NOTE ON AN ABNORMAL SPECIMEN OF *PHERETIMA POSTHUMA* (L. VAILL.).

By G. E. GATES, *Biology Department, Judson College, Rangoon, Burma.*

Pheretima posthuma has not been previously recorded from Rangoon, but is common in the city nearly all the year round. Some months ago while examining a collection of nearly a thousand worms of this species, procured in this city, one worm which seemed quite abnormal in a number of details was found and put aside for further study. For several reasons it has seemed advisable to use the Arabic numerals in designating the segments of this worm instead of the usual Roman numerals. This prevents confusion in the discussion where the reasons for the use will be more obvious.

DESCRIPTION.

External characteristics.

Length 114 mm. Diameter 5 mm. Number of segments 106. Colour dark slaty grey. Prostomium and setae as usual in this species.

On segments 2 to 10 as well as on all segments posterior to the clitellum there are two secondary furrows per segment, one anterior to, and the other posterior to, the setal circle.

The first functional dorsal pore is in 9/10, and the next pore is in 13/14. There are what at first sight appear to be dorsal pores in 7/8 and 8/9 but no fluid could be squeezed out in this region and they probably merely represent weak places in the body-wall.

The clitellum begins at intersegmental furrow 9/10 on the right side, ending dorsally on segment 10 as a rather jagged line in the region of the mid-dorsal line, and ending ventrally in an abrupt line at about the mid-ventral region. On the left side the clitellum begins with 10/11. The colour is reddish grey. Posteriorly the clitellum ends with 12/13 on the right side, and 13/14 on the left side, while the dorsal and ventral boundary of the clitellum on segment 13 is a nearly straight line in the mid-dorsal and in the mid-ventral region. Setae are present on all segments.

The male pore of the left side is in the usual position in the setal circle but on segment 15, while the male pore of the right side, also in the usual place, as far as position on the segment is concerned, is on segment 14.

There is a rather conspicuous median ventral pore probably female on segment 12 posterior to the setal circle but closer to 12/13 than to the setae.

The spermathecal pores are in 3/4, 4/5, 5/6, and 6/7, more than one-third of the circumference apart. The usual indication of these pores, a minute round papilla on the posterior part of the segment close to the intersegmental furrow, is very much smaller than usual.

Copulatory papillae occur on the left side of 14, the right side of 15, the right and left sides of 16, and the right and left sides of 17, six instead of the usual four. Between the male papilla and the copulatory

papilla of 14 there are 19 setae, of 15—14 setae, and between the copulatory papillae of 16—18 setae, and the papillae of 17—19 setae.

The appearance externally of the male and copulatory papillae is exactly the same as in normal worms of this species.

Internal anatomy.

The first septum present is 2/3 which is very thin ; 3/4 is slightly thickened ; 4/5, 5/6 and 6/7 are very thick ; 7/8 is lacking ; 8/9 and 9/10 are slightly thickened ; the remainder are thin. Septum 6/7 is pushed backwards by the gizzard into contact with 8/9 to which it is fused in the region of the alimentary canal, so that no part of the oesophagus appears in 7 or 8.

The gizzard is in segment 6, the posterior end enlarged, and the anterior end conical. The intestine begins in 12. A pair of characteristic caecae extend forward from 24 into 21.

The supra-pharyngeal ganglia are in segment 2.

In segments 3 and 4 there are on each side of the alimentary canal large nephridial masses attached to the anterior faces of septa 3/4 and 4/5, while loose in each of these two segments are large, red, paired masses of blood glands.

There is a very large lateral commissure on the left side in segment 11 but none on the right side, a pair of large commissures in segment 10, a very large commissure on the right side of 9 but none on the left side. In the anterior part of the combined segments (7 and 8) the dorsal blood vessel gives off a conspicuous pair of commissures which are however not as large as those of 10, 11 and 12. Behind this pair there is a much smaller lateral commissure on the right side only, on the anterior face of 8/9 which must be the commissure of segment eight. There are paired commissures in segments 6, 5, 4, 3 and 2.

Paired testes sacs in 8 lie close under 8/9, and there is only a single testis sac on the left side in 9. There is a large characteristic seminal vesicle on the left side of 10 but none on the right side. In segment 9 there is a pair of large lobed seminal vesicles, that of the right side somewhat smaller than the other.

The prostatic duct of the left side is in segment 15, that of the right side is in segment 14. The right prostate lies in segments 13-15 (3), the left prostate in segments 14-17 (4). The prostatic duct lies on the floor of its segment bent into the form of a U with the limbs pressed into contact with each other, the open end of the U posteriorly. The larger ectal limb is nearer the nerve cord, the smaller ental end bends outward slightly just as it passess into the gland. There is a single sperm duct on the right side which passes into the prostatic duct at the edge of the gland. On the left side the two sperm ducts are in contact but do not unite until just before passing into the prostatic duct.

An ovary of usual size and appearance is flattened against the posterior face of 10/11 on the left side, but no trace of a right ovary can be found in this or any other segment. On the anterior face of 11/12 there is a large oviduct funnel opposite the ovary. The oviduct is long and passes through 12 and into septum 12/13 in which it penetrates into the ventral parietes. The anterior pair of spermathecae is in 4 and is very small, although the picture presented by the whole spermathecal apparatus

is the same as that of norm l worms of the species. The second pair of spermathecae is in 5. The spermatheca on the left side is double, or more correctly, the ducts of two spermathecae join as they pass into the body wall. The diverticulum of the outer spermatheca on this side is split into two longitudinally, beginning at the free ental end and proceeding nearly to the place where the diverticulum narrows suddenly to form the stalk by which it is attached to the duct. The spermathecae of this segment are slightly larger than those of the preceding segment. There are two pairs of spermathecae in segment 6, the posterior pair passing into the body-wall close to 6/7, and the anterior pair close to 5 6. The spermathecae of this segment are slightly larger than those of the preceding segment but only about half the size of the spermathecae of normal specimens of this species. The last spermatheca on the left side also has a diverticulum split in two nearly to the stalk.

DISCUSSION.

The most striking abnormality of the worm is the unusual position of the organs. The gizzard for instance is in segment 6 instead of VIII. Possibly two segments have been elided or have failed to develop. If it is imagined that two segments are intercalated between (what are in this abnormal worm according to the external segmentation) segments 2 and 3, a description of the internal anatomy will then read as follows.

Septa 4/5 present, 5/6 slightly thickened, 6/7, 7/8, 8/9 much thickened, 9/10 absent, 10/11 and 11/12 slightly thickened. Nephridial masses and blood glands in 5 and 6, last heart in 13, testes sacs in 10 and 11, seminal vesicles in 11 and 12, ovary in 13, and spermathecae four pairs, one pair each in 6 and 7 and two pairs in 8, and paired caecae in 26. This is practically the same as a description of similar organs in the normal *posthuma* of Rangoon for in the local forms 8/9 is always present, and 9/10 is always absent ; seminal vesicles are always two pairs in XI and XII ; and the spermathecae are four pairs, one pair each in VI and VII, and two pairs in VIII. (However in the normal *P. posthuma* 5/6 is usually as thick as 6/7 and 8/9 is usually thinner than 7/8, but this is relatively unimportant.) An additional similarity is furnished by the lateral commissures. In the Rangoon form there are large paired commissures in XI, XII, and XIII, the pair belonging to X are very small, located on the anterior face of 10/11 and frequently one of the pair is lacking. There are larger commissures in the anterior part of the combined segment, belonging to IX. This is also just the condition of the commissures in the segments noted in the abnormal worm allowing for the difference of the two segments and the asymmetrical development of the vessels in 9 and 11.

Most of the organs seem to be two segments anterior to their normal position. It is difficult to conceive of all these structures " jumping forward" two segments. It is perhaps easier to think that two segments have been omitted somewhere. Evidence for this and for the place of omission is furnished by the condition of the alimentary canal in the first two segments. The canal in 3 and 4 is narrow and pigmented on the outer surface, which is just the appearance of this organ in a normal *posthuma* in segments V and VI. Between this region (3 and 4) and

the buccal cavity which is confined to segment 1 the canal is only slightly larger than in 3, and the large thickening of the dorsal wall always present on the pharynx in III and IV is lacking.

No evidence as to how the two segments were elided is furnished by the worm exteriorly, for the prostomium is normal in shape and attachment, the intersegmental grooves are sharp and clear, deeper than the secondary furrows. There is no possibility of confusion of the segments due to the intersegmental furrows running into each other as sometimes happens, and the setae are present normally in all segments from 2 on. The absence of a typical pharynx with dorsal thickening seems to indicate that it is segments III and IV which have been elided to produce the abnormal condition. If this is so the brain may have been pushed forward into 2 before the elision or it may have developed there.

But adding two to the numbers of the segments in the abnormal worm does not solve quite all the difficulties, for when this has been done the prostatic ducts and their apertures are still only in 16 on the right side, and 17 on the left side. It does not seem probable that a segment has been lost in this region for the addition of the previous two segments raises the number of the caecal segments of the abnormal worm from 24 to 26 which is the segment in which these organs are normally found in this species. Clearly something else has happened in the region of the prostatic apparatus. In this connection it is interesting to note that Stephenson has found accessory prostates with ducts in segment XVII alongside of the usual prostates with ducts in XVIII.

Another abnormality in this worm is the asymmetrical development of the organs, including the clitellum. On the right side the posterior testis together with its sperm duct and funnel, the seminal vesicle of the posterior pair, and the ovary are absent, or at least not sufficiently developed to be visible when studied with the binocular dissecting microscope. The left prostate is larger than the right, the left caecum than the right, while the right anterior vesicle is larger than the left.

A third abnormality is the tendency for the doubling of the diverticulum or even of the spermatheca, here confined to the left side, but which has been noted in other Rangoon worms of this species on either side or both sides.

FRESHWATER AMPHIPODA FROM THE ANDAMAN ISLES.

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In January 1924 I received from the late Dr. Annandale a small collection of freshwater amphipods which he had collected in the Andaman Islands, with a request that I would work them out for a projected work on the freshwater fauna of these islands, which he was contemplating. Only two species were found in the collection, but one of these is of considerable interest, representing a new genus and species which I wish to dedicate to the memory of the late Director of the Zoological Survey of India, whose magnificent work on the fauna of fresh and brackish water in Asia has done so much to extend our knowledge of this unexplored field of work.

Family TALITRIDÆ.

Genus **Talorchestia** Dana.

? **Talorchestia malayensis** Tattersall.

T. malayensis, Tattersall, 1922, p. 453, pl. xxi, figs. 11-20.

Localities.—S. Andamans, December 1923, Dr. Annandale.

(*a*) Mount Harriet, 500-800 ft., among matted rootlets of trees growing over rocks covered by a thin trickle of water, in a jungle stream, several specimens.

(*b*) West slopes of Mount Harriet, 500 ft., edge of a rocky pool below waterfall in dense jungle, one specimen.

(*c*) Mount Harriet, 500 ft., among dead leaves at edge of small jungle stream, several specimens.

Remarks.—These specimens differ from the types in having fewer serrations on the hind margin of the second joint of pereiopod 5, only 19 teeth instead of 29-30, and in having more spinules on the uropods generally. They agree with *T malayensis* rather than with *T kempii* or *T parvispinosa* in the form of the telson and for the moment I refer them provisionally to the first named species.

Family GAMMARIDÆ.

Genus **Paraniphargus,** nov.

Body compressed, smooth, eyes absent. First antenna longer than the second, with a rudimentary (small) accessory flagellum. Peduncle of the second antenna not unduly elongate, flagellum short. Anterior margin of the upper lip convex. Lower lips with the inner lobes well developed. Mandibles with the cutting edge and molar process well developed, palp short, slender and feebly armed. Inner lobe of the first maxilla not expanded, armed with three setæ at the apex, palp two-jointed, apex

armed with a few feeble setæ. Second gnathopods larger than the first. Last three thoracic limbs of subequal size, basal joint expanded. Uropods one and two well developed with the rami subequal. Uropod three longer than uropods one and two, inner branch rudimentary and scale-like, outer branch one-jointed. Telson cleft to the base.

This genus is closely related to the *Niphargus* group of genera but differs from hitherto described forms in points which appear, in the present state of our knowledge, to be of generic value.

It differs from *Niphargus* in having the gnathopods unequal in size and the outer ramus of the third uropods one-jointed. Chilton (1923 (1)), however, has recently described a species of *Niphargus* from India, *N. indicus*, in which the third uropods are one-jointed but the gnathopods are more or less subequal in development.

On the other hand, Chilton has described three species of *Niphargus*, *N. chilkensis*, *N. philippensis*, and *N. australiensis*, in which the second gnathopods are larger than the first and differ from them considerably in shape. The outer ramus of the third uropod is, however, at least in the first two species, two-jointed and of the typical *Niphargus* form. Chilton does not describe the uropods of *N. australiensis*.

Paraniphargus differs from *Neoniphargus* by the absence of eyes and by the unequal development of the gnathopods, and from *Niphargopis*, Chevreux (1922), by the form of the first maxilla and by the single-jointed outer ramus of the third uropod. In *Niphargopsis* the inner lobe of the first maxilla is armed with one seta and the outer lobe is very broad with eleven pectinate and twenty-six simple spines.

In *Pseudoniphargus* Chevreux (1901), the outer ramus of the third uropods is one-jointed but in the male the whole appendage is greatly elongated and simulates the true *Niphargus* type. But this genus may be distinguished from *Paraniphargus* at once by the telson which in *Pseudoniphargus* is almost entire with a shallow emargination at the apex whereas in *Paraniphargus* it is cleft to the base into two distinct halves.

Paraniphargus shows no kind of affinity with *Bathyonyx* (Vejdovsky, 1905) another freshwater Amphipod, found in Ireland, and obscurely related to the *Niphargus* group.

It may be distinguished at once from the *Crangonyx* group of genera by the telson, which is entire or but slightly cleft in the latter group and cleft to the base in *Paraniphargus*.

Paraniphargus annandalei, sp. nov.

(Figs. 1-13.)

Body delicate, fragile and compressed, no trace of colour in preserved specimens.

Head equal in length to the first two free thoracic somites, lateral lobes slightly produced and rounded.

Eyes absent.

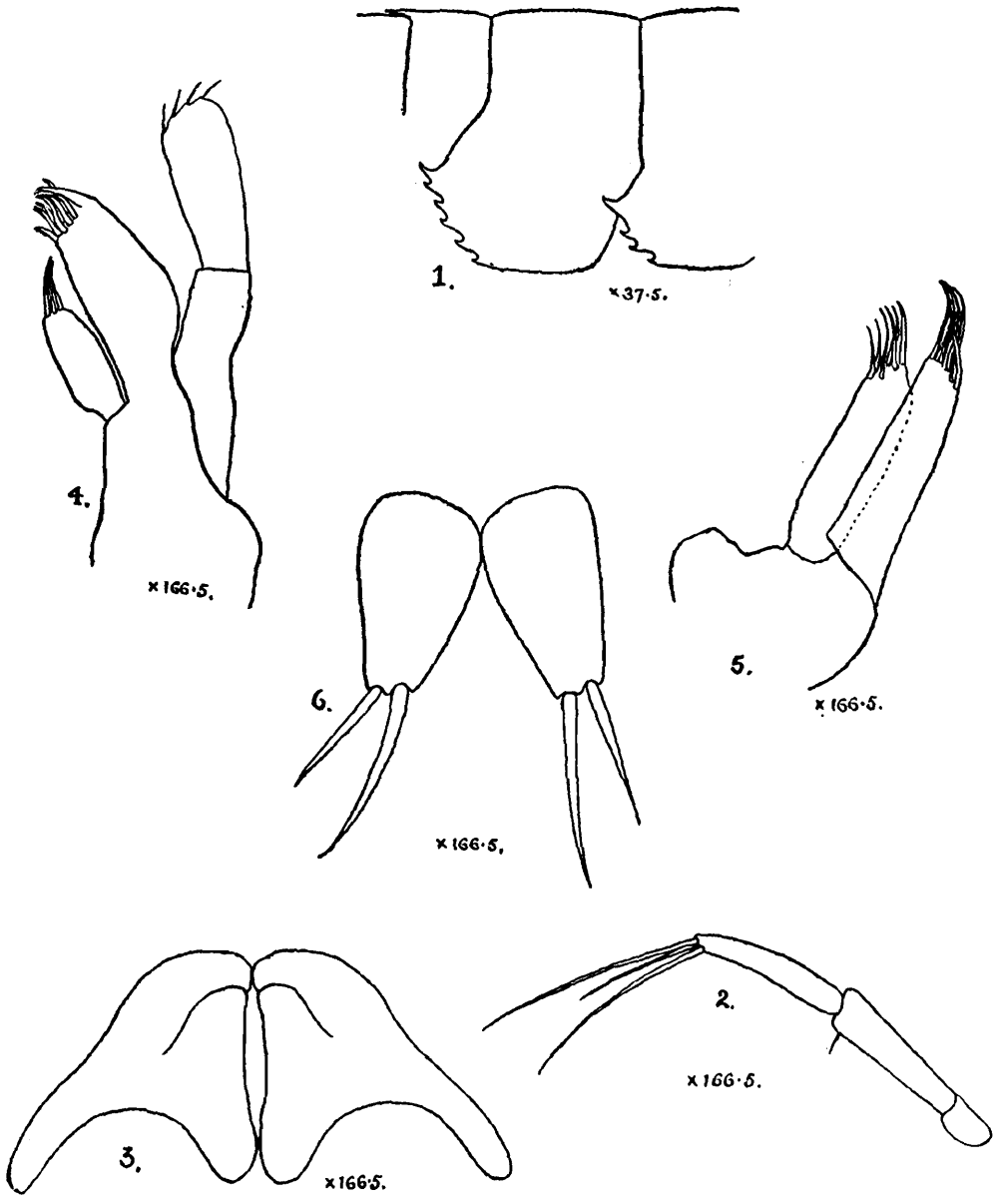
Coxal plates of the first four free thoracic somites rather deeper than their somites ; first three rectangular in shape with a few scattered setæ on the lower and hinder margins ; fourth plate (fig. 11) as wide as high,

deeply excavate on the posterior margin, produced part rounded, a few scattered setæ on the lower margin.

Fourth abdominal somite (fig. 1) produced in the mid-dorsal line to a short acute spine.

Epimeral plates of the first three abdominal somites (fig. 1) with the lower portion of the hind free margin serrate, the teeth coarse, sharp and distantly placed, 2-3 teeth on the first plate, 3-4 on the second and 4-6 on the third.

Antennules (fig. 7) about two thirds of the length of the animal, basal joint of the peduncle about equal in length to the head; second joint



TEXT-FIGURES 1-6.

Paraniphargus annandalei, gen. et sp. nov. :—Fig. 1, Epimeral plates 2 and 3 and spine on the posterior dorsal border of the fourth abdominal somite; fig. 2, mandibular palp; fig. 3, lower lip; fig. 4, first maxilla; fig. 5, second maxilla; fig. 6, telson.

FIG. 1. × 37·5. FIGS. 2-6. × 166·5.

of the peduncle slightly longer than the first and one and a half times as long as the third; flagellum longer than the peduncle, composed of

15-17 joints ; accessory flagellum hardly as long as the first joint of the main flagellum, two-jointed, second joint minute.

Antennae (fig. 8) shorter than the antennules; peduncle equal in length to the peduncle of the antennules, fourth and fifth joints subequal in length ; flagellum shorter than the peduncle, composed of 7-9 joints.

Upper lip with the free border regularly convex.

Lower lip (fig. 3) with well developed internal lobes, lateral lobes rounded, posterior projections rather narrow and bluntly pointed.

Mandible with the molar process well developed ; palp (fig. 2) short and slender and altogether feebly developed, second and third joints subequal in length, third joint armed with three long setæ at the apex, no other armature, except a single short seta on the second joint.

First maxilla (fig. 4) with the inner lobe small and narrow, with three setæ at the apex and none on either margin ; outer lobe armed with six barbed spines at the apex ; palp not longer than the outer lobe, two-jointed, second joint longer than the first with four to six feeble spinules at the apex.

Second maxilla (fig. 5) composed of two equal lobes armed with setæ at the apex but none on the margins.

Maxilliped quite normal and typical ; lobe from the second joint well developed and extending to the middle of the fifth joint ; lobe from the third joint longer and broader than that from the second, hardly extending to the distal end of fifth joint ; fifth joint larger than the sixth or seventh, latter dactyliform.

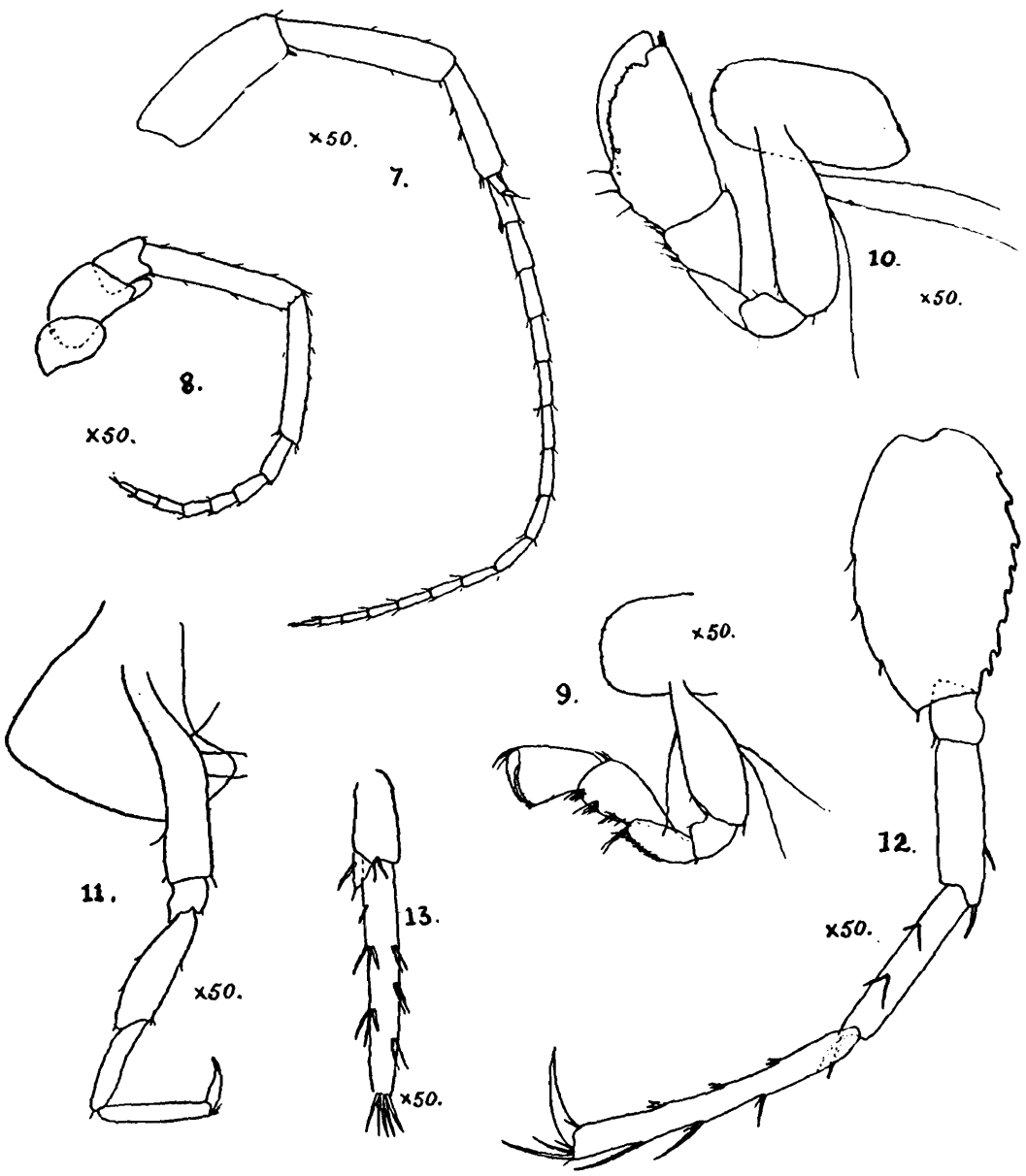
Gnathopod 1 (fig. 9) small and not greatly developed ; second joint very narrow at the point of attachment to the coxal plate, one long seta on the upper margin and two on the lower ; fourth joint with a group of four or five long spiniform setæ on the distal end of the lower (inner) margin, proximal to which are a number of short very fine setæ ; fifth (carpal) joint larger than the fourth, its inner margin armed with three groups of 5-6 setæ ; sixth (propodal) joint rhomboidal in shape, not larger than the fifth, its outer and inner margins practically straight and diverging to a truncate, straight palmar margin which is about two-thirds to three quarters as wide as the joint is long, inner angle of the palm almost a right angle and armed with one seta ; seventh joint (dactylus) recurved, equal in length to the palmar margin on which it impinges.

Gnathopod 2 (fig. 10) larger and more robust than gnathopod 1 and considerably different in shape ; second joint with a narrow attachment to the coxal plate, with three long setæ on the lower margin ; fifth (carpal) joint with three groups of setæ on the inner margin ; sixth (propodal) joint twice as long as the fifth and more robust, inner margin less than half as long as the outer so that the palmar margin is long and oblique, inner margin armed with a few short rather stout setæ, palmar margin lightly crenulate and armed with about 10-12 short fine setæ ; on the inner face of the sixth joint just inside the angle of the palm is a single short stout spine ; seventh joint (dactylus) long and slender, as long as the palmar margin.

Pereiopods 1 *and* 2 (fig. 11) (fourth and fifth thoracic limbs) similar in size and form, second joint longer than any of the others, fourth joint

as long as but wider than the sixth and both somewhat longer than the fifth ; seventh joint scarcely half as long as the sixth ; whole limb very feebly armed with a few scattered setæ.

Pereiopods 3-5 (fig. 12) (sixth to eighth thoracic limbs) essentially of the same form and structure, long and slender limbs, the third shorter than the fourth and fifth which are subequal in length ; in all the second joint is expanded and bears 4-5 spines on the front margin, the hind margin serrate with 7-9 rather coarse teeth ; the fourth joint is shorter



TEXT-FIGURES 7-13.

Paraniphargus annandalei, gen. et sp. nov. :—Fig. 7, Antennule ; fig. 8, antenna ; fig. 9, first gnathopod ; fig. 10, second gnathopod ; fig. 11, second pereiopod ; fig. 12, fifth pereiopod ; fig. 13, third uropod.

All × 50.

than the fifth and the fifth shorter than the sixth while the joints are successively narrower in that order and their armature consists of few setæ scattered or in small groups ; the seventh joint is not more than one-third of the length of the sixth and slightly curved.

Uropod 1 with the rami shorter than the peduncle and equal in size; peduncle armed with three spines; the outer ramus with two lateral and four terminal spines, the inner with one lateral and four terminal.

Uropod 2 with the rami subequal in length to the peduncle and to each other; outer ramus with one lateral and two terminal spines, the inner with two lateral and a group of four or five terminal spines.

Uropod 3 (fig. 13) longer than either of the others; inner ramus small and scale-like and having a single seta at the apex; outer ramus nearly three times as long as the peduncle, one-jointed, with three lateral groups of spines on each margin and a terminal group of five or six spines.

Telson (fig. 6) small, cleft to the base, with two divergent lobes each armed with two apical spines.

Length of the largest specimen, 4 mm.

Locality.—S. Andaman Islands, Mount Harriet, 500-800 feet, among matted rootlets of trees growing over rocks covered by a thin trickle of water in a jungle stream, December 1923, Dr. Annandale, several specimens.

Remarks.—The generic position of this interesting species has already been discussed. It approaches most nearly to *Niphargus indicus* among described forms but can be distinguished from that species by the spine on the fourth abdominal somite, the serrated epimeral plates of the first three abdominal somites and the very different form of the gnathopods. It is an extremely interesting open water form which, in its fragility and absence of colour and eyes, resembles those species which are characteristic of wells and underground waters generally.

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NOTES ON CRUSTACEA DECAPODA IN THE INDIAN MUSEUM.

XVII. On various Caridea.

By Stanley Kemp, *Sc. D.*

In this paper I have brought together notes on Caridea belonging to the families Pasiphaeidae, Stylodactylidae, Rhynchocinetidae, Pandalidae, Palaemonidae (Palaemoninae and Pontoniinae), Hippolytidae, Anchistioididae and Crangonidae.

As points of more than mere taxonomic interest arising out of the work, attention may be drawn to the existence in females of the genus *Leptochela* of a very striking dimorphism correlated with the breeding season, to the monstrous growth of the third maxilliped and first leg in very old males of the genus *Rhynchocinetes* and to the probable occurrence of well-developed photophores in two shallow-water genera of Pandalidae.

Until recently the appendix interna was not known to occur on the first pleopod in any species of Caridea. A few years ago, however, it was noticed by Borradaile in the Pontoniine prawn *Urocaridella gracilis*, in which species it is found in the male only, and it is here reported from the males of *Rhynchocinetes* and of two Palaemoninae, *Leander tenuicornis* (Say) and *Palaemonetes hornelli*, sp. nov. In most, if not all, other species of *Leander* and *Palaemonetes* the appendix is not found on the first pleopod and it is very remarkable that a character—which is presumably primitive—should have persisted only in single species of these two genera.

In the Pandalidae I have drawn attention to the very close affinity which exists between *Thalassocaris*, usually placed in a separate subfamily, and the more primitive members of the Pandalinae and, in setting up two fresh genera showing affinities with *Chlorotocus* and *Thalassocaris*, have suggested the abandonment of the subfamily. A new genus of Hippolytidae, intermediate between *Latreutes* and *Tozeuma*, is proposed; the rediscovery of Paulson's *Anchistioides*, which had not been seen for close on fifty years, is a matter of some interest and so, to students of geographical distribution, is the presence of a species of *Palaemonetes* in S. India.

As this is the last contribution which I shall be able to make to the series entitled "Notes on Crustacea Decapoda in the Indian Museum," I have given at the end of this paper a list of all the titles, together with a reference to the volume in which each was published.

Family PASIPHAEIDAE.

Genus **Leptochela** Stimpson.

1860. *Leptochela*, Stimpson, *Proc. Acad. Sci. Philadelphia* XII, p. 42.
1920. *Leptochela*, de Man, *Decap. 'Siboga' Exped.* IV, p. 18.

Stebbing[1] considers that it is uncertain whether *Leptochela* really belongs to the Pasiphaeidae, but his doubts are not shared by other

[1] Stebbing, *Trans. Roy. Soc. Edin.* L, p. 294 (1914).

authors who have dealt with the genus. In many peculiar features of the oral appendages and in important details in the structure of the legs *Leptochela* shows itself a typical member of the family and it is evidently more closely related to *Pasiphaë* than is the genus *Psathyrocaris*. In addition to structural points it may be noted that in *Leptochela*, as in most if not all Pasiphaeids, the females carry their eggs in a fashion different to that found in other families of Caridea. In the latter the eggs are usually attached to all the pleopods and are distributed throughout the length of the first five abdominal somites; in Pasiphaeids, on the other hand, they are attached only beneath the first two somites and are thus restricted to the anterior part of the abdomen.

Attention has frequently been drawn to the fact that in females of certain species of *Leptochela* the carapace is sharply tricarinate dorsally, whereas in males there is at most only a single median carina. This, however, is a very imperfect statement of the facts and it neglects the most interesting feature of this curious sexual difference.

In the extensive collection which I have examined there are numbers of females in which the carapace is tricarinate, but there are very much greater numbers of specimens in which this feature cannot be detected. That all these should be males seemed improbable, for in collections of Caridea males are usually less abundant than females. On examining the pleopods it was discovered that a large proportion of specimens in which the carapace was not tricarinate were really females, two forms of this sex being thus found in a single species. This remarkable dimorphism of the female is clearly correlated with the breeding periods, for all the specimens with tricarinate carapace are either ovigerous or—as can easily be seen by the condition of the abdomen—have just liberated their young, whereas all those with smooth carapace are not ovigerous and show no sign that they have recently borne eggs. The material examined points to the conclusion that the female moults immediately before the extrusion of her ova, the carapace in the course of this moult developing the longitudinal carinae. Subsequently, after the eggs have hatched and the larvae are liberated, a further moult restores the carapace to its original smooth condition. No specimens with an intermediate type of carapace were found and in almost every large sample that was examined both types of female were discovered. In *Leptochela*, as in many other tropical and sub-tropical Caridea, there seems to be no sharply defined breeding season, ovigerous specimens occurring at almost any time of the year. Dimorphic forms of the female have been found in *L. robusta*, *L. aculeocaudata* and *L. pugnax* and it is not unlikely that the phenomenon occurs throughout the genus.

A list of the six known species[1] of *Leptochela*, with notes on their distribution, is given by de Man (*loc. cit.*, p. 4). The species may be distinguished thus :—

I. Fifth abdominal somite with one or more dorsal teeth [orbital margin entire].

A. Four mid-dorsal teeth on fifth abdominal somite; one dorsal and two lateral pairs of spines on anterior part of telson ... ... *carinata* Ortmann.

[1] On p. 722 of his *Report on the 'Challenger' Macrura* Spence Bate refers to '*Leptochela reversa*'; this, however, is merely a mistake for *L. robusta*.

B. One mid-dorsal tooth on fifth abdominal somite, situated at distal extremity; one dorsal and one lateral pair of spines on anterior part of telson	*gracilis* Stimpson.
II. Fifth abdominal somite without dorsal teeth.	
A. Orbital margin finely serrated or spinulose [one dorsal and two lateral pairs of spines on anterior part of telson][1]	*serratorbita* Bate.
B. Orbital margin entire.	
i. One dorsal and two lateral pairs of spines on anterior part of telson; dactylus of second leg with at least 35 spines [antennal spine absent; fingers of second leg less than twice as long as palm]	*robusta* Stimpson.
ii. One dorsal and one lateral pair of spines on anterior part of telson; dactylus of second leg with at most 25 spines.	
a. Antennal spine absent; fingers of second leg usually less than twice as long as palm ...	*aculeocaudata* Paulson.
b. Antennal spine present; fingers of second leg twice or more than twice as long as palm...	*pugnax* de Man.

Of these six species I have seen all but *L. carinata* Ortmann.[2] I have examined the type of *L. serratorbita* Bate[3] in the British Museum and notes on the other species will be found below. In the curious arrangement of spines on the lower border of the ischium of the fourth leg all the species that I have examined are identical.

Leptochela gracilis Stimpson.

1860. *Leptochela gracilis*, Stimpson, *Proc. Acad. Sci. Philadelphia* XII, p. 42.
1888. *Leptochela gracilis*, Bate, *Rep. 'Challenger' Macrura*, p. 860, pl. cxxxix, fig. 2.
1914. *Leptochela gracilis*, Balss, *Abh. Math.-phys. Kl. K. Bayer. Akad. Wiss. München*, Suppl.-Bd. II, Abh. 10, p. 19.

The principal characters of this species appear to be the following:—

1. The rostrum reaches well beyond the eye, extending to the middle or end of the second antennular segment.
2. The antennal spine is absent and the orbital margin is not serrated.
3. The antennal scale is about 5 times as long as wide.
4. The penultimate segment of the third maxilliped is about 1·4 times as long as the ultimate.
5. In the second leg the palm is about 2·25 times as long as broad and the fingers are about 1·25 times as long as the palm. The spines on the inner margins of the fingers are very numerous, from 55 to 65 on the dactylus and from 73 to 85 on the fixed finger. The spines are not always very clearly arranged in groups, as in most species of the genus; but when this feature is apparent the longer spines in the middle

[1] Bate's figure of the telson is most misleading.
[2] Ortmann, *Decap. Schizop. Plankton-Exped.*, p. 41, pl. iv, fig. 1 (1893); Rathbun, *Bull. U. S. Fish Comm. for* 1900, ii, p. 127 (1901).
[3] Bate, *Rep. Challenger' Macrura*, p. 859, pl. cxxxix, fig. 1 (1888); Rathbun, *loc. cit., supra* (1901).

of the finger-length are separated by series of 7 to 11 shorter spines.

6. The fourth abdominal somite is much compressed but scarcely carinate dorsally. The fifth is sharply carinate, the carina terminating posteriorly in a strong spine which overhangs the sixth somite. The pleura of the fourth and fifth somites are marginally rounded in both sexes.
7. The sixth abdominal somite has a prominent transverse tubercle on the upper side near the anterior end. On each lower edge there is a single strong spine, in length more than one fifth that of the somite.
8. On the telson there are two pairs of spines in advance of the apex; the foremost is dorsal and placed near the base, the second pair lateral and inserted a little behind the middle.
9. There are 13 to 15 spines on the external margin of the outer uropod and 5 or 6 on the upper surface of the inner uropod near the apex.

Large specimens reach a length of about 45 mm.

There is little doubt that the specimens are correctly identified; except for the length of the rostrum, which is stated to be shorter than the eye; they agree very well with Stimpson's original description. De Man's statement [1] that "the outer orbital angle terminates in a small acute spine" is incorrect and is perhaps derived from Bate's inaccurate figure.

This species does not occur on the coasts of British India. The specimens examined are from Misaki, Japan (a single example) and from Amoy Harbour, Amoy market and Foochow in Fukien province, China, collected in 1923 by Mr. S. F. Light. The Misaki specimen is perhaps abnormal; the antennal scale is only four times as long as wide and the spine at the end of the fifth somite is short, bent downwards and looks as though it had been damaged.

The species has been recorded only from Japan (Stimpson, Bate) and from Korea (Balss).

Leptochela robusta Stimpson.

1917. *Leptochela robusta*, Borradaile, *Trans. Linn. Soc. London* (2) *Zool.*, XVII, p. 398.
1920. *Leptochela robusta*, de Man, *Decap. Siboga' Exped.* IV, p. 19, pls. iii, iv, figs. 7-7*x*.
1920. *Leptochela robusta*, Balss, *Kungl. Svenska Vetensk. Handl.* LXI, No. 10, p. 7.

Other references are given by de Man. The principal characters of the species are as follows:—

1. The rostrum reaches almost or quite to the end of the eyes, sometimes extending to the end of the basal segment of the antennular peduncle.
2. The antennal spine is absent and the orbital margin is not serrated.
3. The antennal scale is from 3·5 to 3·75 times as long as wide.

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[1] De Man, *Decap. 'Siboga' Exped.* IV, p. 27 (1920).

4. The penultimate segment of the third maxilliped is 1·25 times as long as the ultimate segment.
5. In the second leg the palm is 2·25 to 2·5 times as long as wide and the fingers are about 1·75 times as long as the palm. There are from 37 to 42 spines on the inner margin of the dactylus and from 45 to 50 on the fixed finger. The spines are divided into groups; in the middle of the finger-length the longer spines are separated by a series of from 4 to 7 shorter spines.
6. The fourth abdominal somite is rounded above; the fifth is compressed but scarcely carinate dorsally and there is no posterior spine. The margins of the pleura of the fourth and fifth somites are rounded. The male does not possess the dentiform postero-inferior angle on the fifth somite, described by de Man (*loc. cit.*, p. 27) but in one very young specimen is obtusely angled.
7. The sixth abdominal somite has a prominent transverse tubercle on the upper side near the anterior end. On each inferior edge near the posterior end there is a single spine of no great length, in advance of which one or two smaller teeth may frequently be found.
8. On the telson there are three pairs of spines in advance of the apex. The foremost is dorsal and placed near the base; the second and third pairs are lateral, the third situated a little behind the middle of the telson-length and the second rather nearer to the third than to the first.
9. There are 14 to 16 spines[1] on the external margin of the outer uropod and 3 or 4 on the upper surface of the inner uropod near the apex.

The largest specimen examined is 22·5 mm. in length. In the form of the carapace the females, as explained on p. 250, are dimorphic.

The specimens examined are from the following localities :—

C828/1.	Haddumati Atoll, Maldives.	Mus. Cantab. (Gardiner coll.).	Two.
C829/1.	Addu Atoll, Maldives.	R. B. S. Sewell, April, 1923.	Five.
C830/1.	Burma Coast; 12° 48′ N., 98° 16′ 10″ E., 24 fms.	'Investigator,' Oct., 1913.	One.
C831/1.	Ross Channel, Port Blair, Andamans.	S. Kemp, March, 1921.	Thirty two.
C832/1.	Nancowry Harbour, Nicobars, 13 fms.	'Investigator,' Oct., 1921.	Eighteen.
C833/1.	Camorta I., Nicobars.	'Investigator,' March, 1922.	Two.

In colour this species bears a close resemblance to *L. aculeocaudata*. Living specimens obtained at Port Blair were almost transparent, with the mouth parts reddish and with a very faint reddish suffusion on the last segment of the antennular peduncle, at the bases of the legs and pleopods and at the tip of the telson.

[1] In the specimens examined: 11 or 12 according to de Man.

The species has been recorded from China and the Loo Choo Is. (Stimpson), the Hawaiian Is. (Rathbun), the N.E. coast of Australia (Balss), from numerous localities in the East Indian Archipelago (de Man), the Maldives (Borradaile) and the Red Sea (Balss). In recording specimens from the last named locality Balss suggests [1] that *L. aculeocaudata* is synonymous with *L. robusta*. The two are here regarded as distinct, but since Balss mentions the presence of 3 pairs of spines on the telson in his Red Sea specimens, there is little doubt that they are correctly referred to *L. robusta*.

Leptochela aculeocaudata Paulson.

1915. *Leptochela aculeocaudata*, Kemp, *Mem. Ind. Mus.*, V. p. 311, pl. xiii, fig. 14 and text-figs. 34, 35.

The following appear to be the principal characters of this species :—

1. The rostrum extends to the middle of the cornea or to the end of the eye and does not reach the end of the basal antennular segment.
2. The antennal spine is absent and the orbital margin is not serrated.
3. The antennal scale is about 4 times as long as wide.
4. The penultimate segment of the third maxilliped is from 1·25 to 1·28 times the length of the ultimate segment.
5. In the second leg the palm is from 2·0 to 2·25 times as long as wide ; the fingers are usually decidedly less than twice as long as the palm (about 1·75 times), very rarely just twice as long. There are from 18 to 25 spines on the inner margin of the dactylus and from 21 to 28 on the fixed finger. The spines are divided into groups ; in the middle of the finger-length the longer spines are separated by series of 2 to 4 shorter spines.
6. The fourth abdominal somite is dorsally rounded ; the fifth is compressed but scarcely carinate above and there is no posterior spine. The margins of the pleura of the third to fifth somites are evenly rounded.
7. The sixth abdominal somite has a well-developed transverse tubercle on the upper side near the anterior end. The spine on each lower border near the posterior end is very short, only one seventh or one eighth the length of the somite, and occasionally there are one or two smaller spines in front of it.
8. The telson has only two pairs of spines in advance of the apex. The foremost of these is dorsal and placed near the base ; the second pair is lateral and placed at about the middle of the telson-length.
9. There are 10 to 15 spines on the external margin of the outer uropod and from 3 to 5 on the upper surface of the inner uropod near the apex.

Large specimens are about 16 mm. in length.

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[1] Balss, *Denkschr. Math.-naturw. Kl. K. Akad. Wiss. Wien* XCI, p 17 (1915).

Balss has suggested that this species is synonymous with *L. robusta*; it seems, however, to be readily distinguished by the number of spines on the fingers of the first and second legs and by the presence of only two pairs of spines (clearly shown in Paulson's figure) on the telson in advance of the apex.

I have already given an account of the colouration of this species and recorded it from a number of Indian localities. Additional specimens are as follows:—

C834/1.	Pandwell Creek, Bombay.	J. C. Caunter, Feb., 1911.	One.
C835/1.	Lawson's Bay, Waltair, Madras Pres., 2½-5 fms.	S. Kemp and B. Chopra, Jan., 1921.	One.
C836/1.	Off Puri, Orissa Coast, 4-4½ fms.	S. Kemp, March, 1916.	Several.
C837-8/1.	Ross Channel and Brigade Creek, Port Blair, Andamans.	S. Kemp, Feb., 1921	Three.
C839/1.	Mergui Archipelago, 11° 17′20″N., 98° 29′40″ E., 6 fms.	'Investigator', March, 1914.	Several.
C840/1.	Nancowry Harb., Nicobars.	'Investigator', Oct., 1922.	Several.
C841/1.	Camorta I., Nicobars.	Investigator', March, 1922.	Several.

The species was described by Paulson from the Red Sea and appears to be common on the Indian Coast. I have already recorded it from the Gulf of Manaar, from Puri and the Chilka Lake on the Orissa Coast, from the Andamans and from the Mergui Archipelago, but on re-examining the specimens I find that some of those from the two last-named localities should be referred to *L. pugnax*.

Leptochela-pugnax de Man.

1920. *Leptochela pugnax*, de Man, *Decap. 'Siboga' Exped.* IV, p. 26, pl. iv, figs. 8-8*d*.

Compared with the preceding forms this species presents the following characters:—

1. The rostrum reaches to or beyond the end of the eye, often extending to the distal end of the basal antennular segment.
2. The antennal spine is small, but outstanding and easily seen. The orbital margin is not serrated.
3. The antennal scale is about 4 times as long as wide.
4. The penultimate segment of the third maxilliped is about 1·4 times as long as the ultimate segment.
5. In the second leg the palm is only about twice as long as wide, with fingers from 2·0 to 2·25 times as long as the palm. There are from 17 to 23 spines on the inner margin of the dactylus and from 19 to 28 on the fixed finger. The spines are divided into groups; in the middle of the finger-length the longer spines are separated by series of 2 or 3 shorter spines.
6. The fourth abdominal somite is dorsally rounded; the fifth is compressed but scarcely carinate above and does not bear a spine posteriorly. The margins of the pleura of the 3rd, 4th and 5th somites in males are bluntly angulate anteriorly, sometimes, more especially in the 5th somite, with a small blunt tooth; posteriorly the margin is rounded.

7. The transverse dorsal tubercle at the proximal end of the 6th somite is very poorly developed. The spine on each lower border near the posterior end is unusually long, about one quarter the length of the somite. On the margin in front of this spine one or two smaller spines are occasionally found.
8. The telson bears only two pairs of spines in advance of the apex. The foremost of these is dorsal and placed near the base, the second is lateral and situated a little behind the middle of the telson-length.
9. There are 9 to 11 spines on the external margin of the outer uropod and 3 or 4 on the upper surface of the inner uropod near the apex.

Large specimens are about 16 mm. in length.

I have no notes on the colouration of this species and can only remark that living specimens do not differ in any conspicuous way from *L. robusta.* The three species *L. robusta*, *L. aculeocaudata* and *L. pugnax* often occur on the same ground, several of the samples examined containing a mixture of two or more species. In the carination of the carapace, as already noted, the females of all three species exhibit a well-marked dimorphism.

Specimens of *L. pugnax* are from the following localities :—

C842/1.	Addu Atoll, Maldives.	R. B. S. Sewell, April, 1923.	One.
9086/10.	Port Blair, Andamans.[1]	S. Kemp, March, 1915 ; Feb., March, 1921.	Many.
9090-1/10.	Mergui Archipelago, 12° 40′ N., 98° 26′ 30″ E.	'Investigator,' Oct., 1913.	Many.
9095/10.	Mergui Archipelago, 11° 19′ 58″ N., 98° 29′ 52″ E.	'Investigator,' March, 1914.	Several.
9092/10.	Mergui Archipelago, 11 27′ 45″ N., 98° 36′ 15″ E.	'Investigator,' March, 1914.	Several.
C843/1.	Octavia Bay, Nancowry Harb., Nicobars.	'Invstigator,' Oct., 1922.	Many.
C844/1.	Camorta I., Nicobars.	'Investigator,' March, 1922.	One.
C845/1.	S. end of Penang I., 4½ fathoms.	N. Annandale, Jan., 1916.	One.

The species is recorded by de Man from several localities in the East Indian Archipelago.

Family STYLODACTYLIDAE.

Genus **Stylodactylus** A. Milne-Edwards.

1881. *Stylodactylus*, A. Milne-Edwards, *Ann. Sci. nat.* (6) XI, iv, p. 11.
1920. *Stylodactylus*, de Man, *Decap.* '*Siboga*' *Exped.* IV, p. 31.

Stylodactylus, the only known genus in the family which bears its name, comprises five or six species, a list of which, together with distributional notes, has been contributed by de Man. The species of the genus seem always to be rare and, in the collection which I have examined, only two are to be found, one belonging to a form which has not hitherto

[1] Specimens were obtained in Brigade Creek, off Viper I. and in Ross Channel.

been described. I have, however, also had the opportunity of examining in the British Museum the material collected by H.M.S. 'Challenger' and I take this opportunity of presenting a synopsis of the species.

I. Rostrum with teeth on its lower border.	
A. Antennal scale with a series of spines on its outer edge.	
1. Antennal scale with 7 to 9 marginal spines; propodus of third leg less than 3 times as long as dactylus; pleura of first five abdominal segments with strong marginal spines; telson with 5 pairs of lateral spines in front of apex	*amarynthis* de Man, p. 258.
2. Antennal scale with 4 marginal spines; propodus of third leg more than 6 times as long as dactylus; pleura of first five abdominal somites unarmed; telson with 4 pairs of lateral spines in front of apex	*rectirostris* A. M.-Edw.[1]
B. Antennal scale with outer edge entire save for terminal spine.	
1. Antennal scale as long as carapace; 3rd abdominal somite produced posteriorly over 4th and dorsally twice as long as 2nd; pleura of 5th somite acutely produced posteriorly; telson with 5 pairs of lateral spines in front of apex	*bimaxillaris* Bate.[2]
2. Antennal scale about half as long as carapace; 3rd abdominal somite not produced posteriorly and dorsally little longer than 2nd; pleura of 5th somite rounded posteriorly; telson with 4[3] pairs of lateral spines in front of apex	*serratus* A. M.-Edw.[4] *discissipes* Bate.[5]
II. Rostrum without teeth on its lower border. [Antennal scale with outer edge entire].	
A. Cornea set terminally on eyestalk; third leg with propodus about 5 times as long as dactylus and with dactylus 3 times as long as broad; telson with 5 pairs of lateral spines in front of apex	*sibogae* de Man.[6]
B. Cornea set obliquely on eyestalk; third leg with propodus less than 2½ times as long as dactylus and with dactylus 8½ times as long as broad; telson with 3 pairs of lateral spines in front of apex	*investigatoris*, sp. nov., p. 260.

[1] *S. rectirostris*, A. Milne-Edwards, *Recueil Figs. Crust. nouv. ou peu connus*, pl. 35 (1883).

[2] *S. bimaxillaris*, Bate, *Rep. Challenger' Macrura*, p. 855, pl. cxxxviii, fig. 3 (1888); Balss, *Abh. math.-phys. Kl. K. Bayer. Akad. Wiss. München*, Suppl.-Bd. II, Abh. 10, p. 27 (1914); Stebbing (as *S. serratus*), *Ann. S. Afric. Mus.* XV, p. 51, pl. lxxvi (1914).

[3] In the type of *S. discissipes* one of the spines is missing and there are thus 3 on one side and 4 on the other; this is no doubt merely an individual abnormality.

[4] *S. serratus*, A. Milne-Edwards, *Ann. Sci. nat.* (6) XI, iv, p. 11 (1881); *id.*, *Recueil Figs. Crust. nouv. ou peu connus*, pl. 35*a* (1883); Faxon, *Bull. Mus. Comp. Zool. Harvard* XXX, p. 160 (1896).

[5] *S. discissipes*, Bate, *Rep. Challenger' Macrura*, p. 851, pl. cxxxviii, fig. 1 (1888); *id.*, *ibid.* (as *S. orientalis*), p. 854, pl. cxxxviii, fig. 2; Rathbun, *Bull. U. S. Fish Comm.* for 1903, iii, p. 927, fig. 75 (1906).

[6] *S. sibogae*, de Man, *Zool. Meded. Leiden* IV, p. 159 (1918); *id.*, *Decap. Siboga' Exped.* IV, p. 38, pl. v, figs. 10–10*c* (1920).

Bate's *S. orientalis*, as de Man has already suggested, is no doubt synonymous with *S. discissipes*. The type specimens [1] of the two species were found at the same station and they differ from one another only in minor details of rostral length and spinulation.

It is probable that *S. discissipes* is synonymous with *S. serratus*, but the former is known only from the Indo-Pacific, while the latter, which I have not seen, is from the West Indies. Until specimens from these two localities have been compared in detail judgment must be deferred. *S. discissipes*, like other species of the genus, possesses a small supra-orbital spine. This is not shown by Milne-Edwards, but he may have overlooked it, just as Bate did. The telson also differs rather widely from Milne-Edwards' figure, the apex being much broader and armed with four spines on either side of the median tooth. In the armature of the apex there is perhaps some variation, for in a specimen which Miss Rathbun refers to *S. discissipes* there are only three pairs of apical spines.

The specimen from S. Africa referred by Stebbing to *S. serratus* seems to belong more properly to *S. bimaxillaris*, a species in which it must not be supposed that spines are absent from the last three legs merely because Bate has not shown them in his figure.

Stylodactylus amarynthis de Man.

1902. *Stylodactylus* sp. (*amarynthis*), de Man, *Abh. Senck. naturf. Ges. Frankfurt* XXV, p. 897, pl. xxvii, fig. 64.
1920. *Stylodactylus Amarynthis*, de Man, *Decap. 'Siboga' Exped.* IV, p. 32, pl. v, figs. 9-9*h*.

Four specimens from the Andaman Is. clearly belong to this well characterized species. The rostrum is broken in two of the specimens in the others it bears 20 teeth above and 7 or 9 below. Three or four of the upper teeth are situated on the carapace behind the posterior limit of the orbit and the posterior tooth is sometimes nearer to the 2nd than the 2nd to the 3rd. The teeth are uneven in size and distribution and near the apex on the lower side a few densely plumose setae are sometimes to be found. Supra-orbital, antennal and pterygostomian spines are present.

In life a circlet of stout and very strongly plumose setae is evidently present on the eyestalk, surrounding the cornea. The setae are easily broken off and appear to have been altogether absent in the specimens examined by de Man. There are two spines at the distal end of the second antennular segment and a series of 8 on the outer border of the antennal scale.

The penultimate segment of the third maxilliped is 12 times as long as wide. The number of spines on this limb and on the first two pairs of legs is frequently lower than indicated by de Man, while the propodus of the third leg is often longer in proportion to the dactylus, the former in one specimen being 2·6 times the length of the latter. The dactylus

[1] Bate records from St. 171 two specimens of *S. discissipes* and one of *S. orientalis*. Only a single specimen of each was, however, received by the British Museum and it is evident from Bate's remarks that the record under *S. discissipes* is erroneous.

of the third and fourth legs bears 3 or 4 teeth in addition to the terminal claw; in one male specimen there are only 4 teeth on the dactylus of the fifth leg, while in another male, as in de Man's ovigerous female there are 7. On all the last three legs there are occasional stout and, heavily plumose setae, readily lost and quite different in character from those on the 3rd maxilliped and first two legs.

The characteristic spines on the pleura of the first five abdominal somites show considerable variation. As a rule three distinct groups of spines can be distinguished on the first two somites and two groups on the next three somites. If the spines are counted from before backwards and the intervals between the groups are indicated by dashes the number present on the right side in each of the four specimens may be tabulated thus :—

Somite.	1	2	3	4
I ..	1—2—3	3—2—2	1—2—2	1—1—1
II	4—2—1	4—3—1	4—4—1	3—2—1
III	4—1	4—1	4—1	4—1
IV ..	3—1	4—1	4—1	3—1
V	3—1	4—1	5—1	3—1

The telson bears 5 pairs of lateral spines behind the apex in three of the specimens; in the fourth, owing to an individual abnormality, there are 5 spines on one side and 4 on the other. The apex is acutely pointed in the middle with 3 spines and 2 plumose setae on either side. The external border of the outer uropod is finely setose and ends in three spines, of which the hindmost alone is movable. The articulated spines mentioned by de Man on the proximal part of this margin appear to be absent, but there are sometimes two small fixed spinules at the proximal end of the inner border of the inner uropod.

The largest of the four specimens is a male about 15 mm. in length.

In life the specimens adopted a curious attitude, not unlike that of the remarkable Hippolytid *Phycocaris simulans*. The abdomen was bent backwards until the third abdominal somite was in contact with the carapace and the telson and antennules almost touched one another. The specimens were closely mottled with pale grey greens, pale browns, black, and pinkish white. On each side of the carapace there was a large pinkish white blotch, terminating anteriorly in a brownish red spot, and other blotches of the same colour occurred on the dorsal aspect of the carapace, mid-laterally on the first abdominal somite and infero-laterally on the second and fourth somites. The tail-fan and tips of the antennules were dull red. The legs were pale grey green with reddish bands at the tips of the third maxillipeds and on the chelae of the first two legs.

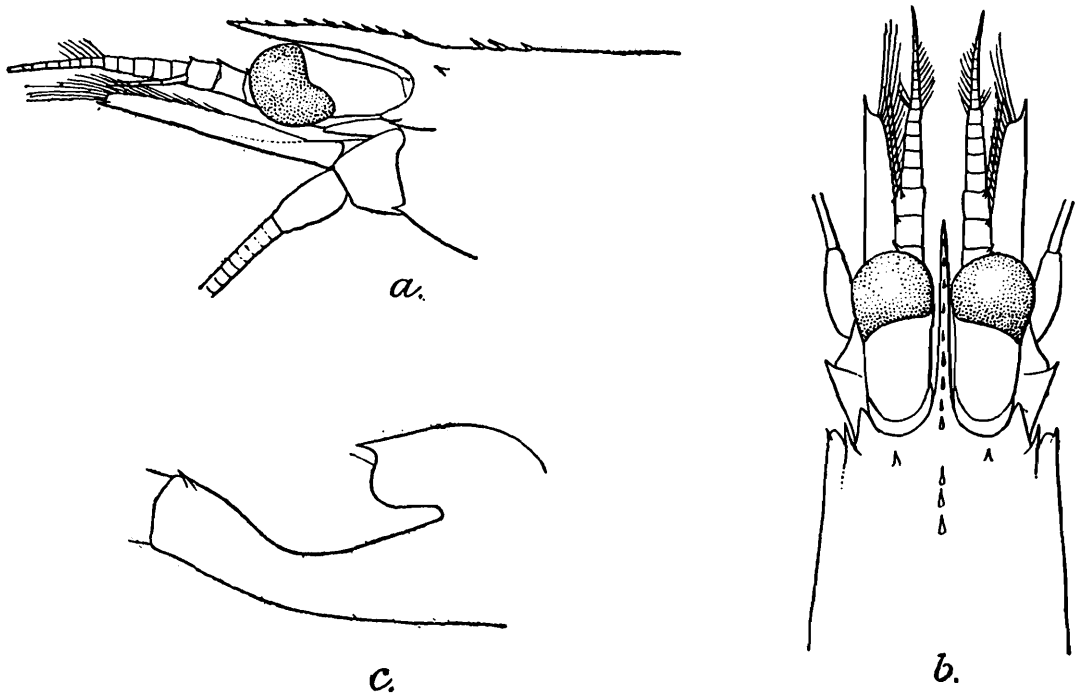
C846/1.	Ross Channel, Port Blair, Andaman Is., 5-8 fms.	S. Kemp, March, 1921.	Four.

The species has been recorded by de Man from Ternate and three other localities in the East Indian Archipelago. One of the specimens was obtained at a depth of 164-218 fathoms.

Stylodactylus investigatoris, sp. nov.

The rostrum reaches just to the end of the second segment of the antennular peduncle and is slender and quite straight. It bears on its upper border nine slender, forwardly-directed teeth, all of which are articulated. The hindmost of these teeth is slightly in advance of the posterior limit of the orbit and is more distant from the second than the second is from the third. The remaining teeth are close-set proximally, the interspaces gradually increasing in length towards the apex. On the carapace in its anterior third there are three additional teeth, separated by a wide interval from those on the rostrum and with the two foremost placed rather close together. The lower border of the rostrum is nearly straight and completely unarmed (fig. 1*a*).

The supra-orbital spine is present. The lower orbital angle is produced to a long narrow process with rounded tip; it projects beyond the end of the antennal spine, which is strong and situated immediately below it (fig. 1*b*). The pterygostomian spine is present, but smaller than the antennal, the margin between the two being rather strongly sinuous. The cervical groove and hepatic sulcus are very ill-defined.



TEXT-FIG. 1.—*Stylodactylus investigatoris*, sp. nov.
a. Anterior part of carapace, etc., in lateral view.
b. The same, dorsal view. *c*. Basal antennular segment.

The eyes are very large; the cornea is much wider than the stalk and, unlike that of *S. sibogae*, is set very obliquely on it, especially in lateral view.

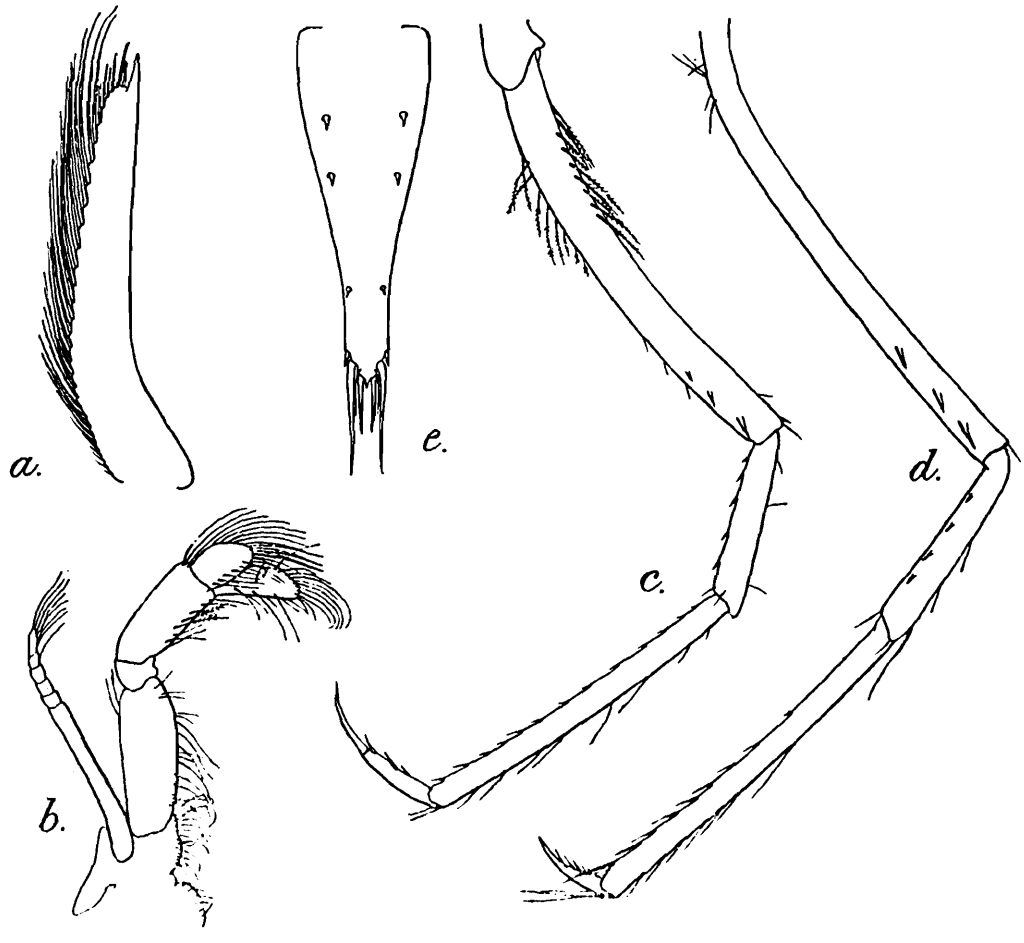
The antennular peduncle reaches to about two-thirds the length of the antennal scale. The lateral process reaches to the middle of the basal segment and is broadly rounded anteriorly with a small tooth at the outer distal angle (fig. 1*c*). The two ultimate segments of the peduncle combined are less than half as long as the basal segment; the second is as long as broad and the third is shorter than the second.

There is a spine at the outer distal angle of each of the peduncular segments. The swollen portion of the outer flagellum is composed of five segments and is only two-thirds as long as the basal segment of the peduncle.

The antennal scale (fig. 2*a*) is very narrow, rather more than 6 times as long as wide. The outer margin is unarmed, concave, and ends in a spine which extends far beyond the narrow apex of the lamella.

The second maxilliped (fig. 2*b*) bears an exopod, a bilobed epipod and an arthrobranch.[1] The endopod does not differ greatly from that of *S. amarynthis*, but the 2nd and 4th segments are rather stouter, the 4th less produced at the upper distal angle and the shorter of the two terminal segments is more pointed distally and bears at the apex three setae which are much stouter than the others.

The third maxillipeds reach beyond the scale by two-thirds of the ultimate segment. The antepenultimate segment bears a few slender outstanding spinules on the outer face near the distal end, and there are similar spinules on the penultimate segment, about 9 on the outer



TEXT-FIG. 2.—*Stylodactylus investigatoris*, sp. nov.
a. Antennal scale. *c*. Third leg.
b. Second maxilliped. *d*. Fifth leg.
e. Telson.

face and 5 on the inner. The last three segments bear long setae on their lower margins, but these, as also those on the first two pairs of legs, are

[1] Not shown in the figure.

more slender and less conspicuous than in *S. amarynthis*. The ultimate segment is about one-tenth longer than the penultimate.

The first pair of legs reaches beyond the scale by more than half the length of the carpus, the second is slightly shorter. In both pairs there are 8 or 9 slender spinules in a row on the outer face of the carpus, but they are otherwise unarmed except for the long feathered setae on the lower margins. In the second pair the carpus is 6 times as long as wide and is very slightly shorter than the chela.

The last three pairs of legs are slender and increase slightly in length from before backwards, all reaching beyond the scale by about the length of the dactylus. In the third pair (fig. 2*c*) the ischio-merus is about ten times as long as wide, with some long setae on both upper and lower margins in the proximal half. It is rather strongly curved (concave above), with a spinule at the distal end of the upper border and with 6 spines (3 on the inner face and 3 on the outer) in the distal quarter of its length. On the posterior border the carpus bears 5 or 6 small spinules and the propodus 11 to 13 ; the latter extend throughout the length of the segment and are longest distally. The propodus, which also has a few setae on its anterior border, is 14 times as long as wide and $2\frac{1}{4}$ times as long as the dactylus. The dactylus differs greatly from that of *S. sibogae* in its slender form ; it is $8\frac{1}{2}$ times as long as wide and bears three slender spinules on the posterior border behind the long terminal spine. The fourth legs are similar to the third, but there are only two spinules on the dactylus.

In the fifth legs (fig. 2*d*) the merus bears three spines on the outer face near the distal end and none on the inner face. There are four spinules on the carpus. The spinulation of the propodus is similar to that of the other legs, but the spinules are more widely separated anteriorly and are longer distally ; the terminal spinule is much larger than any of the others. The propodus is 15 times as long as wide and slightly more than 4 times the length of the dactylus. The dactylus is much shorter than in the two preceding pairs of legs, but is slender, not quite 6 times as long as wide ; on the posterior margin it bears six slender spines.

The abdominal pleura are rounded inferiorly.

The telson (fig. 2*e*) is scarcely longer than the sixth somite and bears only three pairs of dorsal spines. The two foremost pairs are situated in the anterior half, the third being nearer to the apex than to the second. The apex is acutely pointed in the middle with three spines on either side. The intermediate spines are very long, about one-third the length of the telson, the inner being about half their length. There is a single long seta on either side between the inner and intermediate spines.

The outer uropod is nearly $3\frac{1}{2}$ times as long as broad. The outer margin is entire, slightly concave, and ends in two spines, the foremost short and fixed, the hindmost long and movable.

The species is described from a single ovigerous female, 13·5 mm. in length.

In the absence of all teeth from the lower border of the rostrum *S. investigatoris* resembles *S. sibogae*, but it differs from that species in

many important particulars. The principal distinctions are found in the form of the eye, in the shape of the lateral process of the antennule, in the proportionately longer and very much more slender dactyli of the last three legs and in the presence of only three pairs of dorsal spines on the telson.

C847/1. 2 miles off Gt. Torres I., Mergui Archipelago, 40 fms. 'Investigator'. One. TYPE.

Family RHYNCHOCINETIDAE.

Genus **Rhynchocinetes** Milne-Edwards.

1837. *Rhynchocinetes,* Milne-Edwards, *Ann. Sci. nat.* (2) VII, p. 165, pl. iv.
1837. *Rhynchocinetes, id., Hist. nat. Crust.,* II, p. 383.

Until now only two species of this genus were known, *R. typus* Milne-Edwards,[1] a name generally applied to the form found on the S.W coast of America, and *R. rugulosus* Stimpson,[2] originally found at Port Jackson in New South Wales. I have here to add a third species, very easily distinguished from the other two, which occurs in the Gulf of Manaar. The three species may be separated thus :—

I. Two teeth on carapace behind rostral articulation ; a strong supra-orbital spine present ; no tooth on posterior edge of fifth abdominal somite.

A. Rostrum with 6 to 8 teeth on upper border near apex and 17 to 21 on lower border; basal segment of antennule with lateral process not reaching tip of distal spine ; carapace and abdomen smooth or with exceedingly faint striation ... ... *typus* Milne-Edwards.

B. Rostrum with 3 to 6 teeth on upper border near apex and 10 to 13 on lower border ; basal segment of antennule with lateral process reaching well beyond tip of distal spine ; carapace and abdomen finely but conspicuously striate ... *rugulosus* Stimpson.

II. Three teeth on carapace behind rostral articulation ; no supra-orbital spine ; a tooth on either side of fifth abdominal somite above posterior edge of pleuron. [Rostrum with 2 teeth on upper border near apex and 8 or 9 on lower border ; carapace and abdomen feebly striate] ... ... *hendersoni,* sp. nov.

Considerable confusion has arisen regarding the distribution of *R. typus* and *R. rugulosus*, but the difficulty is due, in part at any rate, to erroneous identifications. The differential characters noted above are based on an examination of a series of *R. typus* from Coquimbo, preserved in the British Museum, and on a number of specimens of *R. rugulosus* from Sydney, kindly presented to me by Mr. A. R. McCulloch. I have seen other specimens also, but have found no intermediate forms, and the characters seem of sufficient importance to justify specific separation. Chilton [3] has suggested that the two are mere varieties of a single widespread species, but the material examined does not support this view.

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[1] According to Milne-Edwards the habitat of this species is the Indian Ocean, but his description and figures apply best to the S. American form and there is little doubt the record of locality is incorrect.

[2] Stimpson, *Proc. Acad. Sci. Philadelphia* XII, p. 36 (1860).

[3] Chilton, *Trans. N. Z. Inst.* XLIII, p. 548 (1911).

R. typus has, however, been reported from New Zealand by Miers,[1] from the Loyalty Is. and the north island of New Zealand by Borradaile [2] and from Natal by Stebbing.[3] Miers' record appears to rest on an old dried specimen, still preserved in the British Museum, with a label " New Zealand " pinned beside it in the cabinet. The specimen is without doubt an example of *R. typus*, but the locality must in my opinion be regarded as doubtful, more especially as there is a specimen of *R. rugulosus* close by with label " ? " I have seen the specimens from the Loyalty Is. and N. Zealand, identified by Borradaile as *R. typus*, and find that both are in reality *R. rugulosus*. Stebbing's record from S. Africa must unfortunately remain doubtful as, notwithstanding a whole plate devoted to the illustration of the specimen, the critical points are not figured, neither are they referred to in the text.

There is thus some reason for supposing that *R. typus* is restricted to the S. W Coast of America, while *R. rugulosus* occurs in Australian waters, extending further afield to Lord Howe I. (McCulloch [4]), New Zealand (Borradaile), the Kermadec Is. (Chilton), the Loyalty Is. (Borradaile) and the Hawaiian Is. (Rathbun [5]) : I have also seen a specimen from Tanabe, Kii province, on the main island of Japan (S. Yoshida coll.). The specimens which Henderson [6] recorded from S. India as *R. rugulosus* are apparently not now in existence, but they belong without doubt to the new species described below.

The most puzzling record is that of *R. typus* recently made by Balss from Juan Fernandez.[7] *R. typus* is known to range from Peru to Chili and it would naturally be expected that the species would occur on the neighbouring island. Balss notes, however, that in the specimens he examined there are from 4 to 6 teeth at the distal end of the upper border of the rostrum and 12 on the lower border, while the carapace is smooth. In the character of the rostrum the specimens thus agree with *R. rugulosus*, while in that of the carapace they resemble *R. typus*. Careful re-examination of these specimens and close comparison with typical *R. typus* and *R. rugulosus* is necessary before any definite opinion on their identity can be expressed. Information regarding the length of the lateral process of the antennule would be of interest, for, as indicated in the key, it appears to afford a well-marked distinction between the two species.

Occasional references are found in the literature to the great length of the third maxilliped and first legs in large males of this genus. It is not merely that a sexual difference exists in this respect, but that these two limbs, in males which must long have passed the age at which their sexual activity first began, gradually assume monstrous and wholly disproportionate dimensions. The phenomenon, which occurs also in

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[1] Miers, *Cat. Crust. N. Zealand*, p. 77 (1876).

[2] Borradaile, in Willey's *Zool. Results* IV, p. 415 (1899); *Brit. Antarct.* (*'Terra Nova'*) *Exped., Zool.* III, p. 85 (1916).

[3] Stebbing, *Ann. Durban Mus.* II, p. 27, pl. vi (1917).

[4] McCulloch, *Rec. Austral. Mus.* VII, p. 310, pl. lxxxix, figs. 1-8 (1909).

[5] Rathbun, *Bull. U. S. Fish Comm.* for 1903, iii, p. 911, fig. 64 (1906).

[6] Henderson, *Trans. Linn. Soc. London* (2) Zool., V, p. 438 (1893).

[7] Balss, in Carl Skottsberg's *Nat. Hist. of Juan Fernandez* and *Easter I.* III, p. 331 (1922).

the Hippolytid genera *Saron* and *Alope* and to some extent also in *Palaemon*, has been regarded as dimorphism, but this in my opinion is a misapplication of the term.[1] Coutière [2] has made the interesting suggestion that the production of these very large limbs is a feature of senility and if a sufficiently long series of specimens could be obtained during the breeding season it would be possible to test the truth of this hypothesis.

The phenomenon is particularly well marked in *Rhynchocinetes typus* and seems also to be found in *R. hendersoni*. I have not seen it in *R. rugulosus*, but it may well occur in this species also.

In normal males and females of *R. typus* the ultimate segment of the third maxilliped is slightly shorter than the length of the carapace and is furnished near the apex with a series of black spines. In large males, however, the segment may be vastly longer—sometimes even as much as 3·6 times the length of the carapace—and the black terminal spines are absent. The first legs normally do not quite reach the end of the antennal scale and the chela is little, if at all, more than half the length of the carapace. In large males, however, this leg may extend beyond the scale by even the whole length of the chela, the latter being very stout and sometimes 1·5 times the length of the carapace. These facts are illustrated by the following measurements (in mm.) of *R. typus*, taken from specimens in the British Museum :—

No.	Sex.	Total length.	Length of carapace.	Length of ultimate segment of third maxilliped.	Length of chela of first leg.
1	♂	95	21	76	31
2	♂	79	19	18	10
3	♂	78	18·5	15·5	10
4	♂	75	18	46	18
5	♂	64	15·5	13	5·5
6	♀	64	15	20	9·5
7	♀	62	14·5	12·5	5·5

Specimens Nos. 1 and 4 show abnormal development, while in No. 6 it is just beginning.

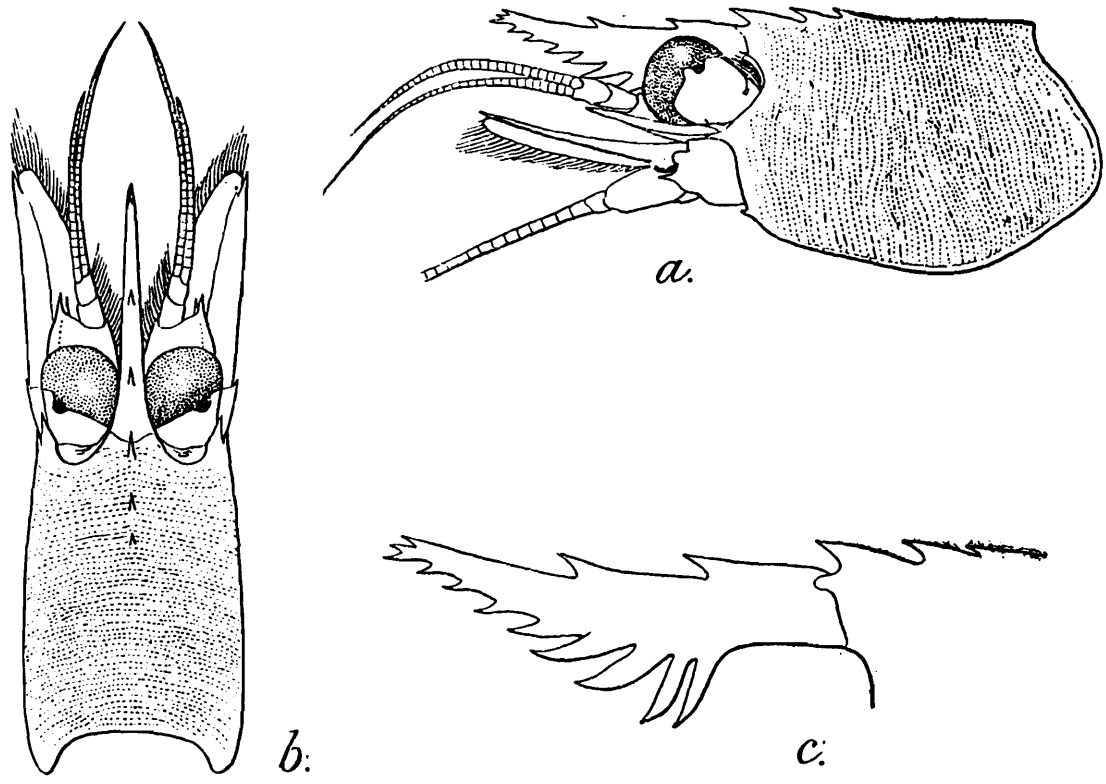
Rhynchocinetes hendersoni, sp. nov.

1893. *Rhynchocinetes rugulosus*, Henderson, *Trans. Linn. Soc. London* (2) *Zool.* V, p. 438.

The rostrum reaches to or rather considerably beyond the apex of the antennal scale and bears, in all, 7 teeth above and 8 or 9 below. A little in advance of the posterior limit of the orbit the rostrum is articulated, as in other species of the genus, so that it is free to move up and

[1] Kemp, *Rec. Ind. Mus.* X, pp.84-87 (1914).
[2] Coutière, *Bull. Soc. philomath. Paris* (10) II, p. 71 (1910).

down but not from side to side. Behind the articulation there are 3 teeth, the foremost much the largest and the hindmost much nearer to the second than the second to the third (figs. 3*a-c*). Of the four remaining teeth on the upper border 2 are large and situated one above



TEXT-FIG. 3.—*Rhynchocinetes hendersoni*, sp. nov.
a. Carapace and anterior appendages of male in lateral view.
b. The same, dorsal view. *c*. Rostrum.

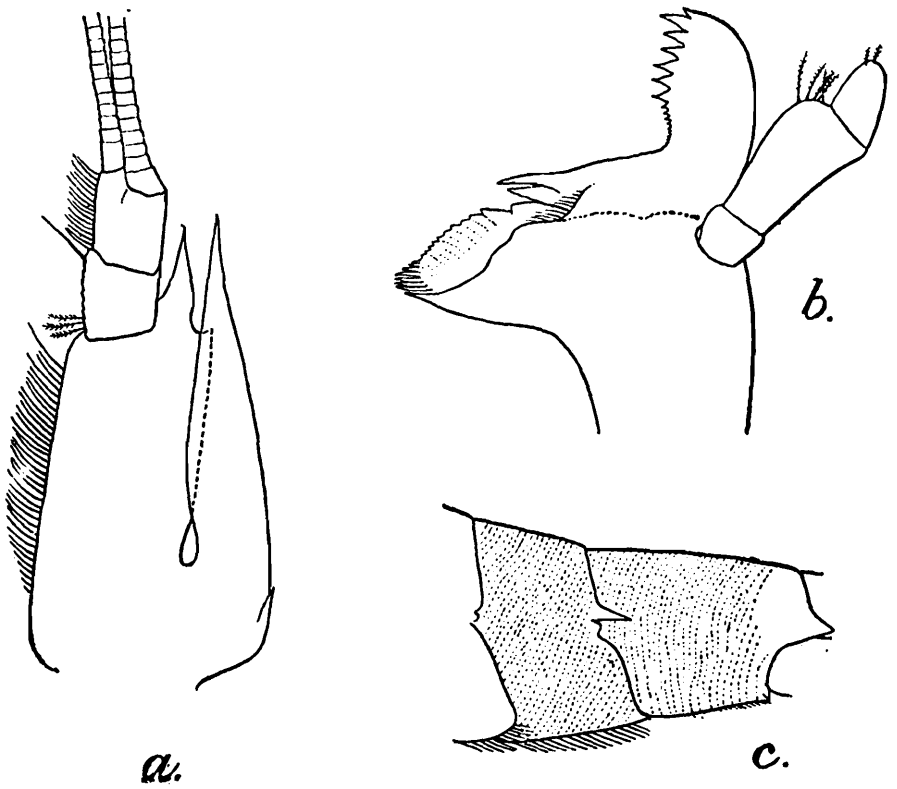
the cornea and one about half-way between it and the tip ; the 2 others are slender and crowded together very close to the apex, which consequently has a trifid appearance. The upper border is strongly concave in the female and slightly concave in the male. The two posterior lower teeth are very long and directed downwards rather than forwards ; the succeeding teeth gradually become shorter and more normal in form ; the foremost is placed not far from the tip and resembles those above it.

The entire carapace is covered with fine vertical striae, resembling those found in *R. rugulosus* but rather less conspicuous. The large supra-orbital, which occurs in both the previously known species of the genus, is entirely absent. The lower limit of the orbit is not defined by an angulation of the anterior border of the carapace, as in the other species, but is continuous with the tip of the antennal spine. There is a small spine at the pterygostomian angle.

The eyes are very large and nearly globular ; the cornea is much wider than the stalk and its greatest diameter is more than one third the length of the carapace. The ocular spot is distinct, convex and circular, touching the cornea.

The antennular peduncle (fig. 4*a*) reaches to nearly two-thirds the length of the scale. The lateral process is very long, acutely pointed

anteriorly, and reaches at least to the middle of the ultimate peduncular segment. At the distal end of the basal segment, on the outer side of the articulation, there is a large triangular tooth which extends nearly as far forwards as the lateral process. The outer margin is notched below the origin of this tooth, there is a small forwardly directed tooth on the outer margin of the lateral process near the base and,



TEXT-FIG. 4.—*Rhynchocinetes hendersoni*, sp. nov.

a. Antennular peduncle. *b*. Mandible.

c. Fourth and fifth abdominal somites, viewed laterally.

as in most if not all Caridea, a small tooth on the lower side of the basal segment near the inner margin. The second and third segments are short. The outer antennular flagellum is uniramous and somewhat thickened throughout the greater part of its length.

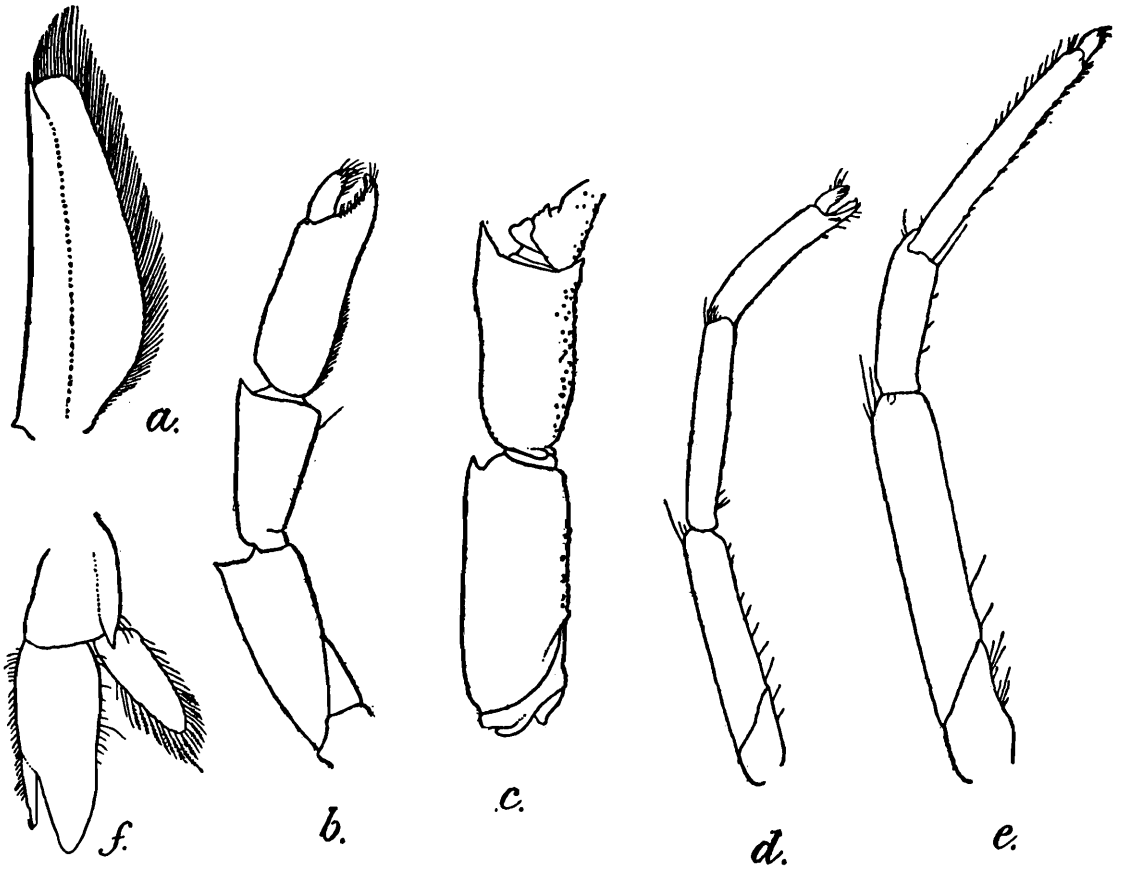
The antennal scale (fig. 5*a*) is 3 times as long as wide and is rather strongly narrowed distally. The outer margin is straight or slightly concave and terminates in a strong spine which reaches to or slightly beyond the end of the lamella.

The incisor-process of the mandible (fig. 4*b*) is provided with 7 teeth and there are 2 sharp teeth at the proximal end of the molar process. As in other species of the genus the crowns of the molar processes face forwards rather than inwards; thus, in the natural position of the mandibles, the two crowns do not grind against one another, but each bears against the labrum which is provided with corneous projections to assist in the trituration of food. The middle segment of the palp is much longer than the others, with the margin next the incisor-process dilated.

In the male specimen the third maxilliped reaches beyond the scale by about one-third of the ultimate segment. The exopod reaches beyond

the end of the antepenultimate segment and the ultimate segment is nearly twice the length of the penultimate. In the female the limb does not reach the end of the scale and the ultimate segment is only about half the length of the penultimate. In the male the distal segment is more sharply pointed than in the female, but the extreme tip is broken. In the female there are 5 corneous spines near the apex.

It is evident from the characters of the third maxilliped that the male is in process of acquiring the extreme development already remarked in *R. typus* (p. 265) and this is also to be noticed in the first pair of legs. Unfortunately only one of these legs is present in the male and in that the chela is missing (fig. 5*c*). The leg is extremely massive and the carpus reaches a little beyond the antennal scale. The merus is about $2\frac{1}{2}$ times as long as wide and is strongly carinate above, the



TEXT-FIG. 5.—*Rhynchocinetes hendersoni*, sp. nov.

a. Antennal scale.
b. First leg of female.
c. Merus and carpus of first leg of male.
d. Second leg.
e. Third leg.
f. First pleopod of male.

carina ending distally in a strong tooth. The carpus is scabrous, three-quarters as long as the merus, about twice as long as wide, and is carinate above. Anteriorly it bears 3 large spines, one dorsal, one infero-external and one infero-internal. In the female (fig. 5*b*) the first legs are much shorter, reaching only to the end of the basal antennular segment. The merus and carpus are similar to those of the male, but instead of a spine at the distal end of the latter on its infero-internal aspect there is merely a rectangle. The chela is about $1\frac{1}{2}$ times as long as the carpus, with palm twice as long as wide and

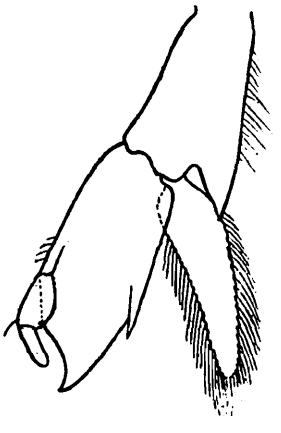
twice as long as the fingers. The fingers are strongly curved, meeting only at the tips and gaping in the middle. At the tip each bears a corneous nail from the base of which hairs arise.

The second legs of the male (fig. 5*d*) are slender and reach about to the end of the antennular peduncle. The ischium and merus are subequal in length, joined by a very oblique articulation. The carpus is 1·3 times as long as the full length of the merus and is 6·5 times as long as wide. The chela is one-sixth shorter than the carpus, with palm 3 times as long as the fingers. The fingers are spatulate, with the tips composed of a number of slender corneous spines set transversely across the apex. This curious arrangement is found also in the other species of *Rhynchocinetes*; it is not unlike that seen in the remarkable Hippolytid genus *Gelastocaris*. In the female the second legs are similar, but the carpus is proportionately longer and more slender; it is fully one-third longer than the chela and is about 8 times as long as wide. In both sexes there are a few hairs on the fingers and a tuft at the end of the carpus.

The third legs (fig. 5*e*) reach almost or quite to the apex of the scale, the fifth to the end of the eye, while the fourth are intermediate in length. In the third pair the merus is $5\frac{1}{2}$ times as long as wide and the propodus, which is set with spinules along the distal two-thirds of its posterior border, is $5\frac{1}{2}$ times as long as the dactylus. The dactylus is stout with 3 conspicuous spines behind the terminal claw. In both the third and fourth pairs there are 2 spines on the outer face of the ischium, 7 on the outer face of the merus (3 near the lower border, 3 near the upper and 1 in the middle at the distal end) and 2 on the outer face of the carpus. The fifth pair closely resembles the others but has only 4 spines on the merus.

The abdomen is covered with fine oblique striae similar to those on the carapace. The fifth somite (fig. 4*c*) differs from that of both the previously known species of the genus in the possession of an angular projection or tooth on either side immediately above the posterior margin of the pleuron. The pleuron itself is pointed at the postero-inferior angle.

In both sexes the endopod of the first pleopod is larger than the exopod. In the male it is oval, rather narrowly pointed distally and bears a large appendix interna (fig. 5*f*). In *R. rugulosus* the endopod is different in shape (fig. 6); it is somewhat hooked at the tip, with a short process in the middle of the outer margin, and the appendix appears to be composed of two segments.



TEXT-FIG. 6.—*Rhynchocinetes rugulosus*, Stimpson. First pleopod of male.

The telson bears striae similar to those on the abdomen. In the male specimen it is damaged at the apex. In the female there are three pairs of dorsal spines, the foremost at about the middle of the telson length, while the apex is pointed in the middle with three spines on either side.

The male is about 38 mm. in total length, the female, which is ovigerous, being 35 mm.

In the British Museum there is a specimen which belongs, almost without doubt, to this species. It has unfortunately been dried and the rostrum is broken off at the base; when complete it was probably about 40 mm. in length. It was collected by H. M. S. 'Herald' at Ngau in the Fiji Is. It agrees with *R. hendersoni* in the presence of 3 teeth behind the rostral articulation, in the form of the orbital angle, in the structure of the antennular peduncle and antennal scale and in the presence of the tooth on the fifth abdominal somite. It is a male with excessive development of the first legs, but, unlike that described above, the third maxillipeds are not abnormal, reaching just to the apex of the antennal scale. The first legs extend beyond the scale by nearly the whole length of the chela. The chelae are about $1\frac{1}{2}$ times as long as the carapace and differ conspicuously from those of females, or of either sex in *R. typus* and *R. rugulosus*, in being only *subchelate*. The propodus is slender, but suddenly dilated in its distal quarter. It is finely scabrous throughout and at the distal end is squarely truncate. The dactylus, which is almost sickle-shaped, is articulated at one end of this truncate margin and folds back on it, the fixed finger being wholly absent. The inner margin of the dactylus is entire, but the distal end of the propodus bears three teeth, the basal one broad and serrate at the summit. Both chelae are the same and there seems no reason to believe that their structure is abnormal. The dried specimen is entirely decolourized except for the chelae which are dull sage green with salmon-pink blotches arranged as shown in the figure. The pink blotch in the middle of the propodus is absent in the left limb of the pair.

Text-fig. 7.—*Rhynchocinetes hendersoni*, sp. nov.
Chela of male from the Fiji Islands.

With this species I have associated the name of Dr. J. R. Henderson whose valuable contributions to Indian carcinology are appreciated by every student of the subject. I had the pleasure of Dr. Henderson's company when the specimens which form the basis of the above description were collected and, twenty years before, he had recorded a *Rhynchocinetes* from Tuticorin under the name of *R. rugulosus*. From the notes which he published it is clear that these specimens belong to *R. hendersoni*.

C350-1/1. Pamban and Kilakarai, Gulf of Manaar. S. Kemp, Feb., 1913. 1♂, 1♀, Types.

The specimens were obtained on the coral reefs. As noted above other localities for the species are Tuticorin (Henderson) and the Fiji Is. (Brit. Mus.)

Family PANDALIDAE.

(Including Thalassocarinae.)

Most of the Indian species belonging to this family are inhabitants of comparatively deep water and the majority have been described by Col. Alcock in his fine monograph of the Indian deep-sea Decapoda, published in 1901.[1]

For a recent and most important contribution to our knowledge of the family we are indebted to Dr. J. G. de Man, who, in his account of the 'Siboga' Pandalidae[2], has given a full list of all known species and some most valuable keys to the genera and species, in addition to many detailed descriptions and critical notes. Only in a very few points of nomenclature does Dr. de Man differ from Col. Alcock. *Plesionika* and *Parapandalus*, regarded as subgenera in 1901, are used as genera, *Chlorotocus gracilipes* is known by the earlier name of *C. crassicornis* (Costa), and the specimens attributed by Alcock to *Heterocarpus ensifer* A. Milne-Edwards are referred to *H. sibogae* de Man.

In recent years the 'Investigator' has trawled in deep water only on rare occasions and, in consequence, the number of undetermined specimens in this family is small. There are, however, a few scarce deep-water forms and some very interesting littoral species, allied to *Chlorotocus* and *Thalassocaris*, for which I have found it necessary to describe two new genera.

De Man in his most useful synopsis of the Pandalid genera has laid himself open to criticism in one direction—he makes no reference to the fact that a series of arthrobranchs occurs at the base of the legs in some genera and not in others.[3] This character is of great value in the *Chlorotocus* section for two of the four genera do not possess the series of arthrobranchs and in this, as well as in other respects, are more highly specialized than the remainder.

The *Chlorotocus* section of the family comprises those forms in which the carpus of the second leg is divided into only 2 or 3 subsegments. The four genera which it contains may be distinguished thus:—

I. An arthrobranch and an epipod at the base of each of the first four legs; 3rd maxilliped with exopod; carpus of 2nd leg composed of 2 subsegments. [Supra-orbital spine absent; mandible with palp of three segments.]	
A. First four abdominal pleura rounded; 6th somite without median spine; apex of telson pointed ..	*Chlorotocus* A. Milne-Edwards.
B. Abdominal pleura acutely pointed beneath; 6th somite with a large spine in middle of distal margin; apex of telson forked	*Chlorotocoides*, nov., p. 276.
II. No arthrobranchs or epipods at base of legs; 3rd maxilliped without exopod; carpus of 2nd leg composed of 3 subsegments.	

[1] Alcock, *Cat. Indian deep-sea Macr.* and *Anomala*, p. 91 (1901).

[2] De Man, Decap. 'Siboga' Exped. IV, p. 100 (1920).

[3] By far the best distinction between *Pandalus* and *Pandalina* is to be found in the presence of these arthrobranchs in the former and their absence in the latter.

A. Supra-orbital spine present; mandible with palp of 3 segments; rostrum long and very slender — *Chlorotocella* Balss, p. 278.

B. Supra-orbital spine absent; mandible without palp; rostrum short and deep ... ... — *Chlorocurtis*, nov., p. 279.

Only six species are contained in these four genera. *Chlorotocus*, which is not represented in the collection under consideration, is perhaps the most primitive genus in the family and comprises three species found in comparatively deep water, *C. crassicornis* (Costa) (=*C. gracilipes* A. M.-Edw.),[1] *C. incertus* Bate[2] and *C. novae-zealandiae* (Borradaile).[3] *Chlorotocoides* is erected for the littoral Indo-pacific species hitherto known as *Chlorotocus spinicauda* de Man (=*Thalassocaris maldivensis* Borradaile); this species differs widely from those which I retain in *Chlorotocus* and should certainly be distinguished, at least subgenerically. *Chlorotocella* contains a single littoral Indo-pacific species, *C. gracilis* Balss, which occurs abundantly at the Andamans and Nicobars. *Chlorocurtis* is based on a remarkable and very small species, *C. miser*, sp. nov., found in the Andamans and also littoral in habit.

The genus *Chlorotocoides* is in some respects intermediate between *Chlorotocus* and *Thalassocaris* and it indicates, in my opinion, that the subfamily Thalassocarinae (sometimes even exalted to the rank of a family) should be abandoned and the genus placed without distinction in the Pandalidae. The chief point in which *Thalassocaris* differs from other genera of Pandalidae is the undivided condition of the carpus of the second leg. But the carpus, though often multiarticulate, is sometimes divided into only three segments, as in *Chlorotocus*, or into only two, as in *Chlorotocella*, so that the existence of a genus in which it is not divided at all is by no means unexpected. In placing *Thalassocaris* in a separate subfamily the importance of the character is unduly emphasized, just as it was in the long-forgotten grouping of the Caridea into Polycarpinea and Monocarpinea, and its other characters cannot be regarded as of more than generic significance.

Apart from these considerations there is another feature which indicates affinity between *Chlorotocoides* and *Thalassocaris*, for I have recently found that both genera possess large organs which are, with little doubt, luminous in function. Among Caridea luminous organs or photophores have hitherto been known to occur only in certain deep-sea species belonging to the family Hoplophoridae. In living specimens of these two Pandalid genera the organs are very conspicuous by reason of the bright colour of their investing membrane and in each genus they occupy the same positions. Similar organs certainly

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[1] See Alcock, *loc. cit.*, p. 101 and de Man, *loc. cit.*, p. 181. There does not seem any sufficient reason for retaining the var. *andamanensis* Anderson of this species. In a Mediterranean specimen which I have examined in the British Museum the postero-inferior angles of the 5th and 6th abdominal pleura are acutely produced just as in Indian specimens; it is probable that A. Milne-Edwards' figure is erroneous in this respect.

[2] Spence Bate, *Rep.* '*Challenger*' *Macrura*, p. 674, pl. cxvi, figs. 1, 2 (1888). The type-specimen of this species is missing from the British Museum.

[3] Borradaile, *Brit. Antarct.* ('*Terra Nova*') *Exped.*, Zool. III, p. 84, fig. 2 (1916) (as *Thalassocaris*).

do not occur in *Chlorotocella* and I believe that they are also absent in *Chlorotocus*.

Parapandalus zurstrasseni Balss.

1914. *Parapandalus zur strasseni*, Balss, *Zool. Anz.* XLIV, p. 597.
1920. *Parapandalus Zur Strasseni*, de Man, *Decap.* '*Siboga*' *Exped.* IV, p. 141, pl. xii, figs. 32-32*d*.

In addition to the two large teeth on the upper border of the rostrum above the eye the single specimen examined bears one extra tooth, much smaller, and situated immediately behind the posterior limit of the orbit. The rostrum is broken and the apical part is missing, but the existing portion is $2\frac{1}{2}$ times the length of the carapace. On the distal part there are 7 extremely small upper teeth and 15, which are considerably larger, below. The branchio-cardiac groove is distinct and the whole surface of the carapace and abdomen is coarsely and closely pitted.

Balss describes the carpus of the second leg as composed of 11 segments and the specimens examined by de Man apparently possessed the same number. In the individual I have examined, however, there are 6 segments on one side and 8 on the other and as the specimen is an ovigerous female it cannot be expected that any further sub-division will take place. The merus of the last three legs is described by Balss as bearing "eine feine Zahnelung," but in this specimen the inferior edge bears large spines, some of them arranged in pairs.

The length of the ovigerous specimen, with the tip of the rostrum broken off, is 44 mm.

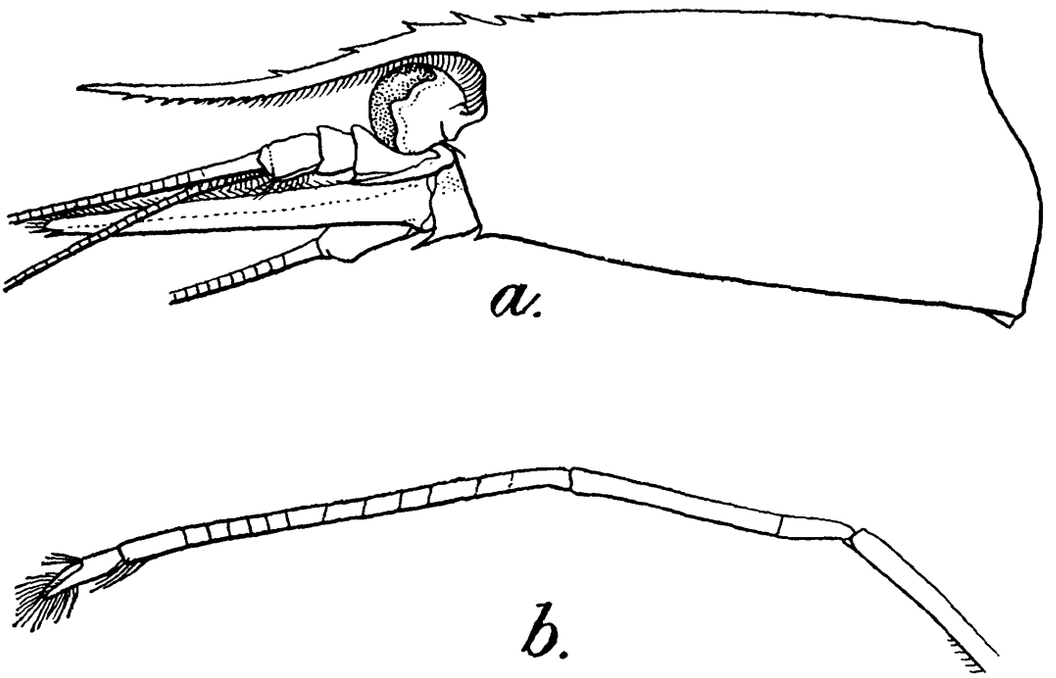
C852/1.	Bay of Bengal; 7° 21′ 6″ N., 85° 7′ 15″ E., 2,000 fms.	Investigator,' Oct., 1911.	One.

The specimen was caught in a midwater net lowered to a depth of 400 fathoms. The species is recorded by Balss from near the Seychelles and from a position to the south-west of Sumatra; de Man's specimens were obtained at four localities in the East Indian Archipelago. The species has apparently always been taken in midwater.

Parapandalus persicus, sp. nov.

The rostrum is very slender, a little shorter than the carapace, and reaches just to the end of the antennal scale (fig. 8*a*). It trends downwards in its proximal half, but the distal half is straight or very slightly inclined upwards. On the slightly convex basal part of the upper border there are 7 or 8 fixed teeth, 3 of which are placed on the carapace behind the orbit. The distances between the teeth increase gradually from behind forwards, the two first being very close together and the 4th, 5th and 6th larger than any of the others. The foremost tooth is situated above, or a little in advance of the distal segment of the antennular peduncle, the anterior half or two-fifths of the upper border being wholly unarmed. The lower border bears 9 or 10 teeth; these are all small, especially those at the proximal end of the series, which in one specimen are represented merely by small nicks in the

margin. The hindmost lower tooth is in one specimen beneath the ultimate of the dorsal series, in the other specimen it is below the



Text-fig. 8.—*Parapandalus persicus*, sp. nov.
a. Carapace and anterior appendages in lateral view.
b. Merus, carpus and chela of second leg.

penultimate. The proximal two-thirds or three-quarters of the lower border bears a double fringe of long hairs.

The antennal and pterygostomian spines are well developed. The eyes are nearly globular; the cornea is very much wider than the stalk and there appears to be no trace of the ocular spot.

The lateral process of the basal antennular segment is long and acutely pointed distally. The antennal scale is one quarter shorter than the carapace and the spine at its distal end reaches as far forwards as the narrow apex of the lamella.

The mandibular palp is composed of 3 segments; the distal segment is oval and 2·3 times as long as broad. The posterior end of the exopod of the maxilla is truncate. The third maxilliped bears a slender exopod and reaches beyond the antennal scale by the greater part of the ultimate segment. The penultimate segment is $1\frac{1}{3}$ times as long as the ultimate.

The first legs reach a little beyond the antennal scale; the carpus is slightly longer than the merus and is $2\frac{1}{2}$ times as long as the propodus.

The second legs are equal and reach almost to the end of the scale. The merus is composed of 2 segments, of which the distal is about 3 times as long as the proximal (fig. 8*b*). The carpus is 1·6 times the length of the merus and is divided into 13 to 15 segments (the proximal 7 or 8 indistinct). The distal subsegment bears a thick tuft of long hair on either side and is fully as long as the 3 preceding subsegments combined and about $2\frac{1}{2}$ times as long as wide. The chela, which also bears long hairs, is slightly longer than the adjacent carpal subsegment and the fingers are about equal in length with the palm.

The three posterior legs are extremely long and in the two specimens examined are either broken or missing. In the third pair the merocarpal articulation reaches a little beyond the end of the antennular peduncle. The merus bears 14 strong spines on its posterior edge and there are numerous fine spinules on the carpus and propodus. In the most perfect limb of this pair the merus is 9 mm. in length, the carpus 8·5 and the propodus, which is however incomplete, 6 mm. The fourth legs have spines on the merus like the third. The fifth legs reach beyond the scale by practically the whole length of the very long propodus. The merus is without spines. The ischium and merus taken together are 8 mm. in length, the carpus 10 mm. and the propodus, though incomplete, 19 mm.; the existing portions of this limb are nearly twice the length of the carapace and rostrum combined (19½ mm.).

There are no epipodites on any of the legs.

The endopod of the first pleopod of the male is broadly oval. The dorsal length of the sixth abdominal somite is twice or rather more than twice that of the fifth and is 2½ times as long as its depth at the middle point. The telson, including the terminal spines, is about as long as the sixth somite, but distinctly shorter than the uropods. It bears three pairs of dorsal spines, the foremost situated in about the middle of its length. The apex is narrow and armed with three pairs of spines, the intermediate the longest and the outermost much the shortest.

The above description is based on two specimens, both males, 43 and 50 mm. in total length. In the larger of the two the carapace is 10½ mm. in length and the rostrum 9 mm.

4944/10.	Gulf of Oman, 23° 44′ 30″ N., 58° 52′ 15″ E., 261 fms.	Investigator,' Oct., 1904.	One, TYPE.
4938/10.	Gulf of Oman, 24° 46′ 15″ N., 57° 15′ E., 745 fms.	'Investigator' Oct., 1904.	One.

Parapandalus persicus appears to be closely related to *P. cottei* [Pfeffer].[1] The latter species seems, however, to differ (i) in having the rostrum nearly twice as long as the carapace and much longer than the antennal scale, with none of the dorsal teeth situated on the carapace and (probably) with numerous minute teeth on the lower border in the distal half, (ii) in having 21 subsegments in the carpus of the second leg and (iii) in having the last three legs much shorter. *P. cottei*, which has served as the subject of some detailed morphological work by Kotte, has never been described systematically and the points mentioned above are derived from a rather crude figure of the entire animal which Kotte has given. The specific name is attributed to Pfeffer, but the promised description has not yet appeared. *P. cottei* was obtained by the 'Valdivia' expedition off the coast of German East Africa.

Heterocarpus (Heterocarpoides) levicarina (Spence Bate).

1920. *Heterocarpus* (*Heterocarpoides*) *levicarina*, de Man, *Decap. Siboga' Exped.* IV, p. 178, pl. xv, figs. 44-44*f*.

I agree with de Man, who gives full references, that this species is subgenerically distinct from *Heterocarpus*.

[1] See Kotte, *Zool. Jahrb. Anat. Ont.* XVII, p. 619, pl. 23 (1903).

In two specimens in which the rostrum is complete, it is equal to or slightly longer than the carapace, in both extending much beyond the antennal scale. In one specimen there are 11 teeth above with 4 behind the orbit; in the other there are 13 and 5 behind the orbit; in both there are 5 teeth below. The carination on the sides of the carapace is distinct when the specimens are partially dried and the whole surface is microscopically shagreened.

The spines on the 3rd, 4th and 5th abdominal terga decrease slightly in length from before backwards, that on the 5th being about three-quarters as long as that on the 3rd.

In Henderson's specimen from the Gulf of Martaban, which I have examined in the British Museum, the rostrum is very slightly shorter than the carapace, while the abdominal spines are similar to those in the individuals here recorded. In Bate's-type specimen the rostrum is fully three-quarters the length of the carapace and the spines on the 4th and 5th terga, though smaller than that on the 3rd, are scarcely as small as shown in the figure. De Man's suggestion that it may be possible to distinguish two distinct varieties by the length of the rostrum and the development of the spines on the abdomen is not borne out by the specimens I have examined.

1753/7.	Off Irrawadi delta, 15° 20′ N., 94° 55′ E., 20 fms.	'Investigator,' Nov., 1889.	One, 40 mm.
C853/1.	Mergui Archipelago, 12° 52′ N., 97° 54′ E., 33 fms.	Investigator,' Oct., 1913.	Two, 48 mm.

The species was described by Bate from the Arafura Sea, near the Torres Straits; it was recorded by Henderson from the Gulf of Martaban but no Indian specimens were examined by Alcock. The species is also known from the Red Sea (Balss) and from four localities in the East Indian Archipelago (de Man). It has been found at depths ranging from 17 to 150 fathoms.

Genus **Chlorotocoides,** nov.

Rostrum moderately slender, not articulated with carapace, armed dorsally with fixed teeth only. Carapace without lateral carinae; antennal and pterygostomian spines present; no supra-orbital spine. Eyes well-developed, with cornea much wider than distal end of eye-stalk. Lateral process of antennule long and acutely pointed anteriorly. Mandible with incisor-process and with palp of three segments. Maxilla with posterior lobe of scaphognathite rounded. Epipods and exopods on all three maxillipeds. An arthrobranch and an epipod on each of the first four legs. Ischium of first leg without laminar expansion. Second legs equal, with carpus divided into two subsegments and with small chela. First five abdominal pleura acutely pointed inferiorly (more conspicuously in male than female); sixth abdominal somite with a large spine in middle of posterior border. Apex of telson bifurcate. Two pairs of luminous organs present one at the base of the maxilla, under the branchiostegite, and one behind the fifth leg.

Type.—Chlorotocus spinicauda de Man.

This genus is erected for a littoral Indo-pacific species which agrees with *Chlorotocus* in all important structural features but shows a most instructive resemblance to *Thalassocaris* in the character of the abdominal pleura and in the possession of organs which appear to be luminous in function. On comparison with *Chlorotocus* it is evident that its affinity with that genus is but slight and it should certainly be distinguished generically.

Chlorotocoides spinicauda (de Man).

1902. *Chlorotocus spinicauda*, de Man, *Abh. Senck. naturf. Ges.* XXV, p. 856, pl. xxvi, figs. 59-59*h*.
1917. *Thalassocaris maldivensis*, Borradaile, *Trans. Linn. Soc. London* (2) *Zool.* XVII, p. 400, pl. lviii, fig. 5.
1920. *Chlorotocus spinicauda*, de Man, *Decap. Siboga Exped.* IV, p. 182, pls. xv, xvi, figs. 46-46*e*.

A single small male from the Andamans, only 12 mm. in length, agrees very closely with de Man's two detailed descriptions and undoubtedly belongs to this species. The rostrum bears 7 teeth above and 2 below; two of the upper teeth are placed on the carapace and behind them there are two small tubercles. The maxillula is normal in form: in de Man's figure the appendage appears to have been badly damaged and the middle lobe to have been lost. There is an arthrobranch and an epipod on each of the first four legs and the characteristic median spine at the posterior end of the sixth abdominal somite is practically as long as the two lateral spines.

I have examined specimens determined by Borradaile as *Thalassocaris maldivensis* and find that they belong to this species. Borradaile failed to notice the segmentation in the carpus of the second leg and has incorrectly described the spines on the carapace as the "suborbital and antennal." When the antennal scale is turned outwards at right angles to the body it lies between the two spines, which should be known respectively as the antennal and branchiostegal, the terms used by de Man. In *Thalassocaris* the supra-orbital spine is present and the branchiostegal absent; when the scale is turned outwards it lies below both spines.

The single specimen of this species found in the Andamans was semi-transparent in life, with minute red and yellow chromatophores on the carapace and abdomen. The rostrum was transparent, barred with pale orange pink. The gastric region was covered with a pigmented membrane, which was clearly visible through the carapace and bore, just in front of the middle point of the latter, two very distinct eye-spots. Each spot was deep red in the centre, narrowly outlined with bright yellow.

For the rest the prawn was practically colourless except for two pairs of large organs which were very conspicuous by reason of their bright pigmentation. One of these organs is close to the base of the maxilla under the branchiostegal wall and one is situated on a slight prominence behind the posterior pleurobranch and above the coxa of the last leg. In shape each organ is nearly spherical and rather less than 0·5 mm. in diameter. The upper part was completely invested with bright red pigment, while the lower part, which in living specimens seemed to be slightly flattened, was glistening white. Organs identical

in position, pigmentation and structure are found in *Thalassocaris crinita* and, judging from external examination of preserved material, exist also in *T. lucida*. Of the last-named species Dana remarks that it was " very brilliantly phosphorescent."

Only one specimen of this species and very few of *Thalassocaris crinita* were obtained at Port Blair. One of the latter was specially preserved with a view to microscopic examination of the organs; but the preparations made from it were destroyed by an unfortunate accident and the rest of the material is not in sufficiently good condition for detailed work. I am thus unable to give a satisfactory account of the organs and must confine myself to a few notes on their grosser structure derived from a specimen of this species obtained by Prof. Gardiner.

The organs, as already remarked, are rather less than 0·5 mm. in diameter and each contains six or more pyriform cell-masses which are regularly arranged with their blunt ends directed downwards (*i.e.*, towards the white portion of the organ when examined in living specimens). Each of the cell-masses has a narrow lumen which, in some instances at any rate, is continuous at the pointed end from one mass to another. The thick walls are composed of a single layer of cells, more or less rectangular in shape, much deeper than broad and with the nucleus lying at the inner end close to the lumen. Though the lumina of the different masses appear to inter-communicate, no common duct could be made out and there are no external openings in the organ itself or in its immediate vicinity. Over the upper part of the organ there appears to be a concavo-convex structure, seemingly of a fibrous nature, which may possibly be a reflector; but no lens was found and it is certain that no such structure exists in the cuticle.

The grounds for believing that the organs are photophores are (i) that Dana has described *Thalassocaris lucida* as being brilliantly phosphorescent, (ii) that the position and pigmentation of the organs in living specimens, is highly suggestive of a luminous function, and (iii) that the cells which compose the main body of the organ are similar to those found in the photophore of *Sergestes*. On the other hand the organs seem to be without a lens and are clearly quite different in structure from the photophores previously known in Decapoda.

It is hoped that these few notes will lead to a more thorough investigation of these remarkable organs.

C929/1. Port Blair, Andamans. S. Kemp. One.

The specimen was dredged at a depth of 5 to 8 fathoms. The species was described by de Man from Ternate and is known from other localities in the East Indian Archipelago (de Man) and from the Maldives (Borradaile).

Chlorotocella gracilis Balss.

1914. *Chlorotocella gracilis*, Balss, *Abh. Math.-phys. Kl. K. Bayer. Akad. Wiss.*, Suppl.-Bd. II, Abh. 10, p. 33, figs. 16-22.

1920. *Chlorotocella gracilis*, de Man, *Decap. 'Siboga Exped.* IV, p. 180, pl. xv, figs. 45, 45*a*.

The numerous specimens of this species which I have examined agree very well with Balss' description as amended and amplified by

de Man. In very young specimens the rostrum only slightly exceeds the antennal scales and is just as long as the carapace; in a very large male, on the other hand, it is twice as long as the carapace. In the number and position of the rostral teeth there seems to be no variation whatever.

The gills are five in number, a single pleurobranch occurring above the base of each leg. There is an epipodite on each maxilliped, but none on any of the legs.

The spines on the margin of the telson vary in number from 6 to 8 pairs.

The largest specimen examined is 24 mm. in length.

Specimens examined when alive were transparent with a red ventral stripe. The distal half of the tail-fan and the basal third and tip of the rostrum were red and there were red chromatophores on the antennal scale. The eggs were very pale brown.

C854-5/1.	Ross Channel, Port Blair, Andaman Is.	S. Kemp, Mch., 1915; Feb., 1921.	Forty-six.
C856/1.	Octavia Bay, Nancowry Harbour. Nicobars.	Investigator,' Oct., 1921.	Sixty.

The specimens were all obtained in shallow water. The collection contains numerous ovigerous females and one individual is infested with a Bopyrid.

The species was described by Balss from Sagami Bay and other localities in Japan and has been recorded by de Man from Java and from between the islands of Misool and Salawatti.

Genus **Chlorocurtis,** nov.

Rostrum short, very deep in lateral view, not articulated with carapace, armed dorsally with fixed and movable spines. Carapace without lateral carinae; antennal and pterygostomian spines present; no supra-orbital spine. Eyes well developed, but with cornea not wider than distal end of eyestalk. Lateral process of antennule reaching only to middle of basal segment, but sharply pointed anteriorly. Mandible with incisor-process but without palp. Maxilla with posterior lobe of scaphognathite rounded. Epipods on all three maxillipeds; exopods on first and second maxillipeds but not on third. No arthrobranchs or epipods on any of the legs. Ischium of first leg without laminar expansion. Second legs equal, with carpus divided into three subsegments and with small chela. First four abdominal pleura rounded inferiorly; posterior margin of sixth somite without a median spine. Apex of telson not bifurcate. Luminous organs absent.

Type.—Chlorocurtis miser, sp. nov.

This genus is formed for a remarkable little species which is much smaller than any Pandalid hitherto known. It is a littoral form, obtained at Port Blair in the Andaman Is. In most of its characters the genus resembles *Chlorotocella*, but it differs at first sight in its stouter build and, in particular, in the short and very deep rostrum. It is also distinguished from *Chlorotocella* by the absence of the supra-orbital spine and the absence of the mandibular palp. In the first of these two char-

acters it resembles *Chlorotocus* and *Chlorotocoides*; in the latter it appears to be unique in the family, for, in all other Pandalidae in which it has been examined, the palp is present and composed of three segments.

Chlorocurtis miser, sp. nov.

The rostrum is short and does not quite reach the end of the eyes or of the basal antennular segment. In lateral view it is very deep at the base with a sharply pointed apex. The upper border is strongly convex and curved downwards, with the result that the tip is much below the level of the dorsum of the carapace; the lower border is practically straight. The rostrum, when viewed from above, is not expanded and does not project over the eyestalks as in *T. crinita*. On the convex upper border there are 5 or 6 forwardly directed teeth, two of which are situated on the carapace behind the orbit. The posterior tooth alone is movable and is rather more distant from the second than the second is from the third. The lower border is unarmed.

The lower orbital angle is narrowly rounded; the antennal spine is strong and the pterygostomian well-developed, but the supra orbital spine (present in *Chlorotocella*) is absent. A shallow furrow extends backwards and upwards from the orbit.

The eyes are slender and rather long. The cornea is scarcely as wide as the distal end of the stalk and the ocular spot is indistinguishable.

The basal segment of the antennular peduncle is slender and fully twice as long as the two ultimate segments combined; the lateral process reaches to about the middle of its length and is acutely pointed anteriorly. The flagella are broken. The fourth segment of the antennal peduncle bears a spine externally. The antennal scale is widest near the distal end and is 2·8 times as long as broad. The outer margin is straight and ends in a spine which does not reach nearly as far forwards as the narrowly rounded apex of the lamella.

The mandible possesses molar and incisor processes, but is peculiar in the absence of a palp. The molar process ends in some rather large and conspicuous teeth, while the incisor process is strong with four or five small teeth at the apex. In the maxilla the posterior lobe of the scaphognathite is rounded, not acutely produced posteriorly as in some genera of Pandalidae. The proximal endite is convex with three long setae; the distal endite is separated from it by a wide notch and is divided into two lobes, the distal of which is the broader.

The first maxilliped has an exopod and a bilobed epipod. The second maxilliped has an exopod and a single-lobed epipod; the ultimate segment of the endopod is large and is attached terminally to the penultimate. The third maxilliped bears an epipod composed of one lobe and, as in *Chlorotocella*, is without an exopod. It reaches to the middle of the basal antennular segment. The penultimate segment is little more than $1\frac{1}{2}$ times as long as wide and is about half the length of the ultimate.

The first legs are feeble and reach only to the middle of the antepenultimate segment of the third maxilliped. The segments bear long scattered hairs which are most numerous on the lower border of the ischium and the distal half of the propodus. The merus and carpus are subequal in length and each is about 3 times as long as wide. The propodus is a little longer and more slender; it has a shallow excavation near the proximal end of its lower border from which six stout plumose setae arise. In the distal half it tapers to a fine point and there appears to be no trace of the dactylus.

The second legs reach to the end of the antennal peduncle and are rather stout. The ischium is somewhat curved and is longer than the merus. The latter is equal in length with the two proximal carpal subsegments taken together and is rather less than 4 times as long as wide. As in *Chlorotocella* the carpus is divided into 3 subsegments; the first and second are subequal in length, while the third is about two-thirds as long. The subsegments are all stout; the first is rather less than twice as long as its distal breadth and the third is scarcely longer than broad. The chela is just equal in length with the merus and the palm is nearly $1\frac{1}{2}$ times as long as the fingers. The fingers are unarmed on their inner edges, but bear large spines arranged transversely on their tips; there appear to be two on the dactylus and three on the fixed finger, the spines interlocking when the claw is shut.

The third legs reach about to the end of the antennal scale; the fourth and fifth are rather shorter. On the ischium, merus and carpus there are a few simple setae and one or two thick and densely plumose setae. The merus is without spines and is from 4·2 to 5 times as long as wide (most slender in the third pair). As usual the anterior edge of the carpus projects distally beyond the carpo-propodal articulation. The propodus is from $5\frac{1}{2}$ to 6 times as long as wide and is 3, or rather more than 3 times as long as the dactylus. The proximal part of the propodus is unarmed but in the distal third it is a little dilated and bears on its posterior margin 6 large spines arranged in pairs. On the edge between these pairs of spines there is a series of extremely fine setae. The dactylus can be folded back on this part of the propodus and the arrangement suggests that the terminal segments are modified to form a rudimentary grasping organ. The dactylus itself is unarmed, strongly curved, rather broad at the base and tapering rapidly to a sharp point.

The gill-formula comprises five pleurobranchs only, one at the base of each leg. As in *Chlorotocella* arthrobranchs are absent and there are no epipods on any of the legs. The luminous organs present in *Chlorotocoides* and *Thalassocaris* appear to be absent.

There are no dorsal spines on any of the abdominal somites and the pleura are rounded inferiorly. The sixth somite, measured dorsally, is rather more than twice as long as the fifth and its depth is less than half its length. Posteriorly there is a backwardly directed tooth on each side above the articulation of the uropods.

The telson reaches about to the end of the uropods. Near the base it bears a tuft of plumose setae and further back 3 pairs of small marginal spines, the foremost a little in advance of the middle. The apex is

narrow and bears 3 pairs of spines. The median spines are situated on a small median projection and are shorter than the intermediate; the outer spines are only about half the length of the median.

The species is described from two ovigerous females, about 7·5 and 8 mm. in total length. The eggs are very large for so small a species and are 0·46 by 0·34 mm. in longer and shorter diameter.

C930/1. Port Blair, Andamans. S. Kemp, Feb., 1915. Two, Types.

The specimens were found when shore-collecting at low water on the north-eastern side of Ross I.

Genus **Thalassocaris** Stimpson.

1852. *Regulus*, Dana, *U. S. Explor. Exped., Crust.* I, p. 599.
1860. *Thalassocaris*, Stimpson, *Proc. Acad. Sci. Philadelphia* XII, p. 42.
1914. *Thalassocaris*, Balss, *Abh. Math.-phys. Kl. K. Bayer. Akad. Wiss.*, Suppl.-Bd. II, Abh. 10, p. 27.
1920. *Thalassocaris*, de Man, *Decap. 'Siboga' Exped.* IV, p. 94.

I have endeavoured to show on p. 272 that the subfamily Thalassocarinae should be abandoned and this genus included without distinction in the family Pandalidae. It is clearly related to more normal members of the family by way of *Chlorotocoides*.

The most important characters of *Thalassocaris* are :—

The supra-orbital spine is present and the branchiostegal (or pterygostomian) absent. The outer edge of the lateral process of the antennule is crenulate and there is a series of spines on the outer border of the antennal scale. A palp of three segments is found on the mandible and the posterior lobe of the scaphognathite is rounded. There is an exopod and an epipod on each of the three maxillipeds, epipods on the first three legs and arthrobranchs on the first four legs. The second legs are equal; the carpus is stout and not divided into subsegments and the chela is unusually large. The first five abdominal somites are acutely pointed inferiorly—a feature most conspicuous in the male. The third somite is provided with a strong backwardly directed spine in the middle of its posterior border, but there is no similarly placed spine on the sixth somite. The apex of the telson is not bifurcate. There are two pairs of luminous organs, one at the base of the maxilla under the branchiostegite and one behind the fifth leg.

Six specific names have been employed in this genus but it is improbable that more than two species are actually known. Dana in 1852 described two species, *crinitus* and *lucidus*, under the preoccupied name of *Regulus* and Stimpson in 1860 substituted *Thalassocaris* for *Regulus*. Spence Bate in his 'Challenger' Report referred to one of Dana's species as "*Thalassocaris fucida*" and described as new species *T danae* and *T stimpsoni*, both based on larval forms which still retain exopods on the legs. *T danae*, as Balss has already suggested, is in all probability a very young *T lucida*. *T stimpsoni*, proposed for a still younger larva, should be suppressed; the form can never be recognised again with certainty and it is not clear that it really belongs to the genus in which it is placed. Borradaile in 1917 described two additional species, *T affinis* and *T maldivensis*. The latter, as I have already

shown, is synonymous with *Chlorotocoides spinicauda* (de Man), while the former, with scarcely a doubt, is the same as Dana's *T lucida.*

Thalassocaris lucida (Dana).

1852. *Regulus lucidus*, Dana, *U.S. Explor. Exped., Crust.* I, p. 598, pl. xxxix, figs. 5*a-q*.
1860. *Thalassocaris lucida*, Stimpson, *Proc. Acad. Sci. Philadelphia* XII, p. 42.
1888. *Thalassocaris danae*, Bate, *Rep. 'Challenger' Macrura*, p. 683, pl. cxvii, fig. 1.
1890. *Thalassocaris lucida*, Ortmann, *Zool. Jahrb. Syst.* V, p. 490, pl. xxxvii, fig. 1 d-l.
1909. *Thalassocaris lucida*, Calman, *Proc. Zool. Soc. London*, p. 706.
1917. *Thalassocaris affinis*, Borradaile, *Trans. Linn. Soc. London* (2) *Zool.* XVII, p. 400, pl. lviii, fig. 4.

This species is not represented in the collection under examination, but I have seen the specimens from Christmas I., determined by Calman, and others from the Maldives identified by Borradaile as *T affinis.*

Borradaile mentions several features in which *T affinis* differs from *T lucida* but the only one of any importance concerns the shape of the chela of the second leg. In *T affinis*, as in the specimens recorded by Calman, it bears a close resemblance to that of *T crinita* and differs rather widely from Dana's figure of *T lucida.* The discrepancy is, however, fully accounted for if it be supposed that the figure represents the chela in a somewhat oblique view. The only figure which Dana gives of the three posterior legs is in his drawing of the whole animal in dorsal view and in this position the large spines on the merus of the third and fourth pairs are not visible.

Examination of preserved specimens shows that two pairs of luminous organs are present in the same positions as in *T crinita* and *Chlorotocoides spinicauda.* Dana in his original description notes that the species is " very brilliantly phosphorescent."

T lucida is very closely related to *T crinita*, but is throughout a more slenderly built species with proportionately longer rostrum and antennal scale. Well grown specimens may be distinguished thus :—

T. lucida.	*T. crinita.*
Rostrum as long as, usually longer than carapace, with smaller teeth ; in dorsal view not greatly dilated and widest at base.	Rostrum shorter than carapace, with larger teeth ; in dorsal view greatly dilated above eyes and wider at this point than at base.
Antennal scale at least as long as carapace, very narrow—about 6 times as long as wide, with smaller teeth on outer margin.	Antennal scale shorter than carapace, broader—about 4½ times as long as wide, with larger teeth on outer margin.
Second legs not reaching end of antennal scale, with at most very feeble tuberculation on edges of merus.	Second legs reaching end of antennal scale, with strong tuberculation on edges of merus.

The outer margin of the lateral process of the antennule is crenulate, as in *T crinita*, and the teeth on the outer edge of the antennal scale are 2 or 3 in number, usually 3. The dactylus of the third and fourth legs does not show the sexual differences discovered by de Man in *T crinita.* There are as a rule two pairs of spines on the back of the telson behind the apex, but occasionally three are found as in *T crinita.*

The species seems to have a wide Indo-pacific distribution. It recorded from the Ladrones (Dana); E. of the Loo Choo Is., 27½° N., 138½°E. (Stimpson); the South Seas (Ortmann); Fiji (Bate); Christmas I. (Calman); the Maldives and Saya de Malha (Borradaile).

Thalassocaris crinita (Dana).

1852. *Regulus crinitus*, Dana, *U. S. Explor. Exped. Crust.* I, p. 599, pl. xxxix, figs. 6 *a-h*.
1914. *Thalassocaris crinitus*, Balss, *Abh. Math.-phys. Kl. K. Bayer. Akad. Wiss.*, Suppl. Bd. II, Abh. 10, p. 28.
1917. *Thalassocaris crinita*, Borradaile, *Trans. Linn. Soc.* (2) Zool. XVII, p. 400.
1920. *Thalassocaris crinita*, de Man, *Decap. 'Siboga' Exped.* IV, p. 95, pl. ix, figs. 22-22 *o*.

The specimens I have seen agree very well with de Man's detailed account and I am able to substantiate his discovery of sexual differences in the form of the dactylus of the third and fourth legs. In the material examined there are from 8 to 10 teeth on the upper border of the rostrum and 3 below, but in an abnormal individual there are only 7 above and 3 below. Occasionally there are 4 teeth on the outer margin of the antennal scale.

Living specimens obtained at Port Blair were almost completely transparent, but the gastric, hepatic and genital organs were grey and dull red and showed through the carapace. There were a few red chromatophores on the upper edge of the rostrum. Otherwise the animal was completely transparent except for two pairs of large organs, invested with bright red pigment above and glistening white below. The organs occupy the same positions as those in *Chlorotocoides spinicauda*, but those above the base of the fifth legs are not situated on prominences as in that species. Otherwise they seem to be identical both in outward appearance and in structure and a repetition of the description given on p. 278 is unnecessary. I suppose these organs, which also occur in *T lucida*, to be luminous in function.

The largest specimen in the collection is about 17·5 mm. in length.

C275/1.	Cheval Paar, Ceylon.	T. Southwell, Nov., 1910.	One.
C931/1.	Port Blair, Andamans.	S. Kemp.	Four.

The species is recorded from the Sulu Sea (Dana), from Japan (Balss), from various localities in the East Indian Archipelago (de Man) and from the Maldives (Borradaile).

Family PALAEMONIDAE.

Subfamily *PALAEMONINAE*.

This subfamily appears to comprise only seven genera, which may be distinguished in the following manner :—

1. Mandibular palp present.
   A. Dactylus of three posterior legs simple.
      1. Hepatic spine usually present, branchiostegal spine absent ; freshwater or estuarine ... *Palaemon* Fabr.
      2. Hepatic spine absent, branchiostegal spine usually present ; mostly marine or estuarine ... *Leander* Desmarest.

B. Dactylus of three posterior legs biunguiculate. [Hepatic spine present, branchiostegal spine absent.] Marine ... ... *Brachycarpus* Bate.

II. Mandibular palp absent.

A. Eyes normal, not concealed by carapace.

1. Hepatic spine present. [Branchiostegal spine absent; dactylus of three posterior legs simple.] Marine ... ... *Pseudopalaemon* Sollaud.

2. Hepatic spine absent.

a. Rostrum compressed and dentate; branchiostegal spine present; dactylus of three posterior legs simple; mostly freshwater or estuarine ... ... *Palaemonetes* Heller.

b. Rostrum depressed and toothless; branchiostegal spine absent; dactylus of three posterior legs biunguiculate; in wells of fresh water ... ... *Euryrhynchus* Miers.

B. Eyes completely concealed beneath carapace. [Hepatic and branchiostegal spines absent; dactylus of three posterior legs simple.] Fresh water ... ... *Cryphiops* Dana.

Nobili's *Leander dionyx*[1], from a forest stream in New Guinea, differs from all species of the genus in having the dactyli of the three posterior legs biunguiculate. By reason of this character it would seem to be entitled to a new generic name; but only a single specimen is known and we are without information regarding the mouth-parts and branchial formula, so that the systematic position of the species must for the present remain undecided.

I use the term *Palaemon* in the sense in which it was employed by Stimpson and by the majority of leading carcinologists since his time. Stimpson in 1860[2] clearly restricted the name to the freshwater species which possess the hepatic spine. I do not accept the contention advanced by certain American authors and upheld by the International Commission on Nomenclature[3] that Latreille in 1810[4] intended to designate genotypes.

The genus *Bithynis*, proposed by Philippi in 1860[5] for *B. longimana* (=*P. gaudichaudii*=*P. coementarius*), is in my opinion to be regarded as a synonym of *Palaemon*. *Bithynis* differs from *Palaemon* in the absence of the hepatic spine and on this account it was for long maintained as a distinct genus. Calman[6] has, however, shown that in *P. hildebrandti* the hepatic spine may be present or absent and this discovery makes it impossible to define Philippi's genus in a satisfactory manner. *Bithynis gaudichaudii*, though of very heavy build and with an excessive degree of spinulation in full grown specimens, does not otherwise differ from *Palaemon* in any character to which generic importance can be attributed.

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[1]Nobili, *Ann. Mus. Hungar.* III, p. 482, pl. xii, fig. 2 (1905).
[2]Stimpson, *Proc. Acad. Sci. Philadelphia* XII, p. 41 (1860).
[3]Opinion 11, *Smithson. Public.*, no. 1938 (1910). See also Stebbing, *Journ. Linn. Soc. London* XXIX, p. 332 and *Natural Science* XII, p. 239 (1898).
[4]Latreille, *Consid. Gén. Crust.*, p. 421 (1810).
[5]Philippi, *Arch. Naturgesch.* XXVI, i, p. 161 (1860).
[6]Calman, *Proc. Zool. Soc. London*, 1913, p. 928, pl. xcii.

The very close affinity between *Palaemon* and *Leander* has become increasingly evident in recent years and it is now extremely difficult to frame a diagnosis which will serve as an absolute distinction between the two genera. In the vast majority of instances *Palaemon* may be recognized by the presence of the hepatic spine and *Leander* by the presence of the branchiostegal spine, but the hepatic is occasionally absent in the former (as noticed above) and in two Indian species of *Leander*[1] the branchiostegal spine is absent. These two species thus cannot be separated from *P. gaudichaudii*, or from some specimens of *P. hildebrandti*, by the spines of the carapace. It happens, however, that the two species of *Palaemon* are of stout build and that in *P. gaudichaudii*, as in many species of the genus, the second legs are extremely large and heavy. The two *Leander*, on the other hand, are slender forms and are obviously related to the group of species typified by *Leander styliferus*.

The affinities of *P. mirabilis*[2], which is common in the R. Hughli at Calcutta, present a problem of considerable difficulty. The species possesses the hepatic spine and lacks the branchiostegal and is thus technically a *Palaemon*. Its affinities seem, however, to be more with the *styliferus* section of the genus *Leander* than with any *Palaemon* and it is not beyond the bounds of possibility that the species is derived from the ancestors of that section by the suppression of the branchiostegal spine and the appearance or reappearance[3] of the hepatic. On this and on other grounds there is some reason for the belief that the genus *Palaemon*, as now understood, is polyphyletic in origin.

Of the seven genera of Palaemoninae in the synoptic table on pp. 284, 285 only three, *Palaemon*, *Leander* and *Palaemonetes*, are known to occur in Indian waters. Discussion of the numerous Indian freshwater species belonging to the first of these genera cannot be undertaken here ; in this paper I shall treat only of *Leander* and *Palaemonetes*, adding some notes on the interesting genus *Brachycarpus*. Sollaud's *Pseudopalaemon*[4] contains two species, found on the Atlantic coasts of S. America. Of Miers' *Euryrhynchus*[5] two species are known ; they are remarkable forms, obtained in wells in Brazil and they appear to be specialized for life in subterranean waters. Dana's *Cryphiops*[6] is monotypic and was established for a most extraordinary species with eyes more deeply concealed beneath the carapace than in any Alpheid. It is recorded from streams of fresh water in Chili and is still known only from the original description published seventy years ago. A fresh account of this genus is badly needed as it is not certain that it is correctly referred to the Palaemoninae.

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[1] *L. fluminicola* Kemp and *L. potamiscus* Kemp.

[2] Kemp, *Rec. Ind. Mus.* XIII, p. 227, pl. x (1917).

[3] The freshwater forms have no doubt been evolved from marine ancestors, but it does not necessarily follow that *Palaemon* is directly derived from *Leander* or that the branchiostegal spine is a primitive feature and the hepatic evidence of specialization.

[4] Sollaud, *Bull. Mus. Paris*, 1911, p. 12 and *ibid.*, 1913, p. 185.

[5] Miers, *Proc. Zool. Soc. London*, 1877, p. 662 and Calman, *Ann. Mag. Nat. Hist* (7) XIX, p. 295 (1907).

[6] Dana, *U. S. Explor. Exped. Crust.*, I, p. 594 (1852).

Genus **Leander** E. Desmarest.

1849. *Leander*, E. Desmarest, *Ann. Soc. Ent. France* (2) VII, p. 91.
1890. *Leander*, Ortmann, *Zool. Jahrb., Syst.* V, p. 519.
1897. *Palaemon*, Rathbun, *Ann. Inst. Jamaica* I, p. 45.
1900. *Leander*, Coutière, *Ann. Sci. nat., Zool.* XII, p. 337.
1914. *Leander*, Stebbing, *Trans. Roy. Soc. Edin.* L, ii, p. 286.

This genus is very closely related to *Palaemon* differring from it only in the presence of the branchiostegal spine and the absence of the hepatic spine. In two species the branchiostegal is absent and these can only be distinguished by the affinities which their specific characters indicate from the few aberrant forms of *Palaemon* in which the hepatic spine is lacking. The difficulty has already been alluded to on p. 286. Strictly speaking *Leander* should probably be regarded as a subgenus of *Palaemon*; in view, however, of the large number of species which each contains it is desirable to keep them separate and the vast majority can readily be placed in one or other genus by means of the spines on the carapace.

Apart from their structure the species of the two genera mostly differ in habitat. *Palaemon* is essentially a freshwater genus and there are few if any authentic records of its occurrence in the sea. Some species, however, make their way to brackish water or to places where the water is subject to seasonal variation in salinity at the time when their eggs are ripe.[1] *Leander*, on the other hand, is mainly marine in habitat though with rather numerous exceptions. In Europe the species of the latter genus are almost exclusively marine but in other parts of the world they show greater adaptability. Several, such as *L. tenuipes* (Bay of Bengal), *L. styliferus* (India to Borneo) and *L. semmelinki* (India to N. Guinea and Celebes) penetrate freely into brackish water; others, such as *L. gardineri* (Maldives) and *L. fluminicola* (Bay of Bengal) seem to occur only in brackish or fresh water, the last named extending some 700 miles up the R. Ganges. Several species, such as *L. potitinga* (Brazil), *L. cubensis* (Cuba), *L. capensis* (Cape Colony), *L. modestus* (Shanghai) and *L. annandalei* (Shanghai) are known only from fresh water, while *L. concinnus* (Aldabra to Fiji) and *L. paucidens* (Japan and Korea) seem quite indifferent to salinity, having been found in water that is salt, brackish or quite fresh.

The type of the genus *Leander* is *L. tenuicornis* (Say), the common prawn of the gulf-weed in the Atlantic and also widely distributed in the Indo-pacific region. This species shows unusual sexual differences in the form of the rostrum and is otherwise peculiar in possessing an appendix interna on the first pleopod of the male. The latter character is not to my knowledge found elsewhere in the genus, but it reappears in a single species of *Palaemonetes* (*P. hornelli*, p. 318) and also occurs in the Pontoniinae in *Urocaridella gracilis*.

The mandibular palp, an essential character of the genus, is normally composed of three segments; but, as demonstrated by Calman,[2] there are only two segments in *L. squilla* and the same number also occurs in *L. semmelinki* and in *L. cubensis*, the latter a species hitherto referred

[1] Kemp, *Mem. Ind. Mus.* V, p. 264 (1915).
[2] See Kemp, *Fisheries Ireland, Sci. Invest.* 1908, I, p. 127 (1910).

to the genus *Palaemonetes*. In *Palaemon* also the palp normally comprises three segments, the only known exception being *P. cavernicola*[1] in which it is two-segmented.

The species of *Leander* form a very uniform series and are often very difficult to discriminate. Some of those that are well known exhibit so great an amount of variation that if, as is not improbable, it exists in an equal degree in others, it is likely that many characters which are thought to possess specific significance will prove of little value for this purpose. It is now over thirty years since a general synopsis of the species was published by Ortmann (*loc. cit.*) and his outline of their classification, though of great value, is in many respects defective. Since then, except for a masterly revision of the European species by de Man,[2] the literature contains little except notes on individual species and descriptions of new ones ; at present it is a matter of extreme difficulty to arrive at an adequate idea of the genus as a whole, while to determine a species accurately involves a vast amount of search in widely scattered literature. But to prepare a reliable synopsis in the present state of our knowledge is almost an impossibility, for the species are as a rule poorly represented in Museum collections and a very large number are inadequately described. It is therefore with great hesitation that I publish the very imperfect key given below. It will, I feel sure, prove to be erroneous in many particulars, partly because the range of variation may be greater than supposed and partly because certain of the characters which are employed are mentioned but vaguely, or not at all, in the descriptions. The first part of the key is adapted from that published in 1917.[3] An asterisk appended to a species denotes that I have myself seen specimens. References to the more important literature are given as footnotes and with the name of each species will be found the rostral formula and a brief note of the distribution.

Partial Synopsis of the species of *Leander*.

A. Branchiostegal spine absent [rostrum with an elevated basal crest ; carpus of 2nd leg at least 1½ times as long as chela ; dactyli of last three legs not abnormally long].

B. Rostrum shorter, with 3 to 5 teeth below; 5th leg reaching beyond scale by little more than dactylus ... ... 1-2) 7-11 + 1-2/3-5[4]. *L. fluminicola** Kemp.[5] Bengal ; Burma ; United Provinces.

BB. Rostrum longer, with 6 to 10 teeth below ; 5th leg reaching beyond scale by at least half of propodus ... ... 1) 7-10+1-3/6-10. *L. potamiscus** Kemp.[6] Patani ; Penang ; Andamans ; Goa.

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[1]Kemp, *Rec. Ind. Mus.* XXVI, p. 42, pl. iii (1924).
[2]De Man, *Tijdschr. Ned. Dierk. Vereen.* (2) XIV, p. 115 (1915).
[3]Kemp, *Rec. Ind. Mus.* XIII, p. 204 (1917).
[4]This formula indicates that there are in all 8 to 13 teeth on the upper border of the rostrum, 7 to 11 at the base and 1 or 2 near the tip, separated from the others by a considerable unarmed interval. The figures on the left of the bracket indicate the number of dorsal teeth situated on the carapace behind the posterior limit of the orbit. The number of teeth on the lower border of the rostrum, in this instance 3 to 5, are on the right, separated by an oblique stroke.
[5] Kemp, *Rec. Ind. Mus.* XIII, p. 223, pl. ix, fig. 2 (1917).
[6] Kemp, *ibid*, p. 225, text-fig. 7.

AA. Branchiostegal spine present.

B. Dactyli of last three legs abnormally long, those of last two pairs at least as long as propodus.

C. Last two legs excessively long, flagelliform, with dactylus much longer than carapace ; carpus of 2nd leg more than half as long as palm.

D. Basal crest of rostrum with at most 7 teeth ; fingers of 2nd leg more than twice as long as carpus. ... ... 2-4) 5-7+1/2-6. *L. tenuipes** Henderson.[1] India.

DD. Basal crest of rostrum with 8 teeth ; fingers of 2nd leg twice or less than twice as long as carpus ... ... 1) 8+1/4-5. *L. hastatus* Aurivillius.[2] W. Africa.

CC. Last two legs not excessively long, dactylus much shorter than carapace ; carpus of 2nd leg less than half as long as palm 1) 5+1/4. *L. annandalei** Kemp.[3] Shanghai.

BB. Dactyli of last three legs not abnormally long, shorter than propodus.

C. Rostrum with an elevated basal crest, or at least with proximal half conspicuously convex.

D. 2nd leg with carpus distinctly shorter than chela, palm swollen in adults.

E. One or more subapical teeth usually present on upper border of rostrum; carpus of 2nd leg shorter than merus or fingers ; last abdominal somite in adults not more than half as long as carapace.

F. Dactylus of 3rd leg more than three quarters, that of 5th nearly half length of propodus ; last four abdominal somites sharply carinate dorsally 1-2) 6-9+1-2/5-7. *L. carinatus** Ortmann.[4] China ; ? Singapore.

FF. Dactylus of 3rd leg scarcely half, that of 5th at most one-third as long as propodus ; last four abdominal somites at most bluntly carinate dorsally ... 0-1) 5-7+1-3/6-10. *L. styliferus** Milne-Edwards.[5] India ; Borneo.

EE. No subapical teeth on upper border of rostrum ; carpus of 2nd leg as long as merus or fingers ; last abdominal somite nearly two-thirds as long as carapace ... ... 0-1) 6-7+0/3-6. *L. japonicus* Ortmann.[6] Japan ; Formosa.

DD. 2nd leg with carpus at most only a trifle shorter than chela, palm little if at all swollen in adults.

E. One or two subapical teeth on upper border of rostrum 1) 9-11+1-2/3-5. *L. mani* Sollaud.[7] Tonkin.

EE. No subapical teeth on upper border of rostrum 1-2) 8-10+0/2-4. *L. modestus** Heller.[8] Shanghai.

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[1] Henderson, *Trans. Linn. Soc. London* (2) *Zool.* V, p. 440, pl. xl, figs. 14, 15 (1893); Kemp, *loc. cit.* p. 206, pl. viii, fig. 1.

[2] Aurivillius, *Bihang till K. Svenska Vet.-Akad. Handl.* XXIV, afd. iv, no. 1, p. 27, pl. iv, figs. 3-6 (1898.)

[3] Kemp, *loc.* cit., p. 211, text-figs. 1-4.

[4] Kemp, *loc. cit.*, p. 219, text-fig. 6 ; Balss, *Atti Soc. Ital. Sci. Nat.* LVIII, p. 77, pl. iv, fig. 3, pl. vi, figs. 8, 9 (1919).

[5] Kemp. *loc. cit.*, p. 214, text-fig. 5, pl. viii, fig. 2 (*ubi syn.*).

[6] Ortmann, *Zool. Jahrb., Syst.* V, p. 519, pl. xxxvii, fig. 14 (1891) ; Rathbun, *Proc. U. S. Nat. Mus.* XXVI, p. 50 (1902).

[7] Sollaud, *Bull. Soc. Zool. France* XXXIX, p. 315, text-figs. (1914).

[8] Heller, *Reise 'Novara' Exped., Crust.*, p. 111, pl. x, fig. 6 (1865) ; Kemp, *loc. cit.*, p. 221, pl. ix, fig. 1.

CC. Rostrum without an elevated basal crest, the proximal half of upper border straight or at most very feebly convex.

D. Carpus of 2nd leg longer than chela.

E. Upper rostral teeth discontinuous, an extensive portion of the margin in the distal half being entire.

F. Two pairs of dorsal spines on telson.

G. Carpus of 2nd leg little if at all less than twice as long as chela.

H. Rostrum with 18 teeth above and 13 below [2nd leg with carpus twice as long as chela and with palm twice as long as fingers]

5) 17+1/13. *L. pandaloides* (Rathbun).[1] Hawaiian Is.

HH. Rostrum with not more than 8 teeth on either border.

J. Outer antenular flagellum with free part of shorter ramus very much longer than fused part; carpus of 2nd leg more than twice as long as chela .. 1) 7+1/8. *L. pandaliformis* Stimpson.[2] Barbados or Trinidad.

JJ. Outer antennular flagellum with free part of shorter ramus not more than 1½ times as long as fused part; carpus of 2nd leg about twice as long as chela

1) 4-6+1/4-8. *L. beauforti** Roux, p. 295. Ceram, Nicobars.

GG. Carpus of 2nd leg decidedly less than twice as long as chela.

H. Outer antennular flagellum with fused part equal to or longer than free part of shorter ramus.

J. Antennal scale at least as long as carapace; carpus of 2nd leg more than 1½ times chela ... 1)·2-6+1/4-10. *L. debilis** (Dana).[3] Aldabra to Hawaiian Is.

JJ. Antennal scale shorter than carapace; carpus of 2nd leg less than 1½ times chela ... 1) 4-6+1/3-7. *L. gardineri** Borradaile, p. 298. Maldives.

HH. Outer antennular flagellum with fused part much shorter than free part of shorter ramus.[4]

J. Rostrum with 9 or 10 teeth on lower border

6-7+1-2/9-10. *L. gracilis* Smith.[5] W. Coast of Nicaragua.

JJ. Rostrum with not more than 7 teeth on lower border.

K. Upper border of rostrum with 12 teeth

2) 10+2/3-4. *L. lepidus* de Man.[6] New Guinea.

KK. Upper border of rostrum with not more than 8 teeth

1) 6-7+1/4-7. *L. concinnus** Dana.[7]

1) 6+1/5-6. *L. potitinga* Ortmann.[8] South Brazil

1) 6+1/3. *L. maculatus* Thallwitz.[9] W. Africa.

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[1] Rathbun, *Bull. U. S. Fish Comm.* for 1903, iii, p. 924, fig. 73 (1906) (as *Palaemon*).

[2] Stimpson, *Ann. Lyceum Nat. Hist. N. York* X, p. 130 (1871).

[3] Dana, *U. S. Explor. Exped., Crust.* I, p. 585, pl. xxxviii, figs. 6, 7 (1852) as *Palaemon*; Ortmann, *Zool. Jahrb., Syst.* V, p. 515 (1890); de Man, *Abh. Senck. Ges.* XXV, p. 40 (1902); Rathbun, *Bull. U. S. Fish Comm.* for 1903, iii, p. 924 (1906) (as *Palaemon*).

[4] It is not certain that this is true of *L. gracilis*.

[5] Smith, *Rep. Peabody Acad. Sci.* for 1869, p. 97 (1871).

[6] De Man, *Zool. Jahrb., Syst.* XXXVIII, p. 410, pl. xxviii, figs. 6-6*d* (1915).

[7] Dana, *U. S. Explor. Exped., Crust.* I, p. 587, pl. xxxviii, fig. 10 (1852); Stimpson, *Proc. Acad. Sci. Philadelphia* XII, p. 40 (1860) (as *L. longicarpus*); de Man, *Arch. Naturgesch.* LIII, i, p. 560 (1888) (as *L. longicarpus*); Ortmann, *Zool. Jahrb., Syst.* V, p. 516 (1890); de Man, *Zool. Jahrb., Syst.* IX, p. 765 (1897). Coutière's specimens from Madagascar (*Ann. Sci. nat., Zool.* (8) XII, p. 357, pl. xiv, fig. 47) seem to be different having the carpus of 1st leg 4 times as long as chela.

[8] Ortmann, *Rev. Mus. Paulista* II, p. 193, pl. i, fig. 13 (1897).

[9] Thallwitz, *Abh. Zool. Mus. Dresden*, no. 3, p. 19, fig. 4 (1891); Balss, in Michaelsen's *Beitr. Kennt. Meeresf. West-Afrikas Crust.* II, p. 26, figs. 7, 8 (1916) (as *L. Edwardsii*).

FF. No dorsal spines on telson [outer antennular flagellum with fused part very much shorter than free part; carpus of 2nd leg 1·8 times as long as chela; mandibular palp composed of two segments]

0-1) 5-6+2/4-5. *L. cubensis** (Hay).[1]

EE. Upper rostral teeth more or less continuous from base to apex.

F. Branchiostegal spine inserted behind margin of carapace; 9 or more teeth on upper border of rostrum.

G. Fingers of 2nd leg as long as palm; only 9 teeth on upper border of rostrum ... ... 9/4. *L. deschampsi* Nobili.[2] Singapore.

GG. Fingers of 2nd leg shorter than palm; 9 to 15 teeth on upper border of rostrum ... ... 3) 9-15/3-4. *L. macrodactylus* Rathbun.[3] Japan.

FF. Branchiostegal spine inserted on margin of carapace; not more than 7 teeth on upper border of rostrum [fingers of 2nd leg shorter than palm]

1) 5-6/2-3. *L. paucidens** de Haan.[4] Japan; Kurile Is.; Korea.

1) 6-7/2. *L. brasiliensis* Ortmann.[5] Brazil.

6/3. *L. exilimanus* Dana.[6] Fiji.

DD. Carpus of 2nd leg shorter than chela, or at most only a trifle longer.[7]

E. Branchiostegal spine inserted behind margin of carapace.

F. Fingers of 2nd leg equal to, or shorter than palm.

G. Carpus of 2nd leg almost as long as chela

2) 10-11/2-3. *L. capensis* de Man.* Cape Colony.

GG. Carpus of 2nd leg decidedly shorter than chela.

H. Rostrum very slender in lateral view, not expanded at level of first lower tooth; 7 or 8 teeth on lower border

2) 7-8+2-3/7-8. *L. longipes* Ortmann.[9] Japan.

HH. Rostrum broad in lateral view, expanded at level of first lower tooth; not more than 5 teeth on lower border.

J. Rostrum with 11 to 17 teeth on upper border; dactylus of last three legs extremely slender, that of 5th from 9 to 10 times as long as wide

3-4) 11-17/3-5. *L. sewelli,** sp. nov., p. 299. Portuguese India; Bay of Bengal.

JJ. Rostrum with not more than 9 teeth on upper border; dactylus of last three legs not unusually slender.

K. Rostrum upturned distally, with apex bifid

2-3) 6-9/4-5. *L. intermedius** Stimpson.[10] S. Australia; Tasmania.

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[1] Hay, *Proc. U. S. Nat. Mus.* XXVI, p. 433, fig. 3 (1903) (as *Palaemonetes*).

[2] Nobili, *Boll. Mus. Torino* XVIII, no. 455, p. 8 (1903).

[3] Rathbun, *Proc. U. S. Nat. Mus.* XXVI, p. 52, fig. 24 (1902) (as *Palaemon*).

[4] De Haan, in Siebold's *Fauna Japonica, Crust.*, p. 170, pl. xlv, fig. 11 (1849) (as *Palaemon*); Rathbun, *loc. cit. supra*, 1902, p. 51 (as *Palaemon*); de Man, *Trans. Linn. Soc., Zool.* (2) IX, p. 409 (1907). In old females of this species the carpus of the 2nd leg is sometimes equal in length with the chela.

[5] Ortmann, *Zool. Jahrb., Syst.* V, p. 524, pl. xxxvii, fig. 16 (1890); *id., Rev. Mus. Paulista* II, p. 191 (1897).

[6] Dana, *U. S. Explor. Exped., Crust.* I, p. 586, pl. xxxviii, fig. 8 (1852) (as *Palaemon*).

[7] Only in the typical form of *L. squilla* is the carpus a little longer than the chela.

[8] De Man, in Weber, *Zool. Jahrb., Syst.* X p. 174, pl. xv. figs. 3*a-g* (1897).

[9] De Man, *Notes Leyden Mus.* III, v. 141 (1881) (as *L. longirostris*); Ortmann, *Zool. Jahrb., Syst.* V, p. 519, pl. xxxvii, fig. 13 (1890); de Man, *Trans. Linn. Soc., Zool.* (2) IX, p. 409, pl. 32, figs. 26-30 (1907).

[10] Stimpson, *Proc. Acad. Sci. Philadelphia* XII, p. 41 (1860); McCulloch, *Rec. Australian Mus.* VII, p. 309, pl. lxxxix, figs. 13, 14 (1903).

KK. Rostrum straight, not bifid at apex

1-2) 7-8/3. *L. distans* Heller.[1]
Nicobars.

FF. Fingers of 2nd leg longer than palm.

G. Branchiostegal spine as large as antennal; carpus of 1st leg less than 1½ times as long as chela.

H. Lower border of rostrum with a double fringe of setae which conceals the teeth; 1st pleopod of male with appendix interna on endopod; proximal dorsal spines of telson situated in anterior half of telson length ... 2) 8-11/5-7. *L. tenuicornis** (Say), p. 302.
Atlantic; Indo-pacific.

HH. Lower border of rostrum with a single row of setae in interstices of teeth; 1st pleopod of male without appendix interna; proximal dorsal spines of telson situated in posterior half of telson-length

2) 7-9/4-5. *L. xiphias** (Risso).[2]
Mediterranean.

EE. Branchiostegal spine inserted on margin of carapace.

F. Outer antennular flagellum with fused part at least half as long as free part of shorter ramus.

G. Fingers of 2nd leg little more than half as long as palm (as 9 : 16) [mandibular palp composed of 2 segments only]

2-3) 6-10/2-4. *L. squilla** (Linn.)[3]
E. Atlantic; Mediterranean.

GG. Fingers of 2nd leg much more than half as long as palm.

H. Outer antennular flagellum with fused part longer than free part of shorter ramus; 4 posterior rostral teeth situated behind orbit; carpus of 2nd leg as long as chela

4) 9+1/4. *L. northropi* Rankin.[4]
Bahamas.

HH. Outer antennular flagellum with fused part shorter than free part of shorter ramus; at most 3 posterior rostral teeth situated behind orbit; carpus of 2nd leg usually shorter than chela.[5]

J. Rostrum with 11-13 teeth on upper border

2-3) 11-13/5-7. *L. paulensis* Ortmann.[6]

JJ. Rostrum with at most 10 teeth on upper border.

K. Apex of rostrum simple; mandibular palp composed of 2 segments
1) 7-10/2-5. *L. semmelinki** de Man, p. 204.
Bombay to Celebes.

KK. Apex of rostrum bifid; mandibular palp composed of 3 segments ... 2-3) 8-9/3-4. *L. affinis* M.-Edw.[7]
N. Zealand; D'Urville & Chatham Is.; Port Rico and Bermuda; S. Africa.

2-3) 6-9/3-4. *L. serenus* Heller.[8]
S. and E. Australia.

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[1] Heller, *Reise 'Novara' Exped., Crust.*, p. 109, pl. x., fig. 4 (1865).

[2] De Man, *Tijdschr. Ned. Dierk. Vereen.* (2) XIV, p. 175, pl. xii, fig. 6 (1915).

[3] *Id., ibid.*, pp. 120-139, pls. x, xi, fig. 1 (*syn. et vars.*); Gurney, *Proc. Zool. Soc. London* 1923, p. 102, figs.

[4] Rankin, *Ann. N. York Acad. Sci.* XI, p. 245 (1898).

[5] Occasionally equal to chela in *L. semmelinki.*

[6] Ortmann, *Rev. Mus. Paulista* II, p. 192, pl. i, fig. 14 (1897); Rathbun, *Bull. U. S. Fish Comm.* for 1900, ii, p. 125 (1901).

[7] Milne-Edwards, *Hist. Nat. Crust.* II, p. 391 (1837); Dana, *U. S. Explor. Exped., Crust.* I, p. 584, pl. xxxviii, figs. 5-5*g* (1852); Rathbun, *Bull. U. S. Fish Comm. for* 1900, p. 125 (1901) (as *Palaemon*); Verril, *Trans. Conn. Acad. Arts Sci.* XXVI, p. 142, pl. xliii, figs. 3-3*b*, pl. xlvii, fig. 7 (1922).

[8] Heller, *Reise 'Novara' Exped., Crust.*, p. 110, pl. x, fig. 5 (1865); McCulloch, *Rec, Australian Mus.* VII, p. 307, pl. lxxxix, figs. 9-12 (1909).

FF. Outer antennular flagellum with fused part less than half as long as free part of shorter ramus.

G. Carpus of 2nd leg as long as or longer than palm.

H. Rostrum very slender in lateral view, not expanded at level of first lower tooth ; 7 or 8 teeth on lower border of rostrum
2) 7-8+2-3/7-8. *L. longipes** Ortmann.[1]
Japan ; Amoy.

HH. Rostrum stout in lateral view, much expanded at level of first lower tooth ; not more than 6 teeth on lower border of rostrum.

J. Carpus of 2nd leg more than two-thirds as long as chela.

K. Upper border of rostrum with 1 tooth placed on carapace behind orbit ... 1) 5-8/2-5. *L. adspersus** Rathke.[2]
Baltic to Mediterranean and Black Sea.

KK. Upper border of rostrum with 2 teeth placed on carapace behind orbit.

L. Shorter ramus of outer antennular flagellum about two-thirds as long as peduncle ; carpus of 1st leg twice or nearly twice as long as chela 2) 7-12/3-6. *L. longirostris** Milne-Edwards.[3]
North Sea to Corsica ; ? Liberia.

LL. Shorter ramus of outer antennular flagellum about as long as peduncle ; carpus of 1st leg little more than 1½ times as long as chela ... 2-3) 9-13/2-5. *L. serrifer** Stimpson, p. 305.
Bombay to Japan and Vladivostok ; S. Africa.

JJ. Carpus of 2nd leg two-thirds or less than two-thirds as long as chela.

K. Outer antennular flagellum with free part of shorter ramus strongly serrate internally ; fingers of 2nd leg usually shorter than palm.

L. Propodus of last three legs distally dilated and armed with 4-6 stout spines ... 2-3) 7-8/2-3. *L. belindae,** sp. nov., p. 308.
Gulf of Manaar.

LL. Propodus of last three legs normal, not dilated distally and with only 1 or 2 slender spines
2-3) 7-11/3-5. *L. pacificus** Stimpson, p. 307.
Red Sea to Hawaiian Is.

KK. Outer antennular flagellum with free part of shorter ramus not serrate internally ; fingers of 2nd leg as long as or longer than palm.

L. Distal half of rostrum with a considerable part of its upper border entire ... 2) 5-8+1-2/3-6. *L. serratus** (Pennant).[4]
N. E. Atlantic ; Mediterranean.

LL. Upper border of rostrum with teeth in a continuous series
2) 9-10/6. *L. hammondi* Kingsley.[5]
Baker's I., N. Pacific.

GG. Carpus of 2nd leg shorter than palm.

H. Apex of rostrum bifid, its upper border with 2 teeth placed on carapace behind orbit ... ... 2) 8/3. *L. litoreus* McCulloch.[6]
Australia.

HH. Apex of rostrum simple, its upper border with 1 tooth placed on carapace behind orbit ... 1) 7-9/3. *L. ritteri** Holmes.[7]
California ; Ecuador.

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[1] Ortmann, *Zool. Jahrb., Syst.* V, p. 519, pl. xxxvii, fig. 13 (1890); Rathbun, *Proc. U. S. Nat. Mus.* XXVI, p. 53 (1902) (footnote, as *P. ortmanni*) ; de Man, *Trans. Linn. Soc.* (2) *Zool.* IX, p. 409, pl. xxxii, figs. 26-30 (1907).

[2] De Man, *Tijdschr. Ned. Dierk. Vereen,* (2) XIV, p. 140, pl. xi, fig. 2 (1915) ; Gurney, *Proc. Zool. Soc. London* 1923, p. 106.

[3] De Man, *loc. cit.* p. 149, pl. xii, fig. 3 (1915) ; Gurney, *loc. cit.* p. 108.

[4] De Man, *loc. cit.* p. 165, pl. xii, fig. 4 (1915).

[5] Kingsley, *Bull. Essex Inst.* XIV, p. 108, pl. i, fig. 2 (1883).

[6] McCulloch, *Rec. Austral. Mus.* VII, p. 308, fig. 16 (1909).

[7] Holmes, *Proc. California Acad. Sci.* (2) IV, p. 579, pl. xxi, figs. 29-35 ; *id., Occas. Pap. California Acad. Sci.* (2) VII, p. 216 (1900), Nobili. *Boll. Mus. Torino* xvi, no. 415, p. 4 (1901).

The following species are not included in the foregoing key :—

L. brandti Czerniavsky,[1] from the Black Sea. Described from a single specimen which appears to have been abnormal in the great length of the merus of the second leg, this segment being equal in length to the carpus and chela united.

L. brevirostris (Andrzeiorwski)[2] from the Black Sea. Insufficiently described.

L. czerniavskyi Brashnikow.[3]

L. dionyx Nobili,[4] from a forest stream in New Guinea. The dactyli of the last three legs are biunguiculate and the species, as already remarked (p.285), does not belong to the genus *Leander*.

L. gilchristi Stebbing,[5] from S. Africa.

L. imbellis (Fischer),[6] from the Bay of Arcachon. Apparently described from an abnormal specimen of *L. adspersus*, without teeth on the lower border of the rostrum.

L. indicus Heller[7], from Java. This species evidently belongs to the *styliferus* group ; it appears to be related to *L. mani* and *L. modestus*, but differs from both in having the carpus of the second leg twice as long as the chela. In young specimens from Celebes, which de Man[8] doubtfully attributes to this species, the carpus is proportionately shorter and the rostral dentition is different.

L. peringueyi Stebbing[9], from S. Africa. Described from a specimen with a malformed rostrum.

L. quoyanus (Milne-Edwards),[10] from New Zealand. Closely related to *L. affinis*, if not identical with it.

The following names are used in a varietal sense :—

elegans (Rathke) is a variety of *L. squilla* (Linn.).
fabricii (Rathke) is a variety of *L. adspersus* (Rathke).
intermedia de Man is a variety of *L. squilla* (Linn.).
treillianus (Milne-Edwards) is a variety of *L. serratus* (Pennant).

The following are synonyms :—

L. edwardsii Heller =*L. longirostris* (Milne-Edwards).
L. erraticus Desmarest = *L. tenuicornis* (Say).
L. latirostris (de Haan) = *L. tenuicornis* (Say).
L. latreillianus Czerniavsky probably = *L. serratus* var. *treillianus* (Milne-Edwards).
L. leachii (Bell) = *L. adspersus* var. *fabricii* (Rathke).
L. longicarpus Stimpson = *L. concinnus* Dana.
L. longirostris (Milne-Edwards, *Hist. Nat. Crust.* II, p. 394, *not* p. 392)= *L. styliferus* (Milne-Edwards).

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[1] Czerniavsky, *Crust. Decap. Pontica littoralia*, p. 43, pl. iii, fig. 8 (1884).
[2] Andrzeiowski, *Bull. Soc. Imp. Nat. Moscou*, ann. 1839, p. 23(1839).
[3] Brashnikow, *Mém. Acad. Imp. Sci. St. Pétersbourg* (8) XX, p. 176 (1907).
[4] Nobili, *Ann. Mus. Hungar.* III, p. 482, pl. xii, fig. 2 (1905).
[5] Stebbing, *Ann. S. Afric. Mus.* XV, p. 76, pl. lxxxii (1915).
[6] Fischer, *Actes Soc Linn. Bordeaux* XXVIII, p. 422 (1873).
[7] Heller, *Reise 'Novara' Exped., Crust.* p. 111, pl. x, fig. 7 (1865).
[8] De Man, *Notes Leyden Mus.* III, p. 139 (1881).
[9] Stebbing, *Ann. S. Afric. Mus.* XV, p. 75, pl. lxxxi (1915).
[10] Milne-Edwards, *Hist. Nat. Crust.* II, p. 393 (1837).

L. natator (Milne-Edwards) = *L. tenuicornis* (Say).
L. ortmanni (Rathbun) = *L. longipes* Ortmann.
L. rectirostris (Zaddach) = *L. adspersus* var. *fabricii* (Rathke).
L. torensis (Paulson) = *L. tenuicornis* (Say).
L. triliana (Risso) = *L. serratus* var. *treillianus* (Milne-Edwards.)

Leander beauforti Roux.

1923. *Leander beauforti*, Roux, *Capita Zoologica*, II, afl. 2, p. 18, figs. 1, 2.

The specimens which I refer to this species have the following characters :—

The rostrum reaches well beyond the antennal scale, sometimes by almost half its length, and is strongly inflected upwards in its distal half. The upper border is conspicuously concave, without any trace of the basal crest found in *L. styliferus* and its allies, and bears in its proximal half from 4 to 6 (nearly always 5) [1] well-separated teeth. The posterior tooth is placed on the carapace behind the longitude of the hinder limit of the orbit; the second tooth is much in advance of this point and is little if at all more distant from the first than from the third. The three posterior teeth appear to be articulated and the remainder fixed, whereas in the allied *L. concinnus* only the hindmost is articulated. On the upper border close to the apex there is, apparently without exception, a single tooth. In lateral view the rostrum is shallow, attenuated distally, and bears on its lower border from 4 to 7 (usually 5 or 6)[2] large teeth.

The length of the carapace, measured from the back of the orbit, is about equal to the dorsal length of the sixth abdominal somite *plus* one half that of the fifth. The branchiostegal spine is situated on the margin of the carapace and is as large as the antennal; immediately above it, as in allied species of the genus, a fine curved horizontal groove is visible extending backwards for about one-third the length of the carapace.

At the distal end of the outer margin of the basal segment of the antennular peduncle there is a short spine which does not reach as far forwards as the strongly convex margin which intervenes between this spine and the articulation of the first and second segments. In the outer antennular flagellum the free part of the shorter ramus consists of some 12 to 17 segments and is from 1·3 to 1·5 times as long as the fused part. The fused part comprises 7 or 8 segments and is twice as long as the ultimate segment of the peduncle. The total length of the shorter ramus is slightly greater than that of the peduncle.

The antennal scale is distinctly longer than the carapace and is about 3·3 times as long as wide; the outer margin is straight and ends in a small spine which is far exceeded by the narrowly produced apex of the lamella.

The mandibular palp is composed of three segments. There is a small pleurobranch and a large arthrobranch at the base of the third maxilliped.

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[1] Of nineteen specimens one has 5 upper teeth, sixteen have 6 and two have 7; in these figures the single apical tooth is included.

[2] Of nineteen specimens one has 4 lower teeth, six have 5, eight have 6 and four have 7,

The first legs extend to a point midway between the tip of the antennular peduncle and that of the antennal scale. The carpus is 9 to 9½ times as long as its distal breadth ; it is nearly 1½ times as long as the merus and is rather more than twice as long as the chela. The proportionate lengths of merus, carpus and chela are as 36 : 47 : 22. The fingers are slightly longer than the palm.

The second legs in adults reach beyond the antennal scale by the chela and a small portion of the carpus. The merus is 10·5 to 12 times as long as its greatest breadth and the carpus from 14 to 19 times, the segments being more slender in males than in females. The carpus is from 1·45 to 1·8 times as long as the merus and is from 1·9 to 2·25 times as long as the chela. The average lengths of merus, carpus and chela are as 19 : 31 : 15. The palm is from 1·2 to 1·3 times as long as the fingers and the fingers are without teeth on their inner edges.

The last three legs are extremely slender ; the third reach a little beyond the antennal scale, while the fifth extend beyond the same point by the dactylus and a small portion of the propodus. In the third pair the propodus is about 2·5 times as long as the dactylus, in the fifth pair about 3·3 times. In the third and fourth pairs there are very few spinules on the posterior border of the propodus ; in the fifth pair there are numerous spinules on the distal half of this segment.

The sixth abdonimal somite, measured dorsally, is more than twice as long as the fifth. There is no appendix interna on the first pleopod of the male. The anterior pair of spines on the back of the telson is placed a little behind the middle of the telson-length ; the second pair is situated about half-way between the first pair and the apex. The armature of the telson-tip is normal.

Large specimens reach a total length of about 34 mm.

On the whole the specimens agree very well with Roux's description, the only discrepancy of any note being that the second and fifth legs are shorter in his specimens.

This species is very closely allied to Dana's *L. concinnus*, specimens of which, from the Aru Is., I have examined in the British Museum. *L. concinnus* differs from *L. beauforti* in the following particulars :—

(i) The antennal scale is shorter than the carapace and is less than three times as long as wide.

(ii) The spine at the distal end of the outer margin of the basal antennular segment is longer, projecting beyond the convex margin which intervenes between the spine and the articulation of the first and second segments.

(iii) The two rami composing the outer antennular flagellum are fused basally for a much shorter distance ; the fused part is only about as long as the ultimate peduncular segment and the free part is about four times its length.

(iv) The carpus of the second leg is only about 1½ times as long as the chela.

(v) The dactyli of the last three legs are shorter : in the fifth pair the propodus is five times as long as the dactyius.

L. beauforti has only been found on a single occasion,—

C857/1.	Nancowry I., Nicobars.	'Investigator', Oct., 1922.	Twenty-two, (2 ovig.).

The specimens were obtained when shore-collecting. The species was described by Roux from specimens obtained in brackish water in Ceram.

Leander prox. **debilis** (Dana).

1852. *Palaemon debilis*, Dana, *U. S. Explor. Exped., Crust*, 1. p. 585, pl. xxxviii, figs. 6, 7.
1892. *Leander debilis*, de Man, in Weber's *Zool. Ergebn. Reise Nied. Ost.-ind.* II, p. 507.
1901. *Leander debilis*, Borradaile, in Gardiner's *Faun. Geog. Maldives Laccadives* I, p. 98.
1901. *Leander debilis*, Lenz, *Zool. Jahrb., Syst.*, XIV, p. 435.
1902. *Leander debilis*, de Man, *Abh. Senck. Ges.* XXV, p. 40.
1906. *Palaemon debilis*, Rathbun, *Bull. U. S. Fish Comm.* for 1903, iii, p. 924.
1917. *Leander debilis*, Borradaile, *Trans. Linn. Soc. London* (2) *Zool.* XVII, p. 404.

Five specimens from the Gulf of Suez resemble *L. debilis* very closely but disagree in a few points which may ultimately prove to possess some significance. They appear to differ from typical individuals only in the following particulars:—

(i) There are 7 or 8 teeth on the upper border of the rostrum (including that at the apex) and only 3 or 4 on the lower border.
(ii) The fused part of the outer antennular flagellum is composed of 14 segments and is from 1·7 to 2·5 times as long as the free part of the shorter ramus, the latter comprising 7 to 9 segments. In typical *L. debilis* the fused part does not seem to be more than 1·3 times the free part.
(iii) The second leg reaches beyond the antennal scale by half, or even the whole of the chela; the carpus is considerably less than $1\frac{1}{2}$ times the length of the chela, the proportionate lengths of the merus, carpus and chela being about as 30 : $40\frac{1}{2}$: 29.

The published accounts of this species do not agree very well and it would at first sight seem probable that distinct subspecies inhabit different portions of the wide area over which the form occurs. Borradaile, however, has drawn attention to the extreme variation shown in specimens from Aldabra and it is possible, though other authors do not mention it, that a similar range of variation occurs elsewhere. The species has not previously been recorded from the Gulf of Suez or the Red Sea and until further examples from this region have been examined it is not possible to estimate the amount of variation which occurs. In the rostral formula the specimens differ rather widely from those found at the Hawaiian is. (the type locality), but in this, as well as in other particulars, they fall within the range of variation exhibited by Borradaile's Aldabra specimens.

C858/1.	Ain Musa, G. of Suez.	R. B. S. Sewell, 1916.	Five.

Leander gardineri Borradaile.

1906. *Leander gardineri*, Borradaile, in Gardiner's *Faun. Geog. Maldives Laccadives* I, p. 98.

This species, as Borradaile has pointed out, is very closely allied to Dana's *L. debilis*, but, compared with specimens of the latter from Rodriguez (Brit. Mus.), exhibits the following differences :—

L. gardineri.	*L. debilis.*
Form stouter, with carapace longer in relation to abdomen ; length of carapace equal to basal length of 5th and 6th abdominal somites *plus*, in most instances, a small portion of the 4th.	Form more slender, with carapace shorter in relation to abdomen ; length of carapace equal to dorsal length of 6th abdominal somite *plus* half or rather more than half that of 5th.
Second tooth on upper border of rostrum usually placed immediately above hinder limit of orbit.	Second tooth of upper border of rostrum usually placed much in advance of hinder limit of orbit.
Anterior margin of carapace below antennal spine not distinctly concave.	Anterior margin of carapace below antennal spine conspicuously concave.
Antennal scale decidedly shorter than carapace.	Antennal scale at least as long as carapace.
Second legs reaching beyond antennal scale by at least the greater part of chela ; carpus less than 1½ times as long as chela.	Second legs reaching little at if all beyond end of antennal scale ; carpus more than 1½ times as long as chela.

In the specimens examined the rostrum as a rule reaches beyond the antennal scale by about one-third of its length. The upper border is straight or very slightly convex in the proximal part, trending upwards at the apex. On the proximal half of its upper border it bears from 4 to 6 teeth (usually 4 or 5), while the distal half is unarmed except for a small tooth placed very close to the tip and giving it a bifid appearance. The posterior tooth is situated on the carapace and is articulated. On the lower border there are from 3 to 7 teeth (nearly always 5 or 6).

As in *L. debilis*, *L. concinnus* and other species, a fine groove or suture may be detected in the anterior third of the carapace, just above the branchiostegal spine. The spine at the distal end of the proximal antennular segment is short, resembling that of *L. debilis*. In the outer flagellum the fused part consists of 12 to 14 segments and is about 1·4 times as long as the free part of the shorter ramus, the latter comprising about 10 segments. The apex of the antennal scale is narrowly rounded and produced far beyond the spine which terminates the outer border. The mandibular palp is 3-segmented.

The first legs reach a little beyond the end of the antennular peduncle and the proportionate lengths of merus, carpus and chela are about as 37 : 45 : 24. The fingers are slightly longer than the palm. In the second legs the merus is 7·5 to 7·7 times as long as its greatest breadth and the carpus 9·5 times. The merus and chela are subequal in length and the carpus is less than 1½ times their length. The proportionate lengths of merus, carpus and chela are about as 48 : 63 : 49.

The third legs reach almost to the end of the antennal scale, the fifth a little beyond it. The merus in each is from 12 to 13 times as long as wide ; in the third pair the propodus is about 2·6 times as long as the dactylus, in the fifth from 3·5 to 3·8 times.

There is no appendix interna on the first pleopod of the male. The telson is normal, with the anterior pair of spines placed a little behind the middle.

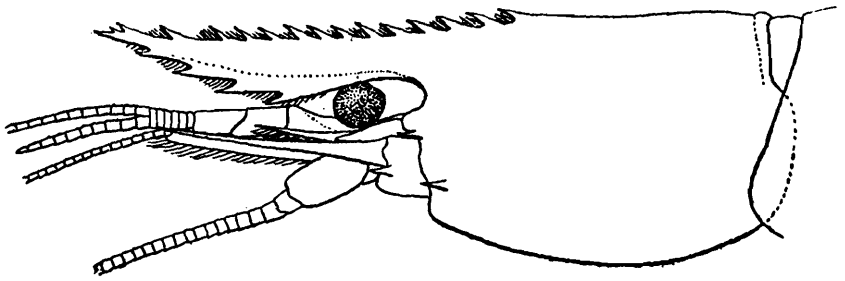
The largest specimen examined is about 33 mm. in length.

C859/1.	Addu Atoll, Maldives.	R. B. S. Sewell, Feb., 1923.	Twenty-two.
C860/11.	Pool on Dunk I., Maldives.	R. B. S. Sewell, Feb., 1923.	Ten.
C861/1.	Lagoon Reef, E. of Maradu, Maldives.	R. B. S. Sewell, April, 1923.	Four.

The majority of the specimens were found in brackish water. The species was described by Borradaile from large numbers of specimens found at the edge of a fresh water 'Kuli' on Miladumadulu Atoll in the Maldives.

Leander sewelli, sp. nov.

The rostrum reaches about to the end of the antennal scale, but is sometimes a little shorter and occasionally rather considerably longer (fig. 9). Its upper border is straight proximally but it is usually a little upturned in its distal third. There are altogether from 11 to 17 upper teeth (usually 12 to 16) [1] of which from 3 to 5 (usually 4) are situated on the carapace behind the posterior limit of the orbit. The posterior tooth is sometimes a little more distant from the second than the second is



TEXT-FIG. 9.—*Leander sewelli*, sp. nov.
Carapace and anterior appendages in lateral view.

from the third and the teeth are generally rather closely packed over the eye and more widely separate distally. The distal one or two teeth are sometimes, but not always, separated by a distinct interval from those further back; the distal tooth is not placed so close to the apex as to give it a bifid appearance. In lateral view the rostrum is deep and it bears on its lower border from 3 to 5 (usually 4) teeth.[2] On both upper and lower borders there are setae in the interspaces between the teeth.

The branchiostegal spine is nearly as large as the antennal; it is set well back from the margin of the carapace, but the tip in lateral view reaches beyond the margin. The ocular spot is distinct and touches the cornea, the cornea itself being rather narrow and not much wider than the stalk.

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[1] Of fifty-two specimens three have 11 upper teeth, six have 12, seven have 13, thirteen have 14, eleven have 15, nine have 16 and three have 17.

[2] Of fifty-two specimens thirteen have 3 lower teeth, thirty-four have 4 and five have 5.

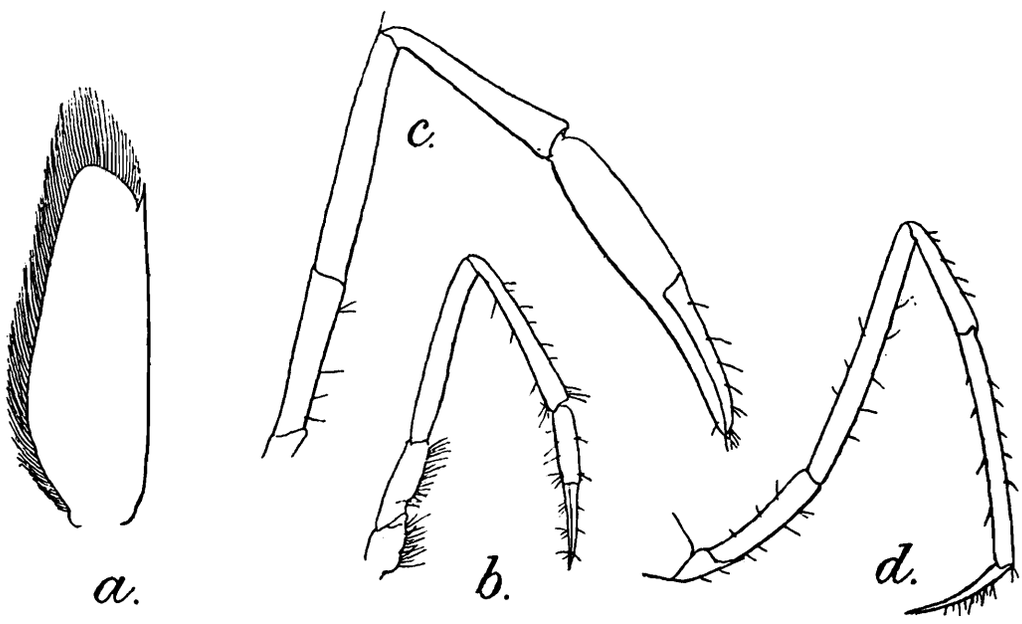
The distal spine of the basal segment of the antennular peduncle reaches to the middle of the second segment; its tip projects far beyond the convex border which intervenes between the base of the spine and the articulation of the first and second segments. In the outer flagellum the free part of the shorter ramus is from 2·7 to 3·1 times as long as the fused part and consists of 10 to 13 elongate segments. The fused part comprises 5 or 6 segments and the total length of the shorter ramus is less than that of the peduncle.

The antennal scale (fig. 10*a*) is from 3·0 to 3·7 times as long as wide and is proportionately broadest in females. The outer margin is straight or slightly concave, terminating in a spine which reaches almost or quite as far forwards as the rather broadly rounded apex to the lamella.

The mandibular palp is composed of three segments and the other oral appendages are normal. There is a large arthrobranch and a small pleurobranch at the base of the third maxilliped.

The first legs (fig. 10*b*) extend to the end of the antennular peduncle. The carpus is slightly shorter than the merus and slightly longer than the chela, the proportionate lengths of merus, carpus and chela being about as 41 : 38 : 34·5. The fingers bear a few setae and are a little longer than the palm.

The second legs of adults (fig. 10*c*) reach beyond the antennal scale by the fingers and about half the length of the palm. The merus is from 7 to 8·5 times as long as its greatest breadth and is from 1·2 to 1·25 times as long as the carpus. The carpus is from 4·7 to 5·3 times as long as wide. The chela is from 1·5 to 1·65 times as long as the carpus, with the palm about 3 times as long as wide and equal in length with the fingers.



TEXT-FIG. 10.—*Leander sewelli*, sp. nov.

a. Antennal scale.
b. First leg.
c. Second leg.
d. Third leg.

The last three legs are slender. The third pair (fig. 10*d*) reaches almost to the end of the antennal scale, while the fourth and fifth pairs

reach a little beyond it. In all three pairs the merus is from 12 to 15 times as long as wide and the propodus, which bears some fine spinules on its posterior edge, is from 2·1 to 2·25 times as long as the dactylus. The dactylus itself is very slender, with a few setae on its anterior border; in the third pair it is from 7·5 to 8 times as long as its basal breadth, in the fifth pair from 9 to 10 times.

The sixth abdominal somite is less than twice as long as the fifth. There is no appendix interna on the first pleopod of the male. The telson bears the usual two pairs of dorsal spines, the foremost placed a little behind the middle of its length. The apex is normal, with two spines and one feathered seta on either side of the median point.

Large specimens reach a length of about 32 mm.

Specimens obtained in Portuguese India were usually deeply pigmented when alive and dull reddish in colour. Occasionally they exhibited pale dorsal blotches on the abdominal somites and very rarely there was a broad pale dorsal stripe extending from the base of the rostrum to the tip of the telson.

In the form of the rostrum and in the position of the branchiostegal spine this species bears a singular resemblance to *Palaemonetes hornelli* (p. 318); it is distinguished by the presence of the mandibular palp, by the absence of an appendix interna on the first pleopod of the male, by the characters of the outer antennular flagellum and by the proportions of the legs. Its nearest relatives appear to be *L. intermedius* Stimpson and *L. distans* Heller, from both of which it differs in the greater number of upper rostral teeth and in the rather longer and more slender dactyli of the last three legs.

I have associated with this species the name of Major R. B. Seymour Sewell, I.M.S., Surgeon-Naturalist on the R.I.M.S. "Investigator," to whom the Zoological Survey of India is indebted for large collections made during recent years on various parts of the Indian coast. In addition I am myself especially grateful to Major Sewell for the opportunity of examining the valuable series of Decapoda that he obtained when stationed on the Gulf of Suez in 1916. Our collections had previously been weak in material from this locality and from the Red Sea and his specimens have proved invaluable for comparison with Indian material.

The species has been taken at the following localities :—

C862/1.	Off Betim Point, opposite Nova Goa, Portuguese India, 2-3 fms.	S. Kemp, Sept., 1916.	Fifty-two including Types.
C863/1.	Junction of Mandavi and Mapusa Rivers, Nova Goa, 3-4 fms.	S. Kemp, Sept., 1916.	Eight.
C864/1.	Above Cortalim, Mormugao Bay, Portuguese India, 1½ fms.	S. Kemp, Sept., 1916.	Six.
C865/1.	Hainze Basin, Tavoy, Burma	'Investigator.'	Four.
2361/7.	1 mi. E. of Pundi Beacon, Ganjam Coast, Bay of Bengal, 7½—9½ fms.	'Investigator', Jan., 1890.	One.

In the last mentioned specimen the second leg is proportionately rather longer than in the other examples, but otherwise agrees well. Col. Alcock, who collected it, has however noted on the label "uniform jet black on black mud." Except for this individual all the specimens were obtained in water of low salinity.

Leander tenuicornis (Say).

1818. *Palaemon tenuicornis*, Say, *Proc. Acad. Sci. Philadelphia* I, p. 249.
1837. *Palemon natator*, Milne-Edwards, *Hist. Nat. Crust.* II, p. 393.
1849. *Leander erraticus*, E. Desmarest, *Ann. Soc. Ent. France* (2) VII, p. 92, fig.
1875. *Palaemon torensis*, Paulson, *Crust. Red Sea*, p. 116, pl. xvii, figs. 3-5.
1882. *Leander natator*, Haswell, *Cat. Austral. Crust.*, p. 195.
1887. *Leander natator*, de Man, *Arch. Naturgesch.* LIII, i, p. 563.
1891. *Leander natator*, Ortmann, *Zool. Jahrb., Syst.* V, p. 525.
1906. *Leander natator*, Nobili, *Ann. Sci. nat., Zool.* (9) IV, p. 74.
1914. *Leander tenuicornis*, Stebbing, *Trans. Roy. Soc., Edin.* L. p. 288.
1918. *Palaemon tenuicornis*, Hay and Shore, *Bull. U. S. Bur. Fish.* XXXV, p. 392.
1922. *Leander tenicornis*, Verrill, *Trans. Connect. Acad. Arts Sci.* XXVI, p. 143.

Other references to this widely distributed species are given by Nobili, Stebbing and Verrill. The following notes on the characters of specimens from the coasts of British India will perhaps be found useful.

The rostrum reaches to or slightly beyond the end of the antennal scale and differs widely in the two sexes. In the male it is frequently upturned with concave upper border and in lateral view is shallow; in the female it is straight with a convex upper border and is very deep in lateral view. The teeth vary in number, but the variation is not correlated with sex as stated by Spence Bate. On the upper border there are from 9 to 12 (usually 10 or 11) teeth,[1] 2 of which are situated on the carapace behind the orbit. They extend in a continuous series, with setae in the interspaces, throughout the length of the upper border and often, more particularly in females, are more crowded near the apex than elsewhere. The teeth on the lower border are from 5 to 7 in number [2] (usually 6 or 7) and, though large, are to a great extent obscured by fringes of plumose setae. These setae differ from those so frequently found on the lower edge of the rostrum, for they are not implanted in the middle line, filling the interspaces between the teeth, but consist of two continuous rows, one on either side of the rostrum, arising from the base of the teeth. They overlie the teeth and render them almost invisible, with the result that the species has more than once been described as having the lower border unarmed.

The branchiostegal spine is almost as large as the antennal and is set well back from the edge of the carapace, the tip reaching just to, or slightly beyond the margin. The ocular spot is, as usual, conspicuous and touches the cornea. The cornea, even in specimens which have been 10 years in alcohol, frequently shows two concentric bands of dark pigment. These bands are not often seen in *Leander*, but they are of very frequent occurrence in *Periclimenes* and other genera of Pontoniinae.

The basal segment of the antennular peduncle terminates externally in a very strong spine which usually reaches to the end of the second segment. The margin between this spine and the articulation of the first and second segments is straight and is not produced forwards beyond the

[1] Of seventy-nine specimens nine have 9 upper teeth, fifty have 10, nineteen have 11 and one has 12.

[2] Of seventy-nine specimens seven have 5 lower teeth, forty-two have 6 and thirty have 7.

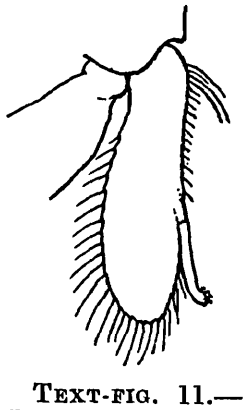
base of the spine. The fused portion of the outer flagellum is composed, apparently without exception, of 5 segments, but there is an unusually high degree of variation in the length of the free part of the shorter ramus and in the number of segments which it contains. The number of segments varies from 8 to 25 in the material I have examined and the free part is from 3 to nearly 5 times as long as the fused part. In males the segments tend to be more numerous and the free part proportionately longer than in females.

In full-grown males the antennal scale is about 5 times, in females less than $3\frac{1}{2}$ times as long as wide. The outer margin of the scale is straight or slightly concave and ends in a spine which does not quite reach the apex of the lamella.

The first legs in the female reach nearly to the end of the scale; in the male they are proportionately shorter. The carpus is a little shorter than the merus and nearly as long as the chela, the lengths of merus, carpus and chela being as 37, 34 and $35\frac{1}{2}$. The fingers are nearly $1\frac{1}{2}$ times as long as the palm.

The second legs are also proportionately rather longer in the female than in the male—a most unusual feature in Palaemonidae; in the female they reach beyond the scale by the fingers and part of the palm. There is, however, little difference between the sexes in the proportionate lengths of the segments, those of the merus, carpus and chela being about as 42, 44·5 and 63. The palm is swollen, about 2·5 times as long as wide and the fingers are curved and from 1·2 to 1·45 times as long as the palm—proportionately longest in large males. In the male there is a minute tooth at the base of the dactylus.

The three posterior legs are all slender. In each pair the merus is from 11·5 to 12·5 times as long as wide and the propodus bears a series of spinules on its posterior margin. In the third pair the propodus is from 2·8 to 3 times as long as the dactylus, in the fifth from 3·2 to 3·5 times. The dactylus bears a tuft of hairs on its anterior margin and is from 6 to 7 times as long as wide.



TEXT-FIG. 11.—*Leander tenuicornis* (Say). Endopod of first pleopod of male.

The endopod of the first pleopod[1] of the male (fig. 11) is provided with a well developed appendix interna.

The foremost of the two pairs of dorsal spines on the telson is placed in advance of the middle; the second pair is midway between the first pair and the apex, or rather nearer to the former. The apex is normal, with a median point, two pairs of spines, two pairs of feathered setae and two other minute setae on each side near the middle.

The largest specimen examined is a female 47 mm. in length. At Port Blair the species does not seem to attain its full size, the largest of numerous examples, an ovigerous female, being only 26 mm. in length.

[1] Heller's figure of the second pleopod of the male (*Crust. südlich. Europ.*, pl. ix, fig. 12, 1863) is erroneous in showing the endopod longer than the exopod.

In life the species is closely mottled with umber, sienna or rich red brown, the mottling tending towards an arrangement in longitudinal streaks. Sometimes there is an ill-defined pale mid-dorsal stripe. The second legs are often rather conspicuously banded with brown and pure white; the palm is dark brown, sometimes with a sprinkling of red chromatophores. The other appendages are banded with brown, with occasional touches of white. The eggs also are brown.

I have compared specimens from India with others from the Sargasso Sea and find, as de Man did in 1881, that there is no appreciable difference between them.

The discovery of an appendix masculina on the endopod of the first pleopod of the male in this species is unexpected, for so far as we know it does not occur in any other member of the genus. It is found, however, in the Pontoniine *Urocaridella gracilis* and is also described below in a species of *Palaemonetes*. This curiously sporadic occurrence of what must presumably be regarded as a primitive character seems to be inexplicable.

The specimens examined are from the following localities :—

C867/1.	Tor, Sinaitic Penin., Red Sea.	R. B. Seymour Sewell, 1916.	One.
C868/1.	Ain Musa, G. of Suez.	do.	Four.
C869-71/1.	Kilakarai, Apa I and Pamban, G. of Manaar.	S. Kemp, Feb., 1913.	Twenty-five.
C872/1.	Ross channel and North Bay, Port Blair, Andman Is.	S. Kemp, Feb., Mch., 1915, Mch., 1921.	Fifty seven.
C873/1.	Octavia Pt., Nancowry Harbour, Nicobar Is.	'Investigator' Nov., Dec., 1922.	Five.
C874/1.	Camorta I., Nicobars.	'Investigator,' Nov., 1922.	One.

On the Indian coast the species occurs in shallow water and, in the Gulf of Manaar, is common among weed. Several specimens are parasitized by a Bopyrid.

The species has an extremely wide distribution. It is the common prawn of the Sargasso Sea and is abundant in the Atlantic extending as far south as the Falkland Is. It has been recorded from the Mediterranean (Heller), is commonly found in the Red Sea and has been obtained at numerous localities in the Indo-pacific ranging as far east as Australia, New Zealand (Brit. Mus.) and Japan.

Leander semmelinki de Man.

1881. *Leander semmelinkii*, de Man, *Notes Leyden Mus.* III, p. 137.
1890. *Leander semmelinkii*, Ortmann, *Zool. Jahrb., Syst.*, V, p. 517.
1893. *Leander modestus*, Henderson (*nec* Heller), *Trans. Linn. Soc. London* (2) *Zool.* V, p. 441.
1903. *Leander semmelinkii*, Nobili, *Boll. Mus. Torino* XVIII, no. 455, p. 8.
1918. *Leander semmelinkii*, Kemp, *Mem. Asiat. Soc. Bengal* VI, p. 268.

I have little to add to the notes I have already published on this species. In the specimens here recorded there are from 8 to 11 teeth (usually 8 or 9)[1] on the upper border of the rostrum, one or two of which

[1] Of forty-eight specimens twelve have 8 upper teeth, twenty-seven have 9, seven have 10 and two have 11.

are placed on the carapace behind the orbit. The upper border is always entire for a considerable distance behind the tip and the sub-apical tooth, found in so many species of the genus, is invariably absent. On the lower border there are from 2 to 4 teeth.[1]

The free part of the shorter ramus of the outer antennular flagellum is composed of 12 to 15 segments and is from 1·3 to 1·6 times as long as the fused part, the latter comprising 8 to 12 segments. There is no appendix interna on the first pleopod of the male.

So far as is known the species is distinguished from all species of the genus except *L. squilla* and *L. cubensis* by possessing a mandibular palp composed of only two segments.

Specimens from the following localities have been examined :—

3416/5.	Bombay.	W. T. Blanford.	Eleven, young.
C875/1.	E. of Cacara Pt., Mormugao Bay, Portuguese India.	S. Kemp, Aug., Sept., 1916.	One, young.
C876/1.	Jack and Una Is., Mergui Archipelago.	'Investigator,' Nov., Dec., 1913.	Thirty-five.
C877/1.	Nancowry I., Nicobars.	'Investigator,' Oct., 1923.	Fourteen.

The species was described from Makassar in Celebes (de Man) and has been recorded from the Philippines (Ortmann), from Singapore (Nobili), from Penang (Kemp) and from the Burma coast, Madras and Bombay (Kemp). I have examined the specimens which Henderson recorded from Madras as *L. modestus* and find that they belong to this species.

Leander serrifer Stimpson.

1860. *Leander serrifer*, Stimpson, *Proc. Acad. Sci. Philadelphia* XII, p. 41.
1881. *Leander serrifer*, de Man, *Notes Leyden Mus.* III, p. 139.
1890. *Leander serrifer*, Ortmann, *Zool. Jahrb., Syst.* V, p. 525, pl. xxxvii, fig. 17.
1902. *Palaemon serrifer*, Rathbun, *Proc. U. S. Nat Mus.* XXVI, p 52.
1902. *Leander serrifer*, Doflein, *Abh. math.-phys. Kl. K. Bayer. Akad. Wiss.* XXI, p. 640.
1914. *Leander serrifer*, Balss, *ibid.*, Suppl.-Bd. II, Abh. 10, p. 57.
1914. *Leander serrifer*, Stebbing, *Ann. S. African Mus.* XV, p. 31.

The numerous Indian specimens which I refer to this species show the following characters :—

The rostrum reaches about to the end of the antennal scale and is straight at the base and rather conspicuously upturned in its distal half. On the upper border it bears from 10 to 13 teeth (usually 11 or 12),[2] including that at the apex. The posterior 2 or 3 teeth are situated on the carapace behind the orbital notch and the hindmost is usually more distant from the second than the second from the third. The teeth are most crowded above the eye. There is nearly always one small tooth close to the tip, giving it a bifid appearance, and this is frequently separated from the next by a considerable unarmed interval. In lateral

[1] Of forty-eight specimens two have 2 lower teeth, forty-three have 3 and three have 4.

[2] Of 100 specimens ten have 10 upper teeth, forty-four have 11, thirty-nine have 12 and seven have 13.

view the rostrum is expanded and it bears on its lower border from 3 to 5 (usually 4 or 5)[1] large teeth.

The branchiostegal spine is strong and is situated on the margin of the carapace.

The spine at the outer distal angle of the basal segment of the antennular peduncle projects beyond the middle of the second segment and reaches beyond the convex margin which intervenes between the base of the spine and the articulation of the second segment. The free part of the shorter ramus of the outer antennular flagellum is composed of 13 to 20 segments and is 2·8 to 3·5 times as long as the fused part, the latter comprising 6 to 8 segments. The total length of the shorter ramus is about equal to that of the peduncle.

The antennal scale is from 2·8 to 3 times as long as wide, with the outer margin terminating in a strong spine which does not reach to the broadly rounded end of the lamella. The mandibular palp is 3-segmented.

The first legs reach to or a little beyond the end of the scale. The carpus is very little longer than the merus and is from 1·5 to 1·6 times as long as the chela.

The second legs in well-grown specimens reach beyond the scale by the chela and a small part of the carpus. The carpus is equal to or a shade longer than the merus and is from 0·74 to 0·89 as long as the chela; the palm is from 1·4 to 1·7 times as long as the fingers.

The remaining legs are moderately slender; in an ovigerous female the propodus of the fifth is 3·4 times as long as the dactylus.

There is no appendix interna on the first pleopod of the male and the telson is normal with the anterior dorsal spines placed a little behind the middle.

The largest specimen examined is about 38 mm. in length. The series contains numbers of ovigerous females, but most of them are small and it seems that the species does not attain its greatest size in Indian waters. Specimens up to 50 mm. in length have been found on the Chinese coasts and Stebbing has recorded an individual 60 mm. in length from S. Africa.

Leander serrifer is very closely allied to the European *L. longirostris* Milne-Edwards. I have compared the two and, except that the latter is slightly more slender, the only differences that I can find are the following:—

L. serrifer.	*L. longirostris.*
Rostrum deeper in lateral view and more conspicuously upturned distally.	Rostrum shallower in lateral view and less clearly upturned distally.
Total length of shorter ramus of outer antennular flagellum about equal to that of peduncle.	Total length of shorter ramus of outer antennular flagellum only two-thirds as long as peduncle.
First leg with carpus very little longer than merus and only about 1·5 to 1·6 times as long as chela.	First leg with carpus at least one fifth longer than merus and almost or quite twice as long as chela.

[1] Of 100 specimens two have 3 lower teeth, sixty have 4 and thirty-eight have 5.

The specimens examined are from the following localities :—

C878/1.	Bandra, nr. Bombay.	J. W. Caunter, Feb., 1911.	Thirty-seven.
C879/1.	Byick Hwaaw Bay, Burma.	'Investigator.'	Forty-one.
C880/1.	Jack and Una Is., Mergui Archipelago.	'Investigator,' Nov., Dec., 1913.	Thirty-two.
C881/1.	Paway I., Mergui Archipelago.	'Investigator,' Feb., 1914.	Six.
1590-6/7.	Diamond I., off C. Negrais, Burma.	'Investigator,' Nov., 1889.	Seven.

The species has not hitherto been noted from the western part of the Indo-pacific region, except S. Africa, and I have unfortunately, not been able to compare my specimens with any from China or Japan. *L. serrifer* was described by Stimpson from Hong Kong and the Liu Kiu Is. and has since been recorded from Japan (Ortmann, Rathbun, Balss), from Vladivostok (Balss), Amoy (de Man) and from Port Elizabeth, S. Africa (Stebbing).

Leander pacificus Stimpson.

1860. *Leander pacificus*, Stimpson, *Proc. Acad. Sci. Philadelphia* XII, *p.* 40.
1881. *Leander pacificus*, de Man, *Notes Leyden Mus.* III, p. 137.
1887. *Leander pacificus*, de Man, *Arch. Naturgesch.* LIII, i, p. 559.
1899. *Leander pacificus*, Borradaile, in Willey's *Zool. Results* IV, p. 410.
1902. *Leander pacificus*, de Man, *Abh. Senck. Ges.* XXV, p. 816.
1906. *Palaemon pacificus*, Rathbun, *Bull. U. S. Fish Comm. for* 1903, iii, p. 924.
1906. *Leander pacificus*, Nobili, *Ann. Sci. nat., Zool.* (9) IV, p. 73.
1914. *Leander pacificus*, Balss, *Abh. math.-phys. Kl. K. Bayer. Akad. Wiss.* Suppl. Bd. II, Abh. 10, p. 57.
1915. *Leander pacificus*, Balss, *Denkschr. math.-naturw. Kl. K. Akad Wiss. Wien* XCI, p. 31.
1917. *Leander pacificus*, Stebbing, *Ann. S. African Mus.* XVII, p. 34, pl. xciii, B.

In the specimens referred to this species the rostrum is straight, slightly upturned at the tip and reaches to or a little beyond the end of the antennal scale. On the upper border there are from 8 to 11 teeth (usually 8 or 9),[1] 2 or 3 of which are situated on the carapace behind the orbit. The foremost dorsal tooth is placed close to the tip and is frequently but not always separated from the next by a rather long unarmed interval. In lateral view the rostrum is greatly expanded and bears from 3 to 5 (nearly always 4)[2] large teeth.

The branchiostegal spine is nearly as strong as the antennal and is situated on the margin of the carapace.

The outer margin of the basal segment of the antennular peduncle ends in a strong spine which extends beyond the convex margin intervening between the base of the spine and the articulation of the first and second segments. In specimens from the Red Sea and Karachi the free part of the shorter ramus of the outer flagellum consists of 21 to 26 segments and is from 3·4 to 4·0 times as long as the fused part, the latter comprising 7 or 8 segments. In a few specimens from Cape Comorin the free part has only 14 to 17 segments and is only 2·3 to 2·7

[1] Of fifty-two specimens eighteen have 8 upper teeth, twenty-six have 9, seven have 10 and one has 11.

[2] Of fifty-two specimens eight have 3 lower teeth, forty-three have 4 and one has 5.

times as long as the 6 or 7 segments which are fused. The outer margin of the free part is always conspicuously serrate and the total length of the shorter ramus is equal to or slightly greater than that of the peduncle. The spine at the end of the antennal scale does not reach as far forwards as the broadly rounded apex of the lamellar portion. The mandibular palp is 3-segmented.

The first legs reach slightly beyond the end of the antennal scale. The carpus is about 7 times as long as its distal breadth and is shorter than the merus and from 1·4 to 1·65 times as long as the chela ; the palm is about equal in length with the fingers.

The second legs reach beyond the scale by part or all the length of the chela. The merus is from 5 to 6·5 times as long as wide and is about one-fifth longer than the carpus in large specimens, less in smaller individuals. The carpus is from 3·8 to 4·4 times as long as its distal breadth and is from 0·55 to 0·63 times as long as the chela. The palm is about one-fifth longer than the fingers, rarely subequal in length with them.

The last three legs are comparatively short and stout ; the third reach about to the end of the scale, while the fifth fall slightly short of it. The merus in all three pairs is $6\frac{1}{2}$ to 7 times as long as wide. The propodus bears some fine spinules on its posterior margin and is not dilated distally as in *L. belindae ;* in the third pair it is from 2·3 to 2·5 times as long as the dactylus, in the fifth pair from 2·7 to 3·3 times.

There is no appendix interna on the first pleopod of the male and the telson is normal, with the anterior dorsal spines placed a little behind the middle.

The largest specimen examined is an ovigerous female about 49 mm. in length.

The species exhibits a considerable range of variation, but I think it is certain that specimens from the Red Sea and Hongkong are conspecific. I have compared them in the British Museum and the only differences I can find are quite trivial. I have seen no specimens with the trifid apex to the rostrum described by Miss Rathbun.

Specimens in the collection are from the following localities :—

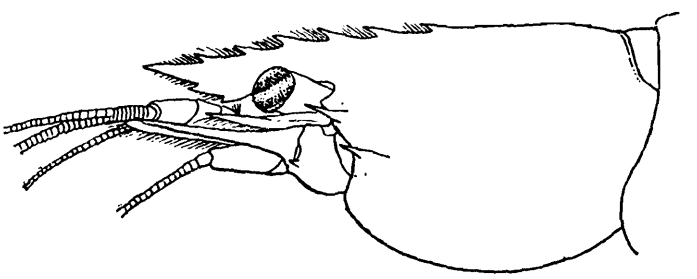
C882/1.	Ain Musa, G. of Suez.	R. B. Seymour Sewell, 1916.	Two.
C883/1.	Tor, Sinaitic Peninsula, Red Sea.	R. B. Seymour Sewell, 1916.	Forty-nine.
1644. 3031-3/7.	Karachi.	Karachi Mus.	Fourteen.
C884/1.	Mormugao Bay, Portuguese India.	S. Kemp, Sept., 1916.	Many young.
C385/1.	Cape Comorin, S. India.	S. N. Pillay, Nov., 1911.	Three.

The species has been recorded from the Red Sea (Nobili, Balss); Mossel Bay, S. Africa (Stebbing) ; Cape of Good Hope (Nobili) ; Ternate and Amboina (de Man) ; Hong Kong (Stimpson) ; Simoda (Stimpson) ; Japan (Rathbun, Doflein, Balss) ; New Caledonia (Borradaile) ; Hawaiian Is. (Stimpson, Rathbun).

Leander belindae, sp. nov.

The rostrum usually reaches almost to the end of the antennal scale, but occasionally is shorter, extending only a little beyond the end of the

antennular peduncle (fig. 12). It is straight with the distal portion sometimes very slightly upturned. The upper border does not exhibit the elevated basal crest seen in *L. styliferus* and its allies and bears from 6 to 8 (usually 7 or 8) strong teeth.[1] These teeth are regularly arranged along the upper margin and 2 or 3 of the hindmost (almost invariably 3) are situated on the carapace behind the orbit. The posterior tooth is sometimes rather more distant from the second than the second is from the third. The eighth tooth, when present, is usually placed very close to the apex, giving it a bifid appearance. In lateral view the rostrum is



TEXT-FIG. 12.—*Leander belindae*, sp. nov.
Carapace and anterior appendages in lateral view.

much expanded and it bears on its lower border 2, or much less commonly 3 teeth.[2] On both upper and lower borders there are setae in the interspaces between the teeth.

The branchiostegal spine is nearly as large as the antennal and is situated on the margin of the carapace, the margin itself being slightly concave in the vicinity of the spine.

The ocular spot is distinct and touches the cornea. As in *L. tenuicornis* there are two concentric rings of dark pigment on the cornea, but the lower one is usually faint.

The antennular peduncle (fig. 13*a*) reaches to the end of the scale. The spine at the distal end of the outer margin of the basal segment extends to the middle of the second segment, projecting beyond the convex margin of the lamella which intervenes between it and the articulation of the first two segments. The outer flagellum, as usual, is split distally into two rami, the fused basal portion comprising 7 or 8 segments. The free part of the shorter ramus is a little stouter in the male than in the female; it consists of 17 to 23 transverse segments and is from 2·3 to 2·7 times as long as the fused portion. The outer margin of the free portion is serrate as in *L. pacificus* and the total length of the shorter ramus is slightly less than that of the peduncle.

The antennal scale (fig. 13*b*) is broad, in the male about 2·8 times and in the female 2·4 times as long as wide. The outer margin is straight and ends in a spine which does not reach as far forwards as the rather broadly rounded distal end of the lamella.

The mouth parts are normal. The mandibular palp is composed of three segments and there is a small pleurobranch and a large arthrobranch at the base of the third maxilliped.

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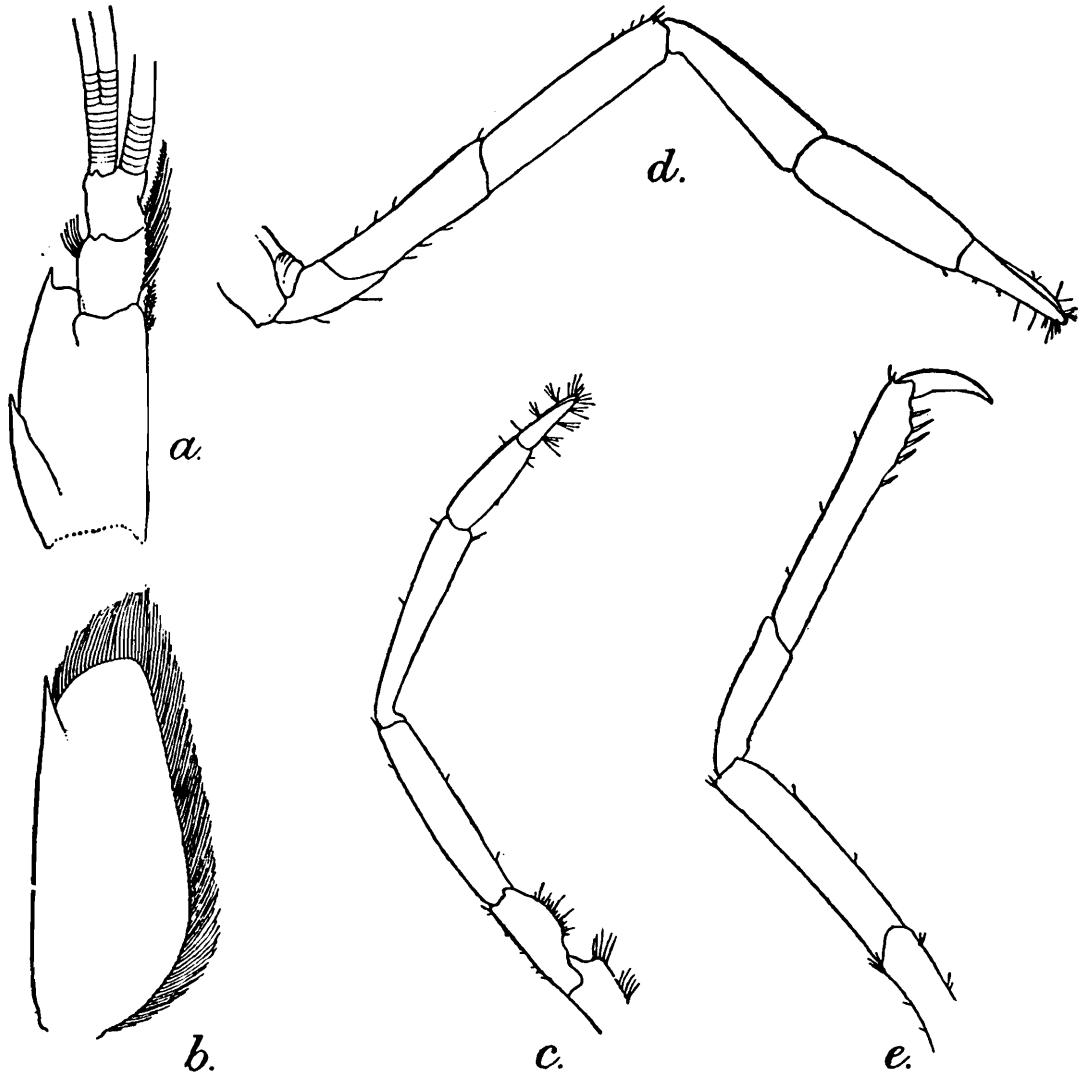
[1] Of forty-seven specimens seven have 6 upper teeth, twenty-six have 7 and fourteen have 8.

[2] Of forty-seven specimens forty-two have 2 lower teeth and five have 3.

The first legs (fig. 13*c*) reach beyond the antennal scale by the fingers. The carpus is fully $6\frac{1}{2}$ times as long as wide and is slightly longer than the merus and one-third longer than the chela. The proportionate lengths of merus, carpus and chela are about as 39 : 42 : 31. The fingers are shorter than the palm.

The second legs (fig. 13*d*) reach beyond the scale by about half the length of the chela. The carpus is shorter than the merus and is from 0·6 to 0·62 times as long as the chela. The proportionate lengths of merus, carpus and chela are about as 44 : 35 : 57 The carpus is from $3\frac{1}{2}$ to 4 times as long as wide. The palm is slightly shorter than the carpus ; in the female it is usually about 2·5 times as long as wide and 1·4 times as long as the fingers, in the male about 2·7 times as long as wide and 1·25 times as long as the fingers. The fingers have inturned tips, but are unarmed on their inner edges except at the extreme base where there is a blunt tooth on the dactylus which can only be seen when the chela is widely open.



TEXT-FIG. 13.—*Leander belindae*, sp. nov.
a. Antennule. *c*. First leg.
b Antennal scale. *d*. Second leg.
e. Third leg.

The last three legs are stout and are similar both in length and in their proportions. The third (fig. 13*e*) reach to the end of the antennal scale, the fifth to the end of the antennular peduncle. The merus is

from 5 to 5·5 times as long as wide and bears no spines. The propodus is characteristic in structure; it is slightly dilated in its distal third and is armed on the dilated portion with from 3 to 6 large movable spines. In this character the species appears to differ from all other known members of the genus. The propodus, which may also bear one or two smaller spinules on the anterior half of its hinder border is from 2·4 to 2·5 times the length of the dactylus, the latter segment being stout, rather strongly curved and from 4·2 to 4·5 times as long as its basal breadth.

The abdomen and its appendages are normal: the sixth somite, measured dorsally, is about 1½ times the length of the fifth and in the male the endopod of the first pleopod is not provided with an appendix interna.

Of the two pairs of dorsal spines on the telson the anterior pair is situated behind the middle, with the second pair midway between the first pair and the apex or nearer to the former. The apex is normal, pointed in the middle, with two spines and one feathered seta on each side.

The largest specimen examined is about 39 mm. in length.

In life the species was translucent, thinly speckled with yellow and dark green chromatophores and with a certain amount of scattered white pigmentation in the middle of the carapace. On the dorsal side of the abdomen at the hinder end of the second and third somites there was a lenticular patch of pale dull pink and the distal two thirds of the tail-fan were heavily spotted with dark green or yellow brown. All the legs were banded with blue and each also bore a light red patch at the distal end of the merus, carpus and propodus or palm. The eggs were dark grey or olive. Young specimens were always paler than adults.

This species is closely related to *L. pacificus* but is readily distinguished from it by the structure of the propodus of the last three legs. Moreover, on the lower border of the rostrum it usually has only 2 teeth, a number never found in the related species.

The specimens examined are from the following localities:–

C886-7/1.	Kilakarai, Gulf of Manaar	S. Kemp, Feb., 1913.	Seventy-five, including TYPES.
C888/1.	Cape Comorin, S. India	S. N. Pillay, Jan., 1911.	One.

The specimens from Kilakarai were obtained in rock-pools at low water.

Genus **Brachycarpus** Spence Bate.

1888. *Brachycarpus*, Spence Bate, *Rep.* '*Challenger*' *Macrura*, p. 795.
1907. *Calmania*, Nobili (*nec* Laurie), *Ann. Mus. Univ. Napoli* (n. s.) II, no. 21, pp. 3, 4.
1911. *Brachycarpus*, Sollaud, *Bull. Mus. Paris*, p. 288.

Spence Bate referred two species to this genus, *B. savignyi* and *B. audouini*, each represented in the 'Challenger' collection by a single specimen. I have examined the types in the British Museum.

B. savignyi possesses a pleurobranch at the base of the third maxilliped and the apex of the telson is provided with two spines on either side with a number of plumose setae between them. It belongs to the

Palaemoninae and, in the possession of a mandibular palp of three segments, in the absence of the branchiostegal spine and in the presence of the hepatic spine, presents close affinities with *Palaemon*. Structurally it is distinguished from this genus only by the dactyli of the last three legs which, in place of being simple, are conspicuously biunguiculate. It differs, however, also in habitat, for whereas the species of *Palaemon*, with a few doubtful exceptions, are found only in fresh or brackish water, *B. savignyi* is exclusively marine and has been found at depths ranging up to 78 fathoms. On these grounds the genus may conveniently be retained.

Some authorities have relegated *Brachycarpus* to the synonymy of *Palaemon*, but this in my opinion is erroneous. Ortmann [1] regards it as a subgenus of *Palaemon* and to this little exception could have been taken if he had not included in it a number of species of true *Palaemon*.

B. audouini, the second species which Bate referred to *Brachycarpus*, proves on examination to belong to the Pontoniinae and to the genus *Periclimenes* (see p. 326). Sollaud has already pointed out that by reason of the simple dactyli of the last three legs it could not be included in the genus *Brachycarpus*.

As will be seen below *B. savignyi* is in my opinion synonymous with *Palaemon biunguiculatus* of Lucas and, so far as our present knowledge goes, there is reason to believe that the genus *Brachycarpus* is monotypic.

Brachycarpus biunguiculatus (Lucas).

1849. *Palaemon biunguiculatus*, Lucas, *Explor. Scient. Algérie, Anim. art., Crust.*, p. 45, pl. iv, fig. 4.
1888. *Brachycarpus savignyi*, Spence Bate, *Rep. 'Challenger' Macrura*, p. 795, pl. cxxix, fig. 4.
1890. *Brachycarpus neapolitanus*, Caro, *Boll. Soc. Nat. Napoli* (i) IV, p. 37, pl. iv, fig. 1.
1898. *Palaemon savignyi*, Rankin, *Ann. N. Y. Acad. Sci.* XI, p. 224.
1900. *Palaemon savignyi*, Verrill, *Trans. Connect. Acad. Sci.* X, p. 579.
1901. *Bithynis savignyi*, Rathbun, *Bull. U. S. Fish Comm.* for 1900, ii, p. 124.
1905. *Brachycarpus biunguiculatus*, Nobili, *Boll. Mus. Torino* XX, no. 502, p. 2.
1906. *Brachycarpus Savignyi* and *biunguiculatus*, Nobili, *Ann. Sci. nat., Zool.* (9) IV, p. 77.
?1906. *Brachycarpus advena*, Nobili, *ibid.*, p. 75, pl. iv, fig. 1.
1907. *Calmania biunguiculata*, Nobili [2], *Ann. Mus. Univ. Napoli* (n.s.) II, no. 21, p. 3, pl. ii.
1920. *Macrobrachium savignyi*, Rathbun, *Repp. Vissch. Industr. Zeeproduct. Curaçao, uitg. J. Boeke*, ii, p. 324 (Gravenhage).
1922. *Palaemon savignyi*, Verrill, *Trans. Connect. Acad. Sci.* XXVI, p. 145, fig. 11.

Hitherto it has been generally considered that the West Indian species which Bate called *savignyi* is distinct from the Mediterranean form to

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[1] Ortmann, *Zool. Jahrb., Syst.* V. p. 727 (1891).

[2] This paper by Nobili, as I have already pointed out (*Rec. Ind. Mus.* XXIV, p. 223, 1922) was written during the author's last illness and is the unfortunate product of a disordered mind. A great number of the statements made are completely erroneous, the branchial formulae are fictitious and the figures are for the most part drawn from imagination rather than fact. It is impossible that Nobili could have examined a 'Challenger' co-type of *B. audouini* sent to him from Brussels, for Bate described the species from a single individual which is still preserved in the British Museum. "*Brachycarpus dentatus* Bate" is a species which has no existence in fact and there is no justification whatever for the erection of a new genus under the preoccupied name of *Calmania*.

which the names *biunguiculatus* and *neapolitanus* have been applied. I have, however, come to the conclusion that the two are identical. At the British Museum I have examined the type of Bate's *savignyi* from Bermuda, four specimens from Messina which clearly belong to the species described by Lucas and two young individuals from the West Indies. I have also examined three specimens from the Gulf of Naples which are preserved in the Indian Museum.

It appears that no one has hitherto had the opportunity of comparing specimens of *Brachycarpus* from the Mediterranean and West Indies, but Nobili, when describing *B. advena* in 1906, gave a key to the four species that he recognized. *B. audouini*, which he retains in the genus, may be left out of account, for, as I have already remarked, it proves on examination to belong to the genus *Periclimenes*. The characters by which the other three species are separated do not seem very important and they break down altogether when specimens are examined.

In one of the young specimens from the West Indies the rostral formula is 8/3; in all the others it is 7/3. There is little difference in the arrangement of the teeth; in the specimen with eight on the upper border the foremost is placed close to the tip, almost giving it a bifid appearance and in the type of *B. savignyi* it is situated rather nearer the apex than usual. In the type of *B. savignyi* the chela of the left leg of the first pair is decidedly shorter than the carpus, but in the right leg it is very nearly or quite as long as the carpus, precisely as in the specimens from Naples and Messina. In Bate's type specimen the fingers of the second chela gape as shown in his figure, but this character also occurs in some Mediterranean specimens; it is just as evident in one of the Messina individuals and in one of those from Naples and is also clearly shown in Cano's figure of *D. neapolitanus*. In all the specimens I have seen there are two well-developed teeth on the fixed finger of the second leg and two to four smaller teeth on the dactylus. These teeth arise from a keel which runs the whole length of the fingers and on either side of the keel and parallel with it there is a thick fringe of setae. At the base of the fixed finger, on the upper and inner aspects, there is a conspicuous and strongly curved ridge surrounding the arthrodial membrane. In this rather remarkable character, which I do not remember to have seen in any other Palaemonid, there is precise agreement between the type of *B. savignyi* and the Mediterranean species. In the Messina and Naples specimens the external maxilliped reaches beyond the antennal peduncle by the whole of the ultimate segment and by one-third to one-half the length of the penultimate; the small difference which Nobili noticed in this respect between *B. biunguiculatus* and *B. advena* is quite insignificant and is probably due to different degrees of contraction in preserved material.

On the closest comparison it does not seem possible to find any valid characters by which the two sets of specimens may be separated and they should consequently be known by the same name, notwithstanding the unusual and apparently discontinuous distribution.

The two young specimens from the West Indies (presented to the British Museum without more precise locality by the West Indian and Panama Telegraph Co.) are only 23 and 32 mm. in total length, whereas

full-grown individuals may be as much as 65 mm. These specimens agree well with the adults, but the second legs, as might have been anticipated, are more slender. The carpus, in particular, shows considerable differences, being about three times as long as its distal breadth and almost one-third the total length of the chela.

Nobili's *Brachycarpus advena* is based on a specimen of uncertain origin which is thought to have been found in the Red Sea. Except for the fact that the specimen has four ventral teeth on the rostrum in place of three, the characters given in Nobili's key do not suffice to distinguish the species from *B. biunguiculatus* and his description does not reveal any other features of particular importance. In *B. advena* the fused basal portion of the outer antennular flagellum is stated to consist of 12 segments, whereas in the material I have examined the number varies from 15 to 23. The small tooth which Nobili mentions at the distal end of the merus of the second leg on the infero-external aspect is also present in *B. biunguiculatus* but varies considerably in development.

Although Nobili's specimen was small, only 33 mm. in length, it seems from his figure to have the second legs fully developed, whereas, as noted above, these legs have not assumed their adult form in a West Indian specimen only 1 mm. shorter. In my opinion the evidence which is available suggests that *B. advena* will prove to be synonymous with *B. biunguiculata*, but the point cannot be decided with certainty until the type has been re-examined. Nobili does not mention the mandibular palp or the gill-formula, but his note that the telson does not differ from that of *B. biunguiculata* renders it probable that the specimen really belongs to the genus in which he placed it.

In the Mediterranean *B. biunguiculata* has been found at Bône and Oran (Lucas), in the Gulf of Naples (Cano) and at Catania (Nobili); there are also specimens in the British Museum from Messina (Norman coll.). In the West Indies the species has been recorded under the name *savignyi* from Bermuda (Bate, Verrill), the Bahamas (Rankin), off Habana, Cuba, 78 fms. (Rathbun), between Jamaica and Hayti, 23 fms. (Rathbun), from Curacao (Rathbun) and Porto Rico (Rathbun).

Genus **Palaemonetes** Heller.

1869. *Palaemonetes*, Heller, *Zeitschr. Wiss. Zool.* XIX, p. 157.

This genus differs from *Leander* only in the absence of the mandibular palp. It comprises fifteen species which live for the most part in fresh or brackish water and are distributed in a curiously sporadic manner over the temperate and tropical regions of the earth. Three of the species are blind and inhabit subterranean waters in Texas and Cuba; of the remainder one occurs in Europe, round the Mediterranean and in Mesopotamia, one in N. Africa, one in Nigeria, one in the Argentine Republic, four in the United States of America, one in Alaska, two in China and one in West Australia.

The marked discontinuity in the distribution of the genus is probably more apparent than real, for *Palaemonetes* is an inconspicuous animal which will no doubt be found in many fresh localities. Until now no

member of the genus was known between Mesopotamia and the coasts of China, but this gap is partially bridged by the discovery in South India of the new species which is described below.

The genus, being based on a single negative character, might well be imagined to possess small claim to a monophyletic origin and it is indeed possible that some of the species have been separately evolved from different forms of *Leander*. The species, however, seem to constitute a reasonably compact group and, unless *P. africanus* is an instance, there is no evidence that the *styliferus* section of *Leander* (a section which predominates in brackish water in the Indo-pacific region) has produced by the loss of its palp what would technically be a *Palaemonetes*.

Apart from the lack of functional eyes the three species found in subterranean waters possess certain structural features which possibly indicate a common origin.

Stimpson's *Palaemonopsis* [1] is without doubt synonymous with *Palaemonetes* and so, in my opinion, are Sollaud's two genera *Allocaris* and *Coutierella* [2]. The two latter are based on differences in the mouth-parts which, though interesting, certainly do not possess the importance which Sollaud has attributed to them. *Coutierella*, however, possesses one very extraordinary character—the apex of the telson is stated to be concave and armed with 6 pairs of spines. In this character, which Sollaud does not appear to regard as of generic value, the species differs from all known Palaemoninae and, if the description is a correct account of the structure of the normal telson, there is perhaps some reason for regarding the species as generically or subgenerically distinct from *Palaemonetes*.

Owing to their close similarity in structure and to the great amount of variation which they exhibit, the species of *Palaemonetes* are often very difficult to determine; it is perhaps for this reason that no one has hitherto attempted to give a synopsis of the species. In preparing that given below I have to acknowledge the very great assistance that I have received from Dr. Waldo L. Schmitt of the United States National Museum. Dr. Schmitt has kindly sent me specimens of a number of species which would otherwise have been known to me only from descriptions, together with most valuable notes—which I have freely utilized—on some of the more critical forms. Thanks to his help I have, in all, been able to examine ten species of the genus [3]; but the key is none the less unsatisfactory in many respects and will require much emendation at the hands of other workers.

Key to the species of *Palaemonetes*.

A. Eyes normal, cornea deeply pigmented and wider than stalk; lower border of rostrum almost invariably dentate; fingers of 2nd leg not longer than palm.

B. Outer antennular flagellum with fused part much longer than free part of shorter ramus.

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[1] Stimpson, *Ann. Lyceum Nat. Hist. N. York*, X, p. 128 (1871).

[2] Sollaud, *Bull. Mus. Paris*, 1911, p. 50 and *Bull. Soc. Zool. France* XXXIX, p 318 (1914). See also Pesta, *Ann. K.-K. Hofmus. Wien* XXVII, p. 9 (1913) and Kemp *Mem. Asiat. Soc. Bengal* VI, p. 271 (1918).

[3] I have not seen *P. argentinus*, *P. tonkinensis*, *P. africanus*. *P. eigenmanni* and *P. calcis*.

C. Rostrum comparatively deep, with apex often bifid and generally with 2 to 6 dorsal teeth ; last three legs comparatively stout ; 6th abdominal somite not more than 1·75 times as long as 5th.

D. 2nd pleopod of male with appendix masculina not nearly reaching end of endopod and with endopod only about half as long as exopod ... *varians* (Leach)[1].

DD. 2nd pleopod of male with appendix masculina reaching for beyond end of endopod and with endopod at least as large as exopod ... *punicus* Sollaud [2].

CC. Rostrum comparatively shallow, with apex simple and with 6 to 8 dorsal teeth ; last three legs more slender ; 6th abdominal somite usually more than 1·75 times as long as 5th ... *exilipes* Stimpson[3]. *kadiakensis* Rathbun[4].

BB. Outer antennular flagellum with fused part not longer than free part of shorter ramus.

C. Rostrum with at most 10 upper teeth ; branchiostegal spine placed on margin of carapace.

D. Carpus of 2nd leg decidedly longer than merus or chela.

E. Rostrum without an elevated basal crest, its upper border at most feebly convex.

F. Apex of telson with a median point, 2 pairs of spines and a variable number of setae.

G. Outer antennular flagellum with fused part only a little shorter than free part of shorter ramus ; rostrum with apex bifid and with upper teeth forming a continuous series ... ... *australis* Dakin[5].

GG. Outer antennular flagellum with fused part about half as long as free part of shorter ramus ; rostrum with apex simple and without teeth on upper border for some distance behind apex ... *argentinus* Nobili[6].

GGG. Outer antennular flagellum with fused part less than one-third as long as free part of shorter ramus ; rostrum with apex simple and with upper teeth extending to near apex ... ... *sinensis* Sollaud[7].

FF. " Bord posterieur dut elson concave, muni de 6 paires d'épines articulées" ... *tonkinensis* Sollaud[8].

EE. Rostrum with a conspicuously elevated, strongly convex basal crest. [Rostrum with upper border entire for a considerable distance behind bifid apex] ... ... *africanus* Balss[9].

DD. Carpus of 2nd leg scarcely if at all longer than merus or chela.

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[1] Norman & Scott, *Crust. Devon and Cornwall*, p. 20 (1906) ; Gurney, *Proc. Zool. Soc. London* 1923, p. 114. For varieties *macrogenitor* and *microgenitor* see Boas, *Zool. Jahrb., Syst.* IV p. 793 (1889) ; var. *mesogenitor*, Sollaud, *C. R. Acad. Sci. Paris.* CLV, p. 1268 (1912). Recently (*Bull. Biol. France Belg.* LVII, pp. 547, 569, 1923) Sollaud uses *occidentalis, n. n.*, for *microgenitor* and *lacustris*, von Martens, for *macrogenitor.*

[2] Sollaud, *C. R. Acad. Sci. Paris*, 26 Dec. 1923, p. 127.

[3] Stimpson, *Ann. Lyceum Nat. Hist. N. York* X, p. 130 (1871).

[4] Rathbun, *Harriman Alaska Exped.* X, *Crust.*, p. 30, fig. 9 (1904).

[5] Dakin, *Proc. Zool. Soc. London* 1915, p. 571, figs. 1-14.

[6] Nobili, *Boll. Mus. Torino* XVI, no. 452, p. 3 (1901).

[7] Sollaud, *Bull. Mus. Paris*, 1911, p. 50, figs. 1, 2 (as *Allocaris*) ; Kemp, *Mem. Asiat. Soc. Bengal* VI, p. 272 (1918).

[8] Sollaud, *Bull. Soc. Zool. France* XXXIX, p. 322, fig. iv (1914) (as *Coutierella*).

[9] Balss, in Michaelsen's *Beitr. Kennt. Meeresf. Westafrikas* II, *Crust.* p. 27, fig. 9 (1916).

EE. Outer antennular flagellum with free part of shorter ramus very little longer than fused part; 1 tooth on carapace behind orbit; carpus of 2nd leg longer than palm and half fingers	*carolinus* Stimpson[1] / *hiltoni* Schmitt[2].
EE. Outer antennular flagellum with free part of shorter ramus 1½ times as long as fused part; 2 teeth generally present on carapace behind orbit; carpus of 2nd leg not longer than palm in adult female, in male not longer than palm and one-third of fingers ...	*vulgaris* (Say)[3].
CC. Rostrum with at least 13 teeth on upper border; branchiostegal spine set back from margin of carapace. [Outer antennular flagellum with fused part less than one-third as long as free part of shorter ramus; carpus of 2nd leg longer than merus, shorter than chela in male, longer in female]	*hornelli*, sp. nov., p. 318.
AA. Eyes reduced, cornea not pigmented and narrower than stalk; lower border of rostrum entire; fingers of 2nd leg longer than palm.	
B. Rostrum with upper border dentate.	
C. Rostrum reaching to end of 2nd antennular segment, with 10-13 dorsal teeth	*antrorum* Benedict[4].
CC. Rostrum reaching to end of antennal scale, with 6-8 dorsal teeth	*eigenmanni* Hay[5]
BB. A single median tooth on carapace behind rostrum, no teeth on blade	*calcis* Rathbun[6].

In this key I have not attempted to distinguish between *P. exiliipes* and *P. kadiakensis*. Though widely separated geographically these two species seem to me to be very closely related; they are, moreover, very variable and careful work with longer series than are at my disposal is necessary before their distinguishing features can be properly elucidated. The same remarks apply also to *P. carolinus* and *P. hiltoni*, which can apparently only be separated on characters which will probably prove valueless when the range of variation is better known.

P. cubensis Hay,[7] according to the description and figures, is a true *Palaemonetes* and lacks the mandibular palp; but I find that a two-segmented palp is present in a specimen which Dr. Schmitt has kindly sent me. As this specimen is one of the type series from Palacio it must be assumed that Hay's statements are based on a misapprehension and the species must in consequence be transferred to the genus *Leander*.

P. natalensis Stebbing [8] lacks the branchiostegal spine and has three pairs of spines at the apex of the telson. Stebbing has unfortunately not mentioned the gill-formula, but the species belongs in all probability to the subfamily Pontoniinae and to the genus *Periclimenes*.

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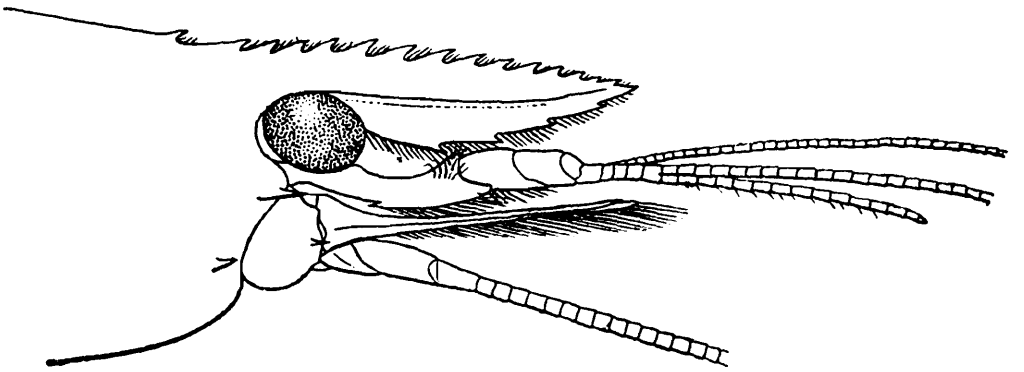
[1] Stimpson, *Ann. Lyceum Nat. Hist. N. York* X, p. 129 (1871).
[2] Schmitt, *Univ. Calif. Publ., Zool.* XXIII, p. 36, pl. xii, fig. 5 (1921).
[3] Say, *Journ. Acad. Sci. Philadelphia* I, p. 248 (1818) (as *Palaemon*).
[4] Benedict, *Proc. U. S. Nat. Mus.* XVIII, p. 615 (1896)
[5] Hay, *Proc. U. S. Nat. Mus.* XXVI, p. 431, fig. 2 (1903).
[6] Rathbun, *Bull. Mus. Comp. Zool. Harvard* LIV, p. 451, figs. 1-5 (1912).
[7] Hay, *Proc. U. S. Nat. Mus.* XXVI, p. 433, fig. 3 (1903).
[8] Stebbing, *Ann. S. Afric. Mus.* XV, p. 78, pl. lxxxiii (1915).

Palaemonetes hornelli, sp. nov.

The rostrum reaches to or a little beyond the end of the antennal scale (fig. 14). It is straight, rarely a trifle upturned at the tip, and in lateral view is deep. The upper border, which is as a rule very feebly convex, bears from 13 to 17 (most commonly 14 or 15) forwardly directed teeth[1] with setae in the interspaces. The first and second teeth are placed on the carapace behind the orbit and the first is twice as far distant from the second as the second is from the third. The remaining teeth of the upper border are regularly arranged, the series extending



TEXT-FIG. 14.—*Palaemonetes hornelli,* sp. nov.
Carapace and anterior appendages in lateral view.

to the apex. The middle teeth are the largest; the foremost is very small and, though near the apex, does not give it a bifid appearance. The lower border of the rostrum is convex, but not deeply excavated at the base. It is rather thickly fringed with setae throughout its length and bears from 3 to 5 teeth[2] (usually 4, 7 in an exceptional specimen) which are rather smaller than those of the upper border. One or more upper teeth are always in advance of the foremost of those on the lower border.

The lower angle of the orbit is broadly rounded and the antennal spine is strong. The branchiostegal spine is almost equally strong and, unlike that of most if not all species of the genus, is set well back on the carapace, the tip reaching the margin. The eye is large with a well-marked ocular spot in contact with the cornea.

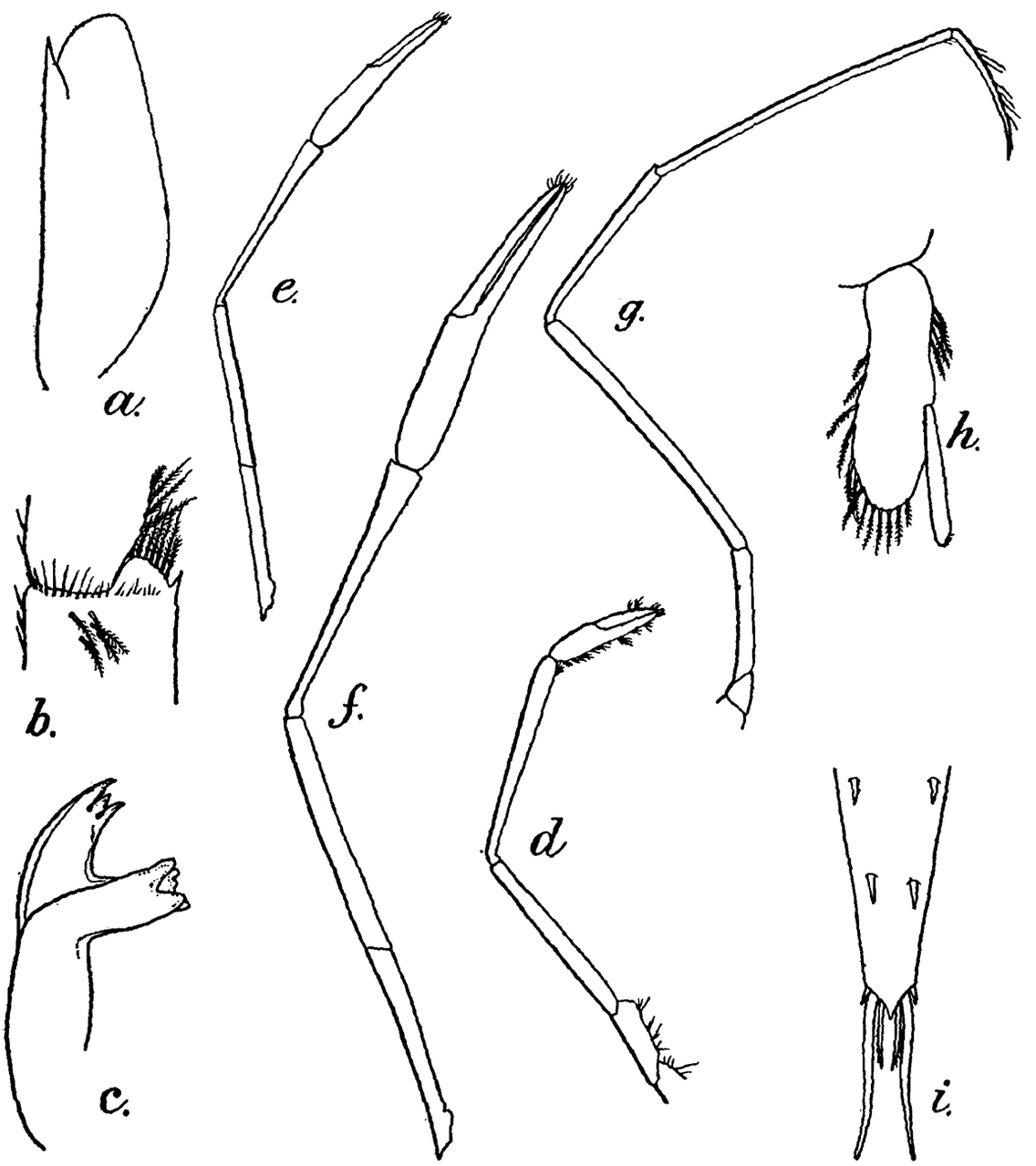
The antennular peduncle is not much shorter than the antennal scale. The lateral process does not reach to the middle of the basal segment and the outer margin of this segment ends in a spine which does not usually reach as far forwards as the strongly convex border which intervenes between the spine and the articulation of the second segment (fig. 15*b*). The second and third segments are short, stout and subequal in length. The two rami composing the outer antennular flagellum are fused basally for a very short distance. There are from 5 to 7 fused segments and the free part of the shorter ramus is nearly four times as long as the fused part. The antennal scale (fig. 15*a*) is from

[1] Of thirty-six specimens seven have 13 dorsal teeth, eleven have 14, eleven have 15, six have 16 and one has 17.

[2] Of thirty-seven specimens seven have 3 ventral teeth, twenty-four have 4, five have 5 and one has 7.

3 to 3·2 times as long as wide; its outer margin is straight or very slightly convex and ends in a spine which does not reach as far forwards as the broadly rounded apex of the lamella.

The mandible (fig. 15*c*) is without a palp and the incisor-process terminates in three sharp teeth. The maxilla and first maxilliped are normal in structure and do not show the modifications noted by Sollaud in *P. tonkinensis* and *P. sinensis*. There is an epipod and a



TEXT-FIG. 15.—*Palaemonetes hornelli*, sp. nov.

a Antennal scale.
b. Terminal part of basal antennular segment.
c. Mandible.
d. First leg.
e. Second leg of male.
f. Second leg of female.
g. Fifth leg.
h. Endopod of first pleopod of male.
i. Terminal part of telson.

podobranch on the second maxilliped and an epipod, a large arthrobranch and a small pleurobranch on the third maxilliped. There are thus, with the five pleurobranchs of the legs, six large gills on each side, the formula being the same as that of *Palaemonetes varians*.

The third maxillipeds reach to the end of the proximal segment of the antennular peduncle. The exopod does not quite reach to the distal end of the antepenultimate segment and the ultimate segment, which bears numerous transverse rows of setae, is rather more than two-thirds the length of the penultimate.

The first legs (fig. 15*d*) are slender and reach beyond the antennal scale by about the length of the chela. The carpus is a little longer than the merus and is nearly twice as long as the chela (as 19 :10). The fingers are considerably longer than the palm.

The second legs are very long, extending beyond the antennal scale by the chela and from one half to three-quarters of the carpus. In females (fig. 15*f*) the carpus is slightly longer than the merus and a little shorter than the chela, the proportionate lengths of merus, carpus and chela being about as 12 : 13 : 15. The carpus is from 1·02 to 1·12 times as long as the merus and the chela is from 1·1 to 1·25 times as long as the carpus. The carpus is widened distally, its breadth at the propodal articulation being about one-eighth of its length. The palm is swollen, wider than the adjacent parts of the carpus and is from 3 to 3·5 times as long as wide. The fingers meet throughout their length when the claw is closed, each being provided at the base with a single very small tooth. The fingers have inturned tips and are usually a little longer than the palm, rarely about the same length. Except for a few very short setae on the fingers the leg is naked.

The only male in the collection is unfortunately damaged and possesses only one leg of the second pair (fig. 15*e*). In general the leg closely resembles that of the female, but the proportionate lengths of the segments are different. The lengths of the merus, carpus and chela are as 12 : $17\frac{3}{4}$: $13\frac{3}{4}$, the carpus thus being almost $1\frac{1}{2}$ times as long as the merus and nearly one-third longer than the chela. The fingers are a trifle longer than the palm.

The last three pairs of legs are very slender and increase in length from before backwards ; the third reach beyond the antennal scale by about one-third of the propodus, the fifth (fig. 15*g*) by about half the propodus. In each pair the propodus is from 2 to 2·3 times the length of the dactylus. The latter segment is slightly curved and extremely slender, from 12 to 14 times as long as its basal breadth. The legs are naked save for a few long setae on the anterior margin of the dactylus and for a few spinules near the distal end of the propodus of the fifth pair.

The abdomen does not differ materially from that of other species of the genus. The sixth segment, measured dorsally, is rather more than one and a half times the length of the fifth. In the first pleopod of the male (fig. 15*h*) the endopod is oval and bears on the inner side an appendix interna which projects far beyond its distal end. In the second pleopod of the male the two appendices are of equal length.

The telson is shorter than the uropods and bears, as usual, two pairs of dorsal spines ; the first pair is situated at, or a little behind the middle of the telson-length and the second is nearer to the first than to the apex. The apex (fig. 15*i*) is pointed in the middle with a single very stout seta and two spines on either side. The outer spines are very short, only

about one-fifth the length of the inner, the latter much exceeding the setae in length and reaching beyond the ends of the uropods. The external border of the outer uropod is ciliated.

Large females reach a total length of nearly 30 mm. and bear eggs which vary in size from 0·45 by 0·36 mm., when first extruded, to 0·56 by 0·42 mm. when fully eyed and ready to hatch. The single male is about 17 mm. in length.

The presence of an appendix interna on the first pleopod of the male is a remarkable character in which *P. hornelli* differs, so far as is known, from all other members of the genus. A similar character is, however, found in one species of *Leander*, *L. tenuicornis* Say, and in the Pontoniinae in *Urocaridella gracilis* Borradaile.

Another remarkable feature is the stout character of the pair of setae at the apex of the telson. In Palaemoninae the apex usually bears 2 pairs of spines and one or more pairs of feathered setae, as compared with 3 pairs of spines in the Pontoniinae. The present species indicates that this character is of less importance than hitherto supposed, for the condition in *P. hornelli* is for all practical purposes the same as in the Pontoniinae. The setae are finely plumose in the present species, but this can also often be detected on the inmost telson spines of the Pontoniinae. That *P. hornelli* really belongs to the Palaemoninae is, of course, at once evident from the branchial formula.

P. hornelli is easily distinguished from all other species of *Palaemonetes* by the great number of teeth on the upper border of the rostrum, by the position of the branchiostegal spine and by the proportionate lengths of the segments of the second leg.

The specimens are from the following localities :—

C889-90/1.	Silavathurai Lagoon, Tuticorin, S. India.	J. Hornell, July, 1917.	40 ♀ ♀ mostly ovigerous.
C891/1.	Cochin backwater, nr. Ernakulam, S. India.	F. H. Gravely, Sept., 1914.	1 ♂, 2 ♀ ♀

All the specimens were probably collected in water of comparatively high specific gravity. Eight individuals from Silavathurai Lagoon are regarded as types of the species and are registered in the collection of the Zoological Survey of India under number C889/1.

With this species I have associated the name of Mr. J. Hornell, until recently Director of the Madras Fisheries Bureau, to whom we are indebted for many interesting specimens from South India.

Subfamily *PONTONIINAE.*

Although little more than a year has elapsed since I published an account of the Indian species of this subfamily, a considerable number of additional specimens have been obtained, collected for the most part in the Nicobars by Major R. B. Seymour Sewell, I.M.S., Surgeon-Naturalist on the R.I.M.S. 'Investigator.'

The following additional records may be noted :—

Palaemonella vestigialis Kemp. Reef off Reed Point, Nancowry I., Nicobars. 'Investigator,' Feb., 1923.

Periclimenes (*Periclimenes*) *indicus* (Kemp). Camorta I., Nicobars. 'Investigator,' Jan., 1923.

Periclimenes (*Ancylocaris*) *spiniferus* de Man. Camorta I. and reef off Reed Point, Nancowry I., Nicobars. 'Investigator,' Jan., Feb., 1923.

Periclimenes (*Ancylocaris*) *elegans* (Paulson). Camorta I. 'Investigator,' Oct., 1922.

Anchistus inermis (Miers). Octavia Bay, Nancowry Harbour, Nicobars. 'Investigator,' Feb., 1923. In *Pinna nigra*.

Coralliocaris graminea (Dana).
Coralliocaris superba (Dana).
Coralliocaris lucina Nobili.
} Camorta I., Nicobars. 'Investigator,' Jan., 1923.

Periclimenes (Periclimenes) impar Kemp.

1922. *Periclimenes* (*Periclimenes*) *impar*, Kemp, *Rec. Ind. Mus.* XXIV, p.147, text-figs. 16, 17, pl. iii, fig. 1.

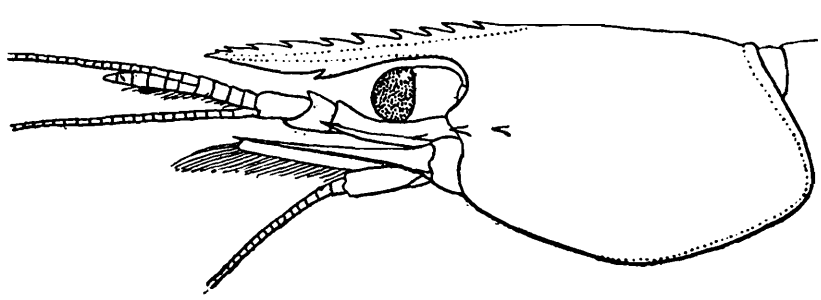
In a second specimen of this species, from Ceylon, the rostrum bears 9 teeth above and only 1 below. The upper border is straighter than in the type and the posterior tooth is more distant from the second than the second is from the third. The lower border is nearly straight and the single tooth is beneath the penultimate of the dorsal series. The antennule almost exactly resembles that of the type, but the spine at the distal end of the antennal scale is a little shorter.

Only one leg of the second pair is present, apparently the larger of the two. The merus is about 5 times as long as wide and the carpus is 2·8 times as long as its distal width. The carpus is two thirds the length of the palm and the palm is 1·25 times as long as the fingers. There are no teeth on the inner edges of the fingers. The last three legs closely resemble those of the type, especially in the characteristic form of the dactylus. In the third pair the merus is $6\frac{1}{2}$ times as long as wide and the propodus is 5·4 times as long as the dactylus.

C894/1. Cheval Paar, Ceylon. T. Southwell. One, 13 mm.

Periclimenes (Periclimenes) signatus, sp. nov.

The rostrum reaches a little beyond the end of the antennal scale and is quite straight (fig. 16). On its upper border, in the single



TEXT-FIG. 16.—*Periclimenes* (*Periclimenes*) *signatus*, sp. nov. Carapace and anterior appendages in lateral view.

specimen examined, it bears 10 more or less evenly spaced teeth; the posterior tooth is not more distant from the second than the second is

from the third and the foremost is small and placed close to the tip. In lateral view the rostrum is slender and on its lower border there is a single large tooth, placed beneath the fifth and sixth of those on the upper border and only a little in front of the middle of the rostral length.

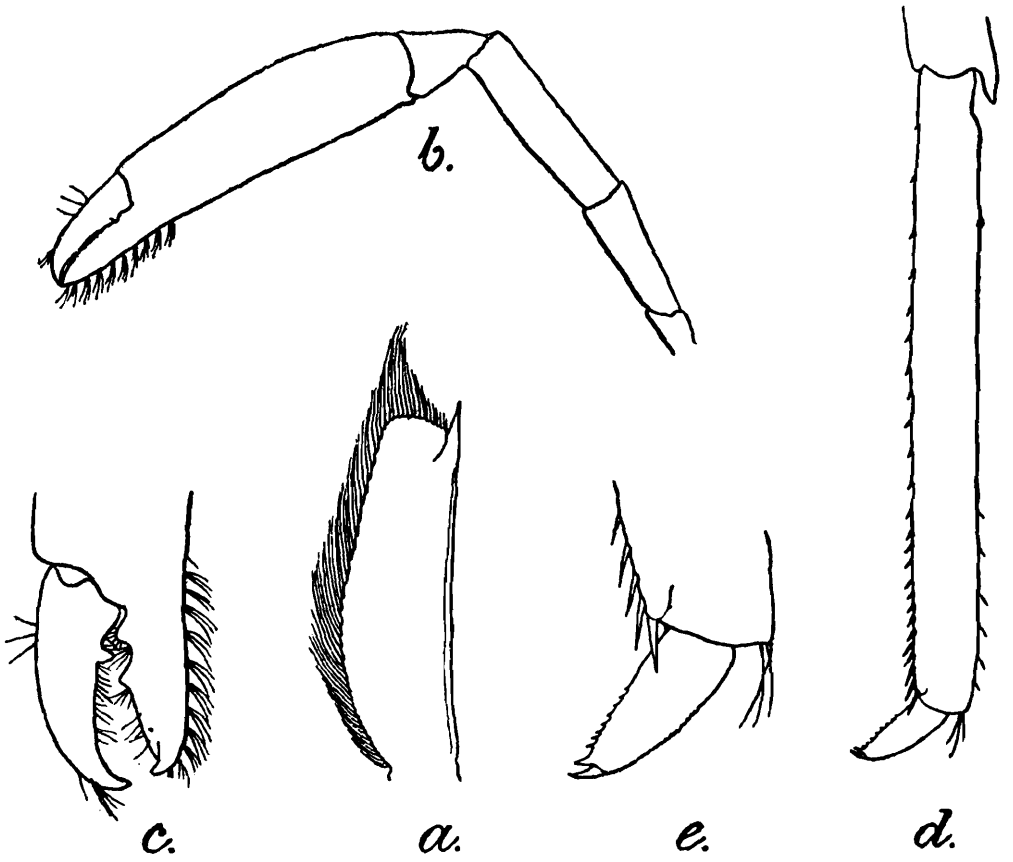
The lower orbital angle is obtusely pointed. The antennal spine is strong with the hepatic placed behind it and on the same level. There is no supra-orbital spine. The eyes are large with a short stalk; the ocular spot is very small and is merged in the cornea.

The lateral process of the antennular peduncle does not reach to the middle of the basal segment. The spine at the outer distal angle is strong, reaching beyond the middle of the second segment. The free part of the shorter ramus of the outer antennular flagellum is about $1\frac{1}{2}$ times as long as the fused part, the latter comprising 4 segments.

The antennal scale (fig. 17*a*) is about $3\frac{1}{2}$ times as long as wide and is very little narrowed at the apex. The outer margin is slightly concave and ends in a spine which extends much beyond the distal end of the lamella.

The third maxillipeds reach nearly to the distal end of the basal antennular segment.

The first legs reach beyond the antennal scale by the greater part of the chela. The carpus is very slightly shorter than the merus and is about 5 times as long as its distal width. The chela is about three-quar-



TEXT-FIG. 17.—*Periclimenes* (*Periclimenes*) *signatus*, sp. nov.

a. Antennal scale.
b. Larger second leg.
c. Fingers of same leg.
d. Last two segments of third leg
e. Dactylus of third leg.

ters the length of the carpus and the fingers are somewhat longer than the palm. The palm is stout, about 1·7 times as long as broad. There

are tufts of hair at the distal end of the carpus, at the proximal end of the palm and on both fingers.

The second legs are unequal, that of the right side (fig. 17*b*), which is the larger, extending beyond the scale by nearly the whole length of the chela. In the larger leg the merus is 4 times as long as wide, without distal spines. The carpus is conical and about as long as broad; its distal margin is entire except for a notch on the inner side. The chela is a little more than twice as long as the merus. The palm is 3 times as long as wide and 3 times as long as the fingers. The fixed finger (fig. 17*c*) bears two teeth in its proximal half and there are two teeth on the dactylus which fit behind those on the fixed finger. The fingers bear thick tufts of long woolly hair and the tips are inturned. The dactylus is not flanged as in *P. latipollex*. In the smaller second leg the carpus is about $1\frac{1}{2}$ times as long as wide and the chela is $1\frac{2}{3}$ times as long as the merus. The palm is rather less than 3 times as long as wide and the fingers, which bear short hairs only, are about two-thirds as long as the palm. The dactylus has one very obscure tooth in its basal third.

The last three legs are long; the fifth reach the end of the antennal scale and the two preceding pairs extend beyond it. The merus in all three pairs is unarmed and about $7\frac{1}{2}$ times as long as wide. In the third pair (fig. 17*d*) the propodus is 6·4 times and in the fifth pair 4·6 times as long as the dactylus. The propodus in each leg bears very numerous small spinules which are close-set proximally. The dactylus (fig. 17*e*) bears the small accessory claw very close to the apex and its posterior border is microscopically serrate throughout its length.

The sixth abdominal somite is short and broad. The telson is shorter than the uropods and is normal in structure except for the very small size of the dorsal spines; the foremost of these is placed in the middle of the telson-length, the second half way between the first and the apex.

The single specimen examined is a male 11 mm. in length.

This species is related to *P. laccadivensis* (Alcock and Anderson) and *P. latipollex* Kemp but differs (i) in the number of rostral teeth and in the form of the rostrum, (ii) in the different form of the antennal scale, in which the spine much exceeds the lamella, (iii) in the stouter palm and in the dentition of the fingers of the larger second leg and (iv) in the position of the accessory spine on the dactylus of the last three legs and in the microscopic spinulation of its posterior edge. It also differs from *P. latipollex* in the absence of a flange on the dactylus of the 2nd leg and from *P. laccadivensis* in having the hepatic and antennal spines on a level with one another.

8788/6. Andamans. G. H. Booley. One male, TYPE.

Periclimenes (Periclimenes) ceratophthalmus Borradaile.

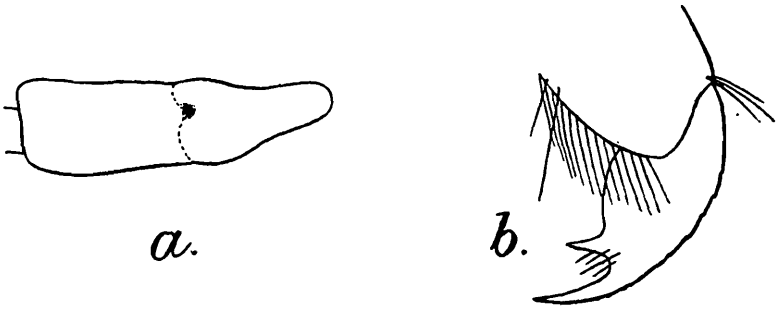
1917. *Periclimenes* (*Corniger*) *ceratophthalmus*, Borradaile, *Trans. Linn. Soc. London* (2) *Zool.* XVII, p. 365, pl. liv, figs. 9*a*,*b*.

In 1922 I included this species in the subgenus *Ancylocaris*. I had not seen specimens and Borradaile does not describe the dactyli of the last three legs, but I assumed from its general resemblance to de Man's

P. amboinensis that it would fall in the same subgenus. Having now examined a specimen I find that the dactyli of the last three legs possess a well-developed accessory claw and the species must in consequence be transferred to the subgenus *Periclimenes*.

The specimen agrees closely with Borradaile's description. The rostrum is slender and bears 5 upper teeth, all situated in the distal two-thirds of its length; the lower border is unarmed. The supra-orbital spine is present and the hepatic is placed unusually close to the antennal but on a slightly lower level. The terminal papilla on the eye (fig. 18*a*), is somewhat larger than in Borradaile's example, its length equalling that of the cornea proper.

The first legs seem considerably longer than Borradaile has indicated; they are very slender and reach beyond the scale by the chela and fully



TEXT-FIG. 18.—*Periclimenes* (*Periclimenes*) *ceratophthalmus* Borradaile.
a. Eye in lateral view. *b*. Dactylus of third leg.

three-quarters of the carpus. The carpus is slightly longer than the merus and about $1\frac{3}{4}$ times as long as the chela.

Only the right leg of the second pair is present, reaching beyond the scale by about the whole of the chela. The merus does not bear a spine at the distal end of its lower border; the carpus is conical and rather more than $1\frac{1}{2}$ times as long as wide. The fingers are about two thirds the length of the palm; they are strongly inturned at the tips but bear only a few very obscure teeth on their cutting edges.

The last three legs are all short and stout. The propodus has no spinules on its posterior edge but bears tufts of long hair distally which tend to conceal the dactylus. The dactylus is short and strongly curved with a large and sharp accessory claw (fig. 18*b*).

The specimen is an ovigerous female about 15 mm. in length. When examined it still retained traces of its original colouration. The carapace and abdominal pleura were closely covered with conspicuous white chromatophores, but a broad longitudinal stripe on either side of the carapace, just below the hepatic spine, was sharply defined by the absence of these chromatophores.

The species is easily distinguished from all others known in the subgenus *Periclimenes* by the structure of the eye. Apart from *P. commensalis* it is, moreover, the only member of the subgenus which possesses supra-orbital spines.

C895/1. Lagoon reef, W. of Heratera I., Maldives. R. B. Seymour Sewell, Feb., 1923. One

The specimen was found on a Crinoid.

Periclimenes (Ancylocaris) amymone de Man.

1902. *Periclimenes amymone*, de Man, *Abhandl. Senckenb. Ges.* XXV, p. 829, pl. xxv, figs. 53*a-g*.

Seven specimens of this species, which has not previously been found in India, have recently been obtained by the R.I.M.S. 'Investigator.' They agree very closely with de Man's excellently detailed description. Two of the specimens have seven teeth on the upper border of the rostrum, four have 8 and one has 9; the posterior tooth is in all cases placed on the carapace behind the orbit. On the lower border there are 2 teeth in one specimen and 3 in the remainder.

In a large male the second legs reach beyond the antennal scale by almost the whole of the carpus. The merus is 4·7 times as long as wide, the carpus 2·5 times as long as its distal breadth, with two strong spines, as described by de Man. The chela is 3·5 times as long as the carpus and the palm is twice the length of the fingers. The teeth on the inner edges of the fingers vary considerably. In the large male the fingers of one leg closely resemble de Man's figure, in the other leg (much as in certain allied species, such as *P. agag*) there is a curved excavation in the cutting edge of each finger. There is a strong tooth on either side of the excavation in each finger; on the fixed finger there are three additional teeth near the proximal end and on the dactylus two.

The last three legs are characteristic. As de Man has pointed out they are without spinules on the posterior border of the propodus and are furnished distally with tufts of fine hairs which partially conceal the short and rather strongly curved dactyli.

The largest specimen, a male, is 21 mm. in length. Three of the females are ovigerous and one specimen is infested with a Bopyrid.

C896/1.	Octavia Bay, Nancowry Harbour, Nicobars.	'Investigator,' Feb., 1923.	Seven.

The species has hitherto been known only from two specimens found at Ternate.

Periclimenes (Ancylocaris) audouini (Spence Bate).

1888. *Brachycarpus audouini*, Spence Bate, *Rep. 'Challenger' Macrura*, p.798, pl. cxxv, fig. 5.

I have examined the type specimen of *Brachycarpus audouini* in the British Museum and find that the position assigned to it by Spence Bate is erroneous. The absence of the pleurobranch above the third maxilliped and the presence of three pairs of spines at the apex of the telson indicate that it belongs to the Pontoniinae. The mandible lacks a palp and the specimen no doubt belongs to the genus *Periclimenes*.

Spence Bate notes that the specimen possessed one leg of the second pair and one of the last three pairs, but these have disappeared and the only limb now remaining is one of the first pair. If Bate's description of the missing legs is to be trusted the species finds a place in the subgenus *Ancylocaris* in the vicinity of *P. brevicarpalis* and is distinguished from this and from related forms by the characters of the rostrum.

P. audouini was found off the coast of New Zealand in 10 fathoms.

Periclimenes natalensis (Stebbing).

1915. *Palaemonetes natalensis*, Stebbing, *Ann. S. Afric. Mus.* XV, p. 78, pl. lxxxiii.

This species, in lacking the branchiostegal spine and in having three pairs of spines at the apex of the telson, does not belong to the genus in which Stebbing placed it. It is almost certainly a species of *Periclimenes*, but it is unfortunately impossible to say in which subgenus it should be put. Stebbing remarks of the dactylus of the last three legs " a little tooth precedes its upturned point, but this may be in preparation for the moult."

Genus **Harpilius** Dana.

Harpilius beaupresi (Audouin).

1922. *Harpilius beaupresi*, Kemp, *Rec. Ind. Mus.* XXIV, p. 229 [1], figs. 67, 68.

This species has not hitherto been recorded further east than Batavia, but five specimens received in exchange from Oahu in the Hawaiian Is. have recently been examined. This extension in the known distribution of the species adds to the probability that Ortmann's *Anchistia spinigera*, recorded from Laysan and Samoa, is synonymous.

Harpilius depressus Stimpson.

1922. *Harpilius depressus*, Kemp, *loc. cit.*, p. 231, figs. 69, 70.

In the above quoted paper I noted that the identification of Indian specimens as *H. depressus* was open to some doubt. The species was inadequately described by Stimpson from the Hawaiian Is. and no detailed account of specimens from this locality had since been published. We have recently received in exchange seven specimens from Oahu in the Hawaiian Is., labelled *Harpilius depressus*. Of these two are identical with the form which I described from Madras [2], while the other five are *H. beaupresi*.

It is probable that Ortmann had both species before him when drawing up his description of *H. depressus*. The difference that he notes between the sexes is readily explained on this hypothesis, for the antepenultimate segment of the third maxilliped is much broader in *H. beaupresi* than in *H. depressus*, while the statement that the fingers of the larger chela are less than half the length of the palm is true of the former species but not of the latter.

Anchistus pectinis, sp. nov.

The rostrum is very strongly directed downwards and reaches the end of the second segment of the antennular peduncle (figs. 19*a*, *b*). In lateral view it is rather slender, compressed distally and with the

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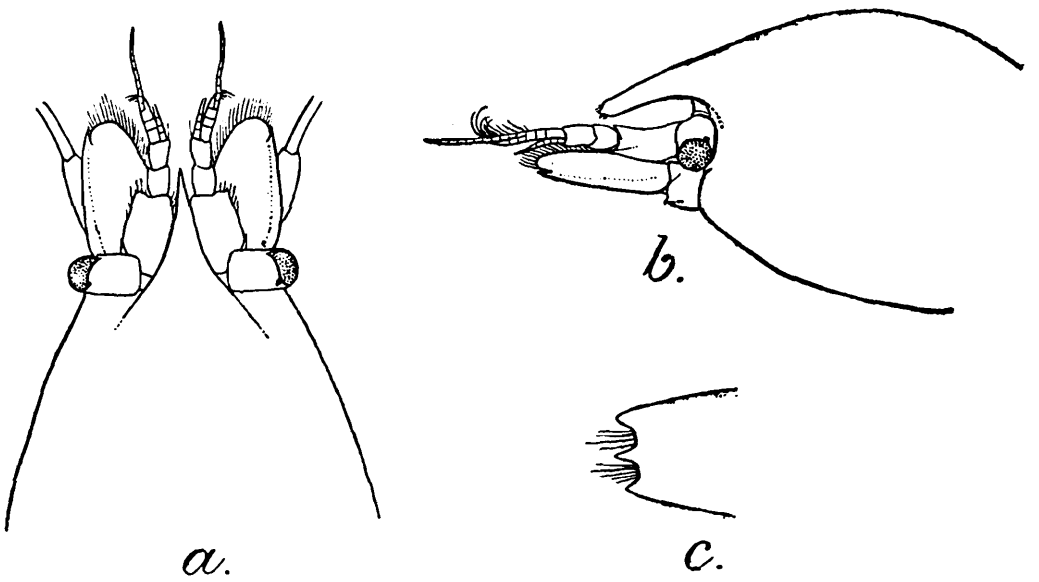
[1] The following correction may be noted,—page 231, line 15 from top, for" merus " read " ischium."

[2] They differ from my description only in the antennal scale, in which the terminal spine reaches almost or quite to the apex of the lamella.

apex abruptly truncate. The only teeth are two or three, very small and placed on the truncate apex (fig. 19*c*). The lower angle of the orbit is acute and beneath it there is a small antennal spine. The cornea is a little narrower than the stalk and the black ocular spot is distinct.



TEXT-FIG. 19.—*Anchistus pectinis*, sp. nov.

a. Carapace and anterior appendages of female in dorsal view.
b. The same, lateral view. *c*. Tip of rostrum of female.

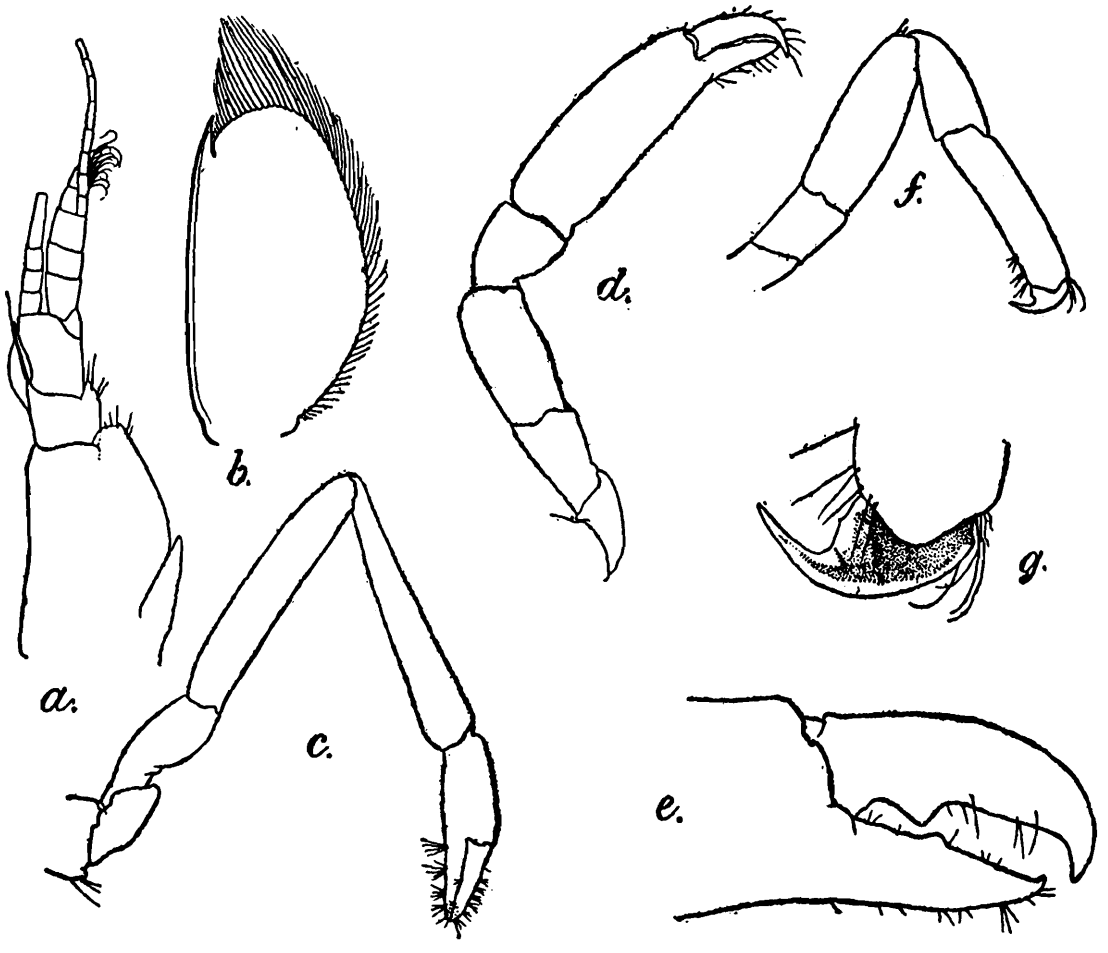
The basal segment of the antennular peduncle (fig. 20*a*) is produced on the outer side beyond the articulation of the second segment and the outer margin ends in a very minute tooth. The fused portion of the two rami composing the outer antennular flagellum consists of three segments. The antennal scale (fig. 20*b*) is only 1·8 times as long as wide and is very broadly rounded distally ; the slightly convex outer margin terminates in a strong spine which reaches almost to the distal end of the lamella.

The antepenultimate segment of the third maxilliped is slender and does not contrast strongly in width with the two succeeding segments. It is about one-third longer than the two following segments combined.

The first legs (fig. 20*c*) reach beyond the scale by the chela and considerably more than half the carpus. The basis and ischium are almost devoid of setae. The merus and carpus are subequal in length ; the chela is two-thirds the length of the carpus, with fingers slightly shorter than the palm. The palm is without the wing-like expansions found in *A. inermis*.

In the female the second legs are equal ; in the male, though similar in structure, they are unequal, the right being the larger. The large leg of the male reaches beyond the antennal scale by about three-quarters of the palm, the smaller leg and those of the female by about half the palm. The merus is about twice as long as broad and the carpus, which is conical, is about as long as broad. The larger chela of the male is about $3\frac{1}{2}$ times as long as wide, with palm $2\frac{1}{2}$ times as long as the dactylus. The fixed finger (fig. 20*e*) is straight, with slightly inturned tip, and its cutting edge bears a conical tooth in the middle and five serrations near the base. The dactylus is much longer than

the fixed finger, with a conspicuously incurved tip which folds round the end of the fixed finger when the claw is closed. On its inner edge it bears a very large tooth just behind the middle and a small lobule near the proximal end. The chela of the female is 3·7 times as long as wide and the palm is about twice as long as the dactylus (fig. 20*d*). As in the male the dactylus is strongly curved and much longer than the straight fixed finger. The fixed finger is armed much as in the large chela of the male, but the dactylus bears only one tooth in the proximal third. The small chela of the male seems to be similar to that of the female, but the fingers are damaged.



TEXT-FIG. 20.—*Anchistus pectinis*, sp. nov.

a. Antennule.
b. Antennal scale.
c. First leg.
d. Second leg of female.
e. Fingers of larger second leg of male.
f. Third leg.
g. Dactylus of third leg.

In the third leg (fig. 20*f*) the merus is nearly three times as long as broad, in the fifth leg exactly three times. The propodus of the third pair is about $3\frac{1}{4}$ times as long as the dactylus, in the 5th nearly 4 times. In all three pairs the propodus bears a few setae near the distal extremity, but is without spinules on the posterior border. The dactylus (fig. 30*g*) is simple, without an additional tooth, and is not scoop-shaped as in *A. miersi* and *A. demani*. At the base it is nearly as broad as the distal end of the propodus and it bears a very slender terminal claw which is bent almost at right angles to the main axis of the segment.

The telson bears two very small pairs of dorsal spinules. The first is placed behind the middle of the telson, the second midway between the first and the apex. The apex itself is rounded and bears three pairs of spines; of these the outermost is short, while the inmost are more slender than the intermediate but nearly as long. The spine which terminates the outer border of the external uropod is very minute.

The female is about 15 mm. in total length, the male about 14 mm.

This species is very closely allied to *A. gravieri* Kemp,[1] but differs in the form of the rostrum, in the shape of the antennal scale, in the structure of the second chela—notably in the dentition and inequality in length of the fingers—and in the stouter merus and different form of the dactylus in the last three legs. In *A. biunguiculatus* Borradaile,[2] in which the fingers of the second chela are also unequal in length, the rostrum is unarmed and the dactyli of the last three legs bear an accessory tooth.

C899/1. Octavia Bay, Nancowry Harb., Nicobars. 'Investigator,' Feb., 1922. Two, TYPES.

The specimens were found together in a species of *Pecten*, from which genus of molluscs no species of *Anchistus* has hitherto been recorded.

Family HIPPOLYTIDAE.

The Indian species of this family have already formed the subject of two papers in this series,[3] but two additional forms are contained in the present collection, one of which is regarded as the type of a new genus. There are also other specimens of interest, including an example of *Merguia oligodon* (de Man), a species hitherto known only from a single individual described in 1888.

The following additional records may be noted :—

Thor paschalis (Heller). Tor, Sinaitic Peninsula, Red Sea; R. B. Seymour Sewell, 1916. Addu Atoll, Maldives; R. B. Seymour Sewell, Feb., 1923.

Latreutes pygmaeus Nobili. Camorta I., Nicobars; 'Investigator,' Oct., 1922.

Latreutes porcinus Kemp. Camorta I., Nicobars; 'Investigator,' Oct., 1922.

Hippolysmata vittata Stimpson. Karachi; G. Matthai, 1921. Madras Harbour; S. Kemp, May, 1918. Port Blair, Andamans; R. P. Mullins, June, 1918.

Thor discosomatis Kemp.

1916. *Thor discosomatis*, Kemp, *Rec. Ind. Mus.* XII, p. 388, text-fig. 1, pl. xxxvi, fig. 1.

Examination of further specimens shows that some of the characters noted in my description of this species are variable. In large individuals the rostral teeth vary in number from 2 to 4; the foremost is occasionally placed so near the apex as to give it a bifid appearance (as in *T. paschalis*) and the hindmost, in specimens with 4 teeth, stands

[1] Kemp, *Rec. Ind. Mus.* XXIV, p. 252, figs. 82-84 (1922).
[2] Borradaile, in Willey's *Zool. Results* IV, p. 408, pl. xxxvi, figs. 5*a-c*.
[3] *Rec. Ind. Mus.* X, p. 81 (1914); *id.*, XII, p. 385 (1916).

immediately above the hinder limit of the orbit. There are from 3 to 6 pairs of spinules at the apex of the telson.

In the dentition of the rostrum and the armature of the telson-tip there are thus no certain distinctions from *T paschalis*. The species may, however, be recognized at once by the presence of the upstanding spine on the outer margin of the lateral process of the antennule near the base. The character is easily seen in lateral view, without dissection, and in my experience affords an absolute means of discrimination.

The largest specimen examined is 16 mm. in length.

C 909/1.	Port Blair, Andamans.	S. Kemp, Feb., March, 1921.	Seven.
C 910/1.	Nancowry I., Nicobars.	'Investigator,' Oct., 1922.	One.
C 911/1	Octavia Bay, Nancowry Harbour, Nicobars.	'Investigator,' Feb., 1923.	One.

The specimens from Port Blair were found at North Bay and on the reef at the north end of Ross I.; all were taken in association with anemones of the genus *Discosoma*.

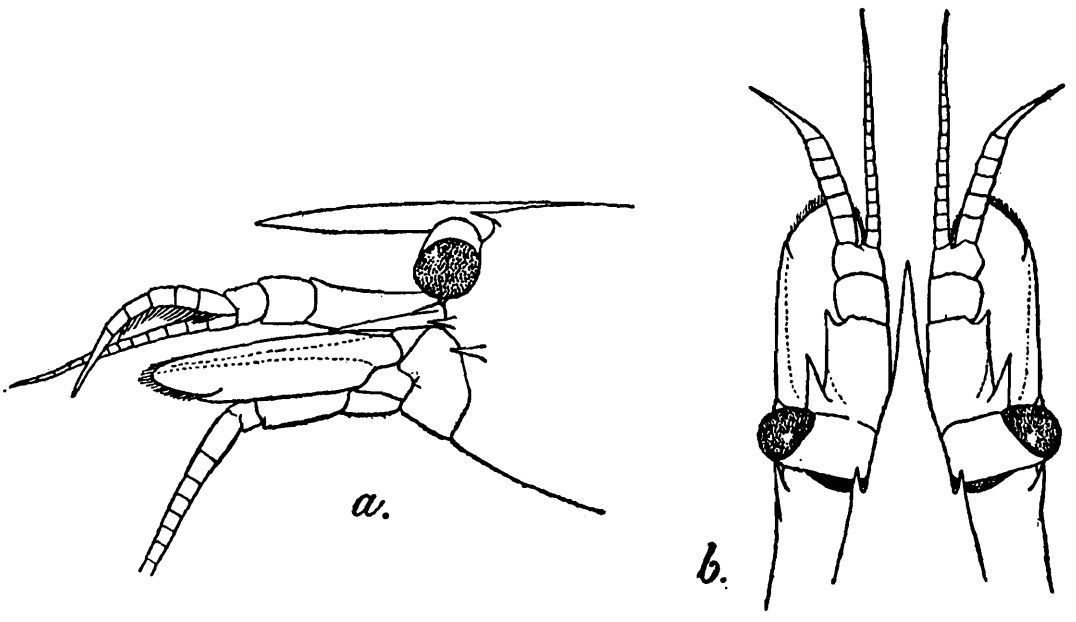
Phycocaris simulans Kemp.

1916. *Phycocaris simulans*, Kemp, *Rec. Ind. Mus.* XII, p. 392, text-fig. 2, pl. xxxvi, fig. 2.

Additional specimens from the Andamans show that the rostrum occasionally bears 1 or 2 very small teeth on the lower border not far from the apex.

Hippolyte commensalis, sp. nov.

The rostrum is straight and reaches to the middle or end of the second antennular segment in females (fig. 21*a*, *b*), to the end of the first segment in males. It is without teeth on either upper or lower border. At the base it is strongly depressed, quite flat above, and its breadth in



TEXT-FIG. 21.—*Hippolyte commensalis*, sp. nov.

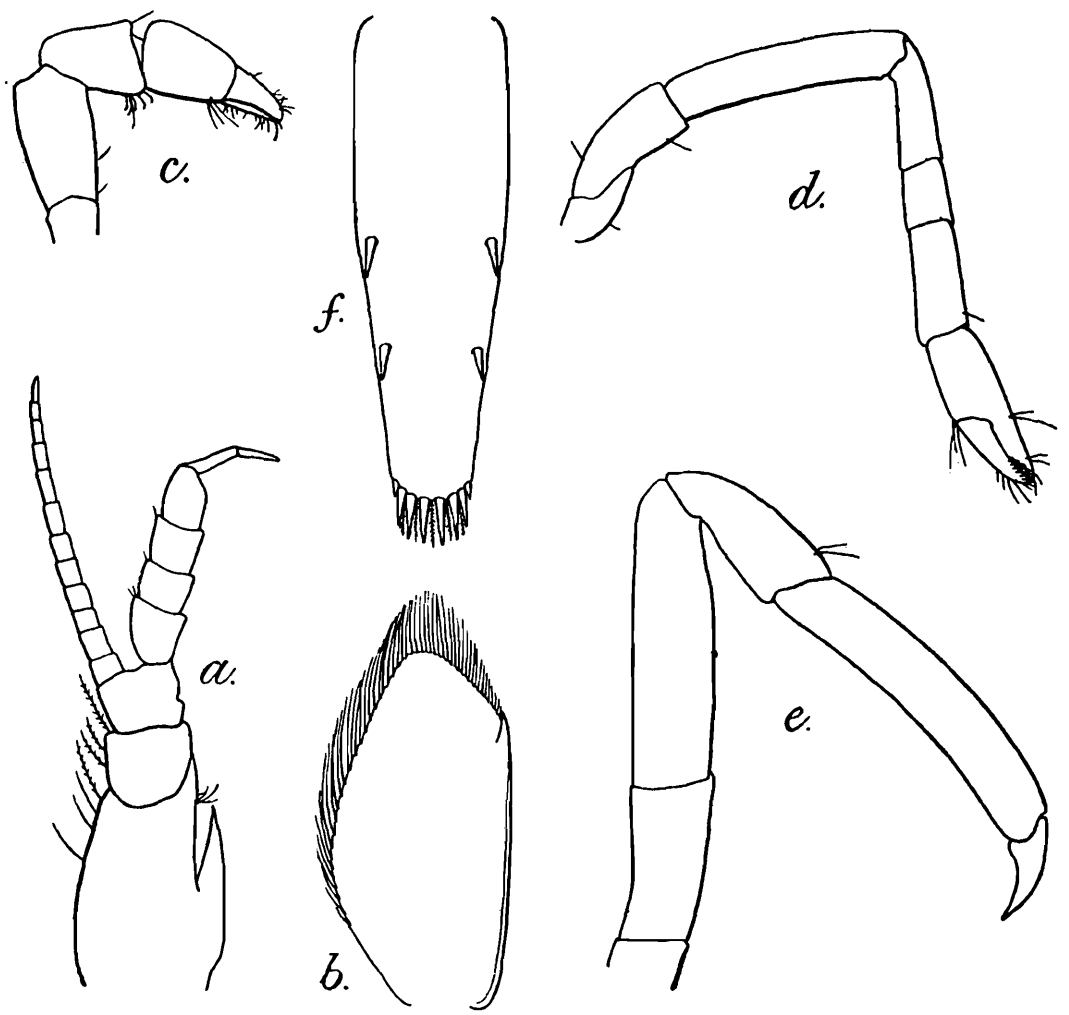
a. Anterior part of carapace, rostrum, etc., of a female, in lateral view.
b. The same, dorsal view.

dorsal view is little less than half its length. Distally it is compressed and its depth in lateral view is about one-seventh its length.

On either side of the base of the rostrum, and on a level with it, is a supra-orbital spine. The lower orbital angle is narrowly rounded, with a strong antennal spine beneath it. The branchiostegal spine is near the antennal and differs in position from that found in *H. varians* and *H. ventricosus*; it is situated further forward, with the tip projecting beyond the margin of the carapace. The antero-lateral angle is rounded.

The eyes are rather slender; the cornea is little broader than the stalk and the ocular spot is indistinguishable.

The lateral process of the antennule (fig. 22*a*) is sharply pointed and reaches to the end of the basal segment. The spine at the outer distal angle of this segment is long. The second and third segments are stout, the former as broad as long, the latter conspicuously broader than long and without the movable plate on the dorsal side which is



Text-fig. 22.—*Hippolyte commensalis*, sp. nov.

a. Antennule.
b. Antennal scale.
c. First leg.
d. Second leg.
e. Third leg.
f. Telson.

found in the allied genus *Thor*. In the female the outer flagellum consists of 9 segments, the proximal 5 very stout and the distal 3 very slender.

The antennal scale (fig. 22*b*) is broad, twice as along as wide; the outer margin is straight and ends in a strong spine which does not reach nearly as far forwards as the broadly rounded apex of the lamella.

The mandible is typical, with molar and incisor processes but without a palp. In the maxilla the two lobes of the basipodite are imperfectly separated by a small marginal notch. The third maxilliped reaches about to the end of the proximal antennular segment and bears a well-developed exopod.

The first legs (fig. 22*c*) are stout and exceedingly short, reaching only to the middle of the antepenultimate segment of the third maxilliped. The carpus is scarcely longer than broad and the fingers are about equal in length with the palm.

In the second legs (fig. 22*d*), which reach to the end of the antennal scale, the merus is nearly 5 times as long as broad. The carpus is 1·3 times as long as the merus and nearly twice the length of the chela; it is divided as usual into 3 subsegments, the first and third nearly equal in length, the second slightly more than half as long. The lengths of the segments are about as 50 : 27 : 49 and the middle subsegment is about $1\frac{1}{2}$ times as long as wide.

The three posterior legs are similar in structure and decrease successively in length. The third (fig. 22*e*) reach beyond the scale by about one-third of the propodus, the fourth by about half the dactylus, while the fifth extend only to the end of the proximal antennular segment. In each pair the merus bears a single strong spine on the outer side near the distal end. In the third pair the merus is about 3·7 times as long as broad and is equal in length with the propodus; in the other two pairs it is rather stouter and somewhat shorter than the propodus. The propodus is distinctly curved, without any spinules on its posterior margin, and is rather more than $2\frac{1}{2}$ times the length of the dactylus. The dactylus itself is rather strongly curved with a slender terminal claw. On the posterior edge there are no spinules, but near the base is a tubercle on which a pore appears to open. The structure closely resembles that found in the Pontoniinae prawn *Dasycaris symbiotes*, a species which seems to have similar habits. It is possible that, as in *Dasycaris*, a fleshy process can be protruded through the pore.

The abdomen is normal, with the third segment produced backwards as in typical species of the genus. The telson (fig. 22*f*) is about as long as the uropods with two pairs of dorsal spines; the first pair is in front of the middle, the second rather nearer to the first than to the apex. The apex itself is convex and rather broad, with four pairs of spines.

The specimens examined vary in length from 4·5 to 14 mm.; an ovigerous female is only 6 mm. in length. The eggs are 0·53 × 0·33 mm. in longer and shorter diameter.

This is, I believe, the only known species of *Hippolyte* which is commensal in habit. At Port Blair, in the Andaman Islands, I have twice found the species on a grey and white Alcyonarian, the colour of the prawn being noted on one occasion as "pale creamy buff throughout, with an inconspicuous transverse dark band at the anterior end of the last abdominal somite." Other specimens collected by Major R. B. Seymour Sewell, I.M.S. in the Nicobars were found on an Actinian.

Major Sewell notes " these prawns, together with a Portunid, were found living among the tentacles of a compound Actinian. The latter was white and the prawns when alive were white with pale brown markings imitating the shadows cast by the various polyps and their tentacles."

Hippolyte commensalis is easily distinguished from other species of the genus by its toothless rostrum, by the position of the branchiostegal spine, by the proportionate lengths of the subsegments in the carpus of the second leg and by the structure of the three posterior legs.

C 912/1.	Coral reef off Reed Point, Nancowry I., Nicobars.	'Investigator,' Feb., 1923.	Four, Types.
C 913/1.	Aberdeen reef, Port Blair, Andamans.	S. Kemp, March, 1915.	Five.
C 914/1.	Reef on Ross I., Port Blair, Andamans.	S. Kemp, March, 1915.	One.

As noted above the specimens from Port Blair were found on an Alcyonarian while those from the Nicobars were on a compound Actinian.

Genus **Paralatreutes,** nov.

Carapace without supra-orbital, but with antennal spine; a series of small spines on antero-lateral margin. Lateral process of antennular peduncle sharply pointed anteriorly; outer antennular flagellum uniramous. Mandible without incisor-process or palp. Third maxilliped without exopod. No arthrobranchs at base of legs, but epipods present on first four pairs. Carpus of second leg composed of three segments.

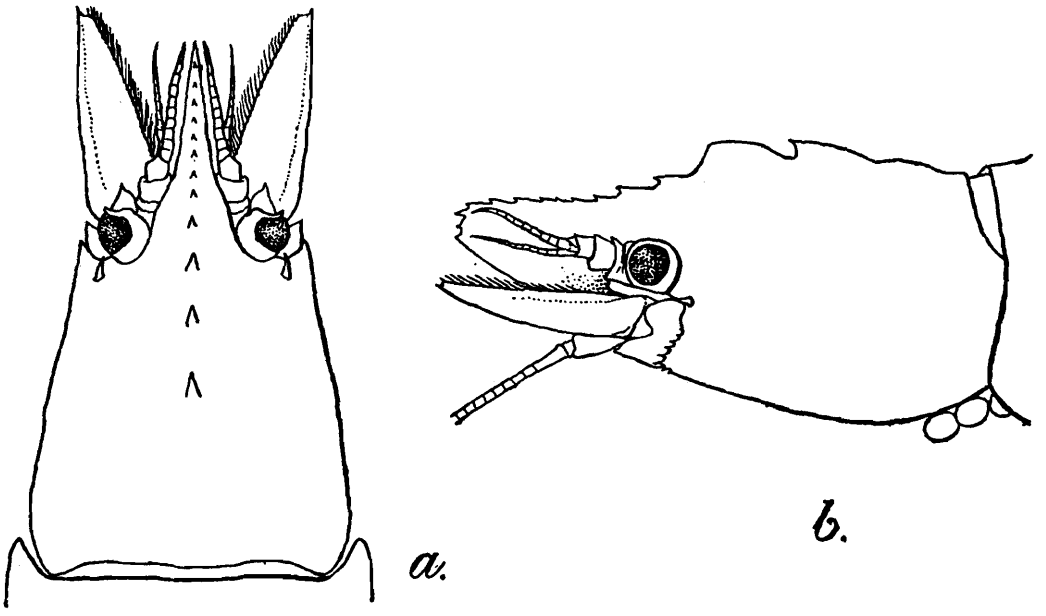
Type.—Paralatreutes bicornis, sp. nov.

This genus occupies an intermediate position between *Latreutes* and *Tozeuma* but is most nearly allied to the former. It differs from *Latreutes* in the absence of the exopod on the third maxilliped and in the form of the lateral process of the antennular peduncle. In both these points it resembles *Tozeuma*, but it differs at first sight from this genus in its robust form, in the presence of a series of spinules on the antero-lateral border of the carapace and in possessing epipods on the first four legs.

Paralatreutes bicornis, sp. nov.

The rostrum reaches almost or quite to the apex of the antennal scale and is broadly lanceolate in shape; its length is about $1\frac{3}{4}$ times its depth (figs. 23*a*, *b*). The upper border is straight or slightly concave, the lower border convex and the apex truncate. The carapace is carinate in its anterior two-thirds and bears two huge teeth, while a third and smaller tooth is situated further forward, just in advance of the posterior limit of the orbit. In front of these three teeth the rostrum bears a series of much smaller teeth; they extend to the extreme apex, where they are rather larger and more strongly procurved, and one or two are to be found on the truncate anterior border. The total number of dorsal teeth, including those on the carapace, varies from 13 to 16 in

the three specimens examined. The lower border of the rostrum is unarmed throughout its length.



TEXT-FIG. 23.—*Paralatreutes bicornis*, gen. et sp. nov.
a. Carapace and anterior appendages in dorsal view.
b. The same, lateral view.

The lower orbital angle is acutely produced and the antennal spine is strong and is articulated. The antero-lateral margin bears a series of 9 or 10 spinules exactly as in *Latreutes*.

The cornea in dorsal view is rather narrower than the stalk and no ocellar spot is visible. The eyestalk is provided on its antero-internal aspect with a slender process which runs up alongside the cornea and projects slightly beyond it.

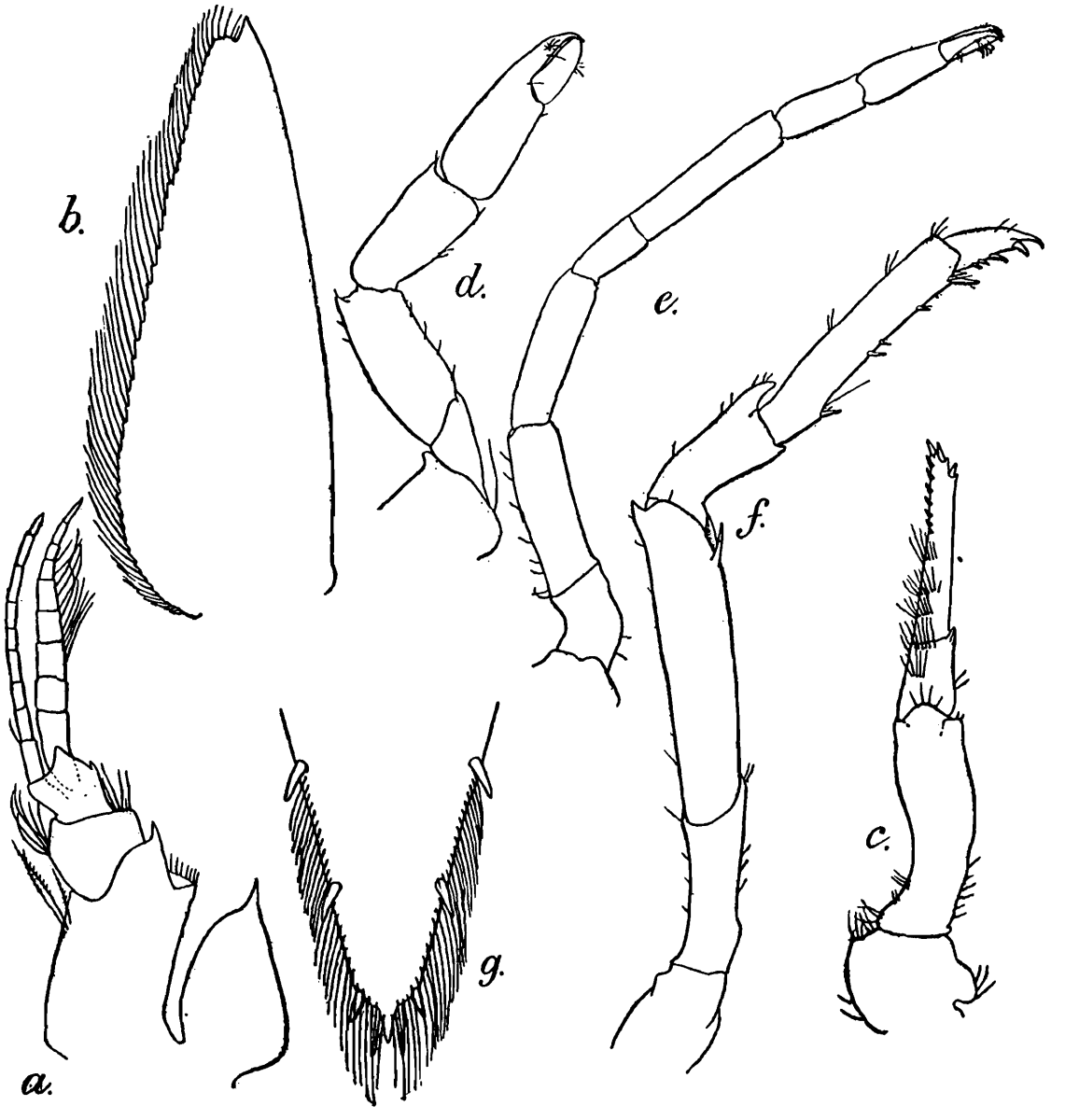
The lateral process of the antennule (fig. 24*a*) is broad at the base and tapers to an acute point which reaches the articulation of the second segment.

The distal spine of the basal segment is strong. The second and third segments are short and broad and the flagella, which are subequal in length, are rather shorter than the peduncle. The antennal scale is triangular, with straight or slightly convex outer margin (fig. 24*b*). It is nearly 3 times as long as wide and the terminal spine extends much beyond the very narrow apex of the lamella.

The mandible possesses neither palp nor incisor-process. The first and second maxillipeds bear well-developed exopods, but there is no exopod on the third maxilliped (fig. 24*c*). The penultimate segment of the third maxilliped is scarcely longer than wide; the ultimate is 3 times its length, flattened and about 4 times as long as wide.

The first legs (fig. 24*d*) are rather shorter than the third maxillipeds and do not reach to the end of the antennal peduncle. The merus is little more than twice as long as wide and bears a blunt tooth at the distal end of the upper border. The carpus is about twice as long as wide, with tufts of hair on its inner face. The fingers are about two-thirds as long as the palm.

The slender second legs (fig. 24*e*) reach a little beyond the end of the antennal peduncle. The merus is slightly more than half as long as the carpus and is 4 times as long as wide. The carpus, as in *Latreutes*, *Tozeuma* and *Gelastocaris*, is divided into three subsegments ; the middle subsegment is much the longest and is equal in length to the first and third combined, the third being about $2\frac{1}{2}$ times as long as wide. The chela is rather more than $1\frac{1}{2}$ times the length of the distal subsegment of the carpus and the fingers are shorter than the palm.



TEXT-FIG. 24.—*Paralatreutes bicornis*, gen. et sp. nov.

a. Antennule.
b. Antennal scale.
c Third maxilliped.
d. First leg.
e. Second leg.
f. Third leg.
g. Terminal part of telson.

The third legs (fig. 24*f*) reach a little beyond the end of the antennal peduncle, the fifth only to the middle of the carpus of the second pair. In each of the last three legs the merus bears a strong spine near the end on the outer side, while the upper border is produced distally to a blunt tooth. In the third pair the merus is about 4 times as long as wide ; in the fifth it is somewhat dilated in the middle and is rather more than 3 times as long as wide. The propodus bears a few coarse spinules

on its posterior edge; in the third pair it is 2·7 times, in the fifth 3 times as long as the dactylus. The dactylus bears 4 teeth in addition to the terminal claw.

There are no arthrobranchs on any of the legs, but there are epipods on the first four.

A few very small and obscure teeth can usually be discerned above the postero-lateral angle of the fifth abdominal pleuron. The sixth abdominal somite, measured dorsally, is about one and a half times the length of the fifth.

The telson is broad proximally, its breadth at the base being fully 3 times that at the apex. There are as usual two pairs of dorsal spines; the foremost is placed at about the middle of the telson-length and the second half-way between the first and the apex. The margins of the telson in the distal half are setose. The apex (fig. 24*g*) is acutely produced in the middle with two spines on either side; the inner spines are about 1½ times as long as the outer and are a little longer than the median projection.

The species is described from three females, two of which are ovigerous. The largest is 23 mm. in length.

In one of the ovigerous females, when alive, the carapace and abdomen were dull plum-coloured, with a large reddish mid-dorsal patch on the carapace and with the posterior half of the last abdominal somite and telson pure white. The antennules and antennal scale were plum-coloured and faintly mottled. All the legs were red at the base and in the third maxillipeds and first two pairs the merus and terminal segments were dull yellow. The merus and carpus of the remaining legs were pale sage-green; the propodus of the third and fourth pairs was transparent with a large deep blue apical spot, while that of the fifth pair was bright red. The pleopods were dull reddish purple and the eggs orange.

In the other ovigerous specimen the plum colour was largely replaced by vermilion, with the antennal scale and the anterior third of the rostrum mottled with grey and lichen-green. The legs were all vermilion, except that in the last three pairs the distal end of the merus and the whole of the carpus were pale grey green and the propodus purplish red. The eggs were again orange.

C 915/1. Ross channel, Port Blair, Andamans. S. Kemp, Feb., 1921. Three, TYPES.

The specimens were trawled in water 3 to 4 fathoms deep.

Gelastocaris paronae (Nobili).

1914. *Gelastocaris paronae*, Kemp, *Rec. Ind. Mus.* X, p. 107, pl. v, figs. 1-11; *ibid.*, XII, p. 401.

1920. *Gelastocaris paronae*, Balss, *Kungl. Svenska Vetensk. Handl.* LXI, No.10, p. 10.

In an adult male, recently obtained in the Andamans, the spines on the lower edges of the abdominal pleura are more abundant than in the female. On the first pleuron there are 5 spines, on the second 5, on the third 6, on the fourth 6 and on the fifth 8. The specimen is 14·5 mm. in length and was dredged in shallow water in Ross Channel

at Port Blair. The species, though rare, is evidently one of wide distribution. It was described by Nobili from Zanzibar and has recently been recorded by Balss from Cape Jaubert in N. Australia.

Merguia oligodon (de Man).

1888. *Hippolyte oligodon*, de Man, *Journ. Linn. Soc. London* XXII, p. 27, pl. xviii, figs. 1-6.
1914. *Merguia oligodon*, Kemp, *Rec. Ind. Mus.* X, p. 121, pl. vii, figs. 8, 9.

After the lapse of over thirty-five years a second specimen of this species has been found—obtained in the Mergui Archipelago by the R. I. M. S. 'Investigator.'

The additional specimen is about 16½ mm. in length and agrees extremely closely with the type. It has the same number and arrangement of teeth on the rostrum. The antennular peduncle projects by the whole length of the third segment beyond the end of the antennal scale. The lateral process of the basal segment is narrowly lanceolate and very short; the spines at the ends of the first two segments agree with de Man's account. The antennular and antennal flagella are all broken. The spine at the distal end of the antennal scale reaches about to the end of the lamella. The merus of the second leg is obscurely divided into 11 segments and there are 24 segments in the carpus.

In describing the genus *Merguia* I draw attention to the remarkable character of the maxilla, in which the distal endite (the proximal endite is here suppressed) is entire and not divided into two lobes as in most Caridea. The character seems, however, to be nothing more than an individual abnormality; in the specimen here recorded the endite is distinctly divided by a narrow incision into two lobes.

C916/1.	Jack and Una Is., Mergui Archipelago.	'Investigator,' Nov., Dec., 1913.	One.

The specimen was found when shore-collecting. The type was obtained at Elphinstone I., also in the Mergui Archipelago.

Family ANCHISTIOIDIDAE.

Genus **Anchistioides** Paulson.

1875. *Anchistioides*, Paulson, *Crust. Red Sea*, p. 115.
1899. *Palaemonopsis*, Borradaile, in Willey's *Zool. Results*, p. 410.
1901. *Amphipalaemon*, Nobili, *Boll. Mus. Torino* XVI, no. 402, p. 5.
1906. *Anchistioides*, Nobili, *Ann. Sci. nat., Zool.* (9) IV, p. 54.
1917. *Anchistioides* and *Amphipalaemon*, Borradaile, *Trans. Linn. Soc. London* (2) *Zool.* XVII, p. 406.

The family Anchistioididae was proposed by Borradaile, some ten years ago, for the reception of Paulson's genus *Anchistioides* and Nobili's *Amphipalaemon* (=*Palaemonopsis* Borradaile). *Anchistioides* is based on a single species from the Red Sea, *A. compressus*, described by Paulson fifty years ago and not hitherto rediscovered. Of *Amphipalaemon* some four species have been described from the Indo-Pacific region, most of them founded on single specimens.

I have here to record the rediscovery of the type-species at Port Blair in the Andaman Islands. The specimens have enabled me to amplify

the original description and I have come to the conclusion that *Amphipalaemon* is no more than a synonym of *Anchistioides*.

In 1917 Borradaile gave an account of the principal characters of the family and supplied a key to the two genera, but on examination of the type species the characters noted in this key are found to be invalid. The most conspicuous difference between the genera was thought to be the presence in *Amphipalaemon* and the absence in *Anchistioides* of a large blunt process situated on the carapace behind the eye. This process, however, though not observed by Paulson, is present in *A. compressus*. The other characters mentioned by Borradaile are the armature of the telson-tip and the presence or absence of the "scaphocerite." The former does not, in my opinion, possess the significance which Borradaile attributes to it and the reference to the latter appears to be based on some misconception. The word "scaphocerite" is presumably a slip of the pen, for both genera agree in possessing a well developed antennal scale; and if stylocerite (the lateral process of the basal antennular segment) be intended, the character does not hold, for both *Anchistioides* and *Amphipalaemon*, as I can state from my own observations, possess this process in a poor degree of development.

Anchistioides compressus Paulson.

1875. *Anchistioides compressus*, Paulson, *Crust. Red Sea*, p. 115, pl. xix.
1906. *Anchistioides compressus*, Nobili, *Ann. Sci. nat., Zool.* (9) IV, p. 54.

The rostrum reaches a little beyond the end of the antennal scale. It is deep in lateral view at the level of the eye and tapers to a sharp point. On the very slightly convex upper border there are 11 teeth in each of the specimens examined (10 according to Paulson). These teeth are placed close together, more or less evenly spaced, and the hindmost is in advance of the posterior limit of the orbit. The middle teeth are the largest and the foremost is not far from the tip and immediately above the most anterior of those on the lower border. The lower edge is straight and is armed with 7 or 8 teeth[1] which are evenly spaced and considerably smaller than those on the upper edge.

On the carapace behind the eye there is a large blunt tubercle, not figured or described by Paulson, and behind this tubercle there are two very obscure longitudinal ridges extending nearly the whole length of the carapace, one situated above the level of the tubercle and one below it. The lower orbital angle is obtuse and the antennal spine strong. Anteriorly between the tubercle and the antennal spine the carapace is rather conspicuously depressed.

The eyes are short, with cornea but little expanded and without any trace of the ocular spot. The antennular peduncle reaches about to the middle of the antennal scale. The basal segment bears a rather feeble lateral process, but the distal spine is strong and reaches the end of the second segment. The second and third segments are short and broad. The outer flagellum is biramous, the accessory branch being

[1] Paulson, according to Nobili's translation of his description, does not mention the teeth on the lower border. In his figure only 4 are shown.

sausage-shaped, shorter than the peduncle and provided with an abundance of fine setae. It is attached to the long and slender inner ramus for only about one quarter its length and is segmented throughout. The antennal scale is only $2\frac{1}{2}$ times as long as wide. At the distal end the lamella is broad and acutely angled internally as shown in Paulson's figure. The spine which terminates the outer margin does not reach nearly as far forwards as the lamella.

In the mandible the molar- and incisor-processes are widely separate and there is no palp. The incisor-process is broad, toothed at the apex and the molar-process terminates in five large cusps. In the maxilla both proximal and distal endites are completely absent. The first maxilliped bears an exopod and a large bilobed epipod, but the lash of the former is vestigial. The endopod is unsegmented, swollen in the middle and with two setae on the inner side. The endites are not strongly setose and are undivided save for a shallow notch near the proximal end. The second maxilliped bears an exopod and a unilobed epipod. The ultimate segment of the endopod is large and applied obliquely to the penultimate. In the third maxilliped there is an epipod but no exopod. The endopod is short and slender with the antepenultimate segment larger than the two terminal segments combined.

The first legs reach to the end of the antennal scale. The merus is 1·2 times as long as the carpus, the latter being six times as long as wide. The carpus is 1·3 times as long as the chela and the palm is longer than the fingers. The fingers bear some setae, but the patch of hairs frequently found in Caridea on the inner face of the palm is absent.

The second legs reach beyond the antennal scale by little more than the fingers. The merus is 3·3 times as long as its distal width and is two-thirds the length of the chela. The carpus is very short, about 1·3 times as long as wide, and the palm is 1·4 times the length of the fingers. The palm is swollen and rather less than twice as long as wide. The chela, as a whole, is conspicuously hollowed beneath and convex above. The fixed finger is almost straight and is somewhat broader at the base than the dactylus. The dactylus is a little inturned at the tip. The cutting edges of both fingers are very thin and without any trace of teeth.

The third legs reach to the end of the antennular peduncle, the fifth to the end of the eye. In the third pair the merus is $9\frac{1}{2}$ times as long as wide. The propodus is slightly carved, nearly four times as long as the dactylus, with one spinule in the distal third of its posterior border and two at the apex. The dactylus is about four times as long as wide with a small tooth behind the apical claw. In the fifth pair the merus is $6\frac{1}{2}$ times as long as wide and the propodus bears some setae at the apex but is without spinules on the posterior border.

The margins of the 3rd, 4th and 5th abdominal pleura are setose, but not serrate as in some other species of the genus. The infero-posterior angles of the 6th somite are acutely produced and on either side of the base of the telson there is a short plate bearing 1 or 2 small spines. In the male the first pleopod bears an appendix interna which reaches nearly to the end of the endopod.

The telson is equal in length with the uropods and is deeply channelled in a longitudinal direction on its upper side. It bears two pairs of dorsal spines, the foremost placed in the anterior half at rather more than two-fifths the length of the telson from the base, and the second pair less than half as far from the first as from the apex. The apex itself is narrow and furnished with two pairs of spines, the outer scarcely one-fifth the length of the inner. Between the inner pair the margin is rounded and bears a pair of stout and very long feathered setae in the middle and on each side of them two long simple setae. The outer uropod is about 2·8 times as long as wide.

The two specimens on which this description is based are about 12·5 mm. in length. One of them was noted to have been absolutely transparent when alive.

The species may easily be distinguished from those described as belonging to the genus *Amphipalaemon* by the following characters:—

(*i*) The ventral teeth of the rostrum are much smaller than the dorsal.

(*ii*) The antennal scale is broader, the distal spine does not reach the apex of the lamella and the antero-internal angle is sharply angulate.

(*iii*) The palm of the second leg is much larger than the fingers.

(*iv*) The last three legs are larger and more slender.

(*v*) The armature of the telson-tip is different.

The specimens were found when shore-collecting at Port Blair in the Andaman Islands. One was obtained on the reef at the N.-W end of Ross Island and one on the east side of North Bay.

The species has hitherto been known only from the Red Sea (Paulson).

Family CRANGONIDAE.

The following additional records of Indian specimens belonging to this family may be noted:—

Pontophilus hendersoni Kemp. Lawson's Bay, Waltair, Madras Pres., 2½-5 fms.; S. Kemp and B. Chopra, Jan., 1921.

Pontophilus lowisi Kemp. Octavia Bay, Nancowry Harbour, Nicobars; 'Investigator', Feb., 1923.

Pontophilus parvirostris Kemp.

1916. *Pontophilus parvirostris*, Kemp. *Rec. Ind. Mus.* XII, p. 372, text-fig. 6, pl. viii, fig. 6.

Among a small number of additional specimens of this species there is a single young male 6·5 mm. in length. In this individual the endopod of the pleopods is greatly reduced and without appendix interna. In the development of the pleopods the species thus resembles *P. bispinosus* Hailstone and Westwood and *P. trispinosus* Hailstone (see Kemp, *loc. cit.*, p. 381).

The largest specimen is an ovigerous female 12 mm. in length.

C 936/1.	Waltair, Madras Pres.	S. Kemp and B. Chopra, Jan., 1921.	Seven (4 ovig.)

The specimens were found at low water in sandy pools among rocks.

Pontophilus angustirostris de Man.

1920. *Pontophilus angustirostris*, de Man, *Decap.* '*Siboga*' *Exped.* IV, p. 279' pls. xxii, xxiii, figs. 67-67*o*.

The specimens agree excellently with de Man's detailed description and figures. In the second pleopod of the male, however, the appendix masculina is large, as broad and as long as the endopod and twice the length of the appendix interna. De Man's single male appears to have been abnormal.

The largest specimen examined is 13 mm. in length.

C 937/1.	Octavia Bay, Nancowry Harb., Nicobars.	'Investigator,' Feb., 1923.	Sixty-eight.
C 938/1.	Brigade Creek, Port Blair, Andamans.	S. Kemp, Feb., 1921.	One young.

LIST OF PREVIOUS PAPERS.

Notes on Crustacea Decapoda in the Indian Museum :—

I.—The species of *Gennadas*, Vol. V, p. 173.

II.—Descriptions of two new Crangonidae with observations on the mutual affinities of the genera *Pontophilus* and *Philocheras*, Vol. VI, p. 5.

III.—The species obtained by the R. I. M. S. S. "Investigator" during the Survey Season 1910-11 (*in collaboration with R. B. Seymour Sewell*), Vol. VII, p. 15.

IV.—Observations on the primitive Atyidae with special reference to the genus *Xiphocaridina*, Vol. VII, p. 113.

V.—Hippolytidae, Vol. X, p. 81.

VI.—Indian Crangonidae, Vol. XII, p. 355.

VII.—Further Notes on Hippolytidae, Vol. XII, p. 385.

VIII.—The genus *Acetes*, Milne-Edwards, Vol. XIII, p. 43.

IX.—*Leander styliferus*, Milne-Edwards, and related forms, Vol. XIII, p. 203.

X.—Hymenosomatidae, Vol. XIII, p. 243.

XI.—Atyidae of the genus *Paratya* (=*Xiphocaridina*), Vol. XIII, p. 293.

XII.—Scopimerinae, Vol. XVI, p. 305.

XIII.—The Indian species of *Macrophthalmus*, Vol. XVI, p. 383.

XIV.—On the occurrence of the Caridean genus *Discias* in Indian waters, Vol. XIX, p. 137.

XV.—Pontoniinae, Vol. XXIV, p. 113.

XVI.—On two interesting Crabs from the mouth of the River Hughli, Vol. XXV, p. 405.

NOTES ON WESTERLUND'S SPECIES OF FRESHWATER MOLLUSCS FROM CEYLON.

By B. PRASHAD, *D.Sc., Zoological Survey of India.*

Westerlund in 1885[1] described eight new species of freshwater molluscs from Ceylon collected by the "Vega" Expedition. Of the eight species two were Hydrobiids, one a Melaniid and five Planorbids. No reference to these species is included in any of the works published since that date except by Preston, who in his volume in the "Fauna of British India"[2] copied the Latin descriptions of the five Planorbids. Regarding the other three species he neither included any references to them, nor did he comment on their validity. Germain in his valuable Catalogue of the Indian Planorbids[3] did not refer to any of the five species of Westerlund's Planorbids from Ceylon. From Westerlund's descriptions and figures I was not able to fully understand the species described by him and so requested Dr. Nils Hj. Odhner of the Riksmuseum, Stockholm, Sweden, who had the "Vega" collections under his charge, to kindly send me Westerlund's Ceylon specimens for examination. He was not only good enough to send me the whole material, but presented duplicates of the species, as far as available, for the collections of the Zoological Survey of India, Indian Museum, Calcutta. For all this I am greatly indebted to Dr.Odhner, and wish to express here my hearty thanks to him for his kindness.

As a result of my examination and comparison of the type-specimens with authentically named material in the Indian Museum, I find that all the species described by Westerlund as new are to be referred to already known species. I give below the species to which they are to be relegated as synonyms, but for the sake of easy reference have written up the notes under the names given by Westerlund. For the sake of comparison I also publish here outline text-figures of Westerlund's type-shells.

19[4]. **Planorbis (Gyraulus) demissus** Westerlund.

1885. *Planorbis demissus*, Westerlund, *op. cit.*, pp. 204, 205, pl. iv, fig. 16.
1915. *Planorbis (Gyraulus) demissus*, Preston, *op. cit.*, p. 121.

Westerlund considered his specimens to be the same as those described as *P. compressus* by Hutton.[5] Since the name *compressus* was already occupied by Michaud's species[6] from France, he proposed calling it *P. demissus*. The species is, however, not Hutton's *P. compressus*, but what he called *P. convexiusculus*.

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[1] Westerlund, *Land-och Sötvatten. Mollusker. Ur Vega Expeditionens Vetenskapliga Jakttagelser*, Vol. IV, pp. 143-220, pls. 2-6 (1885).
[2] Preston, *Faun. Brit. Ind. Freshw. Moll.* (1915).
[3] Germain, *Rec. Ind. Mus.* XXI, (1921-1924).
[4] These numbers are the ones given by Westerlund to his species in the paper cited.
[5] Hutton, *Journ. As. Soc., Bengal* (2) III, p. 93 (1834).
[6] Michaud, *Compl. Hist. Moll. France*, p. 81, pl. xvi, figs. 6-8 (1831).

I have carefully compared four shells of this species received from Dr. Odhner for the Indian Museum with large series of Indian shells of *G. convexiusculus* (Hutton)[1] and can find no differences between them to justify the separation of the Ceylon shells into a new species.

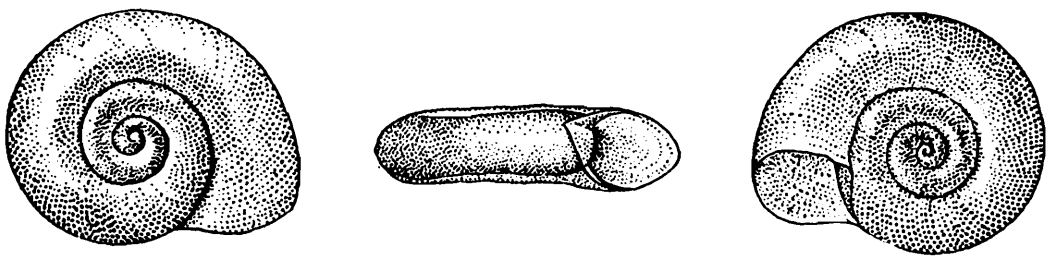

Fig. 1.—*Planorbis* (*Gyraulus*) *demissus* Westerlund. ×6.

I publish here figures of the largest specimen out of Westerlund's collection for comparison with the figures of *G. convexiusculus* published by the late Dr. Annandale and myself in 1919.

20. **Planorbis (Gyraulus) associatus** Westerlund.

1885. *Planorbis associatus*, Westerlund, *op. cit.*, p. 205, pl. iv, fig. 17.
1915. *Planorbis* (*Gyraulus*) *associatus*, Preston, *op. cit.*, p. 122.

As a result of my examination of the types of this species I have no doubt that the species is based on individuals of *G. stelzneri* (Dohrn).[2] Preston was wrong in remarking that it is " almost certainly a variety of *P.* (*G.*) *demissus*." The number of whorls is larger, the shape of the mouth is different, the shell is more carinate and the spiral sculpture is much more pronounced.

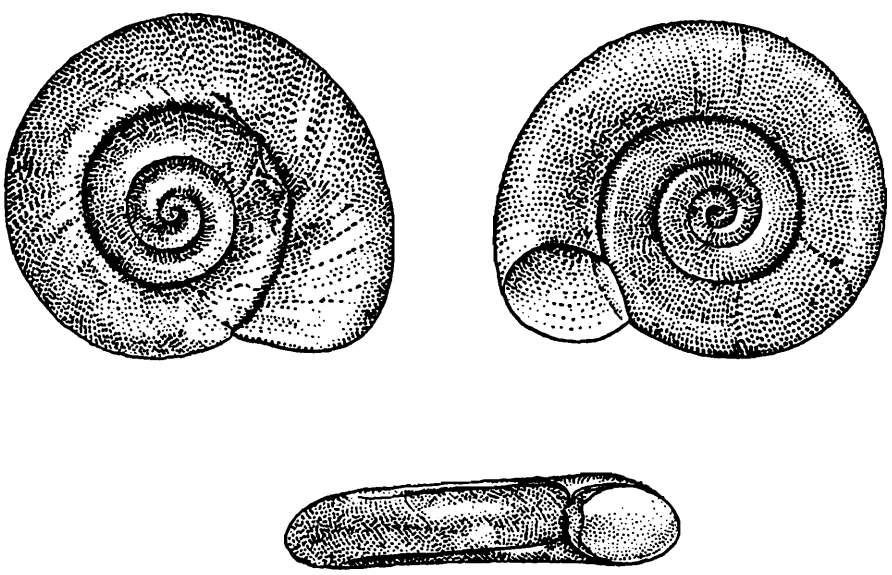

Fig. 2.—*Planorbis* (*Gyraulus*) *associatus* Westerlund. ×6.

I reproduce above enlarged drawings of one of Westerlund's shells.

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[1] See Annandale and Prashad, *Rec. Ind. Mus.* XVIII, pp. 52-54, fig. 7-B (1919), and Prashad, *Rec. Ind. Mus.* XXII, pp. 473, 474 (1921). Germain in 1922 (*Rec. Ind. Mus.* XXI, pp. 119-124) still referred to the species under the name *P.* (*G.*) *saigonensis*, but, as was shown in the first paper cited above, Crosse and Fischer's *saigonensis* is the same as Hutton's older species *convexiusculus*, and should be relegated to its synonomy.

[2] Dohrn, *Proc. Zool. Soc. London*, p. 134 (1885). Also see Germain, *Rec. Ind. Mus.* XXI, pp. 130, 131 (1923) for further references to the species.

21. **Planorbis (Gyraulus) liratus** Westerlund.

1885. *Planorbis* (*Gyraulus*) *liratus*, Westerlund, *op. cit.*, p. 206, pl. iv, fig. 18.
1915. *Planorbis* (*Gyraulus*) *liratus*, Preston, *op. cit.*, p. 121.

Of this species only two shells were sent to me for examination. Both the shells were rather imperfect and I am, therefore, not quite definite about their position. The form and size of the shells, the number of whorls, the sculpture, the outline of the mouth and their measurement, however, remind one of *G. rotula* (Benson). *G. rotula*[1] was originally described from Moradabad in the United Provinces of India, but a large number of specimens from the suburbs of Bombay were, I think, rightly assigned by Germain[2] to this species. If my conclusion that *Planorbis liratus* of Westerlund is the same as *G. rotula* is correct, then the range of distribution of *G. rotula* is more extensive than was hitherto believed. It may also be noted here that I agree with Preston and Germain that Sowerby's figure of *Planorbis rotula* in the *Conchologia Iconica*[3] has no resemblance to Benson's species, which is, however, correctly figured by Hanley and Theobald in *Conchologia Indica.*[4]

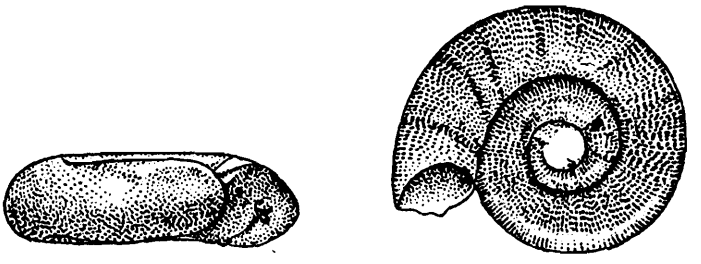

FIG. 3.—*Planorbis* (*Gyraulus*) *liratus* Westerlund. × 8.

I reproduce here outline figures of one of the incomplete specimens prepared from a photograph which was taken for me in the Senckenberg Museum, Frankfurt a. Main.

22. **Planorbis (Hippeutis) versicolor** Westerlund.

1885. *Planorbis* (*Hippeutis*) *versicolor*, Westerlund, *op. cit.*, p. 206, pl. iv, fig. 19.
1915. *Planorbis* (*Hippeutis*) *versicolor*, Preston, *op. cit.*, p. 124.

As a result of my comparison of two specimens of the type-series of Westerlund's species with authentic specimens of *H. umbilicalis* (Benson[5] I am able to definitely confirm their identity. Both the specimens are half grown shells and do not differ in any respect from same-sized shells of *H. umbilicalis* from Sylhet and Manipur, Assam. Westerlund in his account of *P. versicolor* also referred to *H. umbilicalis* and stated that his new species was nearly allied to it. I give here figures of one

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[1] Benson, *Ann. Mag. Nat. Hist.* (2) V, p. 351 (1850).
[2] Germain, *Rec. Ind. Mus.* XXI, pp. 128, 129 (1923).
[3] Sowerby in Reeve's *Conch. Icon.* XX, fig. of sp. 121 (1878).
[4] Hanley and Theobald, *Conch. Ind.* pp. xviii, 40, pl. xcix, figs. 2, 3 (1876).
[5] Benson, *Journ. As. Soc. Bengal* V, p. 741 (1836).

of Westerlund's specimens from Point de Galle, Ceylon, and of another, shell from Manipur, Assam for comparison.

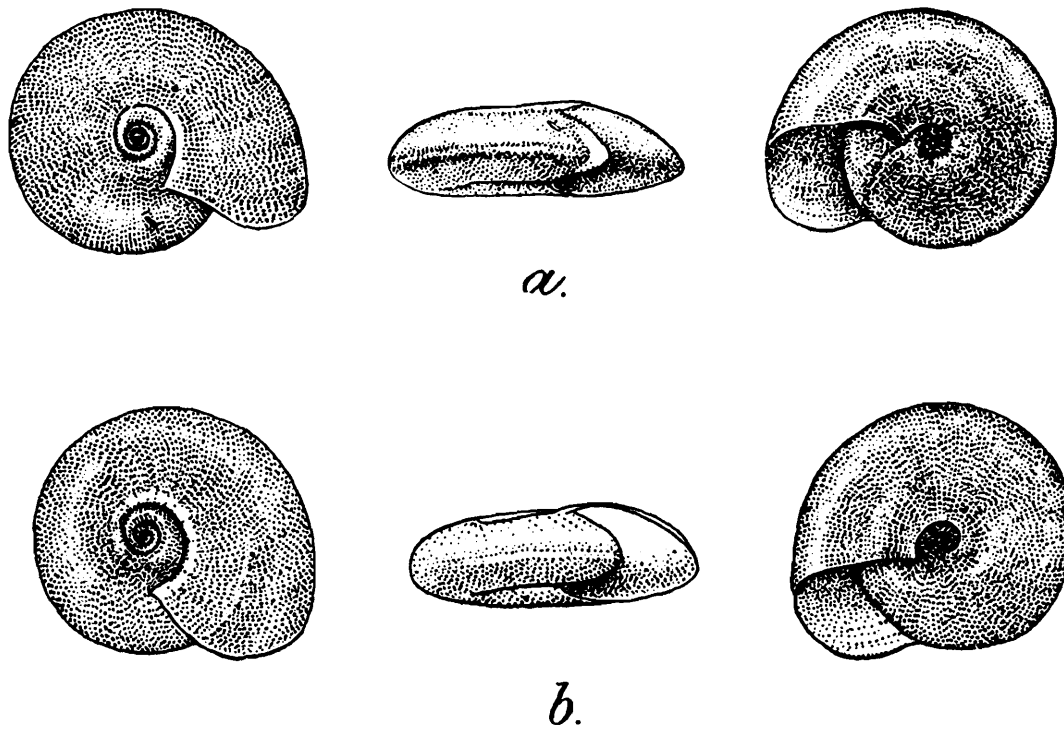

FIG. 4.—(*a*) *Planorbis* (*Hippeutis*) *versicolor* Westerlund; Point de Galle, Ceylon. ×4.
(*b*) *Hippeutis umbilicalis* (Benson); Manipur, Assam. ×4.

It may be noted here that *umbilicalis*, as was proved by an examination of its soft parts,[1] should be placed in the genus *Hippeutis* and not *Segmentina* to which genus Germain assigns it.[2]

24. **Planorbis (Segmentina) spirodelus** Westerlund.

1885. *Planorbis* (*Segmentina*) *spirodelus*, Westerlund, *op. cit.*, p. 209, pl. v fig. 21.
1915. *Planorbis* (*Segmentina*) *spirodelus*, Preston, *op. cit.*, p. 126.

Westerlund in his notes on this species compared it with his new species *mica* from Japan and the European species *nitida*, and ignored the Indian species *calatha* (Benson), *cantoris* (Benson), etc.

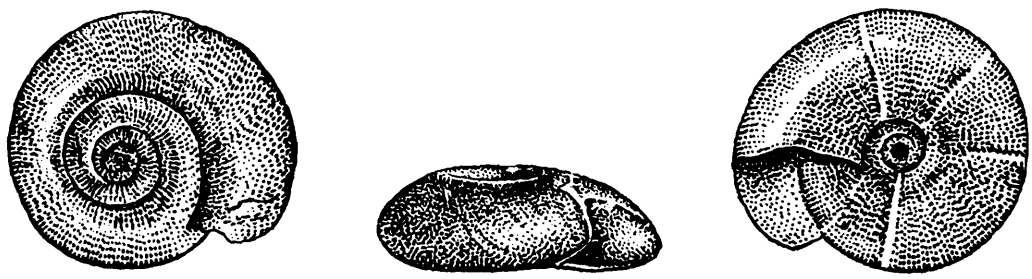

FIG. 5.—*Planorbis* (*Segmentina*) *spirodelus* Westerlund. ×6.

As a result of my examination of one of the type-specimens I am certain that it is nothing more than *Segmentina calatha* (Benson),[3] which

[1] Annandale and Prashad, *Rec. Ind. Mus.* XXII, pp. 584, 585 (1921).
[2] Germain, *Rec. Ind. Mus.* XXI, pp. 176-178 (1923).
[3] Benson, *Ann. Mag. Nat. Hist.* (2) V, p. 349 (1850). See also Germain *Rec. Ind. Mus.* XXI, pp. 168, 169 (1923) for further references.

is widely distributed in India and is represented in the Indian Museum collection from Galle, Ceylon.

I give here outline drawings of Westerlund's specimens made from photographs of type-shells.

27. **Bythynia tumida** Westerlund.

1885. *Bythynia tumida*, Westerlund, *op. cit.*, p. 211, pl. v, fig. 23.

Westerlund in the remarks about this species compared it to *Bythinia orcula* (Benson MSS.) Frauenfeld. The type-specimen, which I have examined, is badly figured by Westerlund and I, therefore, publish

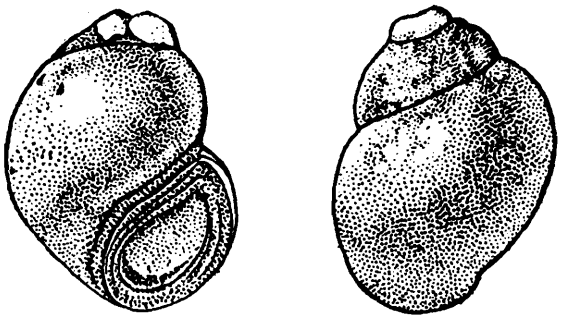

FIG. 6.—*Bythynia tumida* Westerlund. ×6.

new figures here. The specimens are nothing more than *Bithynia stenothyroides* Dohrn, which, as Annandale[1] has shown, should be known as *Amnicola* (*Alocinma*) *stenothyroides* (Dohrn).

32. **Melania lentiginosa** var. **nymphula** Westerlund.

1885. *Melania lentiguiosa* var. *nymphula*, Westerlund, *op. cit.*, p. 215, pl. vi, fig. 30.

I have examined three specimens of this variety presented to the Indian Museum by Dr. Odhner. These specimens are only var. *layardi*

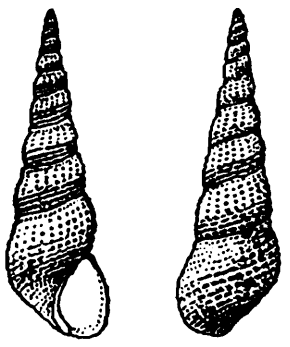

FIG. 7.—*Melania lentiginosa* var. *nymphula* Westerlund. ×1½.

(Dohrn)[2] of *Melanoides tuberculata* (Muller). I figure one of the shells here.

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[1] Annandale, *Rec. Ind. Mus.* XIX, p. 43 (1920).

[2] Dohrn, *Proc. Zool. Soc. London*, p. 135 (1885). See also Preston, *Faun. Brit. Ind. Freshw. Moll.*, p. 16 (1915). The generic name as was pointed out by Annandale, *Rec. Ind. Mus.* XIX, pp. 108, 109 (1920) should be *Melanoides* Olivier.

33. **Nematura ceylanica** Westerlund.

1885. *Nematura ceylanica*, Westerlund, *op. cit.*, p. 216, pl. v, fig. 25.

As Westerlund's descriptions and figures of this species show it is not to be referred to *Nematura* or rather *Stenothyra* as Benson[1] himself later changed the generic name owing to *Nematura* being pre-occupied. As a result of my examination of two of the specimens of the type-series I have no doubt that the species was based on young, complete

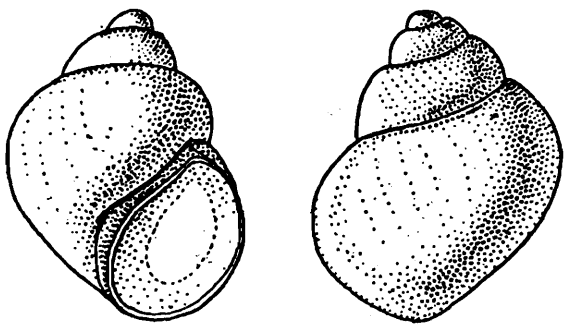

FIG. 8.—*Nematura ceylanica* Westerlund. × 8.

shells of *Amnicola* (*Alocinma*) *stenothyroides* (Dohrn). Westerlund's species *Bythynia tumida*, as pointed out above, was also described from shells of this species, but the shells were larger and had the apex eroded.

I figure one of the shells here for reference.

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[1] Benson, *Ann. Mag. Nat. Hist.* (2) XVII, p. 496 (1856).

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