

FURTHER NOTES ON CRUSTACEA DECAPODA IN THE INDIAN MUSEUM.

II. ON SOME DECAPOD CRUSTACEA FOUND IN THE CLOACA OF HOLOTHURIANS.

By B. CHOPRA, D.Sc., F.L.S., Zoological Survey of India, Calcutta.

(Plate VII.)

Early last year Mr. D. D. Mukerji, Laboratory Assistant, Zoological Survey of India, brought back from the Andamans, among other things, a small miscellaneous collection of the animals that he found living in the cloaca of the large black Holothurians¹ that are very common round about Cinque Island in the South Andamans. He was particularly looking for the small interesting fish *Fierasfer* that is known to live in this curious habitat, and for that purpose had occasion to dissect quite a large number of these Holothurians. He not only got the fish that he was looking for, but also made a collection of a number of very interesting Decapod Crustacea from this habitat. Most of the species in Mr. Mukerji's collection are represented by single specimens, and as some of these, at any rate, appeared to be remarkable, I made attempts to obtain more specimens from the same locality. Dr. S. B. Setna, Officiating Assistant Superintendent, Zoological Survey of India, who was at the time stationed at Port Blair in connection with the Shell Fisheries there, at my request opened up a large number of Holothurians, from different localities and at different times, extending over a period of about two months, and though he sent me a large collection, he was unfortunately unable to obtain most of the species represented in Mr. Mukerji's collection. Further attempts made by Mr. K. N. Das, Laboratory Assistant, Zoological Survey of India, have been equally unsuccessful; he too has not been able to obtain most of the species brought back by Mr. Mukerji. This may perhaps be accounted for by the fact that whereas a number of species of animals, like some Pinnotherid crabs, for instance, normally live in Holothurians, there are others that visit this habitat only very occasionally for protection, or perhaps in search of food. This appears certainly to be the case with the Oxyrhynchid crabs *Achaeus* and *Menaethius*, and possibly with the Portunid *Lissocarcinus* also. It will thus be seen that whereas any extensive collection made from Holothurians is almost certain to contain Pinnotherid crabs, representatives of other genera are likely to be met with only rarely.

Besides the specimens collected by Mr. Mukerji, Dr. Setna and Mr. Das, I have obtained some additional material by looking through the unnamed collections of the Zoological Survey of India. All the specimens

¹ A specimen of the Holothurian brought back by Mr. Mukerji has been identified by Dr. H. S. Rao as *Actinopyga mauritiana* (Quoy and Gaimard).

thus obtained are of Pinnotherid crabs, and unfortunately none of the other genera is represented.

The collection I have examined comprises seven species: one of *Natantia* and six of *Reptantia Brachyura*. Among the latter I have described a new species of the Portunid genus *Lissocarcinus*, and have also felt it necessary to add two new species to *Pinnotheres*—a genus in which unfortunately the species are already rather perplexingly numerous. I give below a list of the species dealt with in the present note:—

Family Palaemonidae.

Conchodytes tridacnae Peters.

Family Portunidae.

Lissocarcinus ornatus, sp. nov.

Family Pinnotheridae.

Pinnotheres villosissimus Doflein.

Pinnotheres setnai, sp. nov.

Pinnotheres deccanensis, sp. nov.

Family Maiidae.

Achaeus affinis Miers.

Menaethius monoceros (Latreille) M.-Edwards.

Of the four genera of crabs represented in the collection, members of the genus *Pinnotheres* are already known to live as commensals with Holothurians and bivalve Molluscs. Some species are free living also, and in a number of cases females only are commensals, while the males are exclusively, or for the major part of their life, free living. The females usually far outnumber the males and several species are described from females only. Of the three species described by me one, *Pinnotheres villosissimus*, is remarkable for the fact that the body and appendages of the animal are very densely covered with fur-like feathered hairs, giving it a superficial resemblance to certain Xanthid crabs. This species was so far known from a single female specimen; I have examined a large number of examples and have thus been able to amplify Doflein's original description of it. Most of the species of the genus *Lissocarcinus* are free swimming, but one species has been recorded from a Salp, and another is already known to live in a Holothurian. The other two genera, *Achaeus* and *Menaethius*, are so far known to be exclusively free living, and their occurrence inside Holothurians is of interest. But as mentioned above they appear only to be chance, or perhaps occasional, visitors to this habitat.

The case of the Caridean shrimp *Conchodytes tridacnae* is perhaps of greater interest. The different species of the genus *Conchodytes* normally live in the mantle cavity of Lamellibranch molluscs, and though there is hardly any recognisable specific relationship between the crustacean and the mollusc, one species of the former is generally restricted to one particular genus of the latter. This as a rule holds good in most cases of specialized commensalism and parasitism—a particular species of crab or shrimp, or whatever the animal may be, is generally associated with a particular genus of the "host" or at most with a group of more or less allied "host"-genera. The occurrence in Holothurians of the members of a species hitherto known to live

exclusively in the mantle cavity of *Tridacna* is, therefore, somewhat remarkable.

In addition to the Decapod Crustacea listed above, Holothurians appear to provide shelter and food (or perhaps shelter alone) to a number of other animals also. The small fish *Fierasfer homei* Richardson¹ (or *Carapus homei*, as it is now called) is, as mentioned above, very commonly met with in the cloaca of Holothurians. A small, probably a young, specimen of a Gastropod mollusc of the genus *Cypraea* is in the collection, and a Polychaete worm has also been collected. The latter belongs to the family Aphroditidae, and is in a fragmentary condition. Besides these there is, encrusted on the carapace, a little behind the rostrum, close to one of the antero-lateral margins of the crab *Menaethius*, what appears to be a part of the test of a Tunicate. A large number of spheroid spicules that are so characteristic of Tunicates can be made out, along with a few skeletons of Foraminifera, but no trace of the internal structure of the Tunicate has been seen.² There is also, attached to one of the Pinnotherid crabs, on the undersurface of the arm of the cheliped, a small bivalve mollusc, probably belonging to the family Tellinidae. The specimen is apparently a young one, and is attached to the crab by catching hold of some of the long hairs on the arm between its two valves.

The exact relationship of the crabs with the Holothurian is not definitely known. There is no doubt that the Holothurian provides them with shelter and a safe retreat from the perils they would encounter outside, and through its activity sufficient food also is provided to them. The association between the Holothurian and the crabs would, therefore, appear to be of the nature of commensalism, the crabs and the Holothurian sharing the same food. The Holothurian, however, does not apparently derive any benefit from this association, and in so far as some of the crabs, like Pinnotherids at any rate, deprive it of a portion of its food, they may be regarded as parasites also. This latter view is further strengthened by the fact that the Pinnotherid crabs show one of the important characteristics of parasites in being somewhat degenerate in structure. Among other such characters may be mentioned the soft carapace, the degenerate sense organs like the eyes and antennules, and the production of a large number of eggs. The same is perhaps partly true of the Pontonine *Conchodytes* also. Some of the other animals, like the fish *Fierasfer*, at any rate, probably live inside the Holothurian only as a measure of defence. It is stated that the fish feeds in a normal manner, going out of the Holothurian for this purpose, and darting back to its shelter at the approach of danger. Perhaps the two Oxyrhynchid crabs *Achaeus* and *Menaethius* also frequent this habitat occasionally for the sake of shelter, but in the absence of any direct observations it is difficult to express any definite opinion on the nature of their association.

I am thankful to Mr. D. D. Mukerji for making the interesting collection which forms the basis of this note. Dr. S. B. Setna and Mr. K. N.

¹ I am obliged to Mr. D. D. Mukerji for the name of this fish.

² The Polychaete and the Tunicate have been examined by my colleague Dr. H. S. Rao, and the Molluscs by Dr. B. Prashad, for which my best thanks are due to them.

Das also took a lot of trouble and made large collections of Pinnotherid crabs for me. Dr. Bains Prasad, Superintendent, Zoological Survey of India, has been helping me with suggestions and advice in the course of my work.

The drawings illustrating this paper have been made by Babu A. C. Choudhary with his usual skill, for which my best thanks are due to him.

The types of the new species are in the collections of the Zoological Survey of India, and are preserved in the Indian Museum at Calcutta.

DECAPODA NATANTIA.

Tribe CARIDEA.

Family PALAEMONIDAE.

Sub-family PONTONIINAE.

Conchodytes tridacnae Peters.

1917. *Conchodytes tridacnae*, Borradaile, *Trans. Linn. Soc. London* (2) Zool. XVII p. 393.

1922. *Conchodytes tridacnae*, Kemp. *Rec. Ind. Mus.* XXIV, pp. 283-285.

Two specimens, an egg-bearing female and a male, collected in the Andamans, are referred to this species. I have carefully compared the specimens with the published descriptions of the species, as also with a number of specimens from the Andamans, identified by Kemp, that are preserved in the Indian Museum collections, and have no doubt of their identity. In the shape and size of the rostrum, in the shape of the outer distal angle of the basal segment of the antennular peduncle, in the proportionate length of the merus and carpus of the first peraeopod, in the shape and arrangement of the two claws and the basal protuberance on the dactyli of the walking legs, in the size and disposition of the dorsal and terminal spines of the telson, and, in fact, in all the points mentioned by Kemp for the characterisation of this species, the present specimens show a very close resemblance to Peters' species.

Of the two specimens the female is about 30 mm. long, while the male, as usual, is considerably smaller. They were collected in the cloaca of a Holothurian, off Cinque Island, in the South Andamans, by Mr. D. D. Mukerji, in April, 1930. In the Museum collection there are specimens from the Andamans, Laccadives, and a single example from Torres Straits. The species is probably widely distributed all over the Indo-Pacific region.

C. tridacnae, as the specific name indicates, was so far known to live in the mantle cavity of the bivalve *Tridacna* only, the other members of the genus also living in some other genera of bivalve molluscs. With the possible exception of *C. meleagrinae* Peters, which though generally living in the bivalve *Meleagrina*, according to Borradaile sometimes occurs in *Tridacna* also, every species of *Conchodytes* has hitherto been found to be restricted to a particular genus of bivalves only. The present record of *C. tridacnae* living in a Holothurian is, therefore, very remarkable.

DECAPODA REPTANTIA.

Section BRACHYURA.

Tribe BRACHYGNATHA.

Sub-tribe BRACHYRHYNCHA.

Family PORTUNIDAE.

Sub-family CAPHYRINAE.

***Lissocarcinus ornatus*, sp. nov.**

(Plate VII, fig. 1).

The carapace is subcircular in shape, with the angles prominently marked, so as to give it a somewhat hexagonal appearance. It is distinctly broader than long, and has the margins somewhat thin and lamellar. The antero-lateral margins are of about the same length as the postero-lateral. The front is broad, and is on a higher level than the antero-lateral margins ; it is deeply concave in the middle. The antero-lateral margins are evenly rounded, but are not strongly arched ; the postero-lateral margins are strongly convergent posteriorly, are more or less straight, and meet the semi-circular excavations, in which the basal segments of the last legs are accommodated, in a blunt and obtuse angle. The posterior margin is short, being about a third of the greatest breadth of the carapace, is slightly concave about the middle, and meets the excavations mentioned above in a very obtuse angle.

The carapace is strongly convex in both longitudinal and transverse directions, with the cardiac region somewhat flatter than the rest of the surface. It is smooth, except for a low and somewhat inconspicuous ridge running transversely inwards and slightly forwards, from the last tooth on the antero-lateral margin. This ridge runs on the branchial regions only and does not extend to the middle of the carapace.

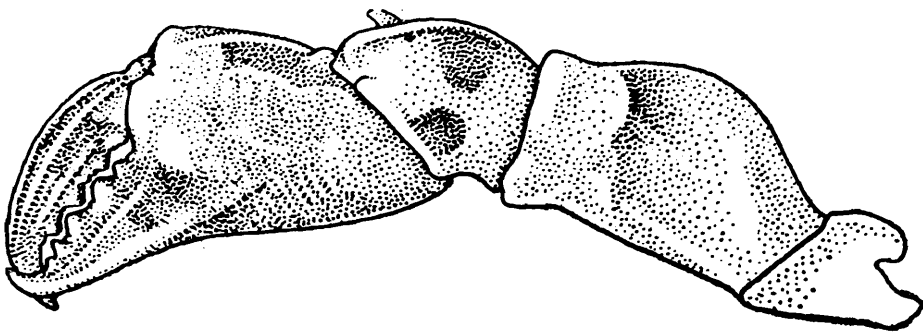
The fronto-orbital border is long, being nearly two-thirds of the greatest breadth of the carapace, and is about twice as long as the posterior margin. Excluding the inner orbital angles, the front is a little more than one-third the greatest width of the carapace. It is somewhat projecting anteriorly, and in the middle line is distinctly a little in advance of the inner orbital angles. Its anterior margin is thin and crest-like, is deeply notched in the middle, and is arched on either side of the notch. The inner orbital angles are broad and rounded, and are not prominent ; they are separated from the front by a broad depression, which gives the frontal margin, on either side of the median notch, a sinuous appearance. The orbits are large, and the supra-orbital margin has a prominent fissure at the junction of its upper and lateral margins, and another less prominent one on the lateral margin, near the base of the outer orbital tooth. The infra-orbital margin is entire, except for a minute fissure, somewhat corresponding in position with the small lateral fissure on the superior margin. The inner angle of the infra-orbital margin ends in a somewhat sharp tooth, and the gap between this angle and

the front is filled by an extension of the antero-external angle of the basal antennal joint.

The antero-lateral margins are also crest-like, and are cut up into five broad lobes (including the outer orbital angle). The incisions cutting up the margin are very narrow, and extend only a little inwards. Except for the outer orbital angle, which is acute, the angles of the other lobes are more or less blunt and rounded. The third and the fourth lobes are somewhat larger than the first two, which are subequal. The margin of the first lobe is slightly concave, that of the second and third more or less straight, while that of the fourth is somewhat rounded. The fifth lobe is more like a blunt tooth, than like any of the lobes preceding it. The distance between the outer orbital angle and the last tooth of the antero-lateral margin is slightly greater than the breadth of the posterior margin.

The antennules fold obliquely. The outer external angle of the basal antennal joint is enlarged so as to fill completely the orbital hiatus to the complete exclusion of the flagellum. This enlarged portion is not carinate.

The chelipeds are subequal in size, and are somewhat longer and considerably stouter than the walking legs. The upper surface of the various segments is only very slightly rugose, and is not conspicuously setose. The merus is more or less smooth, but the outer edge, which is strongly curved, is distinctly setose, and somewhat roughened, especially near its distal end. The inner edge is practically straight, but terminates distally in a broadly rounded lobe. The inferior edge is also straight and smooth, except for a row of setae. The carpus has on its upper surface a prominent ridge, a little on the inside of the outer margin, running almost from the proximal to the distal end. Another ridge, a little less conspicuous than the former, runs in a similar position along the inner edge, while on both the margins themselves there are similar and fairly prominent ridges. The inner edge terminates



TEXT-FIG. 1.—*Lissocarcinus ornatus*, sp. nov.
Cheliped of male: $\times 9$.

at its distal end in a somewhat blunt tooth, while the outer margin also has a blunt lobe at its distal end. In the accompanying illustration, which shows the cheliped from a dorsal view, the prominent ridge a little on the inside of the outer margin can be clearly seen, while projecting from under this margin the blunt tooth on the distal end of the inner margin is seen as a somewhat sharp spine. The blunt lobe on the outer margin is also seen in this view. The upper margin of the

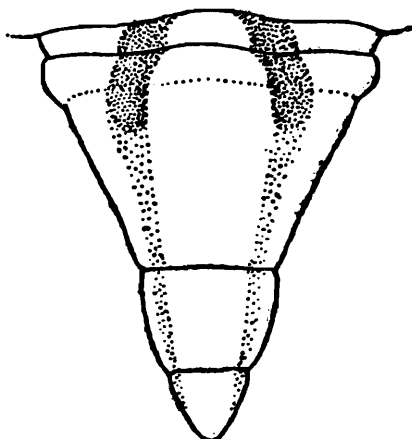
palm is somewhat arched, and ends in a prominent tubercle at its distal end near the articulation of the finger. The palm is quite massive, and its height somewhat exceeds the length of its outer margin. The palm carries on its upper surface two sharp ridges, running almost parallel along the entire length of the margins, and separated from one another by a fairly wide gap. The outer surface is strongly convex, and is not conspicuously rugose. A little below the upper margin is a strong ridge running from end to end of the palm, and another, less conspicuous, ridge runs about the middle of this surface. Except for a low ridge a little below the upper margin, the inner surface of the palm is more or less smooth, and its lower edge, which is also smooth, is somewhat arched. The accompanying text-figure shows the palm from the outer surface, but the ridges on the upper surface of the palm are clearly seen in fig. 1 on plate VII. The fingers are stout and strongly arched, and their cutting edges, which are rather sharp, leave only a slight gap throughout their length. The movable finger has four large bluntly pointed or rounded teeth (excluding the terminal one), while the fixed finger has five. In between each of the larger teeth there are one or two smaller teeth. The tips are strongly pointed, and overlap one another when the fingers meet. On both the fingers there are sharp ridges, separated by fairly deep V-shaped grooves, as in *L. arkati* Kemp.¹ The outer edge of the movable finger is distinctly crested, while a little below this edge, on the outer surface of the finger, is a very prominent ridge. Another ridge, less conspicuous than the former, starts a little proximally to the finger-tip, and runs in an oblique direction towards the base of the finger, so as to leave a V-shaped depression between the two. On the outer surface of the fixed finger also, there are two sharp ridges, with a deep V-shaped groove between them. The lower of these ridges, which runs close and parallel to the lower margin of the finger, extends backwards on the palm also. There are ridges on the inner surface of the fingers also, more or less corresponding to the ridges on the outer surface.

The walking legs are subequal in size, and are somewhat shorter than the chelipeds. The merus is more or less smooth, while the carpus has its upper border, and the propodus both the borders somewhat cristate. The lower border of the propodus does not end in a tooth in any of the legs. The dactylus is slender and lanceolate, and seems to have its surface covered with a number of very fine ridges. It carries a few hairs along its lower border, and ends in a yellowish corneous tip. The last pair of legs are subdorsal in position. The merus is considerably more than twice as long as broad, and does not carry any setae along its anterior or posterior borders. The last two segments are broad and lamellar, and have a conspicuous row of setae along their posterior borders. The dactylus is almost twice as long as broad, and is pointed at the tip, where it is armed with a corneous sharp spine.

The abdomen in the male is as in other species of the genus. It is formed of five pieces only, the 3rd—5th abdominal tergites being fused. The sixth tergite is a little less than $1\frac{1}{2}$ times as long as its breadth at

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

the distal end, and has its lateral borders convex. The terminal segment is broadly rounded distally.



TEXT-FIG. 2.—*Lissocarcinus ornatus*, sp. nov.
Abdomen of male : $\times 9$.

The only male specimen that I have examined has the following measurements in millimetres :—

Length of carapace	7.8
Breadth of carapace	9.2
Fonto-orbital breadth	6.0
Breadth of front (excluding inner orbital angle)	3.9
Breadth of posterior margin	3.0

The species seems to have a very characteristic colouring. In spirit the specimen has a very pale yellowish colour, and the carapace is covered with a number of large spots of a purplish-brown colour, which are more or less symmetrically arranged. The chelipeds and the legs are also encircled with bands of the same colour. The colour pattern is clearly brought out in the accompanying illustration (plate VII, fig. 1).

Type-specimen.—C 1519/1, Zoological Survey of India (*Ind. Mus.*).

Locality.—The single specimen that I have examined was collected by Mr. D. D. Mukerji, off Cinque Island, Andamans, in April, 1930. It was found in the cloaca of the large black Holothurian, that occurs commonly in that locality.

Lissocarcinus ornatus differs in a number of well-marked characters from all the known species of the genus. From *L. boholensis* Semper—Rathbun¹ and *L. arkati* Kemp² it can be readily distinguished, among other characters, by the absence of ridges on the carapace. In *L. polybioides* Adam and White,³ the carapace is as long as broad, and has the posterior part markedly constricted. In *L. orbicularis* Dana⁴ (= *L. pulchellus* Müller) and *L. holothuricola* (Streets),⁵ the front is broadly triangular with its anterior margin more or less entire or only slightly sinuous; the last mentioned species further differs from *L. ornatus*

¹ Rathbun, *Kong. Danske Vidensk. Selsk. Skrifter*, 7 Række, naturvid. og math. V p. 363 (1910).

² Kemp, *Rec. Ind. Mus.* XXV, pp. 405-408, pl. x, fig. 1 (1923).

³ Adam and White, *Samarang Crustacea*, p. 46, pl. xi, fig. 5 (1848); see also Alcock, *Journ. As. Soc. Bengal* LXVIII, pp. 19, 20 (1899).

⁴ Dana, *U. S. Explor. Exped. Crust.*, part 1, p. 288, pl. xviii, fig. 1 (1852); also Alcock, *op. cit.*, pp. 21, 22 (1899).

⁵ Streets, *Bull. U. S. Nat. Mus.* VII, pp. 111-113 (1877). This species was described by Streets under a new genus, which he called *Assecla*.

in having the second tooth on the antero-lateral margin the broadest. The only other species *L. laevis* Miers¹ is characterised by the possession of a remarkably broad and truncate front, having only a small median notch ; further the supra-orbital angles are distinctly dentiform, the postero-lateral margins of the carapace are concave, the teeth on the antero-lateral borders are deeply cleft, the dactylus of the last thoracic leg does not bear a claw, and the chela does not appear to be noticeably carinate.

Though differing from it, as indicated above, the present species seems to resemble fairly closely *L. holothuricola* (Streets). In both the species the carapace is broader than long ; the antero-lateral and postero-lateral borders are subequal in length, the latter converging posteriorly ; the lobes on the lateral borders are separated only by fine incisions ; both have a ridge on the carapace running inwards from the last marginal tooth ; and in both the chelae and walking legs are also similar. The colour pattern is also more or less identical in both, though in *L. holothuricola* the ground colour is said to be purple with only a few streaks and spots of white, whereas in *L. ornatus* the ground colour is yellowish-white and the purple is considerably more restricted. There are, however, some noteworthy differences between the two species. The front in Streets' species, as mentioned above, is broadly triangular, and its anterior margin is only somewhat sinuous ; the second lobe of the antero-lateral border is the broadest ; the tooth-like projection at the junction of the antero-lateral and postero-lateral borders is dentiform and projecting ; and in addition to the ridge mentioned above, there is another flattened ridge running parallel and anterior to it. Further the single ridge in *L. ornatus* is quite low and inconspicuous, whereas in *L. holothuricola* it is described as high and prominent.

Besides *L. arkati* Kemp, there are in the Indian Museum the three species mentioned by Alcock,² viz., *L. polybioides*, *L. orbicularis* and *L. laevis*. *L. arkati* is from the mouth of the River Hughli³, *L. polybioides* from Madras, Orissa and Ganjam coast, Malabar and from the Andamans ; *L. orbicularis* from the Laccadives ; while *L. laevis* is represented by specimens from off Ceylon, off the Malabar coast, off Mergui and from the Andamans. All the species of the genus are Indo-Pacific in their distribution.

Most of the species of *Lissocarcinus* are free-living, though some members of the genus have apparently taken to commensalism. *L. bohokensis* is mentioned by Miss Rathbun as living in a Salp, while *L. holothuricola*, as the name indicates, is recorded from a Holothurian. The fact, however, that the carapace and other parts of the body in some species have strong ridges and tubercles, and that some, like *L. ornatus*, have a more or less well-marked colour pattern, seems to show that the members of this genus have taken to this mode of life only very recently, or that they visit this habitat only occasionally in search of food or for shelter.

¹ Miers, *Challenger Brachyura* (Zool. XVII), pp. 205, 206, pl. xvii, fig. 3 (1886) ; see also Alcock, *Journ. As. Soc. Bengal* LXVIII, pp. 21, 22 (1899).

² Alcock, *op. cit.*, pp. 19-22 (1899).

³ Miss Gordon has recently recorded this species from Hongkong : *vide Journ. Linn. Soc. London Zool.* XXXVII, p. 533 (1931).

Family PINNOTHERIDAE.

Sub-family PINNOTHERINAE.

***Pinnotheres villosissimus* Doflein.**

(Plate \ II, fig. 2).

1904. *Pinnotheres villosissimus*, Doflein, *Wiss. Ergebn. Valdivia Exped.* VI, pp. 125, 126, pl. xxxvii, figs. 5, 6.
 1918. *Pinnotheres villosissimus*, Tesch, *Siboga Exped. Rep.* XXXIX C¹, pp. 251 and 255.

This remarkable species was so far known from a single female specimen collected by the "Valdivia" Expedition, off the coast of Sumatra. The species is remarkable for the fact that the upper surface of the carapace, and the chelipeds and legs are very thickly covered with long, feathered hairs, which give the animal a superficial appearance like some species of the Xanthid crab *Pilumnus*.

I have in my collection a large number of specimens that are clearly referable to Doflein's species. As is usual in the family, the female specimens in my collection far outnumber the males; but from an examination of three examples that I have in the collection, I have been able to give a brief description of the male also.

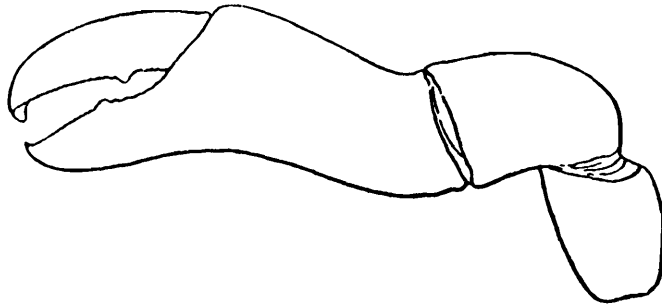
The female specimens that I have examined resemble very closely the excellent description given by Doflein. The quantity of hairs that cover the animal differs to a considerable extent in different specimens; in some examples the upper surface of the carapace is all a mass of more or less uniformly thick fur, while in others small parts of the posterior region of the carapace are left either totally uncovered, or are very thinly covered. The lateral walls of the carapace, as mentioned by Doflein, are not covered with feathered hairs, although on account of the long hair on the rest of the body these walls can hardly be seen. The two prominent stripes on the edges of the sides, described by Doflein, are hardly distinguishable in my specimens. The chelipeds, legs and the lower surface of the carapace are all thickly covered with fur-like feathered hairs. The large abdomen of the female is not covered with hair of this kind, and the tips of the large claws and the dactyli of the walking legs are also generally uncovered.

In a denuded specimen the carapace is seen to be somewhat broader than long and only slightly arched above. It is thin and the regions are hardly distinguishable. The anterior margin is arched, and the front is somewhat projecting and markedly deflexed. The antero-lateral margins are very much arched, while the postero-lateral borders, which strongly converge posteriorly, are considerably less so, and towards the posterior end are somewhat concave. The posterior border is short, being about a third of the greatest breadth of the carapace, and is practically straight.

The eyes are rather well developed, and have dark, pigmented corneas supported on short stalks. The external maxillipeds are as described by Doflein. They are covered with feathered hair, and the ischium and merus are, as usual, united. The lamellar projection on the inside of this united part is clearly seen. The carpus is proportionately small; the

propodus is large and broad and the dactylus, which is inserted at the base of the latter, extends beyond its tip. As is usual, it is broader distally than near its base.

The chelipeds are also covered over with feathered hairs. They are much longer and considerably stouter than the walking legs. The description given by Doflein does not appear to apply accurately to a denuded cheliped. The length of the palm along its upper border almost



TEXT-FIG. 3.—*Pinnotheres villosissimus* Doflein.
Cheliped of female : $\times 8$.

equals the length of the movable finger, but the height of the palm is distinctly less than its length. Both the fingers are provided with a large tooth, besides a number of minute ones. These teeth can only be seen clearly after removing the hair. The distal part of the cutting edge is entirely devoid of teeth. The tips are sharply pointed, and somewhat overlap when the fingers meet. The cutting edges of the fingers distally to the large teeth are grooved, and the edges, as described by Doflein, are sharp.

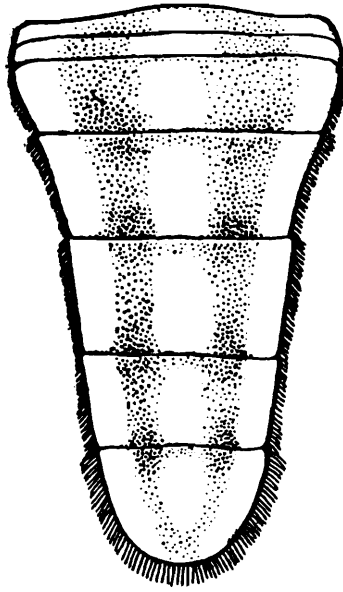
The walking legs are as described by Doflein. All the dactyli are sharply bent backwards and are somewhat curved.

The large abdomen of the female has all the seven segments distinct ; the terminal segment has its free margin more or less straight, with a slight concavity about the middle. The upper surface of the abdomen is in most cases covered with short hairs only, while the margins bear long hairs. In a few examples a part of the abdomen also is covered with thick fur.

The male specimens that I have examined are much smaller than the females, but agree closely with the latter in most of the characters. The front is somewhat larger, and is slightly depressed in the middle. The external maxilliped is like that of the female. The cheliped is also similar, but the palm appears to be a little more massive. The teeth on the fingers are like those in the female. The abdomen, as usual in the genus, is formed of seven free segments, the basal two of which are short. The terminal segment is the longest and has its apex broadly and regularly rounded. The surface of the abdomen is covered with short hairs, while there are longer hairs on the margin.

One male specimen from Aberdeen, Andamans, differs from the description given above in so far as the carapace and legs are almost entirely devoid of the coarse, feathered hairs that are such a characteristic feature of the species. The chelipeds have a few of these hairs, but the rest of the body is more or less bare. In the shape of the outer maxilliped, the shape and dentition of the large claw, and, in fact, in

all other characters the specimen shows an unmistakable resemblance to the other examples in the collection. Another specimen from



TEXT-FIG. 4.—*Pinnotheres villosissimus* Doflein.
Abdomen of male : $\times 14$.

Viper Island has the propodus of its external maxilliped of a shape somewhat different from what has been described above. In all other characters, however, it shows such a marked similarity with other typical specimens, that there can hardly be any doubt of its specific identity.

A number of ovigerous females and male specimens have yielded the following measurements in millimetres :—

	♀	♀	♀	♂	♂	♂
Length of carapace	8.0	8.3	6.8	4.7	6.0	4.2
Breadth of carapace	8.8	9.2	7.6	5.0	6.2	4.5
Fronto-orbital breadth	3.6	3.7	3.2	2.5	3.1	2.2
Length of palm	2.2	2.7	2.0	1.5	—	—
Height of palm	1.7	1.9	1.6	1.1	—	—
Length of finger	2.4	2.9	2.2	1.5	—	—

Locality.—*P. villosissimus* appears to be a common species round about Port Blair and some of the islands in the Andamans.

C 1509/1 Reef at North-West end of Ross Island, Andamans.	S. Kemp. February, 1921.	3 ♀♀ (including 2 ovigerous).
C 1510/1 Off Aberdeen, Andamans	S. Kemp. February, 1921.	6 ♀♀ (including 4 ovigerous) and 1 ♂.
C 1511/1 South Point, Port Blair, Andamans.	S. Kemp. March, 1921.	5 ♀♀ ovigerous.
C 1512/1 Eastern shore of Havelock Is., Ritchie Archipelago, Andamans.	B. Prashad and S. L. Hora. January, 1930.	16 ♀♀ mostly ovigerous.
C 1513/1 Off Cinque I., Andamans	D. D. Mukerji. April, 1930.	6 ♀♀ (including 2 ovigerous) and 1 ♂.
C 1514/1 Off Viper I., Andamans	S. B. Setna. January, 1931.	1 ♀ and 1 ♂.
C 1515/1 North Bay, Port Blair, Andamans	K. N. Das. April, 1931.	4 ♀♀ (including 3 ovigerous).

All the specimens were collected from the cloaca of Holothurians ; those found by Dr. Kemp were living in Holothurians that, according

to the station-book, are "black and yellow-brown above, white below." The Pinnotherids are "densely coated with yellowish and blackish hairs," and never more than one crab is said to have been found in one Holothurian. Those collected by Mr. Mukerji were probably from the Holothurian *Actinopyga mauritiana* (Quoy and Gaimard).

The species was so far known from a single specimen collected near Padang, off the west coast of Sumatra, and was found living in the cloaca of the Holothurian *Actinopyga lecanora* (Jäger). The species possibly occurs commonly in the Indo-Pacific region.

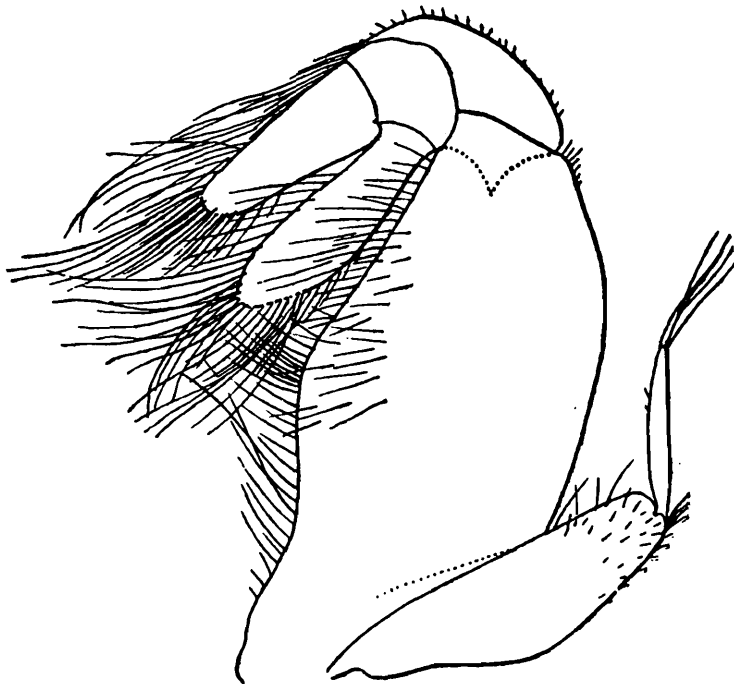
Pinnotheres setnai, sp. nov.

(Plate VII, fig. 3).

The carapace in the female is almost as long as broad, is more or less circular in outline and is distinctly arched both antero-posteriorly and from side to side. Its surface is covered with short hairs, but the hairs are more dense near the margins than on the middle of the carapace, and in some specimens this part of the body is almost bare. The chelipeds and the legs are thickly covered with longer and coarser hairs, and the sides of the body and the ventral surface are also hairy.

The carapace after removing the hair is seen to be smooth, somewhat shining, and without any noticeable granules. The front is somewhat projecting and is very much deflexed. The anterior margin of the carapace in dorsal view is broadly truncate, and is distinctly concave. The antero-lateral margins are rounded, the lateral margins are more or less straight and parallel to one another, while the postero-lateral margins are strongly convergent posteriorly. The posterior margin is short, and is sharply rounded. In younger specimens this margin is somewhat more broadly rounded.

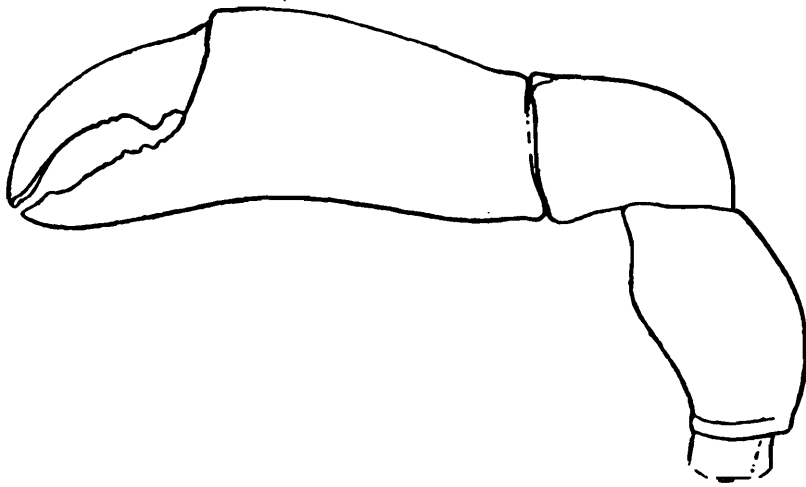
The eyes are small, and are not visible from above. They have small darkly-pigmented corneas,



TEXT-FIG. 5.—*Pinnotheres setnai*, sp. nov.
Outer maxilliped of female : $\times 20$.

The external maxillipeds have the usual shape. The fused ischium and merus is rather small, and has its margin strongly produced on the inside. The dactylus is inserted at the base of the propodus, and somewhat over-reaches its tip. It is distinctly thicker than the propodus, and is broader at the tip than near its base. The propodus narrows towards the tip gradually. The propodus and the dactylus carry long hairs on their margins, and the surface of all the segments is also hairy.

The chelipeds are considerably stouter and longer than the walking legs. They are covered all over with coarse hairs, except at the tips of the fingers, which are bare. The hand is quite massive, but the length of the palm along the upper border is distinctly more than its height. The upper margin of the palm is more or less straight or is only slightly



TEXT-FIG. 6.—*Pinnotheres setnai*, sp. nov.
Cheliped of female : $\times 5.5$.

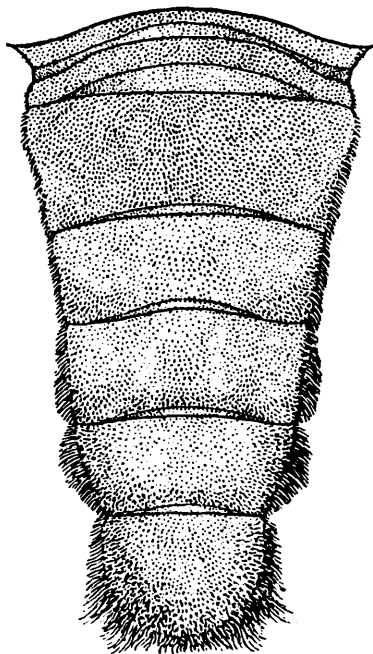
arched towards its distal end. The dactylus is somewhat shorter than the palm, and is distinctly arched. The fingers leave a noticeable gap when they meet, and are spooned near the tips. There is a large blunt tooth near the base of the movable finger, and a number of smaller teeth distally to it, extending up to about the middle of the finger. There are some small teeth on the fixed finger also extending practically throughout the length of its inner margin; some of these teeth, especially near the base of the finger, are larger than the others. The tips do not overlap one another when they meet, but have a large meeting surface.

The walking legs are rather small, but are not particularly stumpy. The first three pairs are subequal in length, while the last is the smallest. The latter is not, however, much shorter than the preceding pairs. The merus in all the legs, and especially in those of the first three pairs, is flattened. The dactyli are sharply pointed, somewhat curved, and are bent backwards; they are subequal in length.

As is usual, the abdomen in the female is large, and has all the seven segments clearly defined. The free margin of the terminal segment is uniformly and broadly rounded. The surface of the abdomen is covered over with short hairs, while the margins have longer and coarser hairs.

The males are smaller than the females, but in the shape and proportions of the body they do not differ to any appreciable extent from the females. The posterior border of the carapace is, however, less sharply rounded, like those of the younger females. The chelipeds are quite

stout, but are not proportionately more massive than those of the female specimens. The legs are also like those of the female. The abdomen is formed of the usual seven free segments, and has a long and narrow



TEXT-FIG. 7.—*Pinnotheres setnai*, sp. nov.
Abdomen of male : $\times 10$.

triangular shape. The terminal segment is broadly rounded, and is somewhat semicircular in appearance. Its surface and margins are thickly covered with hairs.

A number of specimens have yielded the following measurements (in mm.) ; all the females measured are ovigerous :—

	♀	♀	♀	♀	♀	♀	♂	♂	♂	♂	♂	♂
Length of carapace	12.8	11.9	11.5	9.8	9.1	8.4	9.0	8.8	8.6	8.0	7.8	7.8
Breadth of carapace	12.4	11.6	11.2	9.8	9.5	8.8	9.2	8.8	9.2	8.5	8.0	7.8
Length of palm	5.1	5.2	5.0	4.3	4.0	4.1	5.2	4.7	4.5	4.5	4.7	4.2
Height of palm	3.2	3.1	3.0	2.9	2.9	2.8	2.8	2.8	2.8	2.7	3.1	2.7
Length of finger	4.2	4.1	3.9	3.7	3.4	3.5	3.5	3.6	3.5	3.5	3.5	3.6

From the measurements given above it is seen that in the smaller ovigerous females the length of the carapace is slightly shorter than its breadth, while in older examples the length somewhat exceeds the breadth. In females with a carapace length of approximately 10 mm. the length and breadth seem to be equal. In males, on the other hand, the length never seems to exceed the breadth, though in some specimens these are equal. Another remarkable point brought out in the above table is that whereas in older females the length of the palm along its upper border is more than $1\frac{1}{2}$ times its height, in younger ovigerous examples the palm appears to be proportionately higher. The males in this character seem to resemble the older females, the length of the palm being in most cases more than $1\frac{1}{2}$ times its height.

Type-specimen.—C 1516/1, Zoological Survey of India (*Ind. Mus.*).

Locality.—I have examined a large number of specimens of this species collected by Dr. S. B. Setna, round about Port Blair, in the Andaman Islands. The specimens were found in the "main respiratory stem" of Holothurians of an unnamed species, and most of them were obtained off Viper Island. As is usual in most cases, one Pinnotherid was found in one Holothurian, but in some instances a pair, a male and a female, were obtained. In the collection there is a number of these crabs *in situ* in the cloacal chambers of the Holothurian, and on cutting open the walls some were found to contain two crabs in each. These lie free in the cavity, and the males and the females, when there is a pair of specimens in each, do not appear to occupy any definite position with reference to one another.

C 1516/1	Off Viper Island, Port Blair, Andamans.	S. B. Setna.	Jan. 1931.	Several ♂♂ and ♀♀, including TYPES and CO-TYPES.
C 1517/1	Viper Island, Port Blair, Andamans.	K. N. Das.	April, 1931.	Numerous ♂♂ and ♀♀, including ovigerous examples.
C 1518/1	Viper Island and Dundas Point, Port Blair, Andamans.	K. N. Das.	April, 1931.	7 ♂♂ and 7 ovigerous ♀♀.

Most of the specimens collected by Mr. Das were found in pairs, a male and a female crab occurring in one Holothurian.

According to the key to the species of *Pinnotheres* given by Tesch,¹ *P. setnai* seems to resemble *P. semperi* Bürger,² chiefly in the character of the external maxilliped. There are, however, important differences between the two species. The carapace in my species is distinctly arched, with the front truncate, and the anterior margin depressed about the middle, while in Bürger's species it is only slightly arched, and the anterior margin is pointed. In the present species the large claw is less massive, with the palm proportionately longer, and the fingers have well-developed teeth. Further, the last walking leg in Bürger's species is very much smaller than the preceding ones, while in *P. setnai* it is only slightly smaller than the others. Even the external maxilliped of the new species differs from that of *P. semperi* in having the propodus broader than the dactylus, whereas in the last-named species these two segments are subequal.

***Pinnotheres deccanensis*, sp. nov.**

(Plate VII, fig. 4).

The carapace in the female is slightly broader than long, is roughly circular in outline and is strongly arched both antero-posteriorly and from side to side. It is quite thin, somewhat shining, and is without a hairy covering. As is usual, the regions are not strongly demarcated, but the cardiac region is separated off from the rest of the surface by fairly deep grooves. There is also in most of the specimens a shallow longitudinal groove running on the middle of the carapace, from the cardiac region towards the front. In some cases the groove can be seen

¹ Tesch. *Siboga Exped. Rep.* XXXIX C¹, p. 255 (1918).

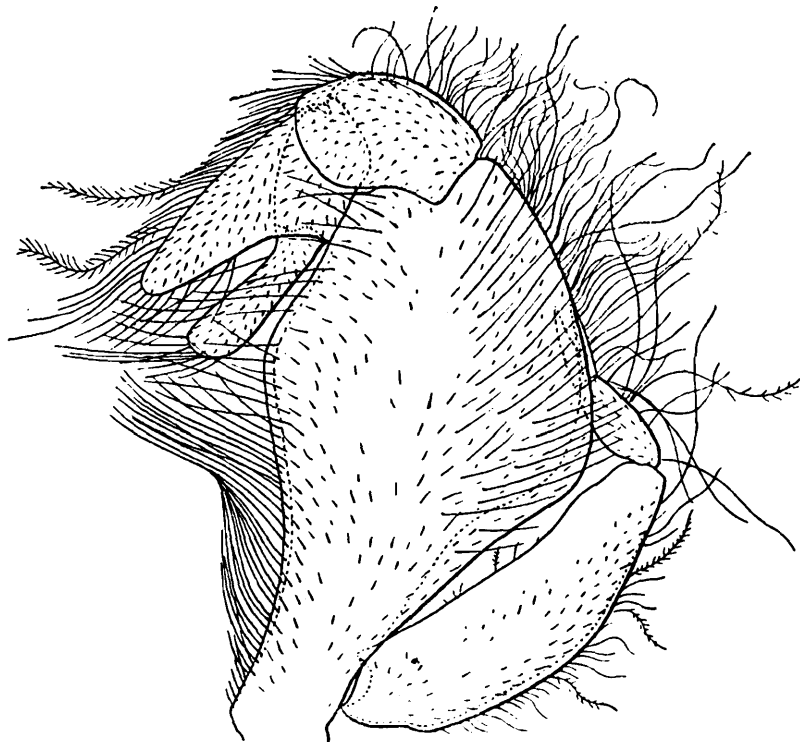
² Bürger, *Zool. Jahrb. Syst.* VIII, pp. 382, 383, pl. ix, fig. 28, pl. x, fig. 27 (1895).

all the way to the anterior margin, while in others only a small part of it can be made out. The branchial regions are swollen.

The front is somewhat projecting and strongly deflexed, and its anterior margin is straight, with a slight depression in the middle. The anterior end of the carapace above the front has also a shallow and broad concavity. The antero-lateral margins are strongly arched, the lateral borders are more or less straight, while the postero-lateral converge posteriorly. The posterior margin is only slightly rounded.

The eyes are not particularly small, but are invisible from a dorsal view. They do not seem to have darkly-pigmented corneas.

The propodus of the external maxilliped is very broad at the base and tapers gradually towards the tip, where it is rounded. The dactylus, which is inserted near the base of the propodus, is spatulate, being broader

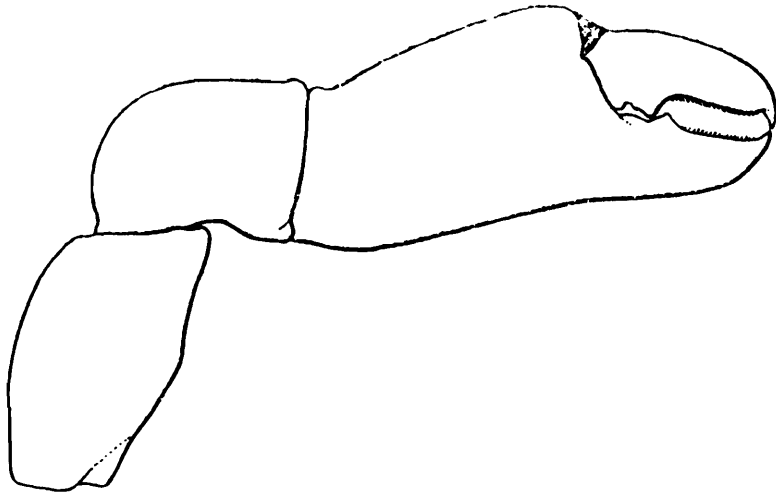


TEXT-FIG. 8.—*Pinnotheres deccanensis*, sp. nov.
Outer maxilliped of female : $\times 15$.

at the tip than at its base, and is as long as the propodus. The fused ischio-merus segment is short and broad, and strongly projects inwards about its middle. The entire surface of the maxilliped is covered over with long hairs, some of which are feathered.

The chelipeds are considerably stouter than the walking legs, but are not very much longer. The hand is quite massive, but the palm is distinctly longer than its height, being about $1\frac{1}{2}$ times as long as high. The movable finger is shorter than the palm and is moderately arched. The fingers, when they meet, leave an appreciable gap for about the distal three-fourths of their length. The dactylus has a large blunt tooth, which works between two teeth on the fixed finger, a small one near the base, proximal to the tooth on the movable finger, and a larger one distal to the latter. The tips are very much pointed, and overlap when they meet. On the cutting edge of each finger, distally to the teeth

described above, there is a row of very short stiff setae, looking somewhat like minute teeth. There are hardly any hairs on the outer surface of

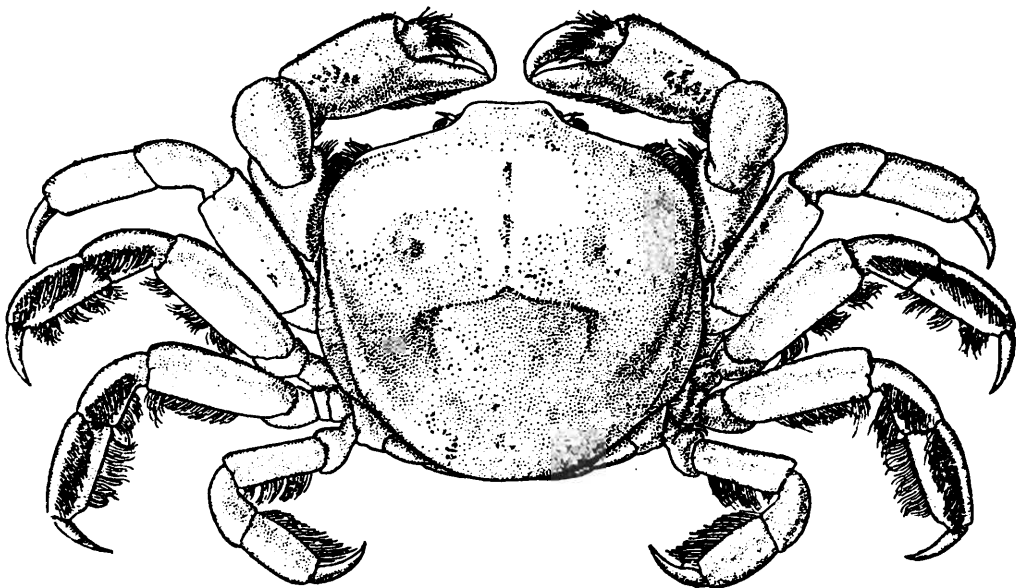


TEXT-FIG. 9.—*Pinnotheres deccanensis*, sp. nov.
Cheliped of female : $\times 6$.

the chela, but the inner surface of the fingers is covered with short stiff setae, interspersed with longer hairs. Some of these hairs, especially at the junction of the dactylus with the palm, and also at other joints of the cheliped, are feathered.

The legs are long, and rather narrow. All the four pairs are of more or less the same length, or somewhat progressively increase in length from the first to the fourth. The dactyli of the first three pairs are short and subequal; those of the fourth are very much longer, and are only slightly shorter than the preceding segment. All the dactyli are only slightly curved. The legs carry rows of long hairs on the inside, and the dactyli also carry stiff setae. Some of the hairs on the other segments of the leg are feathered.

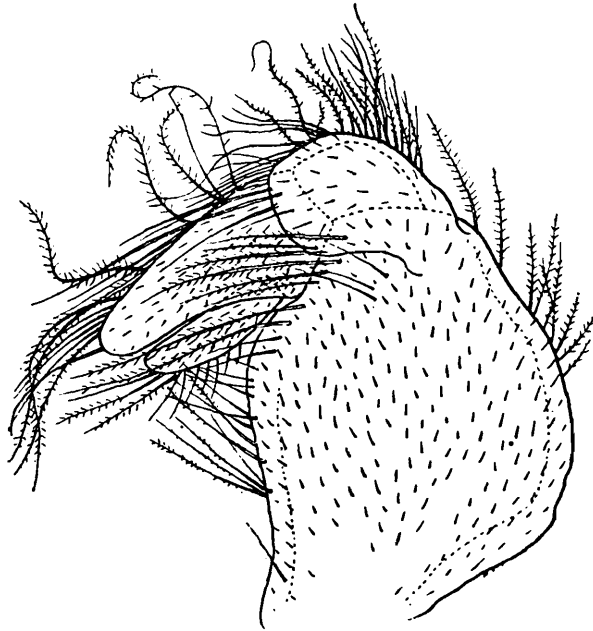
The terminal segment of the female abdomen is short, and its free edge is rounded, with a small projection in the middle. The abdomen has no hairs on the exposed surface, but there is a fringe of long feathered hairs all along the free margin.



TEXT-FIG. 10.—*Pinnotheres deccanensis*, sp. nov.
Dorsal view of male specimen : $\times 4$.

The single male specimen that I have examined is not very much smaller than the female examples in the collection. The carapace is almost as broad as long, and appears to be a little less strongly arched. The front is markedly projecting, and is less strongly deflexed, so as to be visible from above. Its anterior margin is truncate. The lateral margins are somewhat convergent, and the posterior border is straight. The cardiac region of the carapace is demarcated by distinct grooves, and the median longitudinal groove is only faintly marked in places.

The eyes are quite large and are visible from above. The corneas are somewhat darkly pigmented.



TEXT-FIG. 11.—*Pinnotheres deccanensis*, sp. nov.
Outer maxilliped of male : $\times 24$.

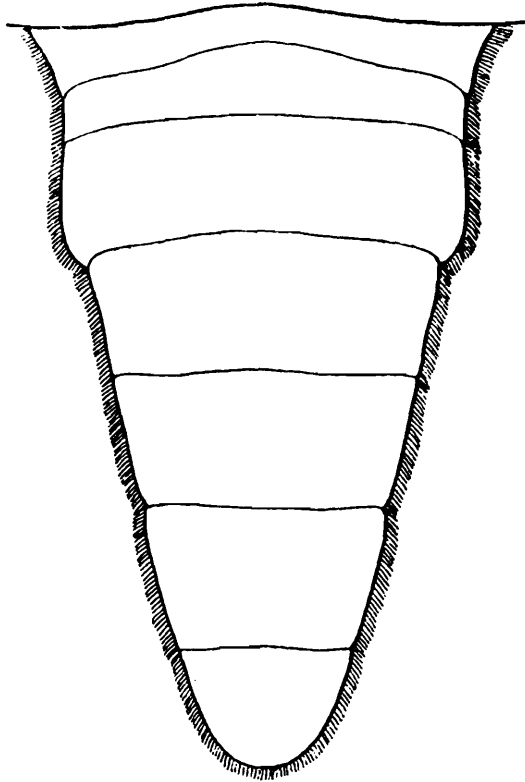
The external maxilliped differs from that of the female in so far as the dactylus does not quite reach the tip of the propodus. The latter is also proportionately thicker than that of the female. The fused ischium and merus also appears to be shorter and broader.

The chelipeds are like those of the female, but the hand is somewhat more massive, the palm being proportionately much higher than in the female. The fingers gape as in the female, and the teeth are also similar.

The first three pairs of walking legs have their claws better developed than in the female, and those of the fourth pair are only a little longer than the claws of the preceding legs. The legs are more thickly covered on the inside with feathered hairs, than in the female.

The abdomen is triangular in shape, and has all the seven segments free. There is a somewhat sharp constriction of the margin between the 3rd and 4th somite, beyond which the margins slope regularly towards the posterior end. The 4th to 6th somites are subequal in length, while the 7th is somewhat shorter than these. The terminal segment is broader than long, and is broadly rounded along the distal margin. The

surface of the abdomen is not covered over with hairs but the margins are fringed with setae.



TEXT-FIG. 12.—*Pinnotheres deccanensis*, sp. nov.
Abdomen of male : $\times 12$.

In the following table I give the measurements (in mm.) of a number of ovigerous females and the single male specimen in the collection :—

	♀	♀	♀	♀	♂
Length of carapace	12.5	11.8	11.6	10.9	9.7
Breadth of carapace	12.7	12.0	11.8	11.5	9.6
Fronto-orbital distance	4.2	4.3	4.2	3.8	4.2
Length of palm	4.8	4.5	4.5	4.5	3.4
Height of palm	3.2	3.0	3.0	3.0	2.7
Length of finger	3.6	3.2	3.3	3.3	2.8

Type-specimen.—C 1522/1, Zoological Survey of India (*Ind. Mus.*).

Locality.—The species is described from a dozen specimens, 11 females and one male, found in the cloaca of the Holothurian *Holothuria scabra* Jäger, and collected by the Department of Fisheries, Madras. The exact provenance of the specimens is not recorded, but the host-species, *H. scabra*, occurs quite commonly all around the coasts of the Madras Presidency.

Pinnotheres deccanensis seems to resemble in several respects *P. ortmanni* Bürger¹ from Aibukit (Philippines). The carapace and chelipeds are naked in both, but parts of the body, like the inside of the legs, and the exposed surface of the outer maxillipeds, are scantily clothed with feathered hairs. The dactylus of the outer maxilliped is more or

¹Bürger, *Zool. Jahrb, Syst.* VIII, pp. 384, 385, pl. ix, fig. 30, pl. x, fig. 28 (1895),

less similar in both, and the dactylus of the last walking leg is remarkably long, being almost as long as the segment preceding it. The differences between the two species are, however, also noteworthy. The carapace in Bürger's species is somewhat longer than broad, whereas in *P. deccanensis* it is slightly broader than long. The grooves described on the carapace of the last-named species seem to be absent in *P. ortmanni*. The shape of the chela in Bürger's species is also different from that of the present one. The dactyli of the first three legs in the present species, though shorter than those of the fourth, are not proportionately as reduced and stumpy as they are in *P. ortmanni*.

P. deccanensis seems to be distinguishable from most of the other species of the genus in having some well-marked grooves on the surface of the carapace.

Sub-tribe OXYRHYNCHA.

Family MAIIDAE.

Sub-family INACHINAE.

Achaeus affinis Miers.

1884. *Achaeus affinis*, Miers, *Zool. "Alert,"* pp. 188, 189.

1895. *Achaeus affinis*, Alcock, *Journ. As. Soc. Bengal* LXIV, pp. 172, 173.

There is one small, probably immature, male specimen in the collection that I have referred to Miers' species.

The carapace is subtriangular, and has the regions fairly well marked. The rostrum is short, with the lobes very small, and somewhat bluntly pointed anteriorly. The post-orbital constriction is quite prominent. There is no supra-orbital spine, and the eye-stalks have a prominent tubercle along their anterior surface. There is a short pointed spine on the upper surface of the cornea also.

The bilobed prominence on the cardiac region, though quite distinct, is not very much elevated. Besides the other prominences and granules mentioned by Miers, there is a small blunt tubercle on the gastric region also.

The chelipeds are somewhat slender. The margins of the arm, wrist and palm are granulated, and their entire surface is covered with hooked hairs, interspersed with a few long straight ones. The fingers are as long as the palm, are incurved and have pointed tips. Along their inner margins they bear small teeth, the dactylus having two large teeth near the base, the distal one of which works against a much larger tooth on the fixed finger. The fingers are carinate along their margins, and leave a fairly large gap; when they meet.

The walking legs are long, slender and filiform, and are scantily clothed with long hairs. The dactyli in the last two pairs are very distinctly falciform, with a prominent row of teeth along their inner margins, and with their tips ending in sharp claws.

The abdomen has its terminal segment broadly rounded along its free margin,

The single specimen that I have examined has its carapace, including the rostrum, 3.7 mm. long, while the breadth is 2.4 mm. The adult male, according to Miers, is over 10 mm. long.

The specimen described above was collected by Mr. D. D. Mukerji, off Cinque Island, Andamans, and was found living in the cloaca of a Holothurian.

From the brief description given above it will be seen that my specimen differs from Miers' account of the species in a number of minor characters. The shape of the claw is somewhat different, and there are in my specimen some large teeth on the fingers, which, when closed, leave a fairly large gap. The bilobed prominence on the cardiac region is also less elevated, and there is a low tubercle on the gastric region not mentioned by Miers. The proportions of the carapace are also slightly different.

The present record of the occurrence of this crab in the cloaca of a Holothurian appears to be of interest, as, so far as I am aware, no Oxynchid crab has hitherto been recorded from such a habitat. Judging from the angular carapace with tubercles, it seems probable, however, that this crab is only an occasional visitor to the habitat from which it was collected.

Achaeus affinis seems to be a fairly common species in the Indo-Pacific region. Among other places it has been recorded along the coasts of Australia, and in the Malay Archipelago. In India Henderson¹ recorded it from the Gulf of Martaban, in the Bay of Bengal.

Sub-family ACANTHONYCHINAE.

Menaethius monoceros (Latreille) M.-Edwards.

1895. *Menaethius monoceros*, Alcock, *Journ. As. Soc. Bengal* LXIV, pp. 197, 198.

A single specimen of this extremely variable and widely-distributed species is in the present collection. It is a gravid female having a carapace length (including the rostrum) of 8 mm. and breadth of about 5 mm. In the outline of the body the specimen appears to be a little less pyriform than is usually the case, but the females in the species are as a rule considerably less elongated than the males. In the Indian Museum collection there is a large number of examples of this species from the Andaman and Nicobar Islands, and the present specimen agrees with them closely.

The single specimen that I have examined was found in the cloaca of an unnamed Holothurian, and was collected by Mr. D. D. Mukerji off Cinque Island in the Andamans in April, 1930. The species is very common in the Indian and the Indo-Pacific oceans.

The present appears to be the first record of this species found living apparently in commensalism with a Holothurian, but the prominently tuberculated carapace seems to show that the crab is perhaps only an occasional visitor to the cloaca of the Holothurian, or has taken to this mode of life only recently.

¹ Henderson, *Trans. Linn. Soc. London* (2) Zool. V, p. 341 (1893).