooth near the base[2], directed slightly backwards, and another which is much smaller in the distal third, fitting close behind the foremost tooth on the fixed finger. Between these larger teeth there is a series of denticles.

The specimens are smaller than those seen by Tesch. In the largest male the carapace is 9·4 mm. in length and 22 mm. in breadth, the length of the chela being 15 mm.

$\frac{9822\text{-}26}{10}$ Chandipur, near Balasore, Orissa. F. H. Gravely. Many.

M. transversus has been recorded from Massouah (Cano), Pondicherry (Milne-Edwards) and Sumatra (de Man, Tesch).

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[1] Pl. xvi, figs. 2, 2*a-d*.

[2] Obscurely shown on the left-hand chela in Milne-Edwards' figure.

Macrophthalmus telescopicus (Owen).

(Plate xxiv, figs. 10, 11.)

1900. *Macrophthalmus verrauxi*, Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 377.

1915. *Macrophthalmus telescopicus*, Tesch, *Zool. Meded. Mus. Leiden*, I, p. 161, pl. v, fig. 2.

I accept Tesch's views on the synonymy of this species as a temporary measure, but further work is necessary before his conclusions can be accepted as final. The species, as understood by Tesch, is one of extremely wide distribution and it is quite possible that two or more allied forms may be confounded. Comparison of specimens from Australia, the Hawaiian Is. and the Red Sea is a necessary step to further progress.

The material at my disposal is very limited, but the three males in which the chelipeds are extant differ considerably from one another.

In a male from Port Blair in the Andamans (one of those examined by Alcock), with carapace 4·2 mm. in length and 6·7 mm. in breadth, the fine keel on the outer face of the palm (fig. 11) near its lower border is decidedly sinuous and the fingers, as in Miss Rathbun's figure [1], gape very widely at the base. There is a small molariform tooth at the proximal end of the dactylus and another, in the form of a crest truncated anteriorly, near the tip of the fixed finger. The teeth on the lateral margin of the carapace behind the orbital tooth are blunt.

In a larger male, also from Port Blair, with carapace 15 mm. in breadth and 9 mm. in length, the chela is of the same type, but the keel on the outer face of the palm is a little straighter. The lateral teeth of the carapace, behind the orbital angle, are sharp and the meral segments of the first walking legs (which have been lost in the smaller specimen) bear a dense patch of fur on the underside.

A male from the northern end of the Gulf of Manaar, with carapace 7·8 mm. in length and 12·4 mm. in breadth, has sharp lateral teeth on the carapace and no furry patch on the lower side of the merus of the first walking legs. The keel on the outer face of the palm is much less sinuous in this specimen (fig. 10), the fingers do not gape, the tooth on the fixed finger is longer and a little more remote from the apex, while the molariform tooth on the dactylus is longer and broader and situated more nearly in the middle of the finger length. In this individual the terminal segment of the abdomen is proportionately broader than in those from Port Blair.

From the material at my disposal I am not able to decide whether the differences in these males are specific or merely a matter of variation.

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[1] *K. Danske Vidensk. Selsk. Skrift.* (7), *naturvid. og math.*, V, p. 322, text-fig. 6 (1910).

In none of the specimens I have seen is the propodus of the last leg dilated as in Borradaile's *M latipes.*[1]

Alcock recorded this species from the Andamans and Mergui; additional specimens are from the following localities:—

$\frac{9820}{10}$	Tor, Sinaitic Peninsula, Red Sea.	R. B. S. Sewell.	One ♀
$\frac{9821}{10}$	Backwater at Pamban, Ramnad Dist., G. of Manaar. ...	S. Kemp.	One ♂.
$\frac{8510}{10}$	Fisher Bay, Port Owen, Tavoy I.	'Investigator.'	Two ♀ (damaged).

Macrophthalmus sulcatus, Milne-Edwards.

(Plate xxiv, figs. 3-5).

1900. *Macrophthalmus sulcatas*, Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 379.
1915. *Macrophthalmus sulcatas*, Tesch, *Zool. Meded. Mus. Leiden*, I, p. 165.

The only specimens in the collection are the male and female examined by Alcock. They differ rather conspicuously in the form of the orbital and antero-lateral teeth. In the female the orbital tooth is shorter than in the male and is separated from the first lateral tooth by a comparatively wide gap (fig. 4). In the male the orbital tooth is curved backwards and upwards, slightly overlapping the margin of the first lateral tooth (fig. 5). The form of the male chela is shown in fig. 3.

I have compared these specimens with an example of the very closely allied *M. grandidieri*, A. Milne-Edwards, from the Red Sea. The differences between the two species have been tabulated by Lenz.[2]

Alcock by a *lapsus calami* states that the Indian examples of this species were obtained in the Andaman Is. They are in reality from Kutch. The species is otherwise only known from Mauritius (Milne-Edwards) and Australia (Ortmann); the latter locality is almost certainly erroneous.

Macrophthalmus brevis (Herbst).

Macrophthalmus carinimanus, auct.
1915. *Macrophthalmus brevis*, Tesch, *Zool. Meded. Mus. Leiden*, I, p. 169, pl. vi, fig. 5 (*ubi. lit.*).

Tesch has shown that the name *M. brevis* must be employed for the species hitherto known as *M. carinimanus*. It was recorded by Milne-Edwards under the latter name from Pondicherry, but it is only within the last few years that it has again been found in Indian waters.

$\frac{9828}{10}$	Paway I., Mergui Archipelago.	'Investigator.'	Five.

The species is known from Mauritius (Milne-Edwards), Pondicherry (Milne-Edwards), Singapore (Gray), Halmaheira (de Man) and Celebes (de Man).

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[1] *Faun. Geogr. Maldives Laccadives*, I, p. 433, fig. 114 (1903).
[2] Lenz, *Abhandl. Senckenb. Ges. Frankfurt*, XXVII, p. 366 (1905).

Macrophthalmus convexus, Stimpson.

(Plate **xxiv**, fig. 2.)

1900. *Macrophthalmus convexus* Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 378.

1915. *Macrophthalmus convexus*, Tesch, *Zool. Meded. Mus. Leiden*, I, p. 175, pl. viii, fig. 8.

A large male from the upper end of the Gulf of Manaar is referred with considerable doubt to this species, for it differs widely from all other adult specimens of the same sex that I have seen in the form of the chelae (fig. 2).

In normal males from Indian waters the chela agrees exactly with the figure of *M inermis* published by A. Milne-Edwards in 1873[1], *M. inermis* being regarded by most authorities as a synonym of *M convexus.* In the abnormal male from the Gulf of Manaar the form is altogether different, resembling that of females and very young males.

The chela in this specimen is about 2½ times as long as the height at the base of the fingers and the dorsal edge of the palm bears a double row of small tubercles not seen in normal males. The outer surface is minutely granulate in its upper part; but lower down, above the strong serrate carina that runs from the base to the tip of the fixed finger, it is concave and perfectly smooth. In normal males the fingers and a small portion of the palm in the vicinity of the finger-cleft are clothed with hair internally, but in this specimen the hairy covering extends over practically the whole of the inner surface. The prehensile edges bear only rudiments of the large teeth found in normal males and the fixed finger is scarcely at all deflexed. The chela differs from that of the female in only two points,—in the possession of rudimentary teeth on the fingers and in the hairy covering of the inner surface.

In all other respects the specimen agrees precisely with normal examples of the species. It is, however, unusually large, the breadth of the carapace being 32·5 mm. and the length 16·5 mm. An ovigerous female found with this male is 23·1 mm. in breadth and 12·2 mm. in length; it is as nearly as possible identical with other females taken in company with normal males.

It is difficult to come to any satisfactory conclusion regarding the identity of these two specimens; I believe, however, that they are to be referred to *M. convexus* (=*M inermis*). The abnormal character of the chelae of the male is perhaps to be explained by regeneration; but, if so, the original chelipeds must both have been lost at the same time and at a very early age.

Tesch has followed de Man and Alcock in regarding *M inermis* as a synonym of *M convexus.* Miss Rathbun considers them distinct and has noted various points of difference, but I am not at all certain that the statements are derived from actual comparison of specimens. It appears probable that the informa-

[1] A. Milne-Edwards, *Nouv. Arch. Mus. Hist. Nat. Paris*, IX, p. 277, pl. xii, fig. 5 (1873).

tion regarding *M. convexus* was derived from the posthumous work of Stimpson, then unpublished. Perhaps Miss Rathbun has since changed her opinion on the subject, for if the two species are distinct the specimen from the Gulf of Siam recorded by her as *M convexus* should have been referred to *M inermis*.

Stimpson described *M. convexus* from a young specimen with carapace ·34 ins. in length and ·59 ins. in breadth. I have examined a still smaller individual from the Andamans in which the carapace is 6·5 mm. in length and 11·4 mm. in breadth. Except that the tooth on the merus of the last legs is absent, this specimen is in almost exact agreement with Stimpson's description and figures. I am convinced that it is an example of *M. convexus* and that this species is based on a young specimen of *M. inermis*.

Alcock recorded specimens from the Andamans; additional records are :—

$\frac{9829}{10}$	Jack and Una Is., Mergui Archipelago	Investigator.	One.
$\frac{9830}{10}$	Pamban, Ramnad dist., Gulf of Manaar.	S. Kemp.	Two.

The Gulf of Manaar is the most western locality from which the species has been recorded. Eastwards it extends to Australia, Samoa, the Loo Choo Is. and the Hawaiian Is.

Macrophthalmus erato, de Man.

1898. *Macrophthalmus erato*, Koelbel, *Wiss. Ergebn. Reise Grafen Béla Széchenyi in Ostasien*, II, p. 576, pl. i, figs. 13, 14.
1900. *Macrophthalmus erato*, Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 381.
1915. *Macrophthalmus erato*, Tesch, *Zool. Meded. Mus. Leiden*, I, p. 179, pl. viii, fig. 9.

This species was recorded by de Man and Alcock from the Mergui Archipelago and Akyab; it has since been found at the following localities :—

$\frac{9833\text{-}4}{10}$	Chandipur, near Balasore, Orissa.	F. H. Gravely.	Many.
$\frac{8715}{10}$	Arakan coast.	Investigator.'	One.
$\frac{9181}{10}$	Fisher Bay, Port Owen, Tavoy.	,,	Three.
$\frac{9831}{10}$	Jack and Una Is., Mergui Archipelago	,,	Eleven.
$\frac{9832}{10}$	Parker I., Mergui Archipelago	,,	Two.

The specimen from the Arakan coast is exceptionally large; the carapace is 17·4 mm. in breadth and 11·9 mm. in length.

Outside the Bay of Bengal *M erato* is known from Malacca (de Man), the Gulf of Siam (Rathbun), Madoera near Java (Tesch) and Hongkong (Koelbel).

Macrophthalmus crinitus, Rathbun.

(Plate xxiv, fig. 7.)

1915. *Macrophthalmus crinitus*, Tesch, *Zool. Medea. Mus. Leiden*, I, p. 192.

Four small specimens from the Mergui Archipelago and Singapore belong to this species. The largest male is 6·9 mm. in length and 9·0 mm. in greatest breadth of carapace.

M. crinitus, as Tesch has observed, is much more nearly related to *M. bosci* than to *M pacificus*, with which Miss Rathbun compared it. I have examined a good series of *M bosci* from the Red Sea and find that the two species are to be distinguished by the following characters :—

M. crinitus, Rathbun (fig. 7).	*M. bosci*, Sav. & Aud. (fig. 6).
Carapace widest behind tip of first antero-lateral tooth, less strongly areolated.	Carapace widest between tips of orbital teeth, more strongly areolated.
Orbital teeth not very sharp, their outer margins parallel.	Orbital teeth very sharp, their outer margins posteriorly convergent.
Third tooth [1] of antero-lateral border of carapace distinct.	Third tooth [1] of antero-lateral border of carapace practically invisible.
Granulate crest on outer surface of palm of male conspicuous.	Granulate crest on outer surface of palm of male exceedingly faint.

Tesch is mistaken in supposing that the species differ in the form of the third maxillipeds.

$\frac{9838}{10}$	Paway I., Mergui Archipelago.	Investigator.'	Three.
$\frac{9839}{10}$	Tanah Merah Besar, Singapore.	N. Annandale.	One.

M. crinitus has been recorded only from Halmaheira (de Man) and Amboina (Rathbun). *M bosci*, though described from the Red Sea and since reported from the E. coast of Africa, Malaysia and Oceania, has not yet been discovered in Indian waters.

Macrophthalmus pacificus, Dana.

1915. *Macrophthalmus pacificus*, Tesch, *Zool. Meded. Mus. Leiden*, I, p. 190, pl. viii, fig. 11.

Thirteen specimens from Portuguese India belong to this species; in the largest, which is a female, the carapace is 12·8 mm. in length and 18·7 mm. in greatest breadth. I have compared these individuals with a rather larger male from Australia, obtained many years ago from the Queensland Museum, and am unable to find any difference between them.

Heller's *M bicarinatus* from the Nicobars is almost certainly synonymous with this species.

$\frac{9840}{10}$	Nova Goa, Portuguese India.	S. Kemp.	Four.
$\frac{9869}{10}$	Rachol R., opposite Durbate, Portuguese India	S. Kemp.	Nine.
$\frac{8070}{9}$	Australia.	Queensland Mus.	One.

The specimens from Portuguese India were found in brackish water, under stones on the banks of the Mapusa and Rachol Rivers.

The species is known from the Nicobars (Heller), Penang and Pontianak (de Man), the Loo Choo Is. (Stimpson), Upolu and Samoa (Dana).

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[1] Including the orbital tooth.

Macrophthalmus tomentosus, Eydoux & Souleyet.

1915. *Macrophthalmus tomentosus*, Tesch, *Zool. Meded. Mus. Leiden*, I, p. 193, pl. ix, fig. 12.

The only recent example of this species that I have seen is that recorded by Alcock from the Mergui Archipelago. There are, however, ten fossil or subfossil specimens labelled 'Sandoway,' a locality on the Arakan coast of Burma.

The latter specimens have been preserved in mud and have evidently undergone considerable vertical pressure. The upper and lower surfaces of the carapace have been partially crushed together, frequently without causing any considerable distortion, and the eyestalks and terminal segments of the legs have been broken off. The tuberculation of the upper surface is exceedingly well preserved.

By softening the mud with water and by working at it with a stiff brush I have been able to develop out the specimens to some extent and to satisfy myself of their identity. They agree precisely with the spirit specimen from the Mergui Archipelago and though the chelae are invariably broken or absent, I have been able to find clear indications of the "musical crest" on the inner face of the merus.

M. tomentosus has not hitherto been found in the fossil state.

Macrophthalmus depressus, Rüppell.

1900. *Macrophthalmus depressus*, Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 830 (part only).

1915. *Macrophthalmus depressus*, Tesch, *Zool. Meded. Mus. Leiden.*, I, p. 196, pl. ix, fig. 13.

There appears to be some confusion about this species. Alcock records specimens from both Mergui and Aden, but in my opinion only those from the latter locality are true *M depressus*. The Mergui specimens, which were also examined by de Man, and are labelled *M depressus* in his handwriting, belong in reality to a closely allied undescribed form to which I have given the name *M teschi*. The differences between the two species are explained overleaf.

$\frac{9871}{10}$	Suez.	H. J. Walton.	Two.
$\frac{4913}{4}$	Aden.	J. Wood-Mason.	Seven.
$\frac{9843.4}{10}$	Pamban, Ramnad dist., Gulf of Manaar.	S. Kemp.	Many.

M. depressus has been recorded many times from the Red Sea and is also known from the Persian Gulf (Nobili), Bombay and Pondicherry (Guérin) and Rameswaram I. (Henderson). Haswell's record from Australia (under the name *M affinis*) is almost certainly erroneous. The two specimens from Mergui examined by de Man belong to *M. teschi* and the single female recorded by the same author from Atjeh is probably also to be referred to that species.

Macrophthalmus teschi, sp. nov.

(Plate xxiv, figs. 8, 9.)

1888. *Macrophthalmus depressus*, de Man, *Journ. Linn. Soc. Zool.*, XXII, p. 124 (? all).
? 1895. *Macrophthalmus depressus*, de Man, *Zool. Jahrb. Syst.*, VIII, p. 578
1900. *Macrophthalmus depressus*, Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 380 (in part).

This species is very closely allied to *M depressus* ; males differ only in the following particulars :—

M. teschi, sp. nov.	*M. depressus*, Rüppell.
Granulation of lateral parts of carapace sparse, the interspaces between the granules being much greater than the diameter of the granules.	Granulation of lateral parts of carapace close, the interspaces between the granules being little if at all greater than the diameter of the granules.
The transverse row of granules extending inwards from the posterior antero-lateral tooth of the carapace is conspicuous.	The transverse row of granules extending inwards from the posterior antero-lateral tooth of the carapace is inconspicuous, being lost in the close granulation of the adjacent parts.
Lateral and frontal edges of rostrum crenulate.	Edges of rostrum not crenulate.
Upper border of palm of cheliped without large granules ; lower surface conspicuously granular proximally.	Upper border of palm of cheliped with a row of large granules ; lower surface quite smooth [1].
Fixed finger of chela strongly deflexed with a very large tooth on its prehensile edge not reaching beyond the middle of its length (fig. 8).	Fixed finger of chela very slightly deflexed with a low crest on its prehensile edge reaching beyond the middle of its length.
Sternum granular only near abdomen, quite smooth externally.	Sternum finely granular throughout.

From *M japonicus*, de Haan, with which I have also compared it, *M. teschi* may be distinguished by the following characters,—(i) the orbital borders are less oblique, (ii) the upper orbital border is finely crenulate and the lower serrate (in *M. japonicus* both are finely serrate), (iii) the antero-lateral margins are finely crenulate (rather coarsely tuberculate in *M japonicus*), (iv) the palm is smooth dorsally and does not possess the row of granules found in *M. japonicus* on the upper part of the inner surface, (v) the whole inner surface of the chela, including the fingers, is densely clothed with hair, (vi) there are no spinules on the upper border of the dactylus of the chela, (vii) the posterior borders of the meropodites of the walking legs are finely crenulate, without the blunt spinules seen in *M. japonicus*.

In *M. definitus*, Adams and White, which I have not seen, the carapace is proportionately broader, the length being three quarters the greatest breadth ; the central portions of the carapace are smoother and there is a granular line, anteriorly convex, on each epigastric lobe. Moreover, the upper border of the palm is coarsely granulate in this species and there is a transverse ridge on the third abdominal segment.

[1] Except for an exceedingly fine frosting only visible with a powerful lens, the surface is quite smooth to the touch.

I have seen no females of *M teschi*; four males yield the following measurements (in mm.) :—

	Length of carapace.	Greatest breadth of carapace.
Port Canning	13·9	22·7
Arakan Coast	14·1	22·9
Mergui	14·9	22·7
	14·2	21·7

It will be noticed that in the specimens from Mergui the carapace is proportionately a little longer than in the others.

The specimens examined are from the northern and eastern sides of the Bay of Bengal. The geographical distribution of the species appears therefore to be different to that of *M depressus* which extends from the Red Sea to the Gulf of Manaar.

$\frac{9842}{10}$	Port Canning, Gangetic delta.	Bengal Fishery Dept. (B. Prashad).	One. TYPE.
$\frac{3714}{10}$	Arakan coast.	Investigator.'	One.
$\frac{8138}{6}$	Mergui.	Mus. Collr.	Two.

Macrophthalmus gastrodes, Kemp.

1915. *Macrophthalmus gastrodes*, Kemp, *Mem. Ind. Mus.*, V, p. 228, pl. xii, fig. 5.

This species, described contemporaneously with the publication of Tesch's monograph, differs widely from all other members of the genus in the great proportionate length of the carapace and its very strongly divergent lateral margins. It is known only from two specimens obtained in water of variable salinity near the mouth of the Chilka Lake in Orissa.

EXPLANATION OF PLATE XXIV

Macrophthalmus transversus Latreille).

FIG. 1.—Chela of male.

Macrophthalmus convexus, Stimpson.

FIG. 2.—Chela of abnormal male.

Macrophthalmus sulcatus, Milne-Edwards.

FIG. 3.—Chela of male.
,, 4.—Antero-lateral angle of carapace : female.
,, 5.—Antero-lateral angle of carapace : male.

Macrophthalmus bosci, Sav. & Aud.

FIG. 6.—Antero-lateral angle of carapace.

Macrophthalmus crinitus, Rathbun.

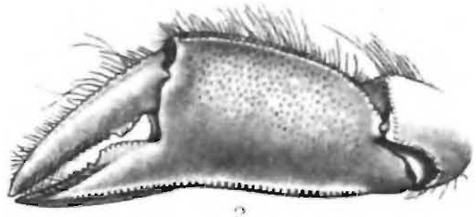
FIG. 7.—Antero-lateral angle of carapace.

Macrophthalmus teschi, sp. nov.

FIG. 8.—Chela of male.
,, 9.—Type male in dorsal view : carapace 22·7 mm. in breadth.

Macrophthalmus telescopicus (Owen).

FIG. 10.—Chela of male from the Gulf of Manaar
,, 11.—Chela of male from Port Blair.



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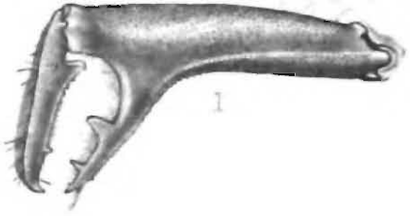

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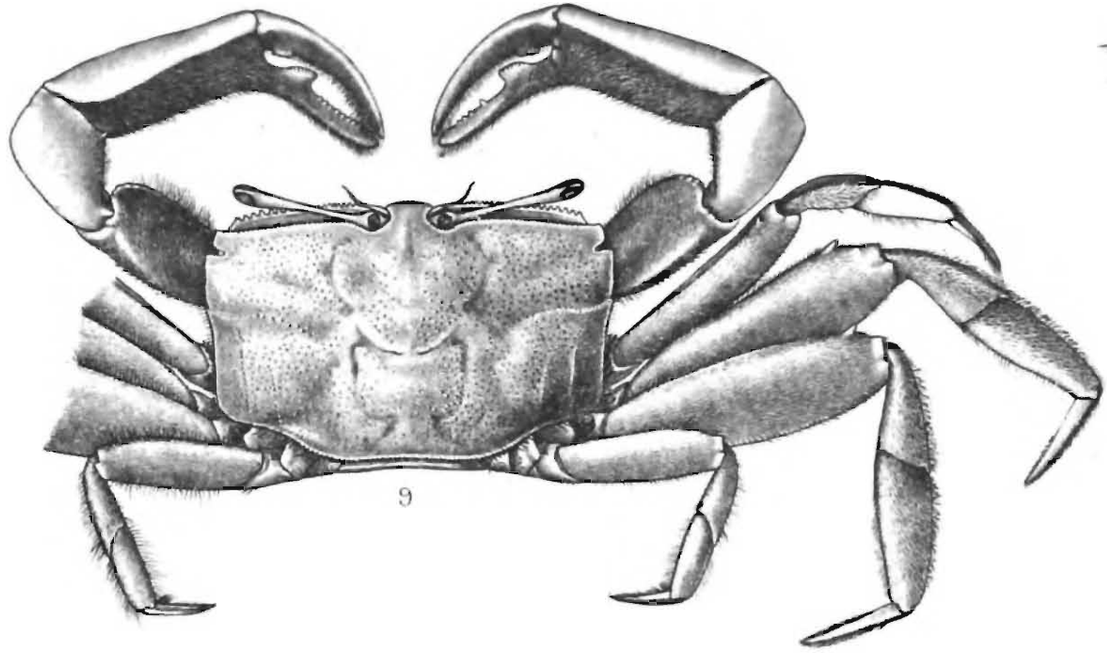

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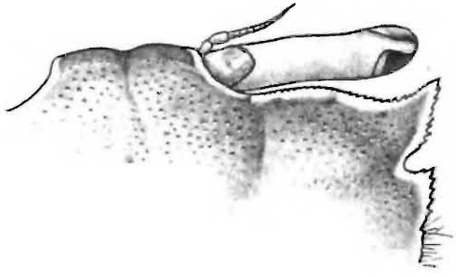

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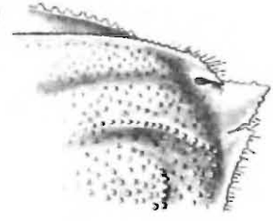

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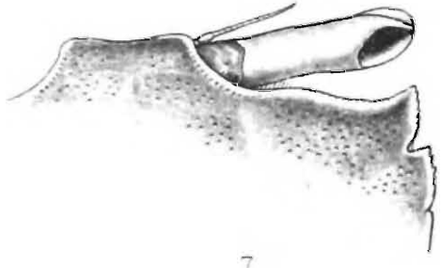

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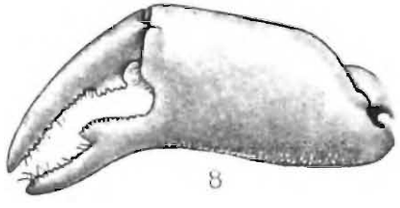

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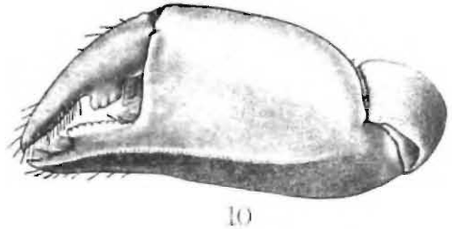

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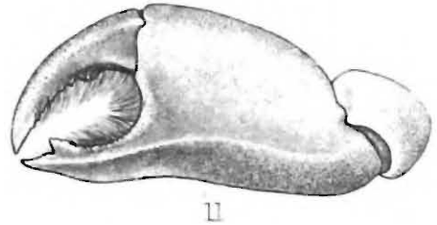

11

A. C. Chowdhury, del.

MACROPHTHALMUS

Photogravure. Survey of India Offices, Calcutta, 1919.