

XX NOTES ON CRUSTACEA DECAPODA
IN THE INDIAN MUSEUM.

VI, INDIAN CRANGONIDAE.

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(Plate VIII.)

The number of Crangonidae known from Indian seas has been considerably increased by recent work in shallow water on various parts of the coast. In dealing with the additional material that has come to hand I have thought it useful to include references to all the known Indian forms and to construct keys to facilitate the identification of the species of *Pontophilus* and *Aegeon*.

Six species hitherto unknown are described, all belonging to the genus *Pontophilus*, while, thanks to the assistance of Dr. W. T. Calman, I have been able to rectify certain errors in the nomenclature of two species of *Aegeon*.

In a previous paper in this series¹ I expressed the view that *Philocheras*, Stebbing (= *Cheraphilus*, Kinahan, *partim*) could not be sustained as a distinct genus, but must be merged in *Pontophilus*. In examining the new forms of this genus a point hitherto overlooked has come to light, namely, that in certain species there are considerable differences between the sexes in the form of the pleopods. The modifications of these appendages are not only of interest as evidence of the affinities of the different species, they also, as it appears to me, afford a valuable clue to the origin of the various genera of the family and point to lines of descent very different from those suggested by Ortmann in 1890. I have thought it best to discuss the structure of these appendages and the phylogenetic conclusions which may be derived from them under a separate heading at the end of the paper.

In all eighteen species of Crangonidae are now known from Indian waters, ten belonging to the genus *Pontophilus*, six to *Aegeon* and one each to *Prionocrangon* and *Crangon*.

Genus *Pontophilus*, Leach.

The six undescribed Indian species of this genus were obtained, two from Kilakarai at the northern end of the Gulf of Mannar

¹ *Rec. Ind. Mus.*, VI, p. 5 (1911).

and four from Port Blair in the Andamans. One of the new forms, *P. incisus*, is a very close ally of the Atlantic and Mediterranean *P. sculptus*, the remainder are sharply distinguished from all species previously described by well-marked characters found in the sculpture of the carapace and abdomen and in the form of the rostrum, lateral process of the antennule, antennal scale and first two pairs of legs.

In some of the species there are considerable differences between the sexes in the form of the last four pairs of pleopods, a feature discussed in detail on p 381, and other sexual distinctions of an unusual nature are met with in *P. lowisi* and *P. candidus*. In the former the antennal scale, which is remarkable for the possession in both male and female of a series of spinules on its outer margin, shows wide differences in form in the two sexes. In the latter a conspicuous spine in the mid-dorsal line of the carapace is present in the male and absent in the female, a remarkable distinction when the great constancy of the armature of the carapace in other species is remembered.

The ten Indian species of *Pontophilus* may be distinguished thus :—

- I.—First peraeopods with rudimentary exopod ; second peraeopods very short, not reaching distal end of merus of first pair, their chela well formed with curved fingers ; lateral process of antennular peduncle styliform, much longer than broad.
 - A. Median carina of carapace with two spines ... *gracilis*, Smith.
 - B. Median carina of carapace with three spines ... *abyssi*, Smith.
- II.—First peraeopods without exopod ; second peraeopods longer, reaching beyond carpus of first pair, their chela ill-formed with parallel fingers ; lateral process of antennular peduncle not styliform, usually subquadrate and broader than long.
 - A. A median longitudinal carina on carapace and on 3rd, 4th and 5th abdominal somites [rostrum broad distally, anterior margin squarely truncate or concave].
 1. Outer margin of antennal scale armed with a spine or a series of spinules in addition to a terminal spine.
 - a. Carapace with five carinae bearing spines ; a single additional spine on outer margin of antennal scale, placed near base ; merus of first peraeopods with a single spine at distal end of outer margin ; first four abdominal somites with strong lateral sculpture ... *incisus*, sp. nov.
 - b. Carapace without spines and without lateral carinae ; a series of spinules on outer margin of antennal scale ; merus of first peraeopods with three spines at distal end of outer margin ; lateral sculpture of first four abdominal somites feeble ... *lowisi*, sp. nov.
 2. Antennal scale without additional spines on outer margin ; [carapace with spines and lateral carinae ; first four abdominal somites with strong lateral sculpture.] ... *sabsechota*, Kemp.
 - B. No median longitudinal carinae on carapace or abdomen.

1. Lateral margins of rostrum anteriorly divergent; apex broad, squarely truncate [carapace with one mid-dorsal spine in male only; two pairs of lateral spines in both sexes] *candidus*, sp. nov.
2. Lateral margins of rostrum anteriorly convergent, apex narrow, rounded or pointed.
 - a. Rostrum of good size, separating the eyes; carapace with one or more teeth in median line; dactylus of second peraeopods not narrower than fixed finger.
 - i. Carapace pubescent with three teeth in mid-dorsal line [four pairs of lateral teeth on carapace; lateral process of antennular peduncle anteriorly spinose] *pilosus*, sp. nov.
 - ii. Carapace not pubescent with only a single tooth in mid-dorsal line.
 - α. Three pairs of lateral teeth on carapace; lateral process of antennular peduncle anteriorly pointed; "thumb" of subchela formed of a single articulated tooth *plebs*, sp. nov.
 - β. No lateral teeth on carapace; lateral process of antennular peduncle anteriorly truncate; "thumb" of subchela formed of two teeth, closely juxtaposed and not articulated *hendersoni*, Kemp.
 - b. Rostrum exceedingly small, eyes contiguous; carapace without teeth in median line; dactylus of second peraeopods very slender, less than half the breadth of fixed finger *parvirostris*, sp. nov.

***Pontophilus gracilis*, Smith.**

1901. *Pontophilus gracilis*, Alcock, *Cat. Indian deep-sea Crust. Macrura and Anomala*, p. 115.
1905. *Pontophilus gracilis*, Stebbing, *Marine Invest. S. Africa*, IV, p. 49, pl. xxv.

***Pontophilus abyssi*, Smith.**

1901. *Pontophilus abyssi*, Alcock, *Cat. Indian deep-sea Crust. Macrura and Anomala*, p. 116.

***Pontophilus incisus*, sp. nov.**

(Plate viii, fig. 1.)

The rostrum is longitudinally channelled; its sides are almost parallel and its distal border, in dorsal view, is strongly concave. The actual apex is rounded, but is abruptly deflexed at a right angle and can therefore be seen only from in front. The sides of the rostrum and the orbital margins are clothed with long hairs which partially conceal the eyes.

On the carapace a shallow groove extends transversely across the base of the rostrum. In the mid-dorsal line there is a rather obscure interrupted carina composed of four short ridges. The first of these ridges ends anteriorly in a conspicuous tooth just behind the transverse groove mentioned above; the second, which is very feebly developed, usually terminates in a minute denticle; the third is

well elevated and its margin in lateral view is a little uneven; the fourth is distinct and ends abruptly. The first lateral carinae are not parallel; but converge anteriorly. Each is composed of a number of short ridges ending anteriorly in denticles. The foremost ridge is short and terminates in a comparatively large tooth placed a little behind the first of those in the median line. The small teeth or denticles on the two ridges posterior to it are also well formed, while the remainder are minute and can only be seen with difficulty. At the posterior end of the carapace there are a few additional short ridges, some bearing denticles, between the median and the first lateral carinae. The second lateral carina is also

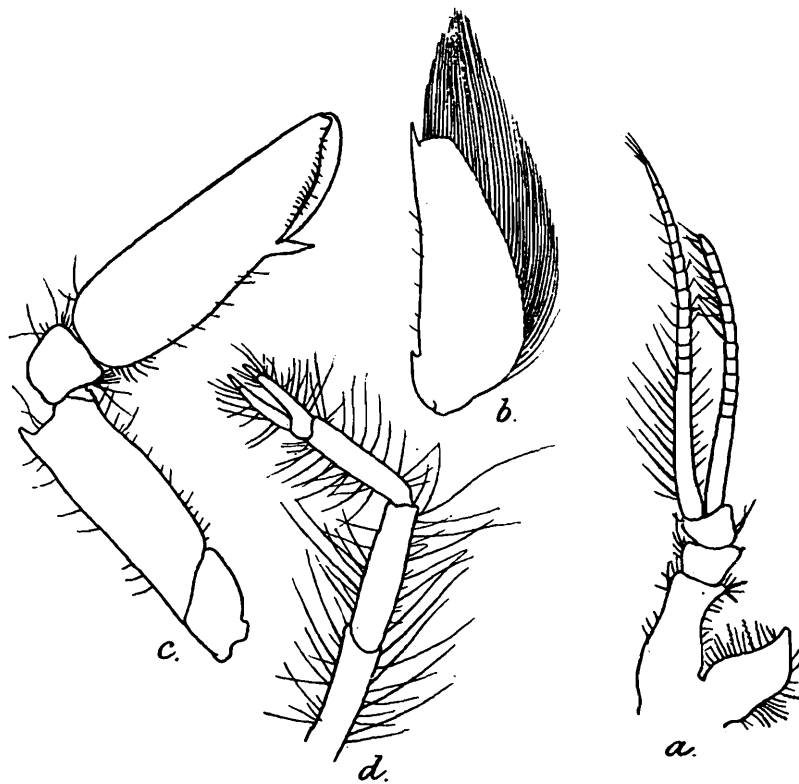


FIG. 1.—*Pontophilus incisus*, sp. nov.

a. Antennule.

b. Antennal scale.

c. First peraeopod.

d. Second peraeopod.

composed of interrupted ridges, the foremost ending in a stout hepatic tooth situated in advance of the primary median tooth. The ridge flanking the hepatic tooth is comparatively long and is succeeded by another, also of considerable length, which ends in a conspicuous tooth; the remaining ridges, three or four in number, are short and each may or may not bear a small denticle. There are sharp orbital and branchiostegal spines, the latter being the longer and extending beyond the level of the rostral apex. Except for the ridges, the entire carapace is covered with a fine pubescence and also, in many cases, bears several upstanding tufts of long setae.

The corneal portion of the eye is reniform in outline. The basal segment of the antennular peduncle (text-fig. 1a) is longitudinally keeled below and usually bears a small tooth near its proximal end. Its lateral process is transversely oblong with the outer distal angle somewhat drawn out and projecting forwards. The second and third segments of the peduncle are extremely short, the two combined being scarcely half the length of the first.

The antennal scale (text-fig. 1b) is broadest near the base and is narrowed strongly towards the apex. It is about three times as long as broad and the short spine which terminates its outer margin extends by almost its whole length beyond the apex of the lamella. On the outer margin, at the end of the proximal quarter is a single stout tooth, recalling that found in *P. sculptus*, but placed much nearer the base. The margin behind this tooth is strongly convex and that in front of it slightly concave.

The outer maxillipedes reach beyond the tip of the antennal scale by almost the entire length of the ultimate segment.

The first peraeopods (text-fig. 1c) are a little shorter than the outer maxillipedes and do not possess exopods. The spine on the outer margin of the merus is strong and, as in *P. sculptus*, is terminal in position. On the distal margin of the carpus there are two external spines. The propodus is nearly three and a half times as long as wide and the "thumb" of the subchela is exceptionally large and strong. At their base the first peraeopods are separated, in both sexes, by a sharp forwardly directed sternal tooth.

The second peraeopods (text fig. 1d) are clothed with long hairs and reach beyond the end of the carpus of the first pair by almost the entire length of the chela. The carpus is about one fifth shorter than the merus and nearly one fifth longer than the chela. The chela, as in allied species, is weakly constructed, without incurved claws at the apex. The fingers are of equal breadth and length and the palm is exceptionally short, occupying only about one fifth the length of the chela.

The slender third peraeopods reach beyond the tip of the antennal scale by the two terminal segments and by one third the length of the carpus. The latter segment is nearly one and a half times the length of the merus, twice the length of the ischium and one and a half times the length of the propodus and dactylus combined. The propodus is equal in length with the ischium and is two and a half times as long as the dactylus.

In the last two peraeopods, which are similar, the four distal segments are practically glabrous; those of the fourth pair reach beyond the antennal scale by the length of the dactylus. The merus in this pair is a trifle longer than the dactylus, four fifths the length of the propodus and nearly twice as long as the carpus. The dactylus is almost three quarters the length of the propodus.

The abdominal segments are deeply grooved and incised, much as in *P. sculptus*, the depressed portions being pubescent and the raised portions glabrous. On the first five somites the sculpture is

transverse for the most part; but there is a sharp longitudinal mid-dorsal carina in the posterior three quarters of the third somite, a pair of juxtaposed carinae, fused posteriorly, in the same position on the fourth somite and a similar pair of carinae, slightly divergent posteriorly, on the fifth. On the sixth somite the only sculpture consists of a pair of longitudinal carinae separated by a broad flat interspace. The pleura of the first four somites are pointed below, bluntly in the female, rather more sharply in the male.

The pleopods show marked sexual differences. In the male the endopod of the last four pairs is comparatively well developed and possesses an appendix interna. In the female the endopod is reduced in size and is extremely small in the case of the last pleopod: the appendix interna is present in the second pair, but is much smaller than in the male; in the third and fourth pairs it is quite rudimentary and from the fifth it is entirely absent.

The outer uropod is shorter than the inner and is very slender, nearly four times as long as broad. The telson is scarcely longer than the inner uropod and is also very slender. It is sulcate above and bears two pairs of small dorso-lateral spinules. The lower edges are fringed with long setae and distally it terminates in a sharp point, flanked by a pair of short spinules and bearing two pairs of long finely plumose setae.

Large females reach a length of 18 mm.; the males are smaller, not exceeding 15 mm., and are apparently much less abundant. The eggs are about 0.4 × 0.3 mm. in longer and shorter diameter.

Pontophilus incisus is a remarkably close ally of *P. sculptus*, Bell, a species known from the Mediterranean and from the French and British coasts.¹ In all conspicuous characters there is a very close similarity between the two forms, but differences in detail are sufficiently numerous to justify their specific separation. In *P. incisus* there is only one strong tooth in the mid-dorsal line of the carapace, whereas in *P. sculptus* there are almost invariably two. In *P. incisus*, also, the antennal scale is narrower and the tooth on its outer margin is placed near the base instead of in the middle. In both species the spine on the outer margin of the merus of the first peraeopods is terminal and not sub-terminal as in some other species of the genus; in *P. incisus*, however, the anterior edge of the merus between this spine and the articulation of the carpus is entire, bearing only a few hairs, whereas in *P. sculptus* two or three additional spines are found in this position. In *P. incisus*, moreover, the lateral process of the antennular peduncle is more pointed distally, the subchela is more slender, the palm of the second peraeopods shorter and the dactyli of the last two peraeopods comparatively longer.

In a previous paper² I have remarked on the presence of the appendix interna in *P. sculptus*; but I failed to notice that in the

¹ I have compared the Indian species with specimens of *P. sculptus* from the Irish Sea.

² Kemp, *Rec. Ind. Mus.*, VI, p. 10 (1911).

development of this appendage there were marked sexual differences. The condition in *P. sculptus* is, in fact, precisely the same as has been described above in the case of the related Indian form.

As regards the characteristic tooth on the outer edge of the antennal scale, I noted, in the paper cited above, that it was apparently absent in a single Mediterranean example of *P. sculptus* preserved in the Indian Museum. Further examination of this individual shows that the tooth is indeed present, but situated at the proximal end of the scale. The specimen is, in fact, in all points identical with the types of *P. incisus* and differs from *P. sculptus* in the characters noted above. It is labeled "Mediterranean" without more precise locality and is said to have been received from E. Cornalia, from whom Wood-Mason obtained a large number of Mediterranean Decapoda. From Heller's description,¹ however, it seems clear that the true *P. sculptus* occurs in the Mediterranean, for in his description of the antennal scale he says "am Seitenrande ausser dem endständigen stachel mit einem zweiten beiläufig in der Mitte." It is probable therefore that some mistake has arisen and that the specimen, said to have been found in the Mediterranean, was in reality obtained in Indian waters.

In life *Pontophilus incisus* is closely mottled with dark grey and brown, the colouration being apparently protective.

All the specimens in the collection are from the Andaman Is.—

$\frac{9027}{6}$	Andamans, 20 fms.	Investigator.	1, 10 mm.
$\frac{9070}{10}$	Port Blair, Andamans, 2-12 fms.	S. Kemp.	41, 7-18 mm.

The specimens from Port Blair, among which the types of the species (9070/10) are included, were obtained in the channel off Ross I. on a rough bottom composed of sand, stones, shells and coral.

Pontophilus lowisi, sp. nov.

(Plate viii, fig. 2.)

The rostrum is longitudinally channelled above; its lateral margins are curved and strongly divergent distally. The anterior margin is very broad and, in dorsal view, a little concave. The true apex is sharply deflexed; it has a rounded margin and is visible only from in front.

On the carapace there is no trace of the transverse groove behind the rostrum which occurs in most species. In the mid-dorsal line there is a longitudinal carina which extends close up to the base of the rostrum. Throughout the greater part of its length this carina is obscure; but for a short distance just behind the middle of the carapace it is sharp and well defined and owing to its greater elevation is distinct in lateral view. A feeble groove runs obliquely forwards and downwards on either side of the cara-

¹ Heller, *Crust. südlich. Europa*, p. 228 (1863).

pace terminating just above the sharp branchiostegal spine. This spine reaches to the level of the rostral apex and extends far in advance of that which defines the outer orbital angle. Except for those on its frontal margin the carapace is entirely devoid of spines and, except for that in the mid-dorsal line, it is without carinae. The carapace does not appear to be pubescent.

The basal segment of the antennular peduncle is about one and a half times the length of the second and third combined; its lateral process is oval (text-fig. 2a).

The antennal scale differs notably in the two sexes. In the female (text-fig. 2b') it is scarcely more than twice as long as broad

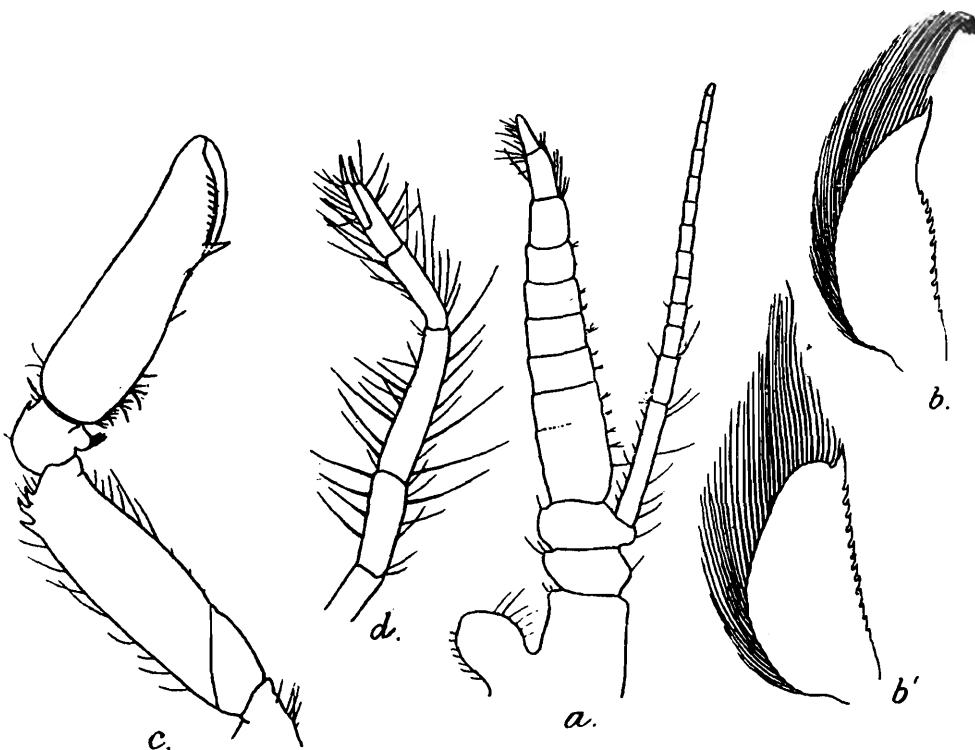


FIG. 2.—*Pontophilus lowisi*, sp. nov.

- | | |
|----------------------------|-------------------------------|
| a. Antennule. | b'. Antennal scale of female. |
| b. Antennal scale of male. | c. First peraeopod. |
| d. Second peraeopod. | |

and the lamella, though narrowed, is of considerable breadth at its distal end. In the male (text-fig. 2b), it is almost three times as long as broad and the lamella slopes sharply away from the base of the distal tooth. The outer margin in both sexes bears numerous spines, in this respect differing from all known species of the genus. In the female the margin is straight or very slightly concave and bears some 12 or 13 spines which increase in size from behind forwards. In the male the margin is strongly sinuous, convex in the middle and concave towards the distal end. It bears from 9 to 11 spines, similar to those of the female, but they are restricted to the basal convex portion of the margin and do not extend on to the concave part nearer the apex.

The third maxillipedes reach almost or quite to the end of the antennal scale. The combined length of the two subequal distal segments is not greater than that of the antepenultimate. The latter segment bears a few small spinules at the distal end of its lower margin and the exopod, when naturally flexed, reaches but little beyond the middle of its length.

The first peraeopods (text-fig. 2c) reach a little further than the third maxillipedes. The merus at its outer distal angle bears three stout curved spines and there is a single external spine near the distal end of the carpus. The subchela is a little more than three times as long as broad; the "thumb" is large and sharp as in *P. incisus*. The first legs are separated at their base by a large forwardly directed sternal tooth.

The second peraeopods (text-fig. 2d) are clothed with long hairs and reach beyond the carpus of the first pair; the merus is as long as the carpus and chela combined, the carpus is one and a third times the length of the chela and the fingers are a little less than one and a half times as long as the palm. Each finger bears a slender spine at its apex, but the spines are not curved and the claw is apparently without cutting edges. The fixed finger is a little broader than the dactylus.

The third peraeopods reach beyond the antennal scale by the length of the two ultimate segments. The proportions are much the same as in *P. incisus*, but the propodus and dactylus are comparatively a trifle longer, their combined lengths being almost three quarters that of the carpus.

The fourth and fifth pairs bear scattered setae on the propodus. The fifth reach beyond the scale by about half the length of the dactylus. The propodus in this limb is two and a half times the length of the carpus and is a quarter longer than the subequal merus and dactylus. Seen under a high power of the microscope the anterior margins of the merus and carpus have a roughened appearance, as though they were studded with small tubercles.

The abdomen in a dried specimen shows faint indications of sculpture, very shallow transverse grooves and elevations being visible on the first four segments. In the posterior half of the second somite and over the greater part of the third and fourth there are sharp longitudinal mid-dorsal carinae. Those on the second and third somites are simple, but that on the fourth is longitudinally grooved in the middle and thus has the appearance of a double carina fused at either end. There are two short dorsal carinae on the fifth somite and a pair of similar widely-separated carinae, which are exceedingly obscure, on the sixth. The pleura are not pointed inferiorly.

The pleopods of the male resemble those of *P. incisus*, the endopod of the last four pairs is well developed and carries an appendix interna. In the female, as in *P. incisus* and *P. sculptus*, the endopod is greatly reduced and the appendix interna, found in those species in a rudimentary condition on the second, third and fourth pairs, is entirely suppressed.

The outer uropod is a little shorter than the inner and bears long setae on its outer, as well as on its inner margin; it is a little more than three times as long as broad. The telson reaches about to the apex of the inner uropod; it is deeply sulcate above with two pairs of dorso-lateral spinules and in the form of its apex resembles *P. incisus*.

This species is, I believe, the smallest known Macruran. It is smaller even than *P. sabsechota*, Kemp, the largest individual in the collection, an ovigerous female, being slightly less than 7.5 mm. in total length. The eggs are comparatively large for such a small species; when not eyed and to all appearances freshly extruded they are about 0.34×0.27 mm. in longer and shorter diameter; when fully eyed and ready to hatch they measure about 0.48×0.36 mm.

Pontophilus lowisi is perhaps distantly related to *P. bidentatus*, de Haan¹, and *P. japonicus*, Doflein², but from both these species it differs conspicuously in the form of the carapace and in the presence of a series of spines on the outer edge of the antennal scale.

The colouring of the species differed considerably in specimens from different localities. Individuals found on a muddy bottom were for the most part densely pigmented with grey and brown, the last abdominal somite and tail-fan being colourless except for a dark transverse band on the latter. Specimens from sandy ground were much lighter in colour, often quite pale and sometimes with one or two transverse brown bands. In one example from this type of bottom the pigmentation is very peculiar, the carapace being deep amber brown, the abdomen white with transverse bars of brown on the fifth somite and tail-fan and the antennules bright red.

$\frac{9074}{10}$ Port Blair, Andamans, 3-12 fms. S. Kemp. 69, 4.5-7.5 mm.

Specimens were found off Ross I. and in various other parts of the harbour, but were most abundant at the inner end on a muddy bottom. The types of the species are numbered 9074/10 in the Indian Museum register.

With this species I have associated the name of Mr. R. F. Lewis, Deputy Superintendent of Port Blair, to whom I am much indebted for assistance during my visit to the Andamans.

Pontophilus sabsechota, Kemp.

1911. *Pontophilus sabsechota*, Kemp, *Rec. Ind. Mus.*, VI, p. 6, pl. ii, figs. 11-14.

A male from Port Blair, only 8 mm. in length, agrees in most particulars with the type, a female. The distal margin of the

¹ De Haan, in Siebold's *Fauna Japonica*, p. 183, pl. xlv, fig. 14 (1849) and Balss, *Abhandl. math.-phys. Klasse K. Bayer. Akad. Wiss. München*, Suppl. Bd. II, p. 68, text-fig. 41 (1914).

² Doflein, *Abhandl. math.-phys. Klasse K. Bayer. Akad. Wiss. München*, XXI, p. 621, pl. iii, fig. 6, and text-fig. p. 622 (1902).

rostrum is, however, more definitely concave in dorsal view and the anterior tooth of the second lateral carina of the carapace is less acute. The outer margin of the merus of the first legs terminates in a small spine and two similar spines exist between it and the articulation of the carpus: these spines do not exist in the type. The dactylus of the second legs is proportionately shorter than in the female, less than twice the length of the palm. The dorsal carina of the fourth abdominal somite is feebly channelled longitudinally; that of the fifth is similar in its anterior half, but posteriorly it is split into two divergent branches. On either side of the median line in the third, fourth and fifth somites are short but well defined carinae, which are transverse on the third but take a more oblique direction on the two succeeding somites. In the type specimen these lateral carinae are obsolete and the median keel of the fourth somite does not appear to be bifurcated posteriorly. In the pleopods there is a wide difference between the sexes. The endopod of the last four pairs is well developed in the female; but in the male is exceedingly small in the second, third and fourth pairs and is entirely absent from the fifth.

In life the male was almost pure white in colour with a black spot in front of the median tooth of the carapace, a pair of similar spots on either side between the first and second lateral carinae and a pair near the posterior margin. There were transverse bars of black pigment on the fourth abdominal somite and on the tail-fan, a black band near the distal end of the subchela and three similar bands on the fourth leg, situated on the ischium merus and propodus.

⁹⁰⁸⁵/₁₀ Port Blair, Andamans, 6 fms.

S. Kemp.

1 ♂, 8 mm.

***Pontophilus candidus*, sp. nov.**

(Plate viii, fig. 3.)

The rostrum is flat and not channelled longitudinally; its lateral margins are curved, convergent from the base to the middle and divergent from the middle onwards. The distal end, seen in dorsal view, is abruptly and squarely truncate. The true apex of the rostrum is sharply deflexed; it is visible only from in front and has a broadly convex margin.

The carapace is entirely devoid of carinae; its surface, though smooth to the naked eye, is microscopically scabrous. The transverse depression usually found behind the rostrum is obsolete. The spinulation shows a remarkable difference in the two sexes. In the male there is a sharp spine in the median line a little behind the base of the rostrum, but of this in the female there is no trace. In both sexes there is a sharp hepatic spine, situated about on the same level as the dorsal spine of the male, and below and in advance of it is another conspicuous spine situated behind the branchiostegal angle. In the male there is a short longitudinal groove above the hepatic spine and another beneath it, shallower

and considerably longer, extending almost to the posterior margin of the carapace. The branchiostegal angle is sharp and reaches the level of the rostral apex. On the margin immediately beneath it is a small spinule.

The basal segment of the antennular peduncle (text-fig. 3*a*) is broad, its outer distal angle is bluntly produced. The lateral process is transversely oval with a straight posterior margin and a sharp point at its antero-external angle. The antennal scale (text-fig. 3*b*) is broad, not more than two and a third times as long as wide; the outer margin is a trifle sinuous and terminates in a sharp spine which does not reach nearly as far forwards as the distal end of the lamella.

The third maxillipedes reach a little beyond the end of the

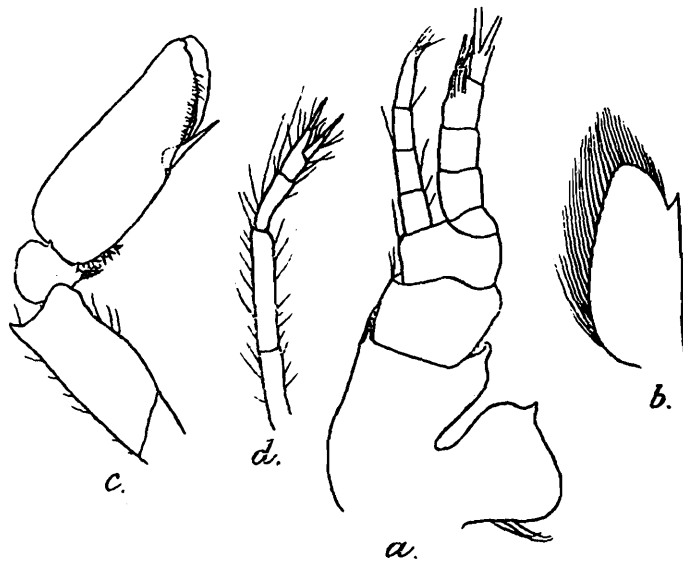


FIG. 3.—*Pontophilus candidus*, sp. nov.

a. Antennule.

b. Antennal scale.

c. First peraeopod.

d. Second peraeopod.

antennal scale; the ultimate segment is decidedly longer than the antepenultimate.

The first peraeopods (text-fig. 3*c*) reach a little beyond the third maxillipede and do not possess an exopod. The outer edge of the merus terminates in a single stout tooth and the margin between this tooth and the carpal articulation is entire. The carpus bears two spines on its outer distal margin. The subchela is little more than two and a half times as long as wide; the cutting margin is strongly oblique and the spine which forms the 'thumb' is extremely long and slender and is remarkable in that it is articulated and movable. The first legs are not separated at their base by the forwardly directed sternal tooth found in some other species of the genus.

The second peraeopods (text-fig. 3*d*) reach beyond the carpus of the first pair and are lightly clothed with hair. The merus is

long, more than twice the length of the carpus; the chela is a little shorter than the carpus. The fingers are a trifle shorter than the palm; they are of equal breadth, without definite cutting margins, and each bears at its apex a single stout seta serrated on the inner side.

The third peraeopods reach beyond the end of the first by the two ultimate segments. The carpus is one third the length of the merus and is a little shorter than the propodus and dactylus combined. In the fourth pair the propodus is the longest segment, nearly a quarter longer than the merus, a trifle longer than the carpus, and about 1.7 times the length of the dactylus.

The abdomen is quite smooth, without trace of sculpture; the lower margins of the pleura are rounded. The pleopods resemble those of *P. lowisi*. The endopod of the last four pairs in the female is greatly reduced and shows no trace of an appendix interna. In the male the endopod is better developed and in all four pairs is provided with a well formed appendix.

The outer uropod is shorter than the inner and is about three times as long as broad; its external margin is without setae, except for a few at the distal end. The telson reaches about as far as the outer uropod and is not sulcate above. It bears two pairs of dorso-lateral spinules and the apex is similar to that of *P. incisus*.

Living specimens were as a rule almost pure white with a narrow transverse brown band on the tail-fan.

^{9082-A}₁₀ Port Blair, Andamans. S. Kemp. 2 ♂, 4 ♀ 7-10 mm.

The type specimens bear the number 9082/10.

***Pontophilus pilosus*, sp. nov.**

(Plate viii, fig. 4.)

The rostrum is well developed and reaches almost to the end of the eyestalks. It is deeply hollowed longitudinally and tapers to a narrow rounded apex. On its ventral side there is a deep vertical keel, extending downwards between the eyestalks. The keel ends abruptly a little behind the apex where it bears a tuft of long setae.

The carapace is everywhere clothed with a fine pubescence, which, over the greater part of the surface, is comparatively short, but becomes more conspicuous laterally and on the antero-lateral portions takes the form of long silky hairs. There are three procurved teeth in the mid-dorsal line, but no carina. The first two of these teeth are placed rather close together in the anterior half of the carapace, while the third is in the middle of the posterior half. Behind the antennal spine, which reaches almost as far forward as the rostrum, there are two small teeth placed one behind the other in the latitude of the first tooth of the mid-dorsal series. Below these there is a stout hepatic tooth which overhangs a deep sulcus—the lateral continuation of the transverse post-rostral

groove, especially well marked in this portion of the carapace. The branchiostegal spine is strong and extends forwards beyond the level of the eyestalks. Behind it is another small tooth, placed further forward than any others of the dorsal series. Exclusive of the spines on its frontal margin, there are in all eleven teeth on the carapace: none of these teeth form the terminations of carinae.

In the male each of the last three thoracic sterna bears a median keel, which ends anteriorly in a small tooth: these keels are absent in the female. The first and second pairs of legs are adjacent at the base in the male and are not separated by the antorse spine found in *P. hendersoni*.

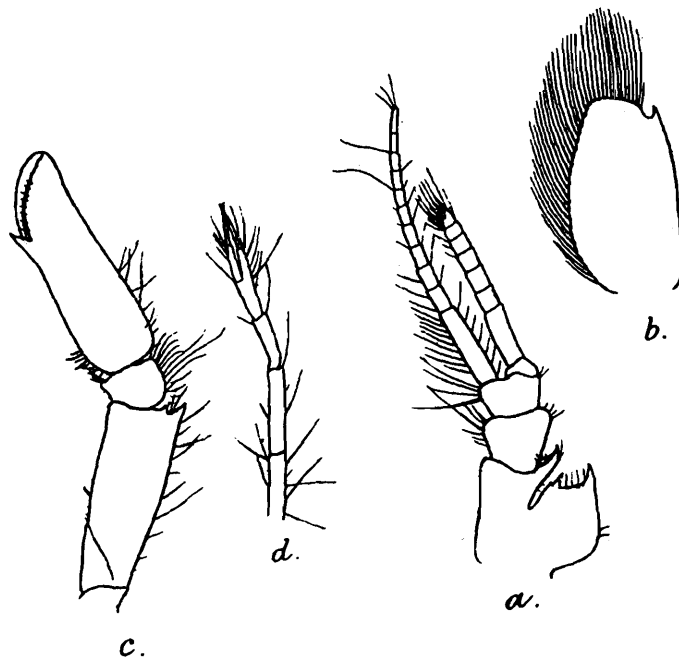


FIG. 4.—*Pontophilus pilosus*, sp. nov.

a. Antennule.

b. Antennal scale.

c. First peraeopod.

d. Second peraeopod.

The eyes are stout and short. In both sexes the distal margin of the stalk, on its upper and inner side, is produced beyond the cornea to a small but conspicuous papilla.

The basal segment of the antennular peduncle (text-fig. 4a) bears a stout ventral spine and another at the distal end of its outer margin. The lateral process is peculiar in form. It is fully as long as broad and is furnished anteriorly with two spines, the outermost the largest and the inner bearing a small internal spinule. The outer flagellum does not appear to be appreciably stouter in the male than in the female and is shorter than the peduncle.

The antennal scale (text-fig. 4b) is broad, its breadth in a large female being more than half its length. The outer margin is convex and terminates in a spine which does not reach as far forward as the lamella and is separated from it by a broad U-shaped gap.

The outer maxillipedes are clothed with long setae and reach beyond the end of the antennal scale by almost the entire length of the ultimate segment.

The first peraeopods (text-fig. 4c) are a little shorter than the outer maxillipedes and are not provided with exopods. The spine on the outer margin of the merus is terminal and on the anterior margin between it and the articulation of the carpus there is another smaller spine. The carpus is short; the inner margin is lobed and bears coarse setae, while on the outer margin are two spines. The breadth of the hand, measured near its base, is about one third its entire length.

The second peraeopods (text-fig. 4d) reach to the carpus of the first pair. The carpus is two thirds the length of the merus and is as long as the palm and half the length of the fingers. In the chela, which as in the preceding species is weakly constructed and without cutting margins or terminal claws, the palm is about one seventh longer than the dactylus. The fixed finger is noticeably shorter than the dactylus and both fingers bear long setae.

The slender third peraeopods reach beyond the antennal scale by about the length of the two ultimate segments. The merus is a little shorter than the ischium and a little longer than the propodus. The carpus is one and two thirds the length of the merus and is one fifth longer than the propodus and dactylus combined. The fourth and fifth legs are rather densely clothed with hairs. The merus, carpus and propodus are subequal and the dactylus is a little more than half their length.

The abdominal somites are quite smooth and are covered with a fine pubescence similar to that on the carapace; the margins of the pleura are rounded. The inner ramus of the last four pairs of pleopods is comparatively well developed in the male and carries an appendix interna; in the female it is reduced and no trace of this appendage is to be found. The outer uropod is shorter than the inner and is nearly three times as long as broad. The telson is one and a half times the length of the last abdominal somite; it is provided with two pairs of dorso lateral spinules and its lower margins are ciliated. The apex is similar to that of *P. parvirostris*.

Pontophilus pilosus is sometimes conspicuously banded in life with dark brown. In examples from very shallow water there is a narrow transverse band at the posterior end of the carapace and others, rather broader, on the second and fourth abdominal somites and across the middle of the telson and uropods. Individuals obtained at a depth of two fathoms were marbled with brown pigment mixed with a certain amount of pure white, the carapace being sometimes of a dull reddish-brown. In all the specimens there was a dark spot at the distal end of the subchela.

The specimens were obtained at the northern end of the Gulf of Mannar.—

$\frac{8979}{10}$ Kilakarai, Ramnad
dist., S. India.

S. Kemp.

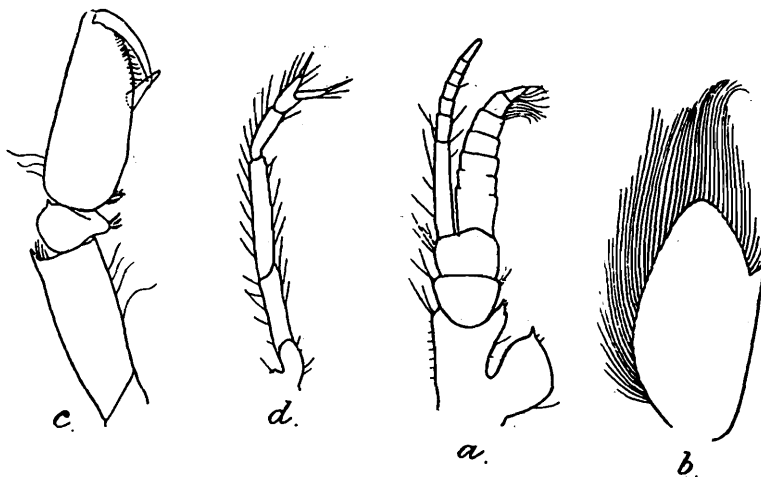
2 juv., 3 ♂, 4 ♀,
5.5-13 mm. TYPES.

Pontophilus plebs, sp. nov.

(Plate viii, fig. 5.)

The rostrum is longitudinally channelled; its lateral margins are convergent and meet in a narrowly rounded apex. The carapace is devoid of pubescence and is not carinated. It bears seven teeth, one situated mid-dorsally, close behind the rostrum and separated from it by a shallow transverse groove, and three pairs on either side. The latter comprise a stout hepatic tooth, on a level with that in the middle line, and two small teeth, both in advance of the hepatic, placed close together behind the sharp spinous branchiostegal angle. In the anterior half of the carapace there are obscure longitudinal furrows above and below the hepatic tooth.

The basal segment of the antennular peduncle (text-fig 5*a*) is longer than the two following combined, externally the distal

FIG. 5.—*Pontophilus plebs*, sp. nov.

a. Antennule.

b. Antennal scale.

c. First peraeopod.

d. Second peraeopod.

margin is produced to an acute tooth. The lateral process is more or less oval in shape, longer than broad, and is anteriorly pointed. The second and third segments are broader than long. The antennal scale (text-fig. 5*b*) is only twice as long as broad; the outer margin is straight and terminates in a tooth which is far exceeded by the distal end of the lamella.

The third maxillipedes reach beyond the scale by about half the length of the ultimate segment. The first peraeopods (text-fig. 5*c*) are scarcely shorter. The outer edge of the merus terminates in a large tooth and the margin between this tooth and the articulation of the carpus is unarmed. The carpus bears a stout external tooth. The hand is about two and a half times as long as wide and the single tooth which forms the 'thumb' of the sub-

chela is articulated, as in *P. candidus*, and not fixed as in most species of the genus.

The second peraeopods (text-fig. 5*d*) reach little beyond the end of the merus of the first pair. The merus is one third longer than the ischium and more than twice the length of the carpus. The dactylus is longer than the palm and conspicuously longer than the fixed finger, the fingers are of equal breadth and each bears a single stout seta at its apex. The whole limb is rather thickly clothed with hairs.

The slender third peraeopods reach beyond the end of the antennal scale. The carpus is a little longer than the merus and as long as the propodus and dactylus combined. The fourth and fifth peraeopods are shorter than the third. In the fifth pair the dactylus and propodus are subequal; the carpus is a little longer than the propodus and a little shorter than the merus.

In the male the last three segments of the thoracic sternum are carinate, the carina of each ending anteriorly in a small tooth. These carinae and teeth do not appear to exist in the female and in neither sex is there a sternal spine extending between the bases of the third legs.

The abdominal somites are smooth, without sculpture or pubescence; their pleura are rounded inferiorly. In the male the endopod of each of the last four pairs of pleopods is comparatively well developed and possesses an appendix interna. In the female there is no appendix interna and the endopod is very small in the second and third pairs, quite rudimentary on the fourth and absent from the fifth.

The telson, including the terminal spines, reaches a little beyond the end of the inner uropod. It is not sulcate above and bears two pairs of lateral spinules between which are two rows of exceedingly minute denticles. These denticles can only be seen if the telson is viewed obliquely from the side under a microscope; they extend from the base almost to the distal end and may be as many as sixteen in number. The apex is closely similar to that of *P. incisus*.

The outer uropod is shorter than the inner. It bears setae on its external margin and is fully three and a half times as long as broad.

The largest of the nine specimens obtained is only 6 mm. in length. No ovigerous females were found and it is possible, therefore, that all are immature. The characters are, however, quite distinctive and experience with other species leads me to believe that they would not change appreciably with further growth. The specimens were pale in life with sparse black dendritic chromatophores.

$\frac{9\frac{1}{10} \times 6}{10}$ Port Blair, Andamans, 2 fms. S. Kemp. 9, $4\frac{1}{2}$ -6 mm. TYPES.

The specimens were all found together in Phoenix Bay on a bottom of muddy sand.

Pontophilus hendersoni, Kemp.

1915. *Pontophilus hendersoni*, Kemp, *Mem. Ind. Mus.*, V, p. 261, pl. xiii, fig. 8.

The characters given in the key on pp. 356 and 357 will suffice to distinguish this species from all other Indian representatives of the genus.

P. hendersoni is very closely allied to *P. megalocheir* (Stebbing)¹, obtained at depths of 25 and 37 fathoms on the coast of S. Africa. The African form agrees in nearly all respects with that from the Indian coast; in particular, there is (as shown in Stebbing's figures) an almost complete identity of form in the structure of the subchela, the 'thumb' being composed of two closely juxtaposed spines instead of the single one found in all other species of the genus.

There are, however, certain discrepancies between Stebbing's account and my own, which, if substantiated, are sufficient to justify the separation of the two forms. The apex of the lamella of the antennal scale is, for instance, much more acute in *P. megalocheir* than in *P. hendersoni*, extending much further beyond the apex of the spine that terminates the outer margin (*cf.* Stebbing's pl. lxxix, fig. *a.i.* and my text-fig. 25*a*). Stebbing also has made no mention of the small tubercle found in *P. hendersoni* on the dorsum of the third abdominal somite and the armature of the telson is totally different. In *P. megalocheir* the telson is furnished at its apex with a long and slender tooth, flanked by a pair of plumose setae (*v.* Stebbing, pl. lxxix, fig. T). In *P. hendersoni* the apex consists of a triangular plate with a minute spinule on either side and with two pairs of plumose setae arising from beneath it (*v.* Kemp, text-figs. 25 g, g').

Since the original account of *P. hendersoni* was published, additional specimens have been taken in the open sea on the Orissa Coast, a circumstance which tends to confirm the view that the occurrence of the species in the outer channel of the Chilka Lake was purely accidental and that it is not normally an inhabitant of brackish water.

$\frac{9.5.8.6}{10}$ Puri, Orissa coast, 4-4½ fms. S. Kemp. 3, 6½-9 mm.

Pontophilus parvirostris, sp nov.

(Plate viii, fig. 6.)

The rostrum is extremely small, far less conspicuous than in any other species of the genus. It recalls that found in many Pagurids and consists merely of a small flat triangular prolongation of the median part of the carapace. The apex is acute and does not reach further than to one third the length of the eyestalks.

The antennal spine is sharp and extends far beyond the level of the rostral apex; the branchiostegal spine is long and reaches

¹ *Philocheras megalocheir*, Stebbing, *Ann. S. African Mus.*, XV, p. 71, pl. lxxix (1915). This work was not received in Calcutta in sufficient time to enable me to refer to it in my account of the Decapods of the Chilka Lake.

almost as far forwards as the ends of the eyestalks. The latter spine is flanked by a short carina which runs obliquely downwards and backwards and, above its posterior termination, in the anterior quarter of the carapace, there is another well marked spine. Except for this spine and for the carina mentioned above the entire surface of the carapace is smooth, save for a feeble transverse depression behind the frontal margin. On the sides of the carapace, most numerous below the branchiostegal carina, are some long silky hairs.

The thoracic sterna of the female are not carinate.

The eyes are elongate and their inner margins are contiguous; the cornea is well pigmented and its length in dorsal view is about equal to that of the stalk.

The basal segment of the antennular peduncle (text-fig. 6*a*) bears two stout teeth, one situated ventrally and one externally

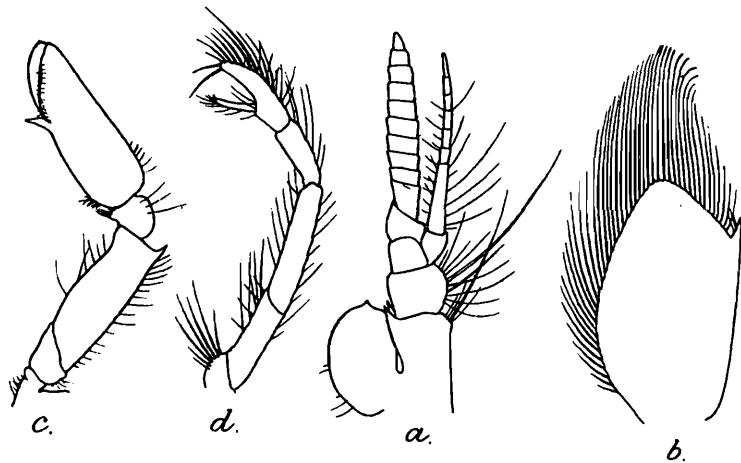


FIG. 6.—*Pontophilus parvirostris*, sp. nov.

a. Antennule.

b. Antennal scale.

c. First peraeopod.

d. Second peraeopod.

at its distal end. The lateral process is elongate oval and is furnished with a minute point anteriorly. The second and third segments are about equal in length and the outer flagellum in the female is about as long as the peduncle.

The antennal scale (text-fig. 6*b*) is about one and two thirds as long as broad; the outer margin is very slightly convex and terminates in a stout tooth which does not reach nearly as far forwards as the apex of the lamella.

The outer maxillipedes reach beyond the apex of the scale by more than half the length of the ultimate segment.

The first peraeopods (text-fig. 6*c*) reach as far forwards as the third maxillipedes and do not possess exopods. The merus bears a terminal (not sub-terminal) spine at the distal end of its outer margin. On the outer and inferior aspect of the carpus there is a sharp spine; the inner angle is produced and is provided with a

tuft of coarse setae. The basal breadth of the hand is little more than one third its entire length. The "thumb" of the subchela is stout and strongly deflected outwards. On the inner surface near the base of the propodus there is the usual tuft of coarse setae.

The second peraeopods (text-fig. 6*d*) reach about to the end of the merus of the first pair. The chela is a trifle longer than the carpus and is remarkable in that the dactylus is extremely slender, less than half the thickness of the fixed finger. As in allied forms the chela is very weakly constructed and is without terminal claws or definite cutting edges. The palm is about two thirds the length of the fingers and the propodus on its outer margin is densely fringed with long setae.

The slender third peraeopods reach beyond the scale by the whole length of the two ultimate segments. The merus is a little longer than the ischium and a little shorter than the propodus and dactylus combined. The carpus is twice the length of the ischium.

The fourth and fifth peraeopods are similar and stouter than the third. The merus is a little longer than the subequal carpus and propodus and about three times the length of the dactylus. The segments are rather densely clothed with hairs.

The abdominal somites are quite smooth, without carinae or grooves, and the margins of the pleura are rounded below. The sixth somite is about equal in length with the telson. The inner ramus of the last four pairs of pleopods is very short and does not possess an appendix interna. The uropods are half as long again as the telson and the exopod is nearly four times as long as broad.

The telson is rather broad at the base, but much narrowed at the apex. The margins are setose and there are two pairs of dorso-lateral spinules. The tip is triangular and sharply acute; beneath it three pairs of spinules arise, the innermost two thirds the length of the intermediate pair and two and a half times as long as the outer.

The colour in life of *Pontophilus parvirostris* was pale, mottled and spotted with dark umber, tending to maroon at the sides and on the appendages and forming distinct blotches on the pleura of the first, fourth and sixth abdominal somites.

The specimens are registered thus,—

$\frac{8989}{10}$ Kilakarai, Ramnad dist., S. India. S. Kemp. 4 ♀, 9-14 mm.
TYPES.

Genus *Aegeon*, Guérin Méneville.

1888. *Pontocaris*, Bate, *Rep. Challenger' Macrura*, p. 495.
1900. *Aegeon*, Stebbing, *Marine Invest. S. Africa*, I, p. 50.
1901. *Aegeon*, Alcock, *Cat. Indian deep-sea Crust. Macrura and Anomala*, p. 117 (including subgenus *Parapontocaris* p. 120).

All the described forms of this genus are represented in the collection of the Indian Museum. Three of them, *Aegeon orientalis*, Henderson, *A. habereri*, Doflein, and *A. lacazei*, Gourret, are intermediate in character between the more typical species of the genus and those which Alcock referred to the subgenus *Parapon-*

tocaris; the latter term should therefore lapse. *Aegeon orientalis* agrees with *Parapontocaris* in the complete absence of the hepatic groove and in the arrangement of the carinae on the first and second abdominal somites and resembles typical *Aegeon* in the very broad antennal scale and in the possession of strong median spines on the abdominal sterna. *Aegeon habereri* and *lacazei* are closely allied forms: in most respects they agree closely with typical species of the genus, but they resemble *Parapontocaris* in the sculpture of the first two abdominal somites and in the elongate form of the antennal scale.

In all six species of *Aegeon* are known from Indian waters; they may be distinguished by the following key:—

- I. Second lateral carina of carapace interrupted anteriorly by a well defined hepatic groove; lateral parts of 1st and 2nd abdominal somites irregularly lobed, without sharp longitudinal keels continuous with those on carapace.
 - A. Median carina of carapace with 4 teeth; two or three tubercles, forming an oblique transverse row, between median and 1st lateral carinae ... *cataphractus* (Olivi).
 - B. Median carina of carapace with 8 or 9 teeth or serrations; surface between carinae of carapace smooth, without tubercles.
 1. Marginal carina of carapace smooth; two lobules separated by a vertical furrow on either side of median carina of 2nd abdominal somite ... *pennata*, Bate.
 2. Marginal carina of carapace serrulate; a sinuous longitudinal ridge, entire and not divided by a furrow, on either side of median carina of 2nd abdominal somite ... *propensalata*, Bate.
- II. Second lateral carina of carapace not interrupted, hepatic groove absent; lateral parts of 1st and 2nd abdominal somites with sharp longitudinal keels continuous with those on carapace.
 - A. 1st and 2nd lateral carinae of carapace with 7 teeth, marginal with 7 to 9; antennal scale as broad as long ... *orientalis*, Henderson.
 - B. 1st lateral carina of carapace with 4 teeth, 2nd lateral with 3 to 6, marginal with 2 or 3; antennal scale much longer than broad.
 1. 2nd lateral carina of carapace with 5 or 6 teeth, marginal with 3; median carina of 2nd abdominal tergum bispinous ... *andamanense* (Wood-Mason).
 2. 2nd lateral carina of carapace with 3 teeth, marginal with 2; median carina of 2nd abdominal tergum unispinous ... *bengalense* (Wood-Mason).

Aegeon cataphractus (Olivi).

1900. *Aegeon cataphractus*, Stebbing, *Marine Invest. S. Africa*, I, p. 50 (*ubi syn.*).
1905. *Aegeon cataphractus*, Pearson, *Ceylon Pearl Oyster Fish., Macrura*, p. 89.

Except that the teeth on the carapace are blunter and that the abdominal sculpture is a little less sharply defined, I can find no difference between the two Indian specimens and others of similar size from the Mediterranean.

Characteristic of *A. cataphractus* are the supernumerary tubercles between the longitudinal carinae of the carapace. Between the median and uppermost carinae are two or three tubercles arranged to form an oblique transverse row, which commences in the middle of the carapace and extends forwards and outwards on either side. Between the first and second lateral carinae there is a single tubercle placed on the posterior edge of the hepatic groove. Though both the Indian examples are small these tubercles are clearly visible.

The occurrence of this species in India is interesting, for very few sub-littoral Decapoda are common to the Mediterranean and to Indian waters. Miers, however, states that the species probably occurs at Senegambia, while Stebbing records it from the Cape of Good Hope, so that there is reason to believe that the distribution is continuous round the African coasts.

In Indian waters *A. cataphractus* appears to be very scarce. Pearson has recorded it from the Ceylon Pearl Banks and there are two specimens in the Indian Museum, both obtained on the west coast of the peninsula:—

- $\frac{5.6.4.6}{9}$ 26 mi. W.S.W. of Honawar, N. Investigator. 1 ♀ 15 mm.
 Kanara dist., Bombay Pres., 28 fms.
 $\frac{9.1.3.1}{10}$ Karachi. W. T. Blanford. 1 ♂, 23 mm.

Aegeon pennata (Bate).

1888. *Pontocaris pennata*, Bate, *Rep. Challenger Macrura*, p. 449, pl. xci.
 1895. *Pontocaris pennata*, Ortmann, *Proc. Acad. Sci. Philadelphia*, p. 175.
 1901. *Aegeon affine*, Alcock, *Cat. Indian deep-sea Crust. Macrura and Anomala*, p. 188, and *Illust. Zool. Investigator*, pl. li, figs. 3, 4.
 1914. *Aegeon obsoletum*, Balss, *Abh. math.-phys. Klasse Bayer, Akad. Wiss. München*, Suppl. Bd. II, p. 70, pl. i, figs. 3.

Alcock, when describing *Aegeon affine*, suggested that the species might prove to be identical with Bate's *Pontocaris pennata*. The description and figures of the latter species being inadequate, the point could only be determined by actual comparison of specimens. In order to settle the question I sent co-types of *A. affine* to Dr. Calman, who, with his usual kindness, readily undertook to give me an opinion. He informs me that Alcock's suggestion is correct and that there is no doubt that the two forms are specifically identical.

An example of *Aegeon obsoletum*, determined by Balss, has been received in exchange from the Munich Museum; it was obtained in Sagami Bay, Japan, at a depth of 50-100 m. The individual agrees precisely with Indian specimens of *A. pennata*.

In addition to the characters noted by Alcock for the separation of this species from *A. medium* (= *A. propensalata*, Bate),

there is a marked difference between the two in the sculpture of the second abdominal somite. In *A. propensalata*, on either side of the middle line, there is a broad sinuous ridge which extends obliquely throughout the length of the somite. In *A. pennata* this ridge is broken in two by a deep vertical furrow.

Dr. Calman has kindly sent me the following notes regarding the types obtained by the 'Challenger'—"The three specimens of *P. pennata* differ among themselves in the form of the rostrum and other characters. In two specimens the rostrum is relatively short, bifid at tip, and with the lateral spines as large as in *A. medium*. In the third specimen the rostrum is longer, sharp-pointed, and with very small lateral spines. In this last specimen also there is a tendency towards a softening of the inequalities of the general surface, *i.e.* the keels and ridges are not so prominent. In particular the two lobules on either side of the median carina of the second abdominal somite are not sharply defined, although the vertical furrow separating them is distinct."

The following records of occurrence in Indian waters may be added to those given by Alcock:—

$\frac{19.11}{10}$	Persian Gulf, 26°20'30" N., 54°52'30" E., 35 fms. ...	Investigator'	Five.
$\frac{11.00}{10}$	Persian Gulf, 26°33' N., 52°23' E., 40 fms. ...	"	One.
$\frac{53.4.3}{10}$	Arabian Sea, 24°26'50" N., 66°35'50" E., 35 fms. ...	"	Seven.
$\frac{9.12.7}{10}$	Coromandel coast, 14°25' N., 80°15'45" E., 12 fms. ...	"	Two.
$\frac{17.0.7.8}{7}$, $\frac{20.8.7.0}{7}$	} Ganjam coast, 26-93 fms.	"	Twenty-two.
$\frac{23.0.5.4.0.1}{10}$, $\frac{21.8.7.0.2}{10}$			
$\frac{1.0.0.2}{7}$	28 mi. S.W. of Puri, Orissa, 25 fms. ...	"	Three
$\frac{02.8.0}{9}$	Off Gangetic delta, 20°18' N., 90°50' E., 65 fms. ...	"	One.
$\frac{9.12.6}{10}$	Off Tennasserim coast, 13°27'30" N., 97°37' E., 50 fms. ...	"	Two.
$\frac{1.0.0}{3}$	Off Cheduba, Arakan coast, 20 fms. ...	"	One.

According to the labels the individual from the neighbourhood of the Gangetic delta was "grey, touched with dark brown and green marks", while some of those from the Ganjam coast were irregularly banded with lichen green and mottled pink.

On the Indian coasts *A. pennata* is evidently common; it has been found at depths ranging from 12 to 93 fathoms. The type specimens were obtained by the 'Challenger' in the Arafura Sea, south of New Guinea, 8° 56' S., 136° 5' E., at a depth of 49 fathoms. Balss, under the name *A. obsoletum*, records numerous specimens from Japan from depths of 80 to 150 metres. The species is apparently one of wide Indo-pacific distribution.

Alpheon propensalata (Bate).

1888. *Pontocaris propensalata*, Bate, *Rep. Challenger Macrura*, p. 409, pl. xc, figs. 2, 3; pl. lxxxv, fig. 5.
1895. *Pontocaris propensalata*, Ortmann, *Proc. Acad. Sci. Philadelphia*, p. 175.

1899. *Pontocaris media*, Alcock and Anderson, *Ann. Mag. Nat. Hist.* (7), III, p. 282.
 1900. *Pontocaris propensalata*, Whitelegge, *Mem. Australian Mus.*, IV, p. 198.
 1901. *Aegeon medium*, Alcock, *Cat. Indian deep-sea Crust. Macrura and Anomala*, p. 120, and *Illust. Zool. Investigator*, pl. xli, fig. 6.

In this case also I am indebted to Dr. Calman for the elucidation of the synonymy. Dr. Calman has kindly compared co-types of *A. medium* with the type of Bate's *P. propensalata* and has sent me the following note on the subject.—“ I cannot find any difference between the type of *P. propensalata* and *A. medium*. The sculpturing of the abdominal somites is less sharp in the former and the serration of the supramarginal carina of the carapace is very obscure—as it tends to be in the smaller of the two specimens of *A. medium* that I have examined.”

The only specimens in the Indian Museum are those described by Alcock from the Andaman Sea, 55-66 fathoms. Bate's type specimen was obtained off the Ki Is., south of New Guinea, 5°49' 15" S., 132° 14' 15" E., at a depth of 140 fathoms, and Whitelegge has recorded the species from 50 fathoms in Botany Bay.

Aegeon orientalis, Henderson.

1893. *Aegeon orientalis*, Henderson, *Trans. Linn. Soc., Zool.* (2), V p. 446, pl. xl, figs. 16, 17.

Three specimens in rather poor condition from the Persian Gulf and the Andamans evidently belong to this species, which does not appear to have been recognised since it was first described more than twenty years ago.

The spinulation of the carapace agrees exactly with Henderson's description except that the serrations on the marginal carina vary in number from 7 to 9. The abdominal sculpture also agrees with the original description; but there are two longitudinal carinae on either side of the second abdominal somite, and the five carinae on the first somite, as well as the median carina on the second, end anteriorly in sharp spines. These spines were perhaps worn away in the type, which is larger than any of the three specimens here recorded.

Although, as Henderson has remarked, the species bears a rather marked resemblance to *A. cataphractus*, it is not in reality a very close ally of that species. As has already been pointed out it is intermediate in character between the more typical species and those that Alcock referred to the subgenus *Parapontocaris*. Pearson's suggestion that *A. orientalis* is merely an extreme variation of *A. cataphractus*¹ is certainly incorrect. *A. orientalis* may readily be distinguished (i) by the complete absence of the hepatic groove, (ii) by the smaller number of serrations on the marginal carina of the carapace, (iii) by the sharp longitudinal lateral carinae of the first two abdominal somites and (iv) by the presence of only a

¹ Pearson, *Ceylon Pearl Oyster Fisheries, Macrura*, p. 89 (1905).

single retrorse spine behind the middle point of each of the submedian carinae of the last abdominal somite. The spines on the first two abdominal somites, if their presence proves to be constant, will also serve to distinguish the two forms.

I think it improbable that the specimens from deep water off the Hawaiian Is., recorded by Miss Rathbun as *Egeon orientalis*¹, are correctly referred to this species. In the examples in the Indian Museum the middle tooth of the median carina of the carapace is not smaller than the rest and the denticulation of the second lateral and marginal carinae is also different. Moreover, the third and fourth abdominal somites though strongly sculptured, only bear a single lateral longitudinal carina. These carinae, which are submedian in position and are clearly shown in Henderson's figure, are sinuous and towards the hinder end of the somite are directed obliquely outwards; that on the third is entire, while that on the fourth is interrupted in the middle. There are certainly not two lateral carinae on the third and three on the fourth as in Miss Rathbun's description.

The specimens examined are registered as follows:—

$\frac{27}{10}$	Persian Gulf, 26°22' N., 56°10' E.,	Investigator.'	1 ♂, 18 mm. 1 ♀, 15 mm.
	48-49 fms.		
$\frac{230}{10}$	Port Blair, Andamans.	J. Wood-Mason.	1 ♂, 14 mm.

The type and only other known example of the species is recorded by Henderson from the Gulf of Martaban.

***Aegeon andamanense* (Wood-Mason).**

1901. *Aegeon* (*Parapontocaris*) *andamanense*, Alcock, *Cat. Indian deep-sea Crust. Macrura and Anomala*, p. 121, and *Illust. Zool. Investigator*, *Crust.*, pl. ix, fig. 2.

***Aegeon bengalense* (Wood-Mason).**

1901. *Aegeon* (*Parapontocaris*) *bengalense*, Alcock, *Cat. Indian deep-sea Crust. Macrura and Anomala*, p. 122, and *Illust. Zool. Investigator*, *Crust.*, pl. ix, fig. 1.
1912. *Aegeon* (*Parapontocaris*) *bengalense*, Kemp and Sewell, *Rec. Ind. Mus.*, VII, p. 22.

Genus *Prionocrangon*, Wood-Mason.

***Prionocrangon ommatosteres*, Wood-Mason.**

1901. *Prionocrangon ommatosteres*, Alcock, *Cat. Indian deep-sea Crust. Macrura and Anomala*, p. 123, and *Illust. Zool. Investigator*, *Crust.*, pl. ix, fig. 4.

Genus *Crangon*, Fabricius.

***Crangon crangon* (Linnaeus).**

I have compared the Indian specimens with examples from Plymouth and the only appreciable distinctions that I can find are

¹ Rathbun, *Bull. U.S. Fish Comm. for 1903*, p. 911 (1906).

that in the Indian form the rostrum is narrower and distinctly longer, reaching almost to the end of the eyes (*cf.* text-figs. 7*a*, *b*) and that the sixth abdominal somite is less distinctly grooved inferiorly. There is the closest resemblance between the two groups of specimens in the form of the subchela and antennal scale.

The characters yielded by the rostrum and last abdominal somite may ultimately afford grounds for the recognition of the Indian form as a distinct subspecies, but in my opinion are insufficient for specific distinction.

A number of forms very closely allied to the common European species have been recorded from Japan; Miss Rathbun¹, indeed, has reported the presence of *C. crangon* itself at Rikuoku (Rikuchu) and Hokkaido. Balss², the most recent author to discuss the Japanese forms, notes that Brashnikow³ (writing in Russian) has established the fact that *C. crangon crangon* does not occur in

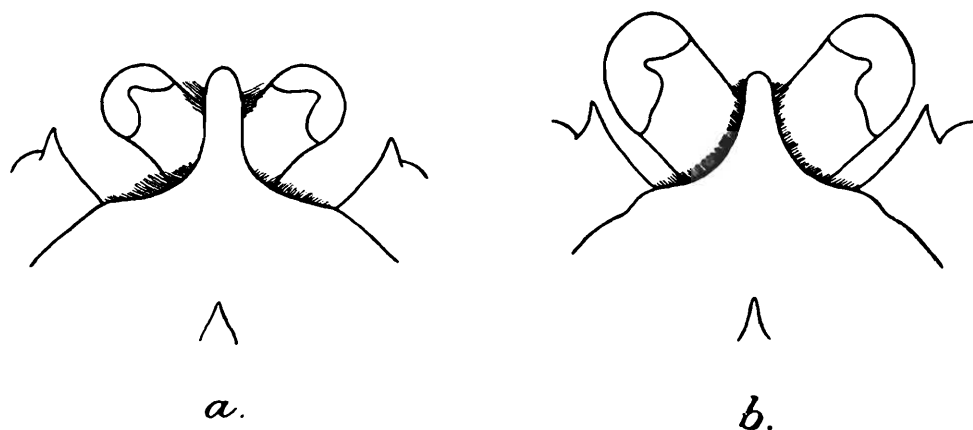


FIG. 7.—*Crangon crangon* (Linn.).

Anterior portion of carapace, rostrum and eyes: (*a*) of an Indian specimen: (*b*) of a specimen from Plymouth.

Japanese waters. He, however, gives a summary of the characters of *C. affinis*, de Haan, *C. propinquus*, Stimpson, *C. hakodatei*, Rathbun, *C. consobrinns*, de Man, and *C. cassiope*, de Man, and remarks that in the collections that he himself has examined these characters are inconstant, even in specimens from a single gathering. He regards the last four of the names just mentioned as synonyms of *C. affinis*, a form which he apparently considers to be merely a subspecies of *C. crangon*.

If Balss is correct, the retention of a distinct subspecific name for the Japanese form seems to have little to recommend it. The characters of *C. crangon*, if tabulated on Balss's plan, will evidently fall within the range of variation of the single Japanese

¹ Rathbun, *Proc. U.S. Nat. Mus.*, XXVI, p. 42 (1902).

² Balss, *Abhandl. math.-phys. Klasse K. Bayer. Akad. Wiss. München*, Suppl.-Bd. II, p. 62 (1914).

³ Brashnikow, *Mém. Acad. Imp. Sci. Nat. St. Pétersburg*, (8), XX, p. 84 (1907).

race that he recognises, the difference between the European and Japanese races consisting solely in the greater variability exhibited by the latter.

The Indian specimens do not show any marked variation, but the series is small. And even should their form prove constant, it is useless to speculate on the precise status of the different races until some general consensus of opinion on the Japanese forms has been reached.

Crangon crangon appears to be very rare on the Indian coasts; the only specimens in the Museum are the following :—

$\frac{4.1}{3}^5$ Akyab, Arakan coast. F. Stoliczka. 5, 35-52 mm.

THE STRUCTURE OF THE PLEOPODS IN *PONTOPHILUS*.

The recognition of the fact that in certain species of *Pontophilus* there are often marked differences between the sexes in the form of the pleopods, and that the species themselves also differ to a great extent in the development of these appendages, has led me to re-examine the material available in the Museum collection. In the Indian Museum twenty-one species of the genus are represented, a very considerable proportion of those that are known; but, unfortunately, in the case of thirteen only do we possess examples of both sexes.

Although in the development of the pleopods there is a certain amount of intergradation, it is possible roughly to classify the species according to the development of these appendages into five groups :—

Group I.

<p><i>P. norvegicus</i>, M. Sars <i>P. gracilis</i>, Smith <i>P. brevirostris</i>, Smith</p>	}	<p>Endopod of last four pairs of pleopods well developed in both sexes, with conspicuous appendix interna.</p>
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P. spinosus, Leach, *P. abyssii*, Smith, and *P. occidentalis*, Faxon, represented in the collection by female specimens only, doubtless also belong to this group.

Group II.

<p><i>P. sculptus</i> (Bell) <i>P. incisus</i>, sp. nov. <i>P. australis</i>, Thomson</p>	}	<p>Endopod of last four pairs of pleopods comparatively well developed in male, reduced in female. Appendix interna present in male on all four pairs, but somewhat rudimentary on the last; in female present on 2nd and 3rd pairs, rudimentary on 4th and absent from 5th.</p>
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P. chiltoni, Kemp, known from female specimens only, also in all probability belongs to this group.

Group III.

- | | | |
|--|---|--|
| <i>P. lowisi</i> , sp. nov.
<i>P. pilosus</i> , sp. nov.
<i>P. candidus</i> , sp. nov.
<i>P. plebs</i> , sp. nov. | } | Endopod of last four pairs of pleopods comparatively well developed in male, reduced in female. Appendix interna present on all four pairs in male, but entirely absent in female. |
|--|---|--|

Group IV

- | | | |
|-----------------------------|---|--|
| <i>P. sabsechota</i> , Kemp | } | Endopod of last four pairs of pleopods large and well developed in female, quite rudimentary in male. Appendix interna absent in both sexes. |
|-----------------------------|---|--|

Group V

- | | | |
|---|---|---|
| <i>P. bispinosus</i> , Hailstone
and Westwood.
<i>P. trispinosus</i> , Hailstone. | } | Endopod of last four pairs of pleopods much reduced in both sexes. Appendix interna absent in both sexes. |
|---|---|---|

P. echinulatus (M. Sars), *P. victoriensis*, Fulton and Grant, *P. hendersoni*, Kemp, and *P. parvirostris*, sp. nov., represented in the Museum collection by examples of one sex only, also in all probability belong to this group.

In Group I the appendix interna is usually tipped with a series of small coupling hooks, which are ill-developed or absent in other groups that possess this appendage. In Group V the separation of a distinct segment at the base of the endopod is clearly marked, whereas in Group I the division is obscurely indicated.¹

P. sabsechota, the sole species comprised in Group IV, is apparently an abnormal form, the distinction between the sexes in the size of the endopod being the reverse of that found in any other species which in this respect exhibits sexual differences. The remaining groups clearly form a morphological series characterised by the progressive reduction of the endopod and by the reduction and suppression of the appendix interna. Group I in which the pleopods have retained their full development is clearly the most primitive, while Group V in which they are more reduced than in any other is the most specialised. It is noteworthy that Group I includes all the deep-water forms in the collection.

The facts are not only of interest in the light they throw on the development of the species within the genus; they also, as it appears to me, form a valuable clue to the evolution of the family as a whole, for the other genera can be divided into two sections agreeing, respectively, in the development of their pleopods with

¹ Cf. Wolleback, *Bergens Museums Aarbog*, 1908, no. 12, p. 44, text-fig. 2.

Groups I and V of *Pontophilus*. Ortmann¹ in 1890 published a genealogical tree of the five genera known to him; but the evidence afforded by the pleopods leads to results directly at variance with those which he obtained and it will be well therefore to discuss the matter briefly.

The two most primitive groups of species in the family are in all probability *Aegeon* and *Pontophilus*, Group I. They possess—most of them at any rate—a rudimentary exopod on the first legs, the number of branchiae is at least as great as that in any other genus and the endopod of the last four pairs of pleopods is well developed and possesses an appendix interna. In *Aegeon* the second leg is larger than in *Pontophilus*, Group I, agreeing more nearly with that of Group V, and the former genus also possesses a rather larger number of branchiae than the latter. In this last feature it appears to be the more primitive of the two, but in the curious C-shaped form of its gills it presents a character not known in any other genus of Caridea. *Aegeon*, in my opinion, must be regarded as an offshoot of the original stock from which the other genera are descended.

The evolution of the remaining genera of Crangonidae can, I think, be traced back to *Pontophilus*, from which there have been two main lines of descent, originating respectively in Group I and in Group V

In Group I of *Pontophilus*, as has already been noted, the second leg is shorter than in the other groups and it is not difficult to understand how *Sabinea*, Owen, and *Paracrangon*, Dana, have arisen from it by successive steps. In *Sabinea* the pleopods are as well developed as in any species of Group I and possess a conspicuous appendix interna; the second leg has, however, undergone further reduction; it is smaller than in any species of *Pontophilus* and terminates simply, the chela being altogether suppressed. *Paracrangon* is apparently a further development on the same line. The second legs are entirely absent and the endopod in the last four pairs of pleopods, though large and well-formed, is without appendix interna.

The other line of development has apparently arisen through forms similar to those of Group V and terminates in four branches, representing respectively the genera *Crangon*, L., *Sclerocrangon*, Sars, *Argis*, Kröyer (= *Nectocrangon*, Brandt) and *Prionocrangon*, Wood-Mason. In all these genera the endopod of the last four pleopods is greatly reduced, possesses a well marked basal segment, and is devoid of appendix interna.

The evidence afforded by the development of the second leg is, in this case, rather difficult to interpret. In all the four genera named above it has a proportionately greater length than in any species of *Pontophilus*; in *Prionocrangon*, evidently a very highly specialised form, it terminates simply, while in the other three it is chelate. But it must be presumed that all Crangonidae have

¹ Ortmann, *Zool. Jahrb., Syst.*, V, p. 530 (1890).

primarily arisen from a form in which this limb was well developed and *a priori* it was not to be expected that the four genera had passed through a stage in which it was to some extent reduced.

It is, however, difficult to see how it could have been otherwise. *Crangon* and its allied genera might, indeed, have arisen independently from an ancestor of *Pontophilus*, that is to say from a form differing from Group I of that genus only in the possession of long second legs. In this case the pleopods must have evolved separately in the two instances; with the result that their identity of structure, as we see it to-day in *Crangon* and the related genera on the one hand and in *Pontophilus*, Group V, on the other, is an example of convergence.

I am inclined to think that this conclusion is erroneous. The tendency that clearly exists towards the reduction or suppression of the second pair of legs shows that these appendages are unusually plastic in Crangonidae: the monodactylous condition of these limbs in *Sabinea* and *Prionocrangon* is evidently an instance of convergence and affords no evidence of real affinity. The structure of the pleopods is more likely to yield a trustworthy estimate of relationship.

Of the genera *Vercoia*, Baker¹, and *Coralliocrangon*, Nobili², I have seen no examples. In the former, according to a sketch kindly sent me by Mr. Baker, the endopod of the last four pleopods is comparatively large, but without appendix interna. The genus has perhaps arisen separately from forms similar to those in Group III of *Pontophilus*; it differs from all species of the latter in the monodactylous character of the second legs. Owing to lack of information regarding the pleopods, it is impossible to make any suggestion regarding the relationships of *Coralliocrangon*. This is particularly unfortunate, for the persistence in the genus of the *linea thalassinica* points to its being a survival of some very primitive form.

¹ Baker, *Trans. Roy. Soc. S. Australia*, XXVIII, p. 158 (1904).

² Nobili, *Ann. Sci. Nat. Zool. Paris*, (9), IV, p. 82 (1906).
