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# FAUNA OF THE CHILKA LAKE

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FAUNA OF THE CHILKA LAKE

CRUSTACEA DECAPODA.

*By* STANLEY KEMP, B.A.

(Plates XII, XIII.)

The methods employed in the capture of the specimens are detailed in the Introduction to this volume (p. 16); an account of the traps used by the Uriya fishermen will be published later.

Our observations on the salinity of the water are expressed in the form of specific gravities. The instrument employed was calibrated for 15°C., and to this temperature all readings have been reduced.

## DECAPODA REPTANTIA

### Tribe OXYSTOMATA.

#### Family CALAPPIDAE.

#### Genus MATUTA, Fabricius.

#### *Matuta victor*, Fabr., Hilgendorf.

1896. *Matuta victor*, Alcock, *Journ. Asiat. Soc. Bengal*, LXV, p. 160.

Six small specimens that appear to belong to this species were found in March 1914, in the outer channel; the carapace of the largest is only 11.5 mm. in length. At the time when they were obtained the water in this part of the lake was as salt as that of the Sea in the vicinity; none were found during September when the outer channel is filled with water which is quite fresh.

The species, which is one of very wide Indo-pacific distribution, is evidently carried into the outer parts of the lake during the inflow of salt water; it should be regarded merely as a visitor to the lake-system and not as a permanent inhabitant.

#### Family LEUCOSIIDAE.

#### Genus EBALIA, Leach.

#### *Ebalia malefactorix*, sp. nov.

(Plate XII, fig. 1.)

The carapace is polygonal in outline and as broad as, or a little broader than long (plate xii, fig. 1.) The postero-lateral borders are very long and gradually convergent posteriorly and the entire margin is elegantly beaded. The side-walls of the hepatic region form a large independent antero-lateral facet on either side of the carapace, extending beneath the eyes to the base of the antennules. The margin that defines the lower limit of this facet is beaded like the true antero-lateral margin and, in dorsal view, is visible in almost its entire extent; a little behind the middle of its length it protrudes slightly in the form of a large obtusely rounded angle.

The front is finely beaded and nearly straight, with a slight and ill-defined median emargination; in dorsal view the edge of the buccal cavern is visible. The antero-lateral margin in large males is obtusely angled in two places and its junction with the postero-lateral margin is very prominent and sharply rectangular. The postero-lateral margin is sharply angulate in its anterior third (this angle marking the termination of a large granular elevation on either side of the carapace) and, in males and some females, one or two of the marginal beads or tubercles in the posterior third

are enlarged, again breaking the evenness of the contour. The posterior margin is convex in the female; in large males it is tridentate owing to the enlargement of the tubercles in the centre and at the outer angles. The infero-lateral margin of the carapace is defined by a beaded ridge immediately above the bases of the legs and this beading extends posteriorly from side to side across the carapace close to the insertion of the first abdominal somite. There are thus, at the posterior end of the carapace, two transverse rows of beading, the uppermost, which is the continuation of the postero-lateral margins, being tridentate in the male.

The most conspicuous feature of the dorsal surface of the carapace is a prominent ridge, much elevated above the general surface and covered with large close-set tubercles, which roughly takes the form of a "broad-arrow" with the point directed forwards. The point is formed by a tuberculate eminence situated in the median line of the carapace a little in front of its middle point. The haft of the arrow extends directly backwards in the mid-dorsal line and ends on the intestinal region before reaching the posterior margin; the wings reach obliquely outwards and backwards on the branchial region and terminate in a sharp prominence in the anterior third of the postero-lateral margin. The tuberculate elevations on the branchial and intestinal regions are separated by narrow grooves from the central cardiac area.

There is usually a short row of large tubercles extending forwards from the cardiac region on either side of the gastric area, continued with or without a brief interruption as a narrow row of smaller tubercles which reaches the front near the inner limit of each orbit, a short branch diverging on the outer side to the back of the orbit itself. There is also a cluster of large tubercles, more conspicuous in the male than in the female, in the vicinity of the first angulation on the antero-lateral margin of the carapace and short row of four or five large tubercles extending transversely outwards on either side from the granular patch on the intestinal region. The areas between the granular patches are sunken and quite smooth; among the granules themselves a few sparse hairs are to be found.

In females, especially in young individuals, the tuberculation of the carapace is much stronger than in males (*cf.* text-fig. 1*a* and pl. xii, fig. 1).

The eyes are small and the cornea is exposed in dorsal view; the orbit is in open communication with the antennular fossae and there is a well-marked space between the edge of the floor of the orbit and the free edge of the buccal cavern. The antennae are small but distinct.

The buccal cavern is a little broader than long. In the external maxillipedes the merus, which is pointed distally, is nearly as long as the ischium and the exopod does not reach so far as the merus of the endopod and is expanded with a convex external margin.

The chelipedes are slightly longer than the carapace in the male, slightly shorter in the female. The merus is more or less cylindrical, covered with vesiculous granules beneath and, dorsally, with granules arranged in parallel rows, a median longitudinal area being left quite naked. The outer edges of the carpus and propodus are very finely granulate and numerous scattered granules are to be seen on the

upper and inner surfaces of the carpus and palm. The palm is scarcely one quarter longer than broad and is not longer than the fingers; near its proximal end on the inner surface there is, in the adult male, a large coarse tubercle. The dactylus of the last pair of walking legs is considerably longer than the propodus.

The margin of the thoracic sternum is festooned with small granules, which also invest the basal parts of the abdomen in both sexes. The abdomen of the male (text-fig. 1b) consists of two pieces only, the penultimate portion bearing a large blunt tubercle at its distal end. The fused segments of the female abdomen are coarsely punctured and in the middle line near the distal end there is a small granular patch; the ultimate segment is about as broad as long (text-fig. 1c).

Living specimens were, as a rule, rather thickly coated with fine mud. When this was removed they were found to be dull grey in colour, flecked with darker grey, the walking legs and the tubercular elevations of the carapace being reddish-brown.

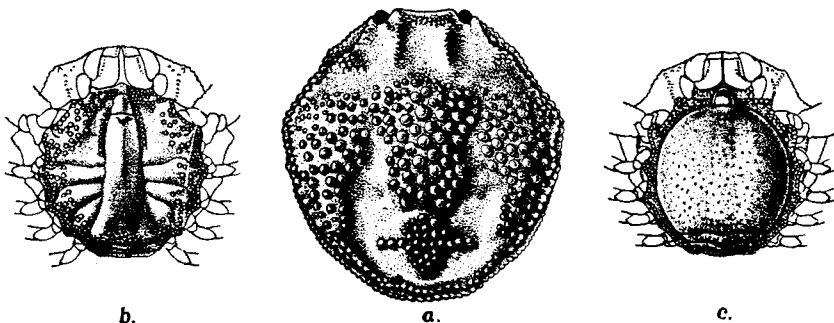


FIG. 1.—*Ebalia malefactorix*, sp. nov.

- a. Carapace of young female with unusually strong tuberculation.  
 b. Carapace of male in ventral view.  
 c. Carapace of female in ventral view.

The largest specimen in the collection is a male, 10.4 mm. in length. The majority of adult examples are from 7 to 9 mm. in length; but one female, only 4.3 mm. long, is fully adult and bears eggs. The smallest individual, about 2 mm. in length, differs in no respect from adults except that the ridges on the carapace are rather more strongly pronounced and the marginal angulations a little sharper.

*Ebalia malefactorix* appears to be closely related to *E. sagittifera*<sup>1</sup>, Alcock, and *E. hypsilon* (Ortmann)<sup>2</sup>. *E. sagittifera*, from Karachi, the types of which I have examined, is a much smaller form and differs in many respects from the Chilka Lake

<sup>1</sup> *E. sagittifera*, Alcock, *Journ. Asiat. Soc. Bengal*, LXV, p. 188 (1896) and *Ill. Zool. 'Investigator'*, *Crust.*, pl. xxix, fig. 9.

<sup>2</sup> *Nursia ypsilon*, Ortmann, in *Semon's Zool. Forschungsreisen Austral. u. Malay Arch.*, *Crust.*, V, p. 36, pl. ii, fig. 7.

species; thus, (i) the margin of the front and orbits is not beaded, (ii) the granular ridges on the carapace, though arrow-shaped, are less strongly elevated and are covered only with minute granules and the other tubercular ridges found in *E. malefactorix* are absent, (iii) the posterior margin bears two tubercles in the female and three large petaloid processes in the male, (iv) the chelipedes and walking-legs are decidedly longer than in the allied species and the fingers in the male are only two-thirds the length of the palm, (v) the apex of the merus of the outer maxillipedes is deeply notched, and (vi) the penultimate segment of the abdomen of the male does not bear a tubercle.

*Ebaha hypsilon*, found at Thursday I., is perhaps even more closely allied; but in this species, according to Ortmann's figure and description, the ribs on the carapace do not form a connected arrow-shaped ridge. The lateral ribs are Y-shaped and are widely separated from the raised area on the cardiac region which bears three isolated rows of large tubercles. There is a disconnected rounded patch of tubercles on the intestinal region and those found on the anterior part of the carapace in *E. malefactorix* are apparently absent. Moreover the entire upper surface of the carapace bears fine scattered granulations and the pterygostomial ridge is not angulate in the middle.

This species, which was found on twenty-seven occasions, is by no means uncommon in the Chilka Lake. In the main area it does not occur in great abundance, but has been found from Rambha in the south to Nalbano in the north, at depths ranging from a few inches to 8½ ft. In the outer channel it occurs on muddy ground near Satpara and Barhampur I., but is not found on the sandy bottom nearer the mouth of the lake.

*Ebalia malefactorix* seems to prefer water of low salinity. At the period when the outer channel was at its saltiest (in March) it was scarce, but in the same locality in September, when the water was quite fresh, it occurred in abundance. Oviparous females were caught in the months of March, September and October in water of specific gravity varying from 1.000 to 1.011.

Specimens of this species were found by Mr. Gravely in September 1914, in the backwaters of Cochín, near Ernakulam, and others were obtained by Dr. Annandale in January 1915, in the backwater at Ennur, near Madras (sp. gr. 1.0025). Oviparous females were caught on both occasions.

The type specimens are registered in the books of the Indian Museum under no. 8941/10.

#### Genus PHILYRA, Leach.

##### *Philyra alcocki*, sp. nov.

(Plate XII, fig. 2.)

The carapace is suborbicular and longer than broad in the proportion of 12 to 11. The whole upper surface is microscopically granulate and is covered with rather coarse and distant pits (pl. xii, fig. 2).

The front is somewhat produced, more so than is customary in the genus, and is

narrow ; the breadth of the fronto-orbital border is contained about four and one-third times in the maximum breadth of the carapace. The frontal margin is straight, not furrowed, with a single large, median tooth which projects over the otherwise visible margin of the endostome. The dorsal surface of the front is coarsely pitted. The orbit is very small, with distinct dorsal and lateral fissures, and beneath the eye there is a small notch in the margin of the endostome. The orbit is in open communication with the antennular fossae and there is no space between the floor of the orbit and the edge of the buccal cavern.

The side walls of the hepatic region form an independent facet, bounded below by a finely beaded ridge, which is strongly convex inferiorly. This ridge ends in front close beneath the antero-lateral margin at the outer limit of the orbit; posteriorly it joins the antero-lateral margin in a well-marked though obtuse angle. A small prominence defines the junction of the antero- and postero-lateral margins and behind this one or two small projections, the terminations of dorsal rows of tubercles, are visible. The posterior margin is short, straight in the female and concave in the male ; the outer angles are strongly marked in the former sex, while in adult males they take the form of two large blunt teeth.

On the upper surface of the carapace the cardio-gastric is separated on either side from the branchial region by a shallow depression and the surface is still further broken by the presence of blunt tubercles which form a definite pattern among the fine granules with which the entire surface is covered. The tubercles are most strongly developed in the adult male, but can readily be seen with the naked eye in both sexes when the surface moisture has been removed. There is, in the first place, a somewhat ill-defined patch of tubercles on the intestinal elevation. In front of this, and not distinctly separated from it, is another similar patch on the cardiac region, which is continued forwards to the gastric region as three ill-defined and widely separated rows of tubercles, the lateral being obsolete in the female. In some specimens the median row is continued as a very fine mid-dorsal carina up to the front.

The tubercles on the branchial region are, as a rule, more distinct than the rest. On either side of the carapace, midway between the middle line and the lateral margin, is a sinuous row of tubercles which curves outwards posteriorly and terminates in the middle of the postero-lateral margin, the junction being often defined by a slight prominence. In front of this row and parallel to its posterior portion is another row of tubercles (less conspicuous in the female) which joins it near its anterior end and is directed obliquely backwards and outwards culminating in a distinct prominence in the anterior third of the postero-lateral margin. This row of tubercles occupies much the same position as the two ridges in *P. olivacea*, Rathbun. Seen in lateral view the figure formed by the tubercles resembles a cursive n.

In the third maxillipedes the length of the merus measured along its inner border is little less than that of the ischium. The flagellum is greatly expanded ; its outer edge is strongly convex and the anterior end broadly rounded. The buccal cavern is decidedly broader than long.

The chelipedes in the adult male are one and a half times the length of the carapace, a little shorter in females and young males—about one and a third times. Except for the under surface of the chela the entire chelipede is covered with minute close-set granules similar to those on the carapace. The upper surface of the merus bears three rather obscure rows of small tubercles and the granules on the outer margin of the palm are rather larger than elsewhere. The palm is about one and three quarter times as long as broad; the fingers are about as long as the palm and are grooved and provided with small teeth; when closed, a small proximal gap remains between them. The dactylus of the last leg is about one and a half times as long as the propodus.

In the male the marginal portions of the sternum are finely granulate and deeply pitted. There is a huge longitudinal ridge, abruptly declivous posteriorly, at the base of each chelipede and, in fully adult individuals, there is a very large tubercle on either side of the abdomen opposite the bases of the first walking legs (text-fig. 2).

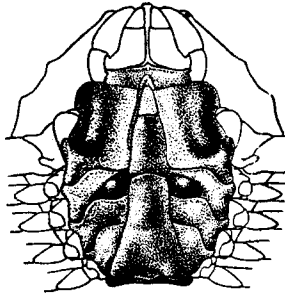


FIG. 2.—*Philyra alcocki*, sp. nov.  
Carapace of large male, ventral view.

The abdomen of the male consists of three movable pieces and is not granulate. The first segment is acutely produced on either side and, though it appears distinct, is in reality fused to the succeeding piece. The penultimate portion is about one and a third times as long as broad; at its base it is sharply angulate on either side and broader than the distal end of the preceding piece. The ultimate segment is a little less than twice as long as broad. The abdomen of the female is very coarsely and deeply pitted, the ultimate segment being a trifle longer than broad.

The largest specimen, a female, is 13.5 mm. in length. It is only in males measuring 12.5 mm.

and upwards that the characteristic sternal tubercles are developed.

In its produced and narrow front, provided with a median tooth that projects beyond the endostome, *P. alcocki* resembles *Pseudophilyra* rather than *Philyra*; but it agrees with the latter genus in the shape of the buccal cavern and of the outer maxillipedes. Laurie, in discussing the characters of *P. adamsi*<sup>1</sup> has already commented on the features in which certain species of *Philyra* resemble *Pseudophilyra*; there is little doubt that the present species, along with that which Laurie examined, may correctly be referred to the *platycheira* section of the former genus.

*Philyra alcocki* seems to find its nearest ally in *P. olivacea*, Rathbun<sup>2</sup>, a species described from Lem Ngob in the Gulf of Siam, but differs from that form in numerous details. In *P. alcocki*, for instance, (i) the carapace is noticeably broader in proportion to its length; (ii) its surface is not so conspicuously granulate; (iii) the rows of

<sup>1</sup> Laurie, *Rep. Pearl Oyster Fisheries, Ceylon*, V, p. 364 (1906).

<sup>2</sup> Rathbun, *Proc. Biol. Soc. Washington*, XXII, p. 108 (1909) and *Danske Vidensk. Selsk. Skrifter* (7), *Naturvid. og math.*, V, p. 311, pl. ii, fig. 17, text-fig. 4 (1910).



granules on either side of the carapace are differently disposed (they form a  $\Lambda$ -shaped figure in *P. olivacea*) and there are distinct angulations at the points when these rows meet the postero-lateral borders; (iv) the posterior margin is bilobate in the adult male (trilobate in *P. olivacea*); (v) there are two pairs of large tubercles on the sternum of the adult male and the margin bordering the anterior part of the abdominal cavity is not granulate; (vi) the palm of the chelae is proportionately more slender and is as long as the fingers; (vii) in the abdomen of the male the penultimate piece is broadest distally, and is at this point sharply angulate on either side.

It also bears some resemblance to *P. sexangula*, Alcock<sup>1</sup>, recorded from the Godavari coast and the Persian Gulf and also obtained a few years ago by Dr. J. T. Jenkins in the Matlah river in the Gangetic delta. *P. alcocki* differs, however, from this species in many notable points, (i) in the narrower front and general shape of the carapace, (ii) in the presence of a  $\Lambda$ -shaped pattern of tubercles on either side of the carapace in place of a single oblique ridge, (iii) in the much shorter chelipedes and in the absence of a granular ridge on the upper surface of the palm, and (iv) in the abdomen of the male, which is composed of three instead of two pieces.

From *P. fuliginosa*, Targioni Tozzetti<sup>2</sup>, *P. alcocki* is more obviously distinct, differing in its much broader form, in the different arrangement of the granules on the carapace, in the proportions of the chela and in the shape of the abdomen of the male.

In life the colour of the carapace was very pale french grey, with fine speckles of dull purplish-red, aggregated to form irregular sinuous markings. The ventral surface was whitish and the legs a very pale brown.

When caught, specimens adopt a catalytic attitude, folding their legs and holding them with the ischial and meral segments directed vertically downwards from the carapace (text-figs. 3a, b). The *Ebalia*, on the other hand, though they kept quite still and also appeared to be simulating death, held their legs normally, with the meral segments tucked up against the carapace.

*Philyra alcocki* was sometimes found in company with *Ebalia malefactorix*, but appeared to be much less common. It is represented in the collection by sixteen specimens obtained over an area ranging from Rambha in the south to Barkul and Nalbano in the north on a bottom of mud or muddy sand and at depths of from 5 to 10 ft. In September it occurred rarely in the outer channel in fresh water.

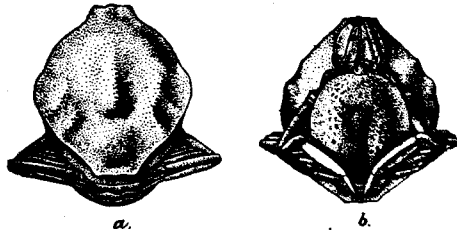


FIG. 3.—*Philyra alcocki*, sp. nov.

A female sketched from life in the attitude which the species adopts when irritated.

a. Dorsal view.

b. Ventral view.

<sup>1</sup> Alcock, *Journ. Asiat. Soc. Bengal*, LXV, p. 241, pl. vii, fig. 2 (1896).

<sup>2</sup> Targioni Tozzetti, *Zool. Viagg. R. P. 'Magenta', Crost.*, p. 201, pl. xii, figs. 3, a-g (Florence, 1877).

Two ovigerous females were obtained in the months of March and September in water of specific gravity varying from 1.000—1.011.

The type specimens are registered under no. 8944/10.

Tribe BRACHYGNATHA.

Family HYMENOSOMATIDAE.

Genus ELAMENA, Milne-Edwards.

Sub-genus *Trigonoplax*, Milne-Edwards.

1853. *Trigonoplax*, Milne-Edwards, *Ann. Sci. nat. Zool.* (3), XX, p. 224.

1900. *Trigonoplax*, Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 386.

*Elamena (Trigonoplax) cimex*, sp. nov.

(Plate XII, fig. 3.)

The carapace is flat and lamellar and more or less cordiform in shape; its length, including the front, is a trifle greater than the breadth, the proportion being as 31 to 28. The postero-lateral borders show a slight emargination at the base of each of the last two pairs of legs and are only about half as long as the antero-lateral. The regions of the carapace are defined by shallow grooves, the margin is not up-turned, devoid of teeth or tubercles, and except for a few sparse hairs, most noticeable on the hepatic region, the surface is bare (pl. xii, fig. 3).

The front is produced to form a distinct rostrum; it is clearly marked off from the general contour of the carapace and, in the angle formed on either side of its base, the eyes along with portions of the eyestalks are visible. Behind the eye there is a blunt tooth. The rostrum is composed of a single flat plate a little longer than broad; its margins are parallel at the base, narrowing anteriorly to a blunt point.

The antennules are closely juxtaposed at the base; the interantennular septum

is wholly missing. The epistome is nearly twice as broad as long. From the anterior angles of the buccal cavern a sharp ridge runs backwards on either side of the carapace to the bases of the walking legs and the surface between this ridge and the true lateral margin of the carapace behind the eye is deeply concave. The external maxillipedes completely close the buccal cavern. The ischium is a trifle longer than the merus and the exopod, though slightly overlapped at the distal end by the adjacent

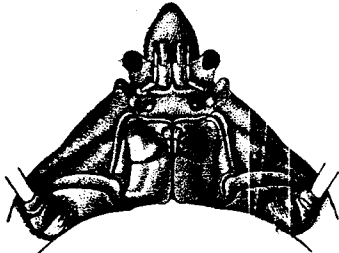


FIG. 4.—*Elamena (Trigonoplax) cimex*, sp. nov.  
Anterior part of carapace of a female, seen from below.

margin of the merus, is nevertheless visible, in part, throughout its length (text-fig. 4).

Unfortunately no adult males were obtained. In females and young males the chelipedes are slender and, as consideration of the other characters of the species indicate that it belongs to the sub-genus *Trigonoplax* rather than to *Elamena*, s.s., it may be surmised that they are also slender in the adult male.

In ovigerous females the chelipedes are about as long as the carapace, not stouter and a great deal shorter than any of the walking legs. The carpus is about two-thirds the length of the palm; the fingers are as long as the palm and are curved both horizontally and vertically; when closed, they meet only at the tips which are toothed and slightly spooned. In young males the fingers appear to be a little shorter than the palm.

The first and second pairs of walking legs are about equal in length, nearly two and a half times as long as the carapace, while those of the last pair are the shortest, about one and a half times the length of the carapace. There are no teeth or denticles on the upper margin of any of the segments and the dactyli, which are not broader than the propodi, are set with short hairs, among which, at the distal end, is a series of short recurved teeth (text-fig. 5).

The largest specimen, an ovigerous female, is 7.9 mm. in length.

*E. (Trigonoplax) cimex*, though it agrees with *E. (Trigonoplax) unguiformis*<sup>1</sup>, the type and only other known species of the subgenus<sup>2</sup>, in many important respects, differs in several notable points, in some of which it bears a significant resemblance to allied genera.

The chief points in which it agrees with typical *Trigonoplax* are (i) the simple—not tridentate—rostrum, (ii) the absence of any teeth or an upturned edge on the margin of the carapace, (iii) the considerable length of the epistome, and (iv) the well-developed external maxillipedes which completely close the buccal cavern.

On the other hand the areolation of the carapace is more distinct than in the other member of the sub-genus; the carapace is proportionately much narrower; there is a distinct post-orbital tooth; the interantennular septum—represented, however, merely by a narrow ridge in *E. (Trigonoplax) unguiformis*—is wholly absent; the exognath of the outer maxillipedes is not entirely hidden.

In some at least of these characters it shows considerable resemblance to

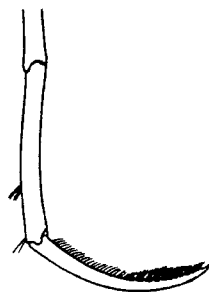


FIG. 5.—*Elamena (Trigonoplax) cimex*, sp. nov.

Propodus and dactylus of last walking leg.

<sup>1</sup> De Haan, in Siebold's *Fauna Japonica, Crust.*, p. 75, pl. xxix, fig. 1 (1839); Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 387 (1900); de Man, *Trans. Linn. Soc., Zool.* (2), IX, p. 396 (1907).

<sup>2</sup> Stimpson's *Trigonoplax truncata* [*Proc. Acad. Nat. Sci. Philadelphia*, X, p. 109 (1858) and *Smithson. Misc. Coll.*, XLIX, p. 146 (1907)] is now regarded as a member of *Elamena*, s.s.

*Rhynchoplax*<sup>1</sup> and to *Hymenicus*<sup>2</sup>, the former of which genera, as Alcock has suggested, is perhaps synonymous with the latter. It differs from both, however, in the simple rostrum and, I believe, also in the slender chelae of the male.<sup>3</sup> In addition, it is distinguished from *Hymenicus*, and perhaps also from *Rhynchoplax*, by the well-developed outer maxillipedes which completely occlude the buccal cavern.

In addition to the points mentioned above, *E. (Trigonoplax) cimex* differs from *E. (T.) unguiformis* in its narrower form, in the proportionately shorter antero-lateral borders of the carapace, in the shorter legs and in the dactyli, which are slender (not spatulate) and armed with a greater number of spines.

The colouring of living specimens of *E. (Trigonoplax) cimex* is rather striking. The carapace of an adult female was of a warm reddish-brown tone, tinged with green posteriorly and with a Y-shaped mark of deep umber brown, incompletely circumscribed by cream, extending forwards and inwards on either side from the middle of the lateral margin. The palm of the chelipedes and the distal half of the propodus of all the walking legs was very dark brown, nearly black. The remaining parts of the legs were pale sienna brown.

The carapace, when the animal is walking, is held almost vertically.

The species is represented in our collection by eight specimens, of which, however, only two, which are ovigerous females, are of large size. All were obtained during September 1914, in the outer channel of the lake, chiefly on the weedy and muddy ground in the vicinity of Barhampur I. At the time they were taken the water was quite fresh, but I have no doubt that they are also to be found in the same locality at other times of the year when the water is as salt as that of the Bay of Bengal. The species appeared to be very scarce and it was only with considerable difficulty that specimens could be detected among the weed brought up by the nets.

The type specimens are registered under nos. 8947-8/10.

#### Family OCYPODIDAE.

##### Subfamily OCYPODINAE.

##### Genus OCYPODA, Fabricius.

Two species of this genus, *Ocyroda macrocera*, Milne-Edwards, and *O. platytarsis*, Milne-Edwards, are found living in the sand at the edge of the outer channel of the Chilka Lake at all seasons of the year. They appear to be equally abundant in this situation both when the water in the channel is fresh and when it is salt.

*O. cordimana*, Desmarest, a species which has not been found in the lake-system, is common on the seaward side of the sand-hills and may at times wander to the shores of the outer channel.

<sup>1</sup> *Rhynchoplax*, Stimpson, *Proc. Acad. Nat. Sci. Philadelphia*, X, p. 109 [55] (1858) and *Smithson. Misc. Coll.*, XLIX, p. 147 (1907).

<sup>2</sup> *Hymenicus*, Dana, *Amer. Journ. Sci.* (2), XII, p. 290 (1851) and *U. S. Explor. Exped., Crust.*, I, p. 387 (1852), redefined by Alcock, *Journ. Asiatic Soc. Bengal*, LXIX, p. 387 (1900).

<sup>3</sup> As has already been pointed out, no fully adult males were obtained.

**Ocypoda macrocera**, H. Milne-Edwards.

1900. *Ocypoda macrocera*, Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 347.

The colouration of adults of this species is very striking. The carapace is of a faint reddish-chestnut colour, greyer in patches and towards the margins, and the cardiac region is defined anteriorly by a semicircular red-brown line. The outer maxillipedes and adjacent portions of the carapace are stained with deep crimson, the sternum being tinged with crimson, dull purple, reddish-yellow and white. The chelipedes are red at the base with red spines and the outer surface of the large claw is bright orange yellow, paler distally. The walking legs are french grey, reddish beneath, with the tips of the claws yellowish. The eyes are greyish-white, with the ocular horn a deep crimson. In immature specimens, about 20 mm. in breadth, there is no trace of red colouration, the carapace being of a dull creamish tint, heavily marbled with dark grey.

For the following interesting notes on the habits of *O. macrocera* in its early stages I am indebted to Dr. Annandale :—

“The young of this species, both in a late megalopa stage and with their skins still soft after the final metamorphosis, were common on the sandy beach of the Ennur backwater, near Madras, in January 1915. They lay in short and imperfectly formed burrows under logs (catamarans), drawn up just above the water-line where the sand was still damp. The megalopae were sluggish and somewhat helpless, but could run along the sand with fair rapidity, their abdomens tucked away beneath the carapace like those of adult crabs. They were easily knocked over, not being at all well-balanced and, when handled or molested in any way, lay still with their legs and tail all pressed together and “shammed dead.” Their excavating powers were limited. When one was placed in a dish of wet sand, it turned round and round like a dog, moving its limbs in an unco-ordinated manner, until it had found a small hole in which it remained quiescent. The megalopae were not seen coming out of the water, but there is little doubt that they did so at night, for all those found on the shore were approximately the same size (almost the same as that of the fully formed young crabs), and older members of the same species were observed on several occasions, in the early morning, running towards their burrows with young megalopae in their claws. The larvae exhibited considerable power of colour-change, becoming much paler than usual when submitted to a strong light. Their dorsal surface, when they were in their holes, was of an almost uniform dark leaden grey; when they were placed in a glass vessel it became of a pale glaucous shade.”

“The period of the metamorphosis was evidently one of great danger and numerous individuals were observed that had died, both before and after the ecdysis, without apparent injury, probably owing to exhaustion. Allusion has already been made to the cannibal habits of the older crabs of the species, which evidently capture the megalopae and carry them away to be leisurely devoured in their burrows. That they were not merely carrying their young relatives to a place of safety was proved by the fact that one crab was captured carrying the already half-devoured corpse of a megalopa, although in other cases the captives were still uninjured.”

"Under the catamarans on the shore a Doryline ant had constructed galleries in the wet sand. These galleries in several cases were noticed to lead to the burrow of a megalopa or newly perfected crab. In such cases the ants were devouring, or had already devoured, the rightful owner, but whether they had waited till its death before doing so, or had attacked it and eaten it alive, could not be ascertained."

"Full-grown crabs of this species are much more retiring in their habits than young and half-grown individuals, which, at any rate in dull weather, may be seen running about the shore, and even in the neighbouring Casuarina woods at all times of the day. The pellets of sand produced in excavating the burrows were merely shovelled out of the holes in a fan-shaped mass and no effort seemed to be made, at any stage in the life-history, to arrange them neatly. In this respect the holes offered a striking contrast to those of *Dotilla intermedia* on the same beach."

The megalopa and first post-larval stage are figured in text-figs. 6a and 6b from material obtained by Dr. Annandale at Ennur. The megalopa is remarkable for the

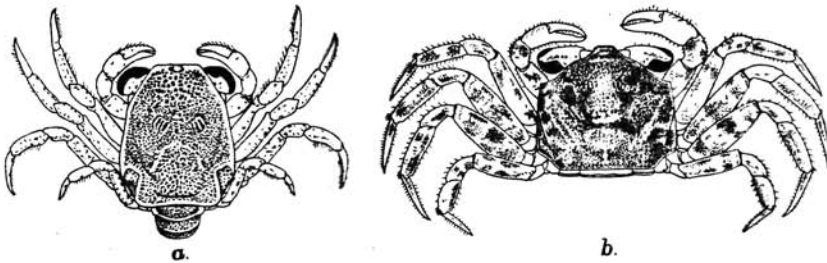


FIG. 6.—*Ocyroda macrocera*, Milne-Edwards.  
a. Last megalopa stage. b. First post-larval stage.

presence of deep cavities at the postero-lateral angles of the carapace, into which the last pair of the legs can be folded.

*Ocyroda macrocera* is common on the sandy shores which fringe the outer channel of the Chilka Lake and also occurs on the adjacent islands. It extends from the mouth of the lake up to Satpara and is found throughout the year, both when the water in the channel is fresh and when it is salt. We failed to find specimens on the neighbouring shores of the Bay of Bengal; but I have little doubt that it occurs there. In the largest specimen obtained, a female, the breadth of the carapace is 32 mm.

The species is known only from the Bay of Bengal and the Gulf of Siam.

#### *Ocyroda platytarsis*, H. Milne-Edwards.

1900. *Ocyroda platytarsis*, Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 348.

This species is abundant on the sandy banks of the outer channel near the mouth of the lake. Like *O. macrocera* it is found at all seasons of the year, when the water

is either fresh or salt. It does not, however, extend so far up the channel as the allied species and it has not been found south of Manikpatna. It is common on the adjacent shores of the Bay of Bengal.

The breadth of the carapace in the largest specimen, a male, is 53 mm.

*O. platytarsis* is known from both coasts of Peninsular India and from Ceylon.

#### Genus GELASIMUS, Latreille.

1897. *Uca* (Leach, not of Latreille), Rathbun, *Proc. Biol. Soc. Washington*, XI, p. 154.

1900. *Gelasimus*, Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 350.

#### *Gelasimus annulipes*, Latreille (M.-Edw.)

1900. *Gelasimus annulipes*, Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 353.

The numerous specimens agree well with other examples in the Indian Museum determined by Alcock; the form of the hand in the adult male corresponds very closely with the figure given by Milne-Edwards.<sup>1</sup> The examples are, however, very much smaller than those found in other parts of India, for the breadth of the carapace in the largest male does not exceed 12.5 mm.

Nobili<sup>2</sup> has drawn attention to a difference in the form of the chela in specimens from the eastern and western portions of the Indo-pacific region. To the eastern form he gave the name var. *orientalis*, but subsequently notes<sup>3</sup> that that form is identical with *G. perplexus*, M.-Edw., a name relegated by Hilgendorf and Alcock to the synonymy of *G. annulipes*. Still later, Miss Rathbun<sup>4</sup> recognized *G. perplexus* as a distinct species and gave photographic illustrations of it. The specimens she examined were found at Ceram I. and at Makassar in Celebes, many specimens of typical *G. annulipes* being also found at the latter locality. From the last of these records it is evident that the two forms are not, as Nobili supposed, restricted to separate parts of the Indo-pacific region. But, until further evidence is available, the status of *G. perplexus* must remain doubtful. So far as one is able to judge—for Miss Rathbun gives no description—it is only in the toothing of the large claw of the male that the differential characters are to be found, and in this respect the species of *Gelasimus* often show a wide range of variation. It is only by the examination of long series of specimens from different localities that the point can be determined in a satisfactory manner.

A colony of *Gelasimus annulipes* was found to have established itself in March 1914, on one of the islands in the outer channel of the lake close to Manikpatna. The specimens were living on a narrow strip of land between the water's edge and the coarse grass with which the island was covered. We noticed that the larger individuals occupied the (apparently) more eligible situations close to the water line, while

<sup>1</sup> Milne-Edwards, *Ann. Sci. nat. Zool.* (3), XVIII, pl. iv, fig. 15b (1852).

<sup>2</sup> Nobili, *Boll. Mus. Torino*, XVI, No. 397, p. 13, text-figs. A, B (1901).

<sup>3</sup> Nobili, *Ann. Sci. nat. Zool.* (9), IV, p. 312 (1906).

<sup>4</sup> Milne-Edwards, *Ann. Sci. nat. Zool.* (3), XVIII, p. 150, pl. iv, figs. 18, 18a (1852).

<sup>5</sup> Rathbun, *Bull. Mus. Comp. Zool., Harvard*, I, II, p. 306, pl. i, figs. 1, 2 (1910).

those that were younger were compelled to live higher up, close to and among the roots of the grass. A detailed and most interesting account of the habits of this and other species of *Gelasimus* has lately been published by Pearse<sup>1</sup>, who finds reason to dissent from some of Alcock's views<sup>2</sup> as to the use of the large claw of the male as a means of sexual attraction. In this connection it may be mentioned that large claws of the male, in the rather diminutive specimens found in the Chilka Lake, were for the most part white and showed only the faintest trace of the deep pink colour which characterises well-grown specimens of the species. There was no indication of the bright blue bands which Nobili<sup>3</sup> noticed in certain specimens from S. India.

At the period when the specimens were found, the water in the outer channel was as salt as that of the open sea in the vicinity of the lake. In September of the same year, when it was quite fresh, the colony had entirely disappeared, though whether the individuals were killed off by the fresh water or were induced, by reason of it, to migrate to a more favourable spot remains a matter of conjecture. No specimens of the species were found anywhere in the outer channel in September 1914, though a single example was obtained in the same month of the preceding year on the shore at Satpara; the example may possibly have been brought there by the fishing boats, but this seems unlikely.

The evidence available appears, therefore, to point to the fact that the species is unable to withstand the periodical freshwater floods, and to this conclusion the small dimensions of the specimens also lends colour. Certain other species of amphibious Crustacea found in the outer channel (*Ocyropa*, *Dotilla pertinax* and *Cardiosoma*) seem, on the contrary, in no wise affected by the great changes in salinity.

#### Subfamily SCOPIMERINAE.

#### Genus DOTILLA, Stimpson.

#### *Dotilla pertinax*, sp. nov.

(Plate XII, fig. 4.)

The carapace is broader than long in the proportion of 4 to 3 and is strongly areolated and grooved; the grooves are always smooth, while the areolae are for the most part either tubercular or clothed with short stiff setae.

From the front a deep groove runs backwards and bifurcates almost immediately; its two branches are continued obliquely backwards in a straight line to the postero-lateral angles, gradually decreasing in depth towards their distal extremities. Another groove starts in the anterior third of the carapace from each of the branches and runs transversely outwards to the lateral margin; from each transverse groove a short branch runs forwards to the middle of the orbit. In the posterior two-thirds of the carapace, parallel to the lateral margin is a deep and very conspicuous groove, anteriorly bifurcated and Y-shaped (as in *D. malabarica*, *D. sulcata* and *D. fenestrata*),

<sup>1</sup> Pearse, *Philippine Journ. Sci.*, VII, p. 113 (1912).

<sup>2</sup> Alcock, *Ann. Mag. Nat. Hist.* (6), X, p. 412 (1832).

<sup>3</sup> Nobili, *Boll. Mus. Torino*, XVIII, No. 452, p. 20 (1903).



while another groove, faint but distinct, runs transversely close to the posterior margin (pl. xii, fig. 4).

The central triangular region of the carapace, delimited by the two oblique grooves mentioned above, is rather obscurely divided by shallow depressions into post-gastric and cardio-intestinal areolas. The first of these is bluntly elevated anteriorly and the lateral portions of both bear a few coarse and ill-defined tubercles. There is no median longitudinal groove on the anterior part of the post-gastric region. The elevated portions of the carapace behind the orbit also bear tubercles, while those which surround the Y-shaped lateral grooves are finely granulate and set with coarse, stiff setae.

The orbital margin is sinuous and its outer angle, owing to a deep emargination immediately behind it, is prominent and acute in dorsal view. The trough in which the eye lies is continuous beneath this point with a groove which extends along the upper limit of the side-walls of the carapace. The apex of the front is narrowly

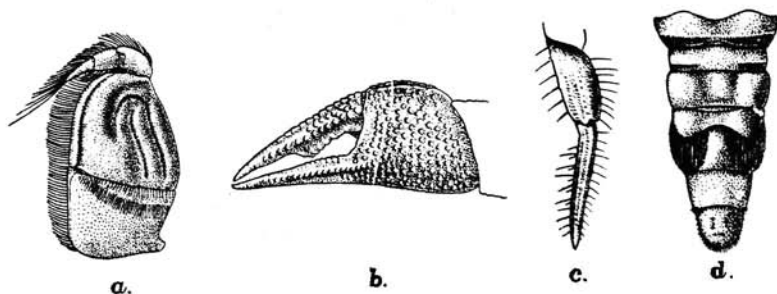


FIG. 7.—*Dotilla pertinax*, sp. nov.

a. Outer maxillipede.

b. Chela of male.

c. Propodus and dactylus of last leg.

d. Abdomen of male.

rounded and the subhepatic and pterygostomial regions are finely granular, set with coarse setae, and show the characteristic convolute sulci.

In the external maxillipedes the merus is very much larger than the ischium and is deeply sulcate as shown in text-fig. 7a; the grooves cover the greater part of the segment and are not restricted to its outer half as in *D. blanfordi*, *D. intermedia* and *D. wichmanni*. The surface is minutely granulate and bears very short stiff setae.

Measured round the curve, the length of the chelipedes in males that appear to be adult is less than twice the length of the carapace. The spine or tubercle found on the under surface of the merus in *D. sulcata* is absent. The outer surface of the carpus and chela is closely covered with large vesiculous granules (text-fig. 7b) which, in some specimens, also invest the inner surface of the palm. On the dorsal edge of the palm the granules are often a little elongated, forming an obscurely defined double ridge; this feature, however, frequently cannot be detected. From the apex of the fixed finger, on its outer side, a granular ridge extends backwards on to the palm,

where it merges with the other granules; the palm is rounded inferiorly and does not bear the fine carinae found in *D. clepsydrodactylus* or *D. malabarica*. The cutting edge of the fixed finger is serrated in its proximal half, but is without teeth. The dactylus, which is about twice the length of the upper border of the palm, bears several rows of granules and its cutting edge, in large males, is produced in the middle to form an angular blade furnished with a few small serrations. When the claw is closed this blade and the extreme tip are the only points in contact with the fixed finger. In females the blade is entirely absent and it is relatively feebly developed in young males.

There is a small "tympanum" on the outer surface of the merus of the chelipedes and a large one on both upper and lower surfaces of this segment in all the walking legs. The merus of the first three walking legs is expanded and the propodus, which is ornamented with longitudinal rows of granules, is scarcely shorter than the dactylus. The dactyli of all the walking legs are conspicuously grooved dorsally, that of the last pair is about one-third longer than the propodus in adults (text-fig. 7c), a little longer proportionately in young specimens.

The sternal plates corresponding to the chelipedes are transversely ridged at their posterior end<sup>1</sup>, the remainder are smooth except for fine scattered granules. There are no sternal "tympana."

The distal end of the fourth abdominal segment is deeply emarginate and bears the usual tuft of thick bristles overhanging the succeeding segment (text-fig. 7d). The abdomen of the female is closely similar to that of the male; it is scarcely broader and has the same emarginate fourth segment and the same tuft of bristles. It affords no protection to the eggs, which extrude on either side of it like bunches of grapes. The abdomen of fully adult and ovigerous females consists of seven separate segments, thus differing from de Haan's account of *Doto* (= *Dotilla*) *sulcata*<sup>2</sup>.

The carapace of a large male is 5.0 mm. long, 6.4 mm. broad and 4.0 mm. deep. In ovigerous females the breadth of the carapace is only 4.9 mm.

In Alcock's key to the Indian species of *Dotilla*<sup>3</sup>, *D. pertinax* would take its place alongside *D. clepsydrodactylus*, Alcock, a species which was also found during the survey of the Chilka Lake. From this form it may readily be distinguished by several well-marked characters. In *D. clepsydrodactylus* there is a longitudinal mid-dorsal groove on the carapace and four distinct tubercle-like elevations on the post-gastric region, while the deep groove parallel with the lateral margins is simple and not Y-shaped. There is a large tooth in fully adult males in the middle of the fixed finger and on the lower edge of the chela, which is much more finely granulate externally, there is, even in very small individuals, a well-marked double serrated carina. In the legs of the last pair, also, the propodus is much stouter and the dactylus proportionately longer.

<sup>1</sup> Not in the middle as in *D. clepsydrodactylus*.

<sup>2</sup> De Haan, in Siebold's *Fauna Japonica Crust.*, p. 24 (1833).

<sup>3</sup> Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 364.

The configuration of the groove parallel to the lateral margin of the carapace, whether simply linear or Y-shaped, affords a useful character in the discrimination of the species. In this respect *D. pertinax* agrees with *D. malabarica*, Nobili<sup>1</sup>; *D. fenestrata*, Hilgendorf<sup>2</sup>; *D. brevitarsis*, de Man<sup>3</sup>; *D. sulcata*, Forskål<sup>4</sup>; and *D. affinis*, Alcock<sup>5</sup>; and differs from *D. wichmanni*, de Man<sup>3</sup>; *D. intermedia*, de Man<sup>3</sup>; *D. clepsydrodactylus*, Alcock<sup>5</sup>; *D. profuga*, Nobili<sup>1</sup> and *D. myctiroides*, Milne-Edwards<sup>6</sup>.

From *D. malabarica* *D. pertinax* is distinguished (i) by the sculpture of the middle portions of the carapace and by the presence of a faint transverse groove close to the posterior margin, (ii) by the presence of a blade-like tooth on the dactylus of the chela in the male, by the greater comparative length of the fingers and by the absence of carinae on the lower surface of the palm, and (iii) by the presence of a large 'tympaanum' on the upper side of the merus of the last legs and by the proportionately shorter dactyli.

Hilgendorf's *D. fenestrata* possesses sternal 'tympaan', a character which it shares only with *D. myctiroides*, and the features noticed in Alcock's key suffice to distinguish the present form from *D. brevitarsis*, *D. sulcata* and *D. affinis*. Nobili<sup>1</sup> has drawn attention to the close affinity which exists between the two last named species and, in view of his notes on the variation of *D. sulcata* in the Red Sea, coupled with an examination of specimens of both species (including the types of *D. affinis*) I am inclined to agree with his suggestion that *D. affinis* is merely a synonym of Forskål's *D. sulcata*. In the largest of Alcock's types there is a small tubercle on the lower surface of the merus of the chelipedes in the position which the spine occupies in adult *D. sulcata*.

Living specimens of *Dotilla pertinax* are of a pale sandy brown colour, mottled with black, white, dark brown and orange red. The precise colouring is very variable; there is often a black gastric spot and, in many cases, an orange cardiac blotch. Behind this blotch there is usually a white spot partly surrounded by a brown or black Y-shaped patch, the posterior limb of which extends to the middle of the hinder margin, which is pure white on either side. The furrow at the upper limit of the side walls of the carapace is always deeply pigmented, black, brown or reddish-orange; the sub-hepatic and pterygostomian regions are closely speckled with black and the epistome is often orange red. The legs are banded with brown and white, the carpo-propodal joint of the first two walking legs being orange.

The species constructs burrows in the sand close to the water line; usually the boring is made obliquely and extends to a depth of some six or eight inches. Leading

<sup>1</sup> Nobili, *Boll. Mus. Torino*, XVIII, No. 452, p. 20, fig. 6 (1903).

<sup>2</sup> Hilgendorf, in van d. Decken's *Reise in Ost-Afrika*, III, p. 85, pl. iii, fig. 5 (1869).

<sup>3</sup> De Man, *Journ. Linn. Soc., Zool.*, XXII, pp. 130, 135, pl. ix (1888).

<sup>4</sup> Nobili, *Ann. Sci. nat. Zool.* (9), IV, p. 315 (1906).

<sup>5</sup> Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, pp. 363-368 (1900) and *Illust. Zool. 'Investigator'*, *Crust.*, pl. lxiii, figs. 1-3 (1902).

<sup>6</sup> De Man, in Weber's *Zool. Ergebn. einer Reise in Niederland. Ost-Ind.*, II, p. 308, pl. xviii, fig. 8.

<sup>7</sup> Nobili, *Boll. Mus. Torino*, XVIII, No. 447, p. 22 (1903).

to the mouth of the burrow there is always a well-constructed avenue or "run," two to four inches in length, formed by smoothing the sand and heaping it up on either side. The pellets brought up from the burrow are cast to one side of this "run" and, as a rule, form a triangular patch visible on the smooth surface at a considerable distance. The crabs seem never to wander beyond the limits of the "run."

*D. pertinax* occurs commonly on the sandy bars and islands in the outer channel and is abundant, both when the water is fresh and when it is salt; it does not in our experience live within a mile of the actual mouth of the lake. The latter region, during the salt-water season in March 1914, was inhabited by a colony of *D. clepsydrodactylus*. The ovigerous females, of which only two were found, were obtained in March. They accompanied other individuals on the shore.

The type specimens are registered under no. 8937/10.

#### *Dotilla clepsydrodactylus*, Alcock.

1900. *Dotilla clepsydrodactylus*, Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 367; and *Illust. Zool. Investigator*, *Crust.*, pl. lxiii, figs. 2, 2a (1902).

The specimens agree perfectly with the types of the species and with Alcock's account and figures except that the tooth in the middle of the fixed finger is in no case so well developed as is indicated in the original description. Even in individuals in which the carapace is 6 mm. broad, *i.e.* of a size practically identical with that of the largest type specimen, the tooth has merely the form of a low serrated ridge and is only a trifle more prominent than in the preceding species.

In addition to the points mentioned by Alcock it may be noted that the eye is a little flattened and in dorsal view appears almost bilobed, and that there are three finely serrated carinae on the lower surface of the chela, terminating on the fixed finger. Two of these carinae run parallel to one another on the outer aspect of the inferior surface, while the third, situated on the infero-internal border, diverges from them proximally: the lower surface of the palm is in consequence sharply defined, flat and triangular in shape. By the use of this character, coupled with that of the areolation of the carapace (very exactly shown in Alcock's figure) it was easy to distinguish even the smallest specimens of this species from those of *D. pertinax*.

It may ultimately be shown that *D. clepsydrodactylus* is synonymous with *D. intermedia*, de Man, from Sullivan I. in the Mergui Archipelago. I have examined some of the original specimens of the last named species, all of them, unfortunately, small and in rather poor condition. The resemblance to immature *D. clepsydrodactylus* is extremely close, but in the absence of adults from the Mergui Archipelago it is impossible to arrive at any satisfactory conclusion.

Fresh examples of this species were easily distinguished from *D. pertinax* by the absence of the dark speckling on the sub-hepatic and pterygostomian regions.

In March 1914, a colony of *D. clepsydrodactylus* was found to have established itself just inside the mouth of the lake and a stray individual was obtained at the same time in company with *D. pertinax* on the sand-bar opposite Manikpatna. At

this period of the year the water was quite salt. Later, in September, when fire water was fresh, no specimens could be discovered.

No species of *Dotilla* were found on the seashore outside the lake. It is not improbable that the violence of the breakers on the coasts of the Bay of Bengal renders such a situation impossible for small and delicate crabs and that they can only flourish in more sheltered spots. *Ocyropa*, perhaps, is able to save itself by its extremely rapid movements.

A number of very small specimens, obtained by Dr. Annandale in the Ennur backwater, near Madras, are also referred to this species. In none of these individuals is there any trace of the large teeth on the fingers of the chelae and the identification is, in consequence, somewhat doubtful.

The type specimens of *D. clepsydrodactylus* were found at False Point on the sea face of the Mahanaddi Delta, a locality less than a hundred miles distant in a direct line from the Chilka Lake. Mr. F. H. Gravely has recently obtained a fine series of the species at Balasore, a little to the north of False Point.

#### *Dotilla myctiroides* (Milne-Edwards).

1900. *Dotilla myctiroides*, Alcock, Journ. Asiat. Soc. Bengal, LXIX, p. 368.

A single example of this species, the carapace 6.9 mm. in breadth, was found on the shore of an island in the outer channel near Manikpatna. The specimen was obtained in March 1914, when the water in the channel was salt.

A large ovigerous individual of this species was recently obtained by Dr. Annandale in the Ennur backwater near Madras. The specimen bears an enormous number of eggs, so many that the abdomen projects backwards in a straight line with the carapace, the masses of eggs bulging out on either side of it and of the legs. In this example, precisely as in the ovigerous females of *D. pertinax* mentioned above, the abdomen is quite narrow and in external appearance closely similar to that of the male (cf. text-figs. 8a and 8b). It is composed of seven separate segments and it seems probable that this number is found in both sexes of all species of the genus and that de Haan was in error in his statement that in females of *D. sulcata* there are only five.

The supposed scarcity of females in the genus *Dotilla* has often been the subject of comment; but this, I believe, is to be explained by the close similarity in the form of the abdomen in the two sexes. It is, however, curious that ovigerous females are not more abundant; the eggs, which are poorly protected and must be a great encumbrance to the mother, are perhaps only carried for a very short period and it is noteworthy that the ovigerous specimen of *D. myctiroides* from Ennur was

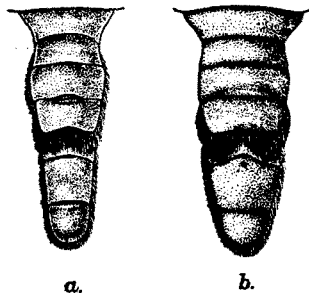


FIG. 8.—*Dotilla myctiroides* (H. Milne-Edwards).

a. Abdomen of male.  
b. Abdomen of female.

not taken on the shore, but on the bottom in several feet of water. With the females of *D. pertinax* this was not the case, but it is possible that the eggs in the specimens of this species were freshly extruded.

Subfamily *MACROPHTHALMINAE*.

Genus *MACROPHTHALMUS*, Latreille.

*Macrophthalmus gastrodes*, sp. nov.

(Plate XII, fig. 5.)

The carapace is sub-quadrate, the greatest breadth being only about 1.2 times the greatest length: it is strongly convex both fore and aft and from side to side. The lateral margins are posteriorly divergent, the point of greatest breadth being near the base of the penultimate legs. The breadth across the orbital angles is very little greater than the length (pl. xii, fig. 5).

The front is obliquely deflexed; though longitudinally grooved above, the

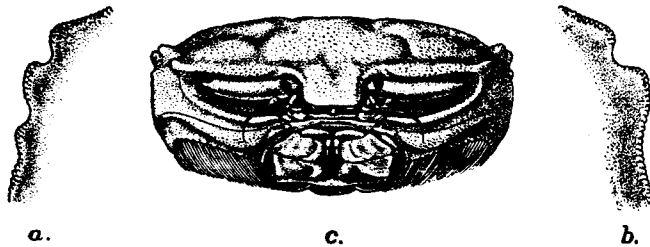


FIG. 9.—*Macrophthalmus gastrodes*, sp. nov.

- a. Antero-lateral border of carapace of the female specimen, left side.  
 b. Do. do. do. do. do. right side.  
 c. Carapace of the male specimen, viewed from in front.

anterior margin is not bilobed, but is straight or very slightly emarginate in the middle (text-fig. 9c). The breadth of the front is about one-sixth the breadth of the carapace at the outer orbital angles, a little wider proportionately in the male than in the female.

The orbits are markedly oblique and rather strongly sinuous. The outer orbital angle is obtuse in both sexes, a little sharper in the male than in the female. Behind it, in the former sex, are three lobular teeth, bluntly rounded and set with small tubercles. The first of these lobes is fully as broad as the outer orbital angle; the second, which is separated from it by a narrow but deep emargination, is much smaller, less than half its breadth; the third is exceedingly indistinct, a scarcely perceptible protrusion of the finely beaded line that marks the margin of the carapace. In the female specimen the antero-lateral borders are not symmetrical. On the left side (text-fig. 9a) there are three lobes, similar to those of the male, but less prominent and separated by shallower emarginations. On the right side (text-fig. 9b) there is only a single large lobe behind the orbital angle.

The surface of the carapace is strongly areolated, the depressed portions being smooth, while those that are elevated bear granules. The granules are small, very close-set in the male, much sparser in the female. A finely beaded line extends from the posterior lobe of the antero-lateral border round the posterior margin of the carapace. The upper orbital margin is not distinctly beaded, but bears scattered granules similar to those on other parts of the carapace; the lower orbital margin is finely crenulate. From either side of the epistome a blunt ridge, covered with granules, extends backwards to a point above the base of the chelipedes (text-fig. 9c). The entire carapace is covered with soft silky hairs, short on the dorsum, longer at the sides and very long beneath the lower orbital margin.

When closed there is a considerable gap between the outer maxillipedes. Both ischium and merus are strongly thickened along their inner margins and both seg-

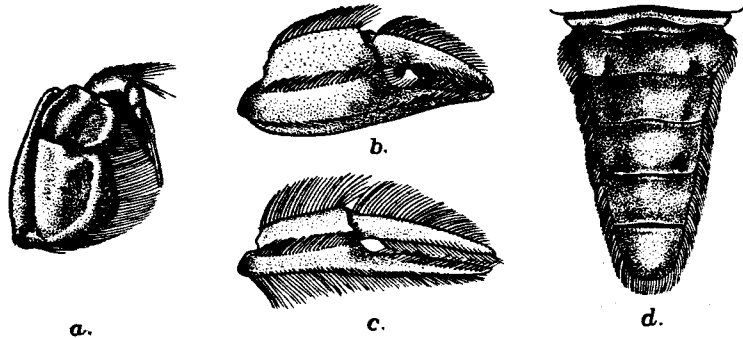


FIG. 10.—*Macrophthalmus gastrodes*, sp. nov.

a. Outer maxillipede.  
b. Chela of male.

c. Chela of female.  
d. Abdomen of male.

ments show traces of a median longitudinal ridge. The merus is much broader than long and partially overlaps the exopod (text-fig. 10a).

The chelipedes of the male are but little longer than the carapace is broad; in the female they are shorter, about equal to the length of the carapace. The merus is slender, without stridulating crest, and without the expanded and crenulate inner margin found in some species of the genus; it bears two rows of long silky hairs. The dorsal surface of the carpus is pubescent; its inner face and the feebly granulate ventral ridge are set with long hairs. In the male the chela is about two and a half times as long as broad (text-fig. 10b), the fingers being about one and a half times the length of the upper border of the palm. The inner face of the chela does not bear a tubercle and, except for a strip along its lower edge, is covered by a patch of long hairs that extends to the tips of the fingers. Externally the palm is quite smooth, but is traversed by two impressed lines from which setae arise. The uppermost of these runs longitudinally across the middle of the palmar surface and is

continued on the mobile finger. The other is parallel to it and runs close to the inferior margin, extending to the tip of the immobile finger. Neither the upper nor the lower edges of the palm are granulate. In the middle of the fixed finger, on the inner edge, is a large serrated crest, like a cock's comb, with the distal serrations much larger than the proximal. At the base of the dactylus is a strong molariform tooth. The chela of the female (text-fig. 10c) is much more slender, about four times as long as wide, and the fingers are unarmed. It bears rows of setae, similar to those of the male and the surface is covered with a fine pubescence.

The third walking legs are the longest, fully twice the length of the carapace. In all four pairs the upper and lower borders of the meri are granular and on these segments in the first three pairs of the female and the two middle pairs of the male there is on the anterior margin a small sub-terminal spine. The dactyli are flattened and all the segments bear long hairs.

In the male the thoracic sterna bear numerous granules, which also occur, though less abundantly, on the abdomen. In this sex the sutures between the 3rd and 4th and between the 4th and 5th abdominal segments are very fine, the joints being almost immovable, and on either side of these sutures and of that between the 5th and 6th segments there is a large pit or depression (text-fig. 10d). The last segment of the abdomen of the female is about one and half times as broad as long.

Only two specimens of this species were obtained; they yield the following measurements (in mm.):—

	♂	♀
Length of carapace .. .. .	14.8	17.2
Breadth across outer orbital angles .. .. .	14.9	17.6
Greatest breadth .. .. .	17.6	20.8
Breadth of front .. .. .	2.6	2.7

*Macrophthalmus gastrodes* is apparently allied to *M. serratus*, White<sup>1</sup>, from the Philippine Is. and Hongkong, and to *M. definitus*, White<sup>2</sup>, which is known from the first of these localities and from Australia. It is easily distinguished from both these forms by many of the characters enumerated above.

In life the species is entirely covered with fine mud; when this was removed the specimens were found to be of an almost uniform clay colour with a purplish-pink flush on the carapace. The scarcity of the species in our collection is perhaps due to the fact that it burrows; in both individuals, however, the cornea is jet-black.

Both specimens were found in the outer channel of the Chilka Lake, on the muddy ground between Satpara and Barhampur I. The male was obtained in March in water as salt as that of the Bay of Bengal in the vicinity of the lake-mouth (sp. gr. 1.0265), while the female was found in September in water that was quite fresh.

The two specimens, types of the species, bear the numbers 9157-8/10 in the Indian Museum Register.

<sup>1</sup> Adams and White, *Crust. Voy. 'Samarang'*, p. 51 (1848) and Stimpson, *Smithson. Misc. Coll.* XLIX, p. 96, pl. xiii, fig. 3 (1907).

<sup>2</sup> Adams and White, *ibid.*, p. 51 (1848) and Ortmann, *Zool. Jahrb., Syst.*, X, p. 342 (1897).



## Family GRAPSIDAE.

In addition to purely marine species this family includes numerous forms characteristic of backwaters and estuaries, some aquatic, some amphibious and some almost wholly terrestrial. A considerable number of species are known to exist in water of low salinity and some have succeeded in establishing themselves in fresh water. In the Andaman Is. for instance, *Ptychognathus andamanicus*, Alcock, lives in streams far above tidal influence, while *Sesarma thelxinoë*, de Man, was described from an altitude of 700 ft. In the case of the Andamans, migration from salt to fresh water is perhaps more easily accomplished than in other parts of India, for Potamonidae are entirely absent and the Grapsids are not therefore brought into direct competition with other crabs. As is pointed out on p. 233 the presence of Potamonidae appears to play an important part in hindering *Varuna litterata* from establishing itself in Lower Bengal.

It is remarkable that the genus *Metaplax*, which is abundant in the Gangetic delta and also occurs in backwaters near Madras, is not represented in the fauna of the Chilka Lake.

## Subfamily GRAPSINAE.

## Genus PACHYGRAPSUS, Randall.

*Pachygrapsus propinquus*, de Man.

1908. *Pachygrapsus propinquus*, de Man, *Rec. Ind. Mus.*, II, p. 216, pl. xviii, fig. 2.

Although many of the specimens of this species obtained in the Chilka Lake are very much larger than the types, they do not differ in any marked features from them or from the exhaustive description which de Man has supplied.

The anterior part of the gastric region of the carapace and the frontal lobes are beset with small tubercles which, posteriorly, tend to form transverse ridges much more conspicuous than in the types. Adults resemble the original specimens in having the inner margin of the ischium of the outer maxillipedes quite straight.

The chelipedes in the largest individuals are a little unequal; they are, however, identical in structure. The inner edge of the merus bears three or four blunt tubercles at the base and projects distally as a thin crest bearing three or four teeth that decrease in size as they approach the carpal articulation. The spines at the distal end of the lower margin of the merus of the ambulatory legs vary in number from two to four; the dactyli in all are conspicuously shorter than the propodi. The propodus in the penultimate pair is three and a third times as long as broad, the dactylus being about two-thirds its length.

The largest individual is a female in which the carapace is 23.0 mm. in length and 28.8 mm. in breadth. In the largest male the length is 16.4 mm. and the breadth 20.0 mm.

The colour of the species when alive was striking. The dorsal surface of the carapace was dull olive, boldly mottled with dark purple. The chelipedes were deep violet, shading to orange red on the fingers, while the ambulatory legs were olive

wn with dark purple marginal spots, specially well defined on the propodus. The ventral surface was of a dull olive tone, paler than the back, and the eggs in an ovigerous female were very deep purple, almost black.

*Pachygrapsus propinquus* is represented in the collection by numerous specimens and appears to be not uncommon at the edge of the lake in those places where a stony foreshore exists. It is a very active species and difficult to catch in numbers; it lives for the most part under stones, but in wet weather may be found running on the shore or on rocks. In the main area of the lake, specimens were obtained in company with *Varuna litterata*, at Barkul, on Barkuda and Cherria Is. and on the rocks at the foot of Ganta Sila. In the outer channel the species was found on three occasions; in March 1914, when the water was as salt as that of the Bay of Bengal, two individuals were obtained clinging to one of the posts that serve to mark the deep water passage near Satpara, and in September and December of the same year specimens were found on the oyster-bed opposite Manikpatna. In September, when the water on the oyster-bed was quite fresh, only a single individual was discovered; but in December, when the water was more saline (sp. gr. 1.0125), numerous young, including specimens in the megalopa stage, were obtained.

The species is common in the Ennur backwater, near Madras, sheltering under blocks of laterite piled up to protect the shore from erosion, and in dull weather running about off these rocks throughout the day.

Ovigerous females found in the lake were obtained at Cherria I. in April and at Barkul in July in water of specific gravity 1.00975 and 1.0075. In the Ennur backwater, near Madras, Dr. Annandale found several ovigerous females in January in water of rather lower density (sp. gr. 1.0025).

The only other known examples of *Pachygrapsus propinquus* are those described by de Man and obtained in brackish pools at Port Canning in the Gangetic delta.

#### Subfamily VARUNINAE.

#### Genus VARUNA, Milne-Edwards.

#### *Varuna litterata* (Fabricius).

1900. *Varuna litterata*, Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 401.

This abundant species is not particularly common in the Chilka Lake, though it may be found in some numbers in suitable localities. It seems to prefer a situation close to the water's edge, where some cover, either stones and boulders or the stems and roots of plants, is available. Such amenities are rare on the shores of the lake, the margin of the main area being for the most part bare mud or muddy sand and that of the outer channel muddy sand or sand. At the southern end of the lake, however, more especially on Barkuda, Cherria and Chiriya Is. and at the base of Ganta Sila, the foreshore is stony and in these localities *Varuna litterata* is not uncommon. At the close of the monsoon, when the water is fresh and in many places reaches to the roots of the screw-pines and other vegetation, suitable cover is afforded for a short period and a few specimens were taken in such situations.

The species does not as a rule reach a large size in the lake. The carapace of a female of quite exceptional dimensions is, however, 50 mm. in length. Oviparous females were not found.

In the Gangetic delta *Varuna litterata* is very much more abundant. Every year at the commencement of the monsoon the waters of the Hughli river in the vicinity of Calcutta teem with young specimens in the megalopa stage. They occur in myriads in all places where the current is sluggish and the water slightly salt and are particularly abundant in the numberless small creeks and backwaters subject to tidal influence. The fact that we never found such larvae during our survey of the lake is strong evidence that the species does not breed there.

It appears that *Varuna* is attempting by two methods to establish itself in fresh water in the neighbourhood of Calcutta and the two modes of invasion may be described respectively as aquatic and terrestrial.

The enormous numbers of young produced in the brackish water are borne, either by their own efforts or by the influence of currents to points where the water is almost or quite fresh, at any rate at certain seasons of the year, and though it appears that the species has not hitherto been able to establish itself in fresh water by this means, the attempt is made annually by countless multitudes. The pipes of the Calcutta unfiltered water-supply have been found completely choked by *Varuna* in its megalopa stage.

The terrestrial method of invasion is adopted by adults. Almost every year the tank (or artificial pond) in the Indian Museum compound, normally inhabited by a Decapod fauna consisting of *Parathelphusa spinigera*, Wood-Mason, *Palaemon carcinus*, Fabr., and *Palaemon lamarrei*, M.-Edw., is visited by stray individuals of the species and large specimens have been seen on the banks vigorously warding off the attacks of crows. To reach this tank the crabs must make their way by night through the streets of the city, probably along the gutters. Specimens have also been found in fresh water in other parts of the delta, but there is no evidence that the species has ever established itself permanently in this medium. That it may eventually succeed in its efforts is not improbable, for a number of Grapsidae are known exclusively from fresh water. In the Gangetic delta the change from salt water is perhaps a minor difficulty; the hordes of Potamonid crabs, which already occupy the desired territory, may prove a more formidable obstacle.

Henderson records the common occurrence of this species at the Ennur back-water, where many other species included in the Chilka fauna are abundant; Dr. Annandale, however, was unable to find specimens there in January 1915.

Alcock<sup>1</sup> notes that *Varuna litterata* is frequently found clinging to logs of drift-wood in the open sea, a fact which accounts for its wide distribution. The species is known from an area extending from the east coast of Africa to New Zealand, Australia and Japan.

<sup>1</sup> Alcock, *A Naturalist in Indian Seas*, London, p. 75 (1902).

Genus **PTYCHOGNATHUS**, Stimpson.**Ptychognathus onyx**, Alcock.

1900. *Ptychognathus onyx*, Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 404, and *Illust. Zool. 'Investigator'*, *Crust.*, pl. lxx, figs. 2, 2a (1902).

1905. *Ptychognathus onyx*, de Man, *Proc. Zool. Soc., London*, II, pp. 542-544 (key to species).<sup>1</sup>

This species, hitherto known from two young males "probably from Tavoy", is represented in the Chilka Lake collection by two females and three adult males.

Due allowance being made for age and sex, the examples agree closely with the type specimens and with Alcock's description and figures.

In the adult male, as in the younger type specimens, the exopod of the outer maxillipedes is scarcely broader than the endopod. In the chelipedes there is a dense patch of hair on the lower surface of the merus at its inner and distal ends<sup>2</sup>, the carpal spine is very strongly developed and the chelae, which are greatly swollen, are nearly as long as the carapace. The palm is covered externally with microscopic granules, so arranged as to form a reticulate pattern and the surface is rather conspicuously puckered near the point of attachment of the carpus.

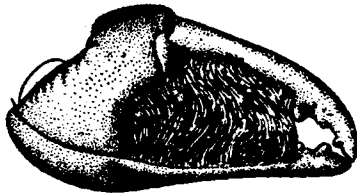


FIG. 11.—*Ptychognathus onyx*, Alcock.  
Chela of male, external view.

The fingers are two and a half times the length of the upper border of the palm; though pointed, they are slightly hollowed

at the tip and are provided with a series of strong teeth, one of which, near the middle of the fixed finger, is larger than the rest. On the outer surface of the palm a conspicuous and slightly sinuous ridge extends from the base to the tip of the fixed finger and the space between this ridge and the teeth in the finger cleft is occupied by a dense patch of hairs similar to that on the merus (text-fig. 11). The mobile finger is not grooved and does not bear a patch of hair, thus differing from *P. barbatus* (A. Milne-Edwards) and *P. pusillus*, Heller.

In the abdomen of the male the penultimate segment is very much broader than the ultimate and its distal angles are sharply and obliquely truncate (text-fig. 12).

Males of this genus are readily determined by the use of the excellent key which de Man has supplied (*op. cit.*). In that which he has given for the identification of females, the present species is omitted, the sex being up till now unknown. Females of *P. onyx* would in this key take place alongside *P. dentata*, de Man, both being separated from *P. riedeli*, A. M.-Edw., and *P. andamanicus*, Alcock<sup>3</sup>, by the much

<sup>1</sup> Since this key was published two other species have been described: *P. easterana*, Rathbun, *Mem. Mus. Comp. Zool.*, XXXV, p. 31, pl. ii, fig. 4; pl. vii, figs. 4, 4a (1907) and *P. johannae*, Rathbun, *Proc. U. S. Nat. Mus.*, XLVI, p. 354, pl. xxx. The latter species, said to be closely related to *P. riedeli*, is apparently still more closely allied to *P. barbatus* and *P. pusillus*.

<sup>2</sup> This patch is also to be seen in the type specimens, but is not nearly so well developed.

<sup>3</sup> De Man has suggested that *P. andamanicus* and *P. riedeli* are synonymous. I have examined the types of the former species, but have not seen examples of the latter.

less conspicuous toothing of the antero-lateral margin of the carapace, by the presence of distinct epigastric lobes and by the proportionately narrower exopod of the outer maxillipedes.

Females of *P. onyx* bear a very close resemblance to females of *P. dentata*; but in the former the carapace is very much flatter both fore and aft and from side to side, its regions are less pronounced, the frontal margin straighter and the upper border of the orbit much less sinuous. The ischium of the outer maxillipedes is proportionately a little broader and there is only a slight prominence, in place of a tooth, in the middle of the anterior border of the buccal cavern. In females of *P. onyx*, also, the movable finger of the chela is deeply grooved<sup>1</sup>, whereas it is almost smooth in *P. dentata*, and, on the outside of the fixed finger, sparse hairs, absent in *P. dentata*, are to be found in the position occupied by the dense furry patch in the other sex.

In the largest adult male the length of the carapace is 14.2 mm. and its greatest breadth 15.6 mm., in the two females the lengths are 11.2 and 8.4 mm. and the breadths 12.0 and 8.8 mm., respectively.

The colouration is apparently very variable. The carapace of the male was, in life, of a dull greyish-green tone with pale spots and mottled with darker grey and dull maroon. One female was pale olive yellow and the other dull grey, in both cases with a few obscure dark markings.

*Ptychognathus onyx* was only found on two occasions in the Chilka Lake. Three individuals were taken together in the outer channel on a mud bottom off the village of Mahosa on Barhampur I. in September 1914. The depth was between 6 and 8 ft. and the water at the time of their capture was perfectly fresh. In December of the same year two additional specimens were found on the oyster-bed near Manikpatna in water of sp. gr. 1.0125. The species is evidently very scarce; but is probably to be found in the locality at all seasons of the year, enduring changes of salinity varying from fresh to water as salt as that of the open sea in the vicinity.

As has already been stated, the types and only other known examples of the species were probably obtained at Tavoy on the other side of the Bay of Bengal.

#### Genus **CAMPTANDRIUM**, Stimpson.

1858. *Camptandrium*, Stimpson, *Proc. Acad. Sci. Philadelphia*, X, p. 106

1907. *Camptandrium*, Stimpson, *Smithson. Misc. Coll.*, XLIX, p. 137.

1910. *Camptandrium*, Rathbun, *Danske Vidensk. Selsk. Skrifter (7), Naturvid. og math.*, V, p. 325.

This genus, hitherto unrecorded from the coast of British India, was originally placed by Stimpson in a separate family; but its affinities are evidently with the

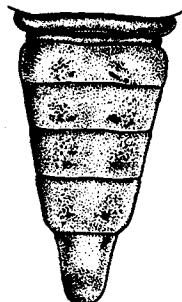


FIG. 12.—*Ptychognathus onyx*, Alcock.

Abdomen of male.

<sup>1</sup> There is a striking difference between the sexes in this respect.

Grapsidae and Miss Rathbun's view that it should be classed with the Varuninae has much to recommend it, though it must be admitted that it is a very aberrant member of the subfamily.

*Camptandrium* differs from the description of the Varuninae as given by Alcock<sup>1</sup> in having the sub-orbital crest and the lower border of the orbit closely adjacent and in the form of the outer maxillipedes. Only a very small gap remains between these appendages when they are closed and their exopod is slender and partially concealed by the merus. The slender exopod forms a ready means of distinguishing the genus from *Varuna*, *Ptychognathus* and *Pyxidognathus* the only other Indian genera of Varuninae. The hexagonal form of the carapace with its oblique and well-marked antero-lateral margins gives the genus a facies very distinct from that of the more typical representatives of the subfamily, to which, however, it is in some degree linked by Dana's *Cyrtograpsus*.

### *Camptandrium sexdentatum*, Stimpson.

(Plate XII, fig. 6.)

1858. *Camptandrium sexdentatum*, Stimpson, *Proc. Acad. Sci. Philadelphia*, X, p. 107.

1907. *Camptandrium sexdentatum*, Stimpson, *Smithson. Misc. Coll.*, XLIX, p. 138, pl. xvii, fig. 4.

Three specimens of this species were obtained in the outer channel of the Chilka Lake, two young males and a large female, the latter, although dead when brought to the surface and with the carapace detached from the body, being nevertheless in a fair state of preservation. The illustration on pl. xii (fig. 6) is of a young male, the carapace of the female is shown in text-fig. 13.

In most particulars the specimens agree very closely with Stimpson's admirable description; on careful comparison with his account I am only able to detect a few minor discrepancies.

The margin of the front is slightly emarginate in the middle when viewed from above and the dorsal surface of the carapace might more correctly be described as unequal with only two conspicuous transverse interrupted ridges. The surface is finely setose in both sexes and all the more elevated portions bear minute granules. The anterior transverse ridge consists in reality of three largish tubercles, the median of which is interrupted in the middle and is placed at the hinder end of the gastric region. This is clearly shown in Stimpson's figure, in which the more prominent ridge across the cardiac and branchial regions is also exactly indicated. The true infero-lateral margin of the carapace is visible in dorsal view at the base of the last two pairs of legs; the postero-lateral margin is granular and, though convex, is markedly sinuous, while

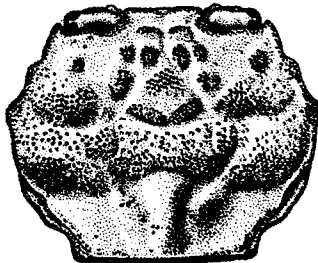


FIG. 13.—*Camptandrium sexdentatum*, Stimpson.

Carapace of female

<sup>1</sup> Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, pp. 288, 389.

the posterior margin, also granular, is perfectly straight and terminates in a rectangular or acute angle on either side. Of the teeth on the antero-lateral margin the first (which corresponds with the outer orbital angle) and the third are more or less acute; the second is smaller and bluntly rounded. The teeth are sharper in the young males than in the adult female. The upper orbital margin is conspicuously elevated, both at the side of the front and behind the eye, the latter border being strongly sinuous. The lower border of the orbit, as Stimpson has explained, bears a small dentiform lobe internally; the margin is well developed and not deficient as in *Varuna*.

The external maxillipedes are precisely as described by Stimpson. Compared with Miss Rathbun's figure of the appendage in *C. paludicola*, the ischium is more quadrate, equal in length to the merus, and the division between the two segments is straighter and more oblique (text-fig. 14).

The chelipedes in all the specimens are small, weak and shorter than the carapace. The carpus is a little shorter than the palm. The chela is very slender and the fingers are about as long as the palm in the female, a trifle longer in young males. They are slightly curved in dorsal view and are very deeply channelled internally throughout their length, so much so that each resembles a greatly elongated spoon.

The first and last walking legs are about equal in length—a little longer than the carapace; the second and third pairs are about one and three quarters the length of the carapace. The merus is more slender than is shown in Stimpson's figure; the ridge near the upper margin is conspicuous and granular. The upper edge is also granular and in young males bears a minute subterminal spinule on the two middle pairs, much smaller than that found in *C. paludicola* and apparently wholly absent in the female. The inferior surface of the merus is provided with two granular longitudinal ridges separated by a comparatively broad interspace. The dactyli are about equal in length with the propodi.

The sternum agrees exactly with Stimpson's description. In the young males the abdomen has a wavy outline, the margin being concave opposite each sternal segment and convex opposite the interspaces of the segments; it could hardly be described as "strongly constricted and sinuated on each side at the middle", but the form is probably subject to change during growth. Except for the most distal one, the sutures between the abdominal segments can scarcely be detected in the larger male example, they are more distinct in the small individual. The sutures in the abdomen of the adult female are conspicuous and markedly sinuous in the middle. The margin of the abdomen is, in this sex, thickly fringed with plumose hairs and, in all the specimens, a number of similar hairs are to be found on the walking legs.

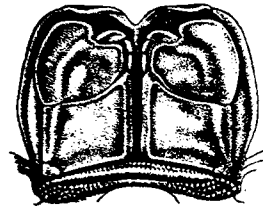


FIG. 14.—*Camplandrium sexdentatum*,  
Stimpson.

Third maxillipedes of young male.

The carapace of the adult female is 7.4 mm. long and 9.4 mm. broad. Its length in the two males is 3.4 mm. and 2.5 mm. The males were, in life, of a dull grey colour, faintly mottled with brown.

The specimens from the Chilka Lake were all found in the outer channel on a muddy bottom, between Satpara and Barhampur I. at a depth of from 1-2 fathoms. At the time they were obtained the water was quite fresh. I have no doubt that they are also to be found in the same locality when the channel is flooded with salt water from the Bay of Bengal; the fact that the species was not met with during March is sufficiently explained by the rarity of its occurrence.

Two minute examples of *Camptandrium sexdentatum* (carapace-length 2.3 mm. and 1.7 mm. respectively) were obtained by Dr. Annandale in the Ennur backwater, near Madras, in January 1915, in water of specific gravity 1.0025.

Stimpson's type specimens are recorded "from a muddy bottom at the depth of six fathoms, in bays of the coast near Hongkong, China."

#### Subfamily *SESARMINAE*.

#### Genus *SESARMA*, Say.

#### *Sesarma tetragonum* (Fabricius).

1900. *Sesarma tetragonum*, Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 420.

A single example of this species, a male with carapace 29 mm. in length, was found dead on an island in the outer channel near Manikpatna. It was obtained in March 1914, at the time when the water in the channel was salt. The species is, in all probability, only an occasional visitor to the lake-system; it may possibly establish itself for short periods, but of this we have no evidence.

*Sesarma tetragonum* is a species of very wide Indo-pacific distribution.

#### *Sesarma batavicum*, Moreira.

(Plate XII, fig. 7.)

1890. *Sesarma barbimana*, de Man (nec Cano), *Notes Leyden Mus.*, XII, p. 104, pl. vi, fig. 13.

1903. *Sesarma batavica*, Moreira (*nom. nov.* for *S. barbimana*, de Man, nec Cano<sup>1</sup>), *Arch. Mus. Rio Janeiro*, XII, p. 117. (*five Zool. Rec.* for 1903.)

The specimens from the Chilka Lake, though rather smaller than the type, agree closely with de Man's description and figure.

The small transverse rows of setae on the carapace are easily seen and are especially conspicuous in life, for each seta is finely plumose and usually retains a quantity of soft mud. The oblique ridges at the sides of the carapace, as de Man has noted, are very similar to those of *S. andersoni*, de Man (the types of which I have examined). The anterior ridge sometimes, but not always, projects a trifle beyond the lateral

<sup>1</sup> Cano, *Eoll. Soc. Nat. Napoli*, III, p. 245 (1889).



margin, forming a very rudimentary tooth behind the outer orbital angle. In *S. andersoni* a short ridge is to be found on either side of the carapace strictly transverse in direction and situated close behind the middle of the orbit. Of this in *S. batavicum* there is no trace.

The chelipedes are almost or quite equal. In the largest specimens the ischium bears a small blunt anterior tubercle and, in all, the antero-inferior edge of the merus is produced distally in the form of a thin triangular crest, apically blunt or rounded and anteriorly serrate. The inner angle of the carpus is rectangular; behind it on the postero-internal face of the segment there is, in both sexes, in addition to the short black hairs on the upper surface noticed by de Man, a linear series of very long stiff setae, also black in colour, and a row of similar but shorter setae extends diagonally across the smooth inner face of the merus. The palm of the chela bears on its upper surface the characteristic ridges figured by de Man. In the male the outermost and best developed of these ridges extends in a sinuous line from the inner end of the dactylar articulation to a point close to the mid-dorsal projection of the carpus (text-fig. 15*b*). This ridge is composed of horny tubercles, the anterior of which are very high and upstanding. Inwards of this limiting ridge are several others, also tubercular but for the most part shorter. One of these defines the margin of the hand and, in the space between it and the primary ridge, and more or less parallel with portions of the latter are two or three other ridges and a few odd tubercles. Below the marginal ridge on the upper and inner face of the palm are other less conspicuous rows of tubercles. The precise arrangement of the ridges is somewhat variable; it corresponds comparatively closely with de Man's figure, though one would gather from his description that only two dorsal ridges existed. The tuft of hairs found on the outer surface of the fingers is conspicuous in all males (text-fig. 15*a*), but, owing perhaps to the small size of the specimens, does not occupy such a long area in lateral view as is shown in the original figure. The hairs extend through the base of the finger-cleft and are visible on the inner side. The fingers in other respects agree in the closest manner with de Man's description, but possess more teeth, often as many as six, on their cutting edges.

The chela of the female bears on the upper surface ridges closely comparable to those of the male; there are, however, only a few sparse hairs at the base of the

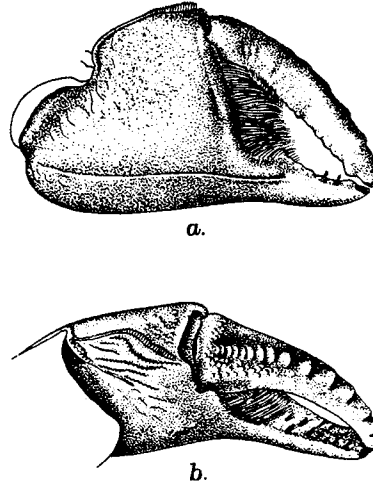


FIG. 15.—*Sesarma batavicum*, Moreira.

- a. Right chela of male, external view.  
b. Left chela of male, viewed obliquely from above.

finger-cleft and the upper edge of the dactylus is quite smooth, showing no indication of the transverse ridges or tubercles possessed by the male.

The ambulatory legs are a little shorter and broader than in *S. andersoni*, but are much more hairy than in that species; in particular the anterior borders of the carpi and propodi are covered with a dense coating of coarse setae of varying length. The meral segments bear a small tooth at the distal end of their anterior margin and a group of two or three teeth in a similar position on the posterior margin<sup>1</sup>.

The abdomen of the male is decidedly narrower than in *S. andersoni*.

The length of the carapace in the largest specimen from the Chilka Lake, a male, is 7.5 mm. and its breadth 9.6 mm.

This species, which has not hitherto been found on the coast of British India, belongs to the subgenus *Parasesarma* of de Man's terminology<sup>2</sup> and is one of a small group of five species readily distinguished from the others by the presence of spines on the ambulatory legs at the distal end of the posterior margin of the merus. In 1890 de Man (*loc. cit.*, pp. 97, 98) gave a key to the species of *Parasesarma* then known, three forms belonging to the *andersoni* group being included. Later, in 1909, Calman<sup>3</sup> supplied some valuable notes on the species of the group in his description of *Sesarma murrayi*. *Sesarma batavicum* is readily separated from all its allies by the use of characters derived from the chelae; the arrangement of the ridges on the upper surface of the palm and the presence in the male of a tuft of hairs in the finger-cleft.

Moreira's choice of '*batavica*' as a new name for this form is not a happy one, for de Man, in the same paper that contains his description of *S. barbimana*, has described another species of the genus under the name of *S. bataviana*.

*Sesarma batavicum* is represented in our collection by many specimens found among the clusters of shells on the oyster-bed in the outer channel opposite Manikpatna. Specimens were obtained on every occasion on which the bed was examined, in March, September and December, both when the water was fresh and when it was as salt as the sea outside the lake. None of the females are ovigerous.

The species is very abundant in the natural cavities of laterite blocks in the Ennur backwater near Madras, where, as in the Chilka Lake, it appears to be entirely aquatic in habits. It was found at Ennur also, amongst clumps of oysters. The specimens are larger than those from the Chilka Lake; the carapace of a male being 8 mm. long and 10.2 mm. in breadth; the collection was made in January 1915, in water of specific gravity 1.0025, and includes a number of ovigerous females.

The only other specimen known is the individual described by de Man and found on the sea-shore at Batavia.

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<sup>1</sup> The teeth found in *Sesarma murrayi* at the proximal end of this margin are not present in *S. batavicum*.

<sup>2</sup> De Man, *Notes Leyden Mus.*, XII, p. 97 (1890) and *Zool. Jahrb., Syst.*, IX, p. 181 (1895).

<sup>3</sup> Calman, *Proc. Zool. Soc., Londn*, p. 709 (1909).

Subfamily *PLAGUSIINAE*.Genus *PLAGUSIA*, Latreille.*Plagusia depressa* (Fabricius), subsp. *tuberculata*, Lamarck.

1900. *Plagusia depressa* var. *squamosa*, Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 437.  
 1906. *Plagusia depressa* vars. *tuberculata* and *immaculata*, Laurie, *Rep. Pearl Oyster Fisheries, Ceylon*, V, pp. 429, 430.  
 1906. *Plagusia depressa tuberculata* and *P. immaculata*, Rathbun, *Bull. U.S. Fish Comm. for 1903*, III, pp. 841, 842.  
 1907. *Plagusia orientalis* and (?) *P. depressa*, Stimpson, *Smithson. Misc. Coll.*, XLIX, p. 122.  
 1910. *Plagusia tuberculata*, Rathbun, *Proc. U.S. Nat. Mus.*, XXXVIII, p. 590, and footnotes to references by Stimpson (*op. cit.*).  
 1910. *Plagusia depressa tuberculata*, Rathbun, *Danske Vidensk. Selsk. Skrifter (7), Naturvid. og math.*, V, p. 330.

As Laurie and Miss Rathbun have remarked it is probably best, in view of the uncertainty that exists regarding the identity of Herbst's *Cancer squamosus*, to avoid the use of that term as a varietal or sub-specific name. Examination of the specimens in the Indian Museum leads me to believe that Alcock was right in refusing to recognise more than one form of the species in Indian waters. The series shows every possible intergradation between the vars. *tuberculata* and *immaculata* as defined by Laurie.

The only individual obtained in the Chilka Lake is extremely small, the carapace being 7 mm. in length. The tubercles on the dorsal surface are much depressed, but are heavily fringed with setae.

The specimen was obtained in the outer channel in March 1914, at the time when the water was salt. It was found clinging to a pole that served to mark the deep water passage in the vicinity of Satpara. No specimens were observed when the water was fresh and the species is doubtless to be regarded as a casual visitor to the lake-system.

The subspecies *tuberculata*, which is frequently found on floating timber far out at sea, has a very wide Indo-pacific distribution, extending from the Red Sea and East Africa to the western coasts of America from Lower California to Chili.

Family *GEOCARCINIDAE*.Genus *CARDIOSOMA*, Latreille.*Cardiosoma carnifex* (Herbst).

1900. *Cardiosoma carnifex*, Alcock, *Journ. Asiat. Soc. Bengal*, LXIX, p. 445.  
 1907. *Cardiosoma carnifex*, Rathbun, *Mem. Mus. Comp. Zool., Harvard*, XXXV, p. 26.

The two specimens found in the Chilka Lake agree closely with other examples in the Indian Museum and differ from *C. hirtipes*, Dana<sup>1</sup>, in the characters noted by Alcock and Miss Rathbun. There seems, however, to be some variation in the degree

<sup>1</sup> Miss Rathbun [*Bull. U.S. Fish Comm. for 1903*, pt. 3, p. 838 (1906)] identifies this species with the earlier *Thelphusa rotunda* of Quoy and Gaimard.

of hairiness of the ambulatory legs. In the specimens from the Chilka Lake the hairs are much more numerous than in an individual from the Andamans and occur over almost the entire length of the upper border of the merus.

Miss Rathbun<sup>1</sup> has given a fresh diagnosis of the allied West Indian *C. guanhumi*, Latreille, which leads me to suppose that the species is distinct from *C. carnifex*.

The two specimens are both males and are 61.5 and 62.5 mm. in length and 73.5 and 74 mm. in breadth.

The colour in life is striking. The dorsal surface of the carapace is livid purple with a close and fine reticulation of yellowish-green which gradually disappears towards the sides and is densest in the central part of the cardiac region. The hepatic regions and the sides of the carapace are lilac. The ventral surface is cream-coloured, the epistome tinged with purple. The chelipedes are cream-coloured, deepening to yellow on the palm and fixed finger and suffused on the dorsal surface of the merus and carpus with purple. The extreme tips of the fingers are brown. The basal joints of the walking legs are yellowish; the merus, carpus and propodus are deeply tinged with purple and bear dark brown hairs; the dactylus is orange yellow.

Colonies of this species inhabit the islands in the outer channel near Manikpatna. In March 1914, when the water was low and as salt as that of the sea outside the lake, large burrows of *C. carnifex* were found, their mouths often four or five inches in diameter. Similar burrows were noticed below the surface of the water in the vicinity and, on the shore, fragments of specimens that had been eaten by birds were abundant. In September, when the water in the outer channel was fresh, the species was also in evidence, but on this occasion, owing to the rise in the water-level, most of the burrows were below the surface. The crabs seem to live at a considerable depth in the mud and, as a rule, do not wander by day; it was in consequence difficult to obtain specimens.

#### Family XANTHIDAE.

#### Genus HETEROPANOPE, Stimpson.

1898. *Heteropanope*, Alcock, *Journ. Asiat. Soc. Bengal*, LXVII, p. 207.

1907. *Heteropanope*, Stimpson, *Smithson. Misc. Coll.*, LXIX, p. 62.

#### *Heteropanope indica*, de Man.

1888. *Heteropanope ináica*, de Man, *Journ. Linn. Soc.*, XXII, p. 53, pl. iii, figs. 1, 2.

1898. *Heteropanope indica*, Alcock, *Journ. Asiat. Soc. Bengal*, LXVII, p. 208.

I have compared the specimens in the collection with the individual recorded by Alcock, apparently one of the two examples on which de Man based his original description, and find them in perfect agreement.

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<sup>1</sup> Rathbun, *Bull. U. S. Fish Comm. for 1900*, XX, pt. 2, p. 15 (1902).

The larger chelipede of the female, which de Man was unable to examine in the material at his disposal, is as large as that of the adult male; but the carpus, instead of being smooth, is coarsely and irregularly granulate, the granules forming definite rows or groups near the distal margin. The palm also bears definite granules on its upper edge and on the outer surface at the base of the fingers.

The figure given by de Man is a trifle misleading, for the species is represented a little longer and less transverse than it really is and there is only a faint indication of the transverse granular ridge in the vicinity of the third tooth of the antero-lateral margin. This ridge, which is conspicuous in all the specimens, is of some importance, as it is absent in the closely allied species *H. africana*, de Man.<sup>1</sup> In our specimens the chelae are of a uniform dull yellowish or brownish colour, with the fingers black from tip to base; I have not seen any individual in which the colour resembles that shown in de Man's figure.

*Heteropanope indica* is represented in the collection by twenty specimens. The carapace in the largest example, a male, is 15.2 mm. in length and 22.2 mm. in breadth. In ovigerous females the carapace varies from 9.6 to 14.4 mm. in length.

With the exception of a single individual found on a post, placed to mark the position of the deep water passage near Satpara, all the specimens were obtained on the oyster-bed in the vicinity of Manikpatna. They were found living in the dead and gaping shells and in the chinks and cranies between them and were obtained both when the water was fresh and when it was as salt as the Bay of Bengal near the mouth of the lake. The ovigerous females were taken in the months of March and December.

A single specimen was taken by Dr. Annandale in the Ennur backwater, near Madras, in January 1915, also among oysters.

The species was hitherto known only from the two type specimens, obtained in the Mergui Archipelago.

#### Genus LEIPOCTEN, nov.

Carapace but little broader than long, subquadrilateral, slightly convex both fore and aft and from side to side, not or scarcely areolated, sparsely tuberculate and densely tomentose. Antero-lateral borders entire except for isolated tubercles, or cut into one or two blunt crenulate lobes in addition to outer orbital angles. Postero-lateral borders very short.

Front rather less than a third the greatest breadth of carapace, slightly deflexed, not notched in the middle line; the lateral angles prominent in a facial view.

Fronto-orbital border four-fifths the breadth of carapace. Orbits large, without fissures or sutures. Basal antennal segment short and broad, its inner angle touching the front, the flagellum standing in the orbit.

Antennular region and epistome very short in a fore and aft direction; the latter almost obliterated, especially in the middle where the front almost touches the strongly rounded anterior margin of the buccal cavern. Crests of endostome, defining the

<sup>1</sup> De Man, *Bull. Mus. d'Hist. nat. Paris*, VIII, p. 244, text-figs. 1, 2 (1902).

expiratory channels, not very strong but continued to anterior margin. Buccal cavern broader than long; its lateral borders on either side defined by two conspicuous ridges enclosing a deep trough.

External maxillipedes large. Ischium and merus smooth, the former quadrate with concave anterior (sutural) border. Merus about as long as broad, larger than ischium; inner margin strongly curved, outer margin partially overlapping exopod, anterior margin with a small process external to insertion of palp.

Chelipedes equal in both sexes, much larger in the male than in the female. Palm of chela in female sharply spinulose, fingers without teeth internally. Chela of male swollen, for the most part smooth; inner margin of dactylus with one great tooth at proximal end; tips of fingers not spooned. Walking legs short and stout, meral segments somewhat dilated with large spinous tubercles arranged, as seen from below, in a U-shaped figure. Legs shaggy.

Abdomen of male composed of six segments, the first four, though with distinct sutures, apparently forming a single immovable piece.

Type,—*Leipocten sordidulum*, sp. nov.

The affinities of this genus are obscure. The complete character of the endostomial ridges indicates a position in the section Hyperomerista and of the subfamilies that Alcock includes in this section it agrees more nearly with the Eriphiinae than with any other. From the Eriphiinae it differs in the narrower front and shorter postero-lateral borders, in the form of the outer maxillipedes, in the presence of a double keel on either side of the buccal cavern and in the peculiar spinulation of the walking legs. It clearly cannot be classed with any of the "alliances" of Eriphiinae recognised by Alcock and is perhaps better regarded as the type of a distinct subfamily.

### *Leipocten sordidulum*, sp. nov.

(Plate XII, fig. 9.)

The carapace is subquadrilateral, broader than long in the proportion of 19 or 20 to 15. The antero-lateral borders are subparallel, only a little divergent posteriorly, and are nearly one and half times the length of the postero-lateral. The dorsal surface is slightly convex in both longitudinal and transverse directions—more so in females than in males—and shows only the faintest traces of areolation.

When the dense tomentum is removed, the surface is found to be finely pitted and to bear small pearly grey tubercles, extremely variable in their number and disposition. In some female individuals they are more abundant than in the specimen figured on plate xii, covering the entire surface, in others they are less numerous, while in males they are frequently altogether absent except in the vicinity of the lateral margin. Certain tubercles near the junction of the antero- and postero-lateral borders and a few above the base of the last legs are, as a rule, larger and more conspicuous than the rest.

Even greater variation is shown in the structure of the antero-lateral border. In

the female figured on plate xii, which is extreme in this respect, the margin only bears large scattered tubercles behind the acute orbital angle; in other females and in most males the tubercles are aggregated to form one or two protrusions or lobes which, in some cases, are separated by definite emarginations of the border (text-figs. 17b, 17c).

The front is one-third or a little less than one-third the greatest breadth of the carapace and is only very slightly deflexed. Dorsally it exhibits feeble longitudinal depressions in the middle and near the inner border of each orbit, and there are faint indications of a pair of pre-gastric lobes.

The anterior margin is straight in dorsal view; but, seen from in front, it projects downwards in the middle and at the lateral angles (text-fig. 16).

The fronto-orbital border is about three quarters the greatest breadth of the carapace.<sup>1</sup> The upper margin of the orbit is a little sinuous and is sometimes, but not always, obscurely crenulate in part or in all of its course. The inferior margin is evenly curved and crenulate, meeting the upper margin externally without any appreciable gap or emargination. The side-walls of the carapace beneath the antero-

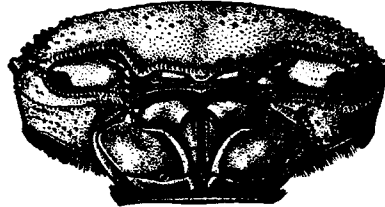


FIG. 16.—*Leipocten sordidulum*, gen. et sp. nov.  
Carapace of a female, seen from in front.

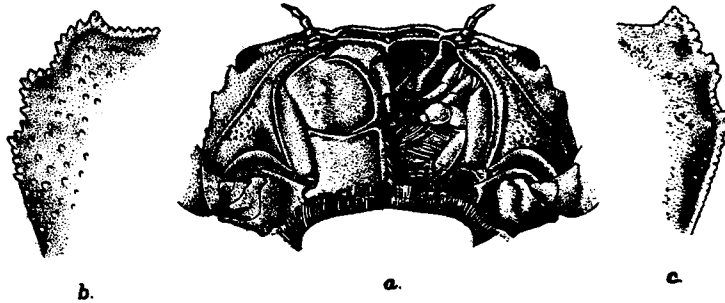


FIG. 17.—*Leipocten sordidulum*, gen. et sp. nov.  
a. Anterior portion of carapace from below, left outer maxillipede removed.  
b. Antero-lateral margin of carapace of a female from Madras.  
c. do. do. of a male from Madras.

lateral border are smooth or feebly tuberculate and are traversed by a finely beaded line that extends from the outer angle of the epistome to the enlarged tubercles above the base of the last leg. The true infero-lateral border is also finely beaded. The posterior border is straight in both sexes and about as long as the front; it is traversed by two beaded lines, rather widely separated and continuous with that on the infero-lateral edge.

<sup>1</sup> It varies from 0.65 to 0.8 times the greatest breadth.

The opening of the buccal cavern is transversely oval, widest in the middle. Its lateral border is formed by a pair of sharp ridges, that coalesce both in front and behind and enclose a deep trough formed to receive the outer edge of the exopod of the third maxillipedes (text-fig. 17a). The structure of the latter appendages is sufficiently described under the generic heading.

The chelipedes are much larger in the male than in the female, but are symmetrical in both sexes. In the female they are a little shorter, and in the male about a third longer than the breadth of the carapace. The merus is trigonal, with the

upper and outer margins serrated and often with a few tubercles beneath; in the male it is about as broad as long. The carpus of the male does not bear a spine at the inner angle; but the inner margins, as seen in dorsal view, are coarsely serrate. In the female the carpus is more elongate; it bears low tubercles or sharp spinules along its inner and distal borders and sometimes a longitudinal row on its upper surface as well. The chelae of the male are greatly enlarged, each is about twice as long as broad (text-fig. 18a). Externally the palm is quite smooth, except that near the carpal articulation there is a patch of low granules which are continued in single row almost to the base of the dactylus. The upper border of the palm also bears granules, irregular in their disposition; the inner surface and the lower border are smooth.

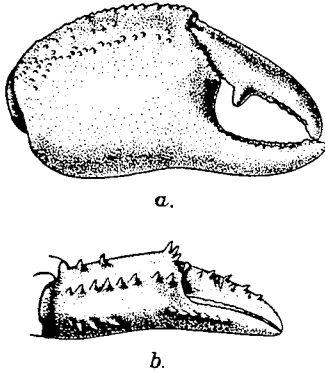


FIG. 18.—*Leisposten sordidulum*,  
gen. et sp. nov.

a. Chela of male.      b. Chela of female.  
Tomentum not represented in b.

The fingers are not grooved and are not spooned at the tips; in adults they meet only at the tips. Each finger is provided internally with three rows of low and inconspicuous tubercles and at the base of the dactylus, which is a little longer than the upper border of the palm, there is a huge blunt tooth.

The chela of the female is slender and widely different from that of the male (text-fig. 18b). It is more than three times as long as wide and the palm, on its upper border and outer surface, bears three or four rows of large spinules, the lowermost being continued on to the fixed finger. The fingers are not armed internally and meet throughout their length when the claw is closed; the dactylus bears small spines and is a trifle shorter than the palm. The chelipedes of the female are densely tomentose, whereas in the male they are almost bare.

The walking legs are short and stout. The upper surface of the merus bears scattered tubercles, sometimes very conspicuous in the female, less well developed as a rule in males; the anterior border is feebly crenulate. On the posterior border and lower surface of the merus are spinules and tubercles, very characteristic in their disposition (text-fig. 19). The posterior border bears a row of spinules of varying size, one or two being as a rule much larger than any of the others. The row



extends back proximally to a point not far from the articulation of the ischium, then turns across the inferior face of the segment in the form of a series of slender teeth with blunt tips and is continued obliquely outwards to the antero-inferior angle of themero-carpal joint. In the last part of their course the spinules are widely separated and are reduced to small tubercles; but, close to the carpus, they are more closely set and form a finely serrate crest. The spinules are better developed in the female than in the male; seen from below they present a U-shaped figure, the upper extremities of the U being situated on either side of themero-carpal joint. The carpus and propodus are short and swollen and bear a few blunt teeth distally. The dactylus is conical and slightly curved.



FIG. 19.—*Leipocten sordidulum*,  
gen. et sp. nov.  
Fourth pereopod viewed obliquely from below.

The form of the abdomen in the male and female is shown in text-figs. 20a and 20b.

Except for the chelipedes of the male the entire upper surface of the animal is densely clothed with a fine woolly hair that retains large quantities of mud and can only be removed with considerable difficulty. Interspersed among the hairs are numerous large black bristles.

The carapace of the largest female is 8.1 mm. in breadth, that of the largest male 6.5 mm.

Of this curious and variable species five females only were obtained in the Chilka Lake. All were found hiding among shells on the oyster-bed in the outer channel opposite Manikpatna. Two individuals were taken in March in water as salt as that of the Bay of Bengal in the vicinity of the lake (sp. gr. 1.0265), one in September in water that was quite fresh and two in December in water of specific gravity 1.025. One of the specimens found on the last of these occasions is ovigerous.

A fine series of specimens, consisting of ten males and twenty-seven females, mostly ovigerous, was obtained by Dr. Annandale in the Ennur backwater near Madras in January 1915. They were found in cavities in laterite blocks forming a sea wall, submerged at high water. The specific gravity of the water was 1.0025.

The types of the species bear the numbers 9163-4/10 in the Museum register.

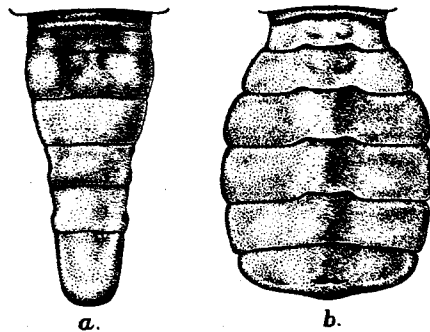


FIG. 20.—*Leipocten sordidulum*, gen. et sp. nov.  
a. Abdomen of male. b. Abdomen of female.

## Family PORTUNIDAE.

## Genus SCYLLA, de Haan.

*Scylla serrata* (Forskål).

1899. *Scylla serrata*, Alcock, *Journ. Asiat. Soc. Bengal*, LXVIII, p. 27.

This species is common in the Chilka Lake, in the outer channel and in the main area, at all seasons of the year and is found both when the water is fresh and when it is as salt as the Bay of Bengal in the vicinity.

In young specimens, as Alcock has noted, the frontal lobes are indistinct and there is an interrupted transverse granular line across the gastric region; the latter is conspicuous even in specimens in which the carapace is 50 mm. in breadth.

*Scylla serrata* is the common edible crab of India and is brought into the markets in great numbers. It is abundant in estuaries, backwaters and mangrove swamps and is evidently able to live in water without a trace of salinity. In the Chilka Lake it must exist in fresh water for several months in the year and large specimens have been taken in the Gangetic delta far beyond the reach of tidal influence. The carapace of a male found under these conditions at Gatiaghar in the Hughli district is 135 mm. in breadth. The species, however, grows to a much greater size than this. In a giant male in the Indian Museum the carapace is 147 mm. in length and 211 mm. in breadth, the length of the larger chela being 195 mm. This individual is, I believe, the largest specimen known.

Examples of the Cirripede, *Dichelaspis cor*, Aurivillius, are commonly found attached to the branchiae of specimens found in the outer channel, but were never obtained on individuals caught in the main area of the lake.

*Scylla serrata* has a very wide Indo-pacific distribution extending from the Red Sea and the eastern coasts of Africa to Japan, New Zealand and Oceania. It is apparently not found at the Hawaiian Is.

## Genus NEPTUNUS, de Haan.

1899. *Neptunus*, Alcock, *Journ. Asiat. Soc. Bengal*, LXVIII, p. 28.

1897. *Portunus*, Rathbun, *Proc. Biol. Soc. Washington*, II, p. 155.

1908. *Lupa*, Stebbing, *Ann. S. African Mus.*, VI, p. 11.<sup>1</sup>

Those interested in the question of the suppression of this long established name should consult the papers by Miss Rathbun and Stebbing cited above.

*Neptunus pelagicus* (Linnaeus).

1899. *Neptunus pelagicus*, Alcock, *Journ. Asiat. Soc. Bengal*, LXVIII, p. 34.

This species is common in the Chilka Lake, both in the outer channel and in the main area; like *Scylla serrata* it is used as an article of food. It is, apparently, un-affected by alterations in salinity and is equally abundant at all seasons of the year.

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In this paper Stebbing supports the claims of *Lupa* against those advanced by Miss Rathbun for us. To these arguments Miss Rathbun has not, I believe, made any reply, yet continues to use for the species so long known by the unequivocal *Neptunus*, de Haan.

In very young specimens the carapace is proportionately much longer than in adults and the frontal margin is entire and not cut into teeth.

The range of the species in the Indo-pacific region is closely similar to that of *Scylla serrata*.

#### Genus THALAMITA, Latreille.

##### *Thalamita crenata*, Latreille.

1899. *Thalamita crenata*, Alcock, *Journ. Asiat. Soc. Bengal*, LXVIII, p. 76.

This species is not uncommon on the oyster-beds at Manikpatna in the outer channel of the Chilka Lake and was found both when the water was fresh and when it was salt. It does not, in our experience, occur in the main area of the lake.

The distribution of *T. crenata* is co-extensive with that of the two preceding species.

#### Tribe PAGURIDEA.

We are indebted to Dr. J. R. Henderson, Superintendent of the Madras Museum, for an account of the hermit-crabs of the Chilka Lake.<sup>1</sup>

The species identified by Dr. Henderson are seven in number. One of these is a form hitherto unknown, which is described under the name of *Clibanarius olivaceus*, and another, *Diogenes miles* (Herbst), is represented by a single individual obtained on the sea-shore near Rambha. The latter species is not a member of the lake fauna proper; it may perhaps wander at times to the shores of the outer channel, though we never found it there.

It is noteworthy that most of the Paguridea found in the lake are represented only by very small specimens. This is possibly due to the fact that their environment, with its great seasonal changes in salinity, hinders a more complete development; but it seems more probable that it is caused by the absence of any shells large enough to accommodate full-grown specimens. Except for a few *Telescopium fuscum*, found in the outer channel and frequently inhabited by moderate-sized *Clibanarius padavensis*, the largest gastropod both in this part of the lake and in the main area is *Thais* (= *Purpura*) *carinifera*, a shell much too small to accommodate large individuals of any species except *Diogenes avarus*. In the main area the distribution of *Thais* is restricted and coincides with that of *Clibanarius*.

#### Family PAGURIDAE.

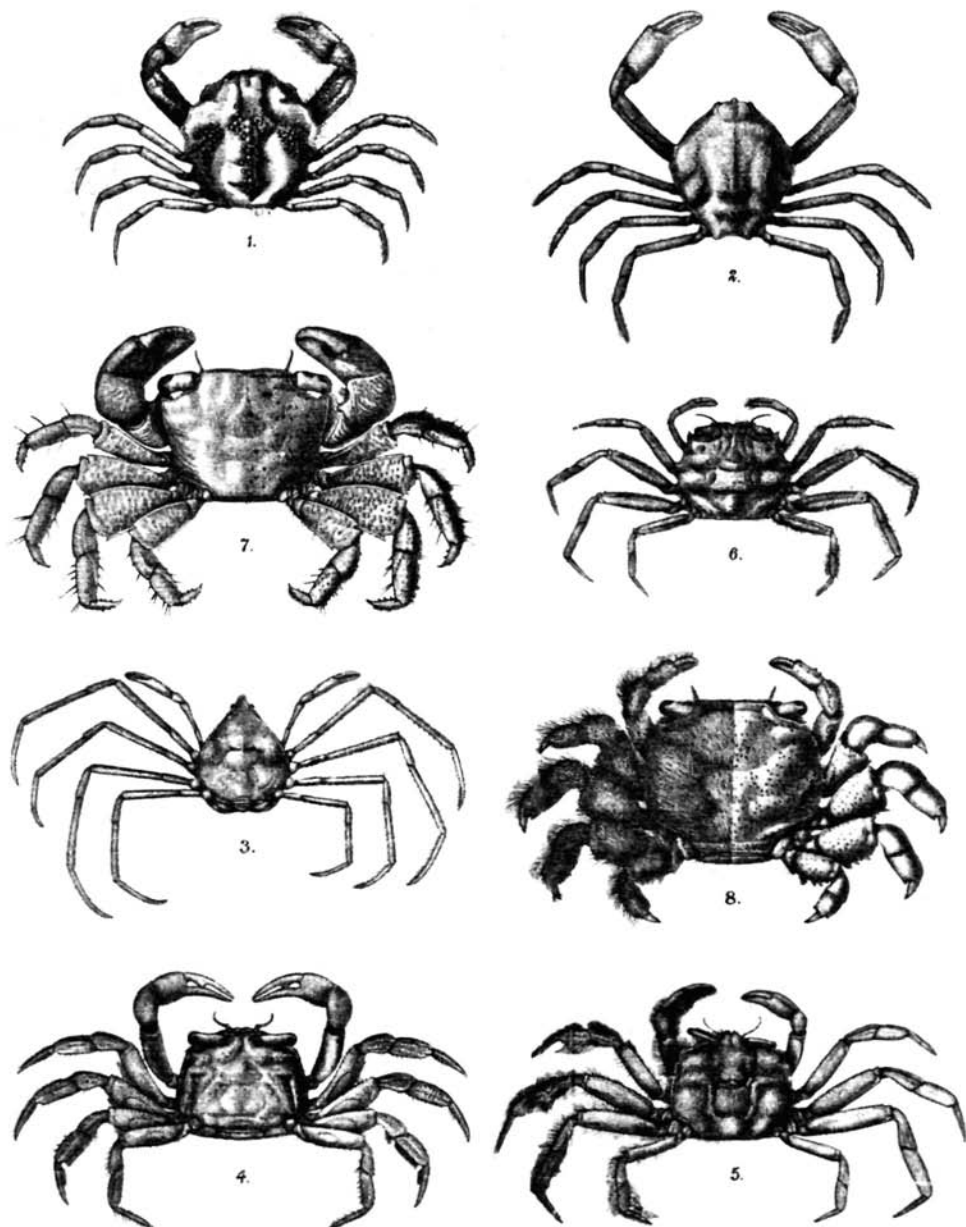
##### Genus CLIBANARIUS, Dana.

The three species of this genus found in the Chilka Lake are very closely allied to one another; but, as Henderson has pointed out, are readily distinguished by their colouration. *C. padavensis* and *C. longitarsis* are very widely distributed forms, and all three are essentially inhabitants of brackish water.

<sup>1</sup> Henderson, *Rec. Ind. Mus.*, XI, p. 25 (1915).

EXPLANATION OF PLATE XII.

- FIG. 1.—*Ebalia malefactorix*, sp. nov., male  $\times 2\frac{1}{2}$  (p. 209).  
,, 2.—*Philyra alcocki*, sp. nov., male  $\times 2\frac{1}{4}$  (p. 212).  
,, 3.—*Elamena (Trigonoplax) cimex*, sp. nov., female  $\times 2\frac{1}{2}$  (p. 216).  
,, 4.—*Dotilla pertinax*, sp. nov., male  $\times 4$  (p. 222).  
,, 5.—*Macrophthalmus gastrodes*, sp. nov., male  $\times 1\frac{1}{3}$  (p. 228).  
,, 6.—*Camptandrium sexdentatum*, Stimpson, young male  $\times 5\frac{1}{3}$  (p. 236).  
,, 7.—*Sesarma batavicum*, Moreira, male  $\times 3\frac{1}{2}$  (p. 238).  
,, 8.—*Leipocten sordidulum*, gen. et sp. nov., female  $\times 4\frac{2}{3}$  (p. 244).



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CRUSTACEA DECAPODA OF THE CHILKA LAKE.

Revised Edition