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STUDIES ON GAMMARIDEAN AMPHIPODA (CRUSTACEA) FROM INDIA

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ABSTRACT

Three gammaridean amphipods are described in this paper and one of them, *Pontogeneia barnardi*, is new to science. Sufficient distinctions have been recognised in *Perioculodes megapleon* (Giles) for reviving this species and keeping it separate from *Perioculodes longimanus* (Bate & Westwood). A discussion on the relationship of some genera very closely related to *Perioculodes* Sars is also included. A brief description of *Quadrivisio bengalensis* Stebbing is given, pointing out some noteworthy variations from the original description.

Three species of gammaridean amphipods are described in this paper. Of these, *Perioculodes megapleon* (Giles, 1890) (family Oedicerotidae), was obtained in large numbers from both offshore and inshore plankton collections, while *Pontogeneia barnardi* sp. n. (family Eusiridae) is an inhabitant of the ocean littoral, associated with the algal growth on submerged rocks. *Quadrivisio bengalensis* Stebbing (1907) (family Gammaridae) was collected from the Kayamkulam lake in Kerala, exhibiting marked fluctuations in salinity. (For details on the range in salinity of this lake, see Rabindranath, 1971). Since its original description by Giles, *Perioculodes megapleon* was redescribed by Pillai (1957). But one or two noteworthy variations, not mentioned by Pillai and which appear to have some generic value, came to light during the present investigation, and therefore, an illustrated description of the species is included in this report. Material of *Pontogeneia* is difficult to identify because many characteristics are nearly identical. However, the species described herein possesses a few characters which justify the creation of a new species. *Quadrivisio bengalensis* is a typical brackish water form and the single male specimen in my collection is nearly identical with the type. A few variations which were noticed are pointed out, and a brief diagnosis of the male is given.

Part of the material, including paratypes of the new species, is deposited in the Zoölogisch Museum, Amsterdam; the remaining specimens in the Marine Biology Laboratory, University of Kerala, Trivandrum, India.

Perioculodes megapleon (Giles, 1890). Figs. 1 and 2.

Monoculodes megapleon Giles, 1890: 235, pl. 7 fig. 51.

Perioculodes megapleon Stebbing, 1906: 238; Pillai, 1957: 41-43, fig. 6.

Material.- 20 ♀♀ and 11 ♂♂ were obtained from the offshore plankton collections at Mandapam, Gulf of Mannar and 11 ♀♀ from the inshore plankton collections at Trivandrum. 23 ♀♀ and 12 ♂♂ were obtained from an offshore plankton collection made at Thankasserry, Quilon, Kerala.

Female.- Body with reddish-brown chromatophores. Cephalon galeate, slightly longer than first 3 pereaeon segments combined, with a short, deflexed rostrum, lateral corners smoothly rounded. Eyes scarlet, dorsally contiguous and extending laterally as far as the base of the 1st antenna. First 3 pleon segments with convex lower margins and rounded posterolateral angles. Fourth pleon segment about $\frac{3}{4}$ as long as 3rd and subequal in length to 5th and 6th combined. Telson longer than broad, distally somewhat excavate and armed with 2 pairs of setae, inner pair longer. First coxa obliquely truncated below, 2nd and 3rd oblong, former narrower, 6th coxal plate also with an obliquely truncated lower margin.

Antennae subequal in length. Second peduncular segment of 1st antenna $\frac{1}{3}$ longer than 3rd, flagellum longer than peduncle and 10-segmented. Last 3 peduncular segments of 2nd antenna subequal in length, flagellum 9-segmented and about as long as the last 3 segments of peduncle combined.

Rounded lower border of upper lip hirsute. Incisor process of mandible feebly toothed, lacinia mobilis bidentate, spine row consisting of 6 flat spines, molar obsolete, palp arising at the level of the molar, apparently 4-segmented, 1st segment shorter than 2nd and unarmed, the two together nearly as long as 3rd, 4th segment slender, about as long as 2nd and with 4 long apical spine-setae. Inner lobe of 1st maxilla oval, rounded distal margin with fine setules and a seta. Outer lobe armed with 7 spine-teeth. Second segment of palp with 9 distal spine-setae. Inner lobe of 2nd maxilla with a swollen base and a truncated apex, outer lobe about as tall as inner and distally rounded. Inner lobes of lower lip placed much lower than usual, apparently not coalesced as hitherto mentioned in literature, hairy along the overlapping inner margins. Apices of outer lobes with a pair of teats on the inside, inner margins hirsute, mandibular processes short, blunt and projecting outwards. The oblong inner lobe of maxilliped with 4 apical setae. Outer lobe tall and nearly reaching the distal margin of 2nd endopod segment, inner border with a row of long, slender spine-teeth. Second endopod segment broad, 3rd segment shorter than 2nd, dactylus strong, curved and as long as 3rd segment.

Gnathopods alike, chelate, 2nd slightly longer. Basis of 1st gnathopod equalling the combined length of the following segments, merus triangular and underriding carpus, inner distal part of carpus produced into a long flexuous process, reaching the tip of propodus and beset with setules on outer border. Propodus oblong, palm oblique, convex, defined by a minute tooth and fringed with a row of spinules. Dactylus slender, curved and as long as palm. Basis of gnathopod 2 shorter than the combined length of the following segments, carpal process more setose, palm comparatively shorter than in gnathopod 1 and defined by a prominent spine. Peraeopods 1-4 densely setose, first 2 subsimilar, basis of 1st slightly longer than next 2 segments combined, outer margin pectinate, merus $\frac{2}{3}$ the length of basis, carpus $\frac{1}{3}$ shorter than merus, propodus subrectangular, subequal

to carpus in length, inner margin with a row of short spines, outer border distally pectinate, dactylus small, subterminal and spine-like. Peraeopods 3 and 4 subsimilar, 4th longer, basis flattened, longer than next 2 segments combined, carpus more than 1/2 length of merus, latter much expanded distally, propodus slender, dactylus nearly straight, flattened, about 1/2 as long as propodus and with a serrate inner margin. Fifth peraeopod very long, basis nearly as long as next 2 segments combined, outer border distally lobe-like, inner margin very minutely pectinate, merus and carpus subequal in length, propodus shorter than carpus, dactylus straight, shorter than propodus and spiny as the preceding segments. Margins of segments 3 - 7 pectinate.

Peduncle of 1st uropod serrate along upper border, longer than the slender subequal rami, opposing margins of rami proximally serrate. Second uropod identical to 1st, but outer ramus slightly longer than inner. Peduncle of 3rd uropod with pectinate upper border, rami subequal in length and longer than peduncle.

Length 3.6 mm.

Male.- The male differs from the female in the following respects:

The flagellum of antenna 1 is closely fringed with fine hairs. Penultimate segment of peduncle of 2nd antenna subequal in length to the ultimate segment and profusely setose. Flagellum slender and longer than body.

Mandibular palp much elongated, 3-segmented, first segment about 1/3 as long as 2nd, 2nd much elongated and longer than 3rd, 3rd segment shaped like a cutlass, pectinate inner border carrying a row of 13 spine-setae, outer convex border with a spine-seta on the distal half.

Dactylus of 5th peraeopod very long, with fascicles of long setae and short spines on its inner surface, apical seta much longer than in female.

Length 3.1 mm.

Discussion.- The original description of *P. megapleon* was rather poor and Chilton (1921), depending on this description by Giles, went wrong in suggesting that *P. megapleon* (Giles) was a synonym of *P. longimanus* (Bates & Westwood, 1868). Pillai (1957) redescribed *P. megapleon* giving better figures. However, he did not illustrate the mouth parts. Part of the material that I have, was obtained from the same locality from where Pillai collected his, and I find that it is nearly identical in all aspects.

My specimens show the following noteworthy differences from *P. longimanus*, as described by Sars (1895): (1) the telson is distally emarginate; (2) the inner lobes of the lower lip are vaguely separated and they overlap one another internally; and (3) the mandibular palp is markedly different in the two sexes. Since these variations are of some importance when relationships between the different oedicerotid genera are considered, a discussion on them is warranted.

(1) Telson: the genus *Perioculodes* possesses a telson which is entire, whereas a distally emarginate telson is a character assigned to *Perioculopsis* Schellenberg, 1925. According to J.L. Barnard (1969a), this is the only important character which distinguishes *Perioculopsis* from *Perioculodes*. If this is so, then my specimens must be regarded as belonging to Schellenberg's genus. Schellenberg erected the genus *Perioculopsis* based on a single female and described the type species, *P. lophopus* Schellenberg, as differing from *Perioculodes* in (1) the short 1st antenna with the 3rd peduncular article shorter than 2nd, (2) the posteriorly excavate telson and (3) the truncate posteroventral edge of coxa 6. The female that I have described satisfies all these criteria. In Pillai's description also the telson has the "distal border bilobed" and the 3rd

peduncular article of 1st antenna shorter than 2nd. Hence, I very seriously doubt the validity of *Perioculopsis*.

(2) Lower lip: Sars described and figured the lower lip in *P. longimanus* with coalesced inner lobes. In my specimens however, I could detect a pair of vaguely separated overlapping inner lobes (fig. 1J), with hairy inner borders. It is not possible to say whether Sars went wrong about the structure of the lower lip in *P. longimanus*, as it is quite unusual of him to do so. Therefore, for the time at least, one has to contend that *Perioculodes* possesses a lower lip with either fused or vaguely separated inner lobes. If this is true, then a reappraisal of some of the oedicerotid genera, erected chiefly on the basis of the structure of the lower lip, is called for. For example, J.L. Barnard (1971) contented that his new genus *Finoculodes* differs from *Perioculodes* "principally by the distinct pair of inner lobes of the lower lip" (p. 49). *Finoculodes omnifera* J.L. Barnard possesses a lower lip whose inner lobes are nearly similar to the one I have figured - "separate inner lobes, defined by a fold of chitin". But the outer lobes of the lower lip in Barnard's species are differently shaped and without the characteristic inner distal processes of *Perioculodes*. Further, in Barnard's species the inner lobes are placed in a line with the outer, instead of being deeply sunk and pleustid-like, as is the case in *Perioculodes*. It may, therefore, be presumed that the genus *Finoculodes* differs from *Perioculodes* principally in its dissimilar gnathopods, with a transverse palm for the 2nd and perhaps in the structure of coxa 6.

The monotypic genus *Arrhinopsis* Stappers, 1911 (see Gurjanova, 1951) differs from *Perioculodes*, chiefly in the absence of the rostrum and in the presence of separate inner lobes for the lower lip. In the light of the observation discussed above, I doubt whether the absence of the rostrum can be regarded as a character of importance by itself for keeping *Arrhinopsis* as a separate genus. It will be more proper, I think, to consider *Arrhinopsis* as a subgenus under *Perioculodes*, because other characters such as the possession of similar gnathopods with long article 5 guarding article 6, the nontritulative molar for the mandible, and a 2nd uropod reaching the end of uropod 3, are common to both genera. It is hoped that taxonomists will consider this question when a revision of the family is undertaken.

(3) Mandible: From the figures I have given it is evident that the mandibular palp of *Perioculodes* shows sexual dimorphism. In the male (fig. 1L), the 2nd article is much elongated and the 3rd, which is only slightly shorter, is cutlass-shaped. Further, the latter segment bears along the inner pectinate border a row of slender spine-setae. In the female (fig. 1G), the basal segment of the palp is faintly divided by a partition, thus giving rise to an apparently 4-segmented palp. It cannot be correctly ascertained whether this partition is a false one or not, but a truly 4-segmented palp for the mandible is observed in the female of yet another gammaridean species, viz. *Ampelisca cyclops* Walker, 1904 (personal observation). Moreover, the first '2 segments' together are as long as the 'third' (which corresponds to the 2nd segment in the male) and the 'fourth segment' is slender, only 2/3 as long as the 'third' and without the inner row of marginal spine-setae. Pillai's description of the mandible suits the condition noticed in the female because according to him, the 2nd segment of the palp is "very long, third short". In *Finoculodes omnifera* (Barnard had a single male) also, article 3 of the mandibular palp is "nearly as long as 2" and the palp as a whole appears to be subsimilar to the counterpart in my specimen, except that the 2nd segment of the palp in Barnard's species is slightly bent outwards and the 3rd segment lacks the outer seta noticed in *P. megaleon*. It is, however, very surprising that Schellenberg's *Perioculopsis lophopus* also has a mandibular palp with subequal 2nd and 3rd articles, the latter bearing marginal setae, as in the male of *P. megaleon*.

J.L. Barnard (1971) has given different views of the mandibular molar of *Finoculodes omnifera* and states that it is "armed with a large articulated process" (p. 49). I wonder whether Barnard was really referring to one of the spines of the spine row, abnormally placed and appearing as a process of the molar. Reference to my figure (fig. 1G) shows that the spine row consists of 6 flat spines, one of which appears to arise from the produced part of the obsolete molar.

Obviously, *Perioculodes megapleon* combines the characteristics of *Perioculodes*, *Perioculopsis* and *Finoculodes*, its closest relative being *Perioculodes longimanus*. The variations noticed in the present material may warrant its transfer to a new genus, but a decision should be postponed until one gets a chance to reexamine the type of *P. longimanus*, particularly for ascertaining the structure of the lower lip. For the present, it is thought safer to revive Giles's species and to regard the present material as well as that studied by Pillai as belonging to this species. It is significant that these three collections are all from the Indian waters.

Nayar (1959) described a few specimens collected from Madras as *Perioculodes longimanus*. It is very probable that these may rightly belong to the present species, since his collections were also from the coastal waters of India.

Pontogeneia barnardi sp. n. Figs. 3, 4, 5.

Material.- 4 ♂♂ and 6 ♀♀ were collected from among green algae growing on submerged rocks in the littoral region of Manoli Island (Gulf of Mannar). 4 ♂♂ were obtained from a similar habitat at Thankasserry, Kerala.

Male.- Cephalon slightly longer than first 2 peraeon segments combined, produced into a short, blunt decurrent rostrum, post-antennal corners very slightly produced and rounded; eyes round and large. Last peraeon segment a little longer than the rest and minutely serrate along posterodorsal margin. Pleon segments somewhat compressed, 1st segment with rounded distal border, 2nd and 3rd with a submarginal row of setules on lower margin, posterolateral angles blunt and distal borders bulging. Fourth pleon segment about $\frac{3}{4}$ as long as 3rd, with a shallow dorsal depression near the middle, 5th segment $\frac{1}{3}$ that of 4th in length, 6th almost triangular and about $\frac{1}{2}$ as long as 4th. Telson extending to more than $\frac{1}{3}$ the length of 3rd uropod, cleft to more than $\frac{1}{2}$ its length, each lobe apically rounded and with a row of submarginal lateral setules. Coxal plates 1 to 3 oblong, lower borders broadly crenulate, 4th about as broad as deep, hind margin a little produced and lower margin convex. Hind lobes of 5th and 6th coxae rounded and deeper than front lobes, 7th coxa nearly oval.

Antennae subequal in length, about $\frac{2}{3}$ the length of body; 1st peduncular segment of 1st antenna nearly twice as long as 2nd, 3rd segment small and carrying an obsolete flat-topped setose lobe, probably representing a vestigial accessory flagellum; flagellum about 4 times the length of peduncle, 31-segmented. Last 2 segments of peduncle and almost every alternate segment of flagellum with calceolus and aesthetasc. Fourth and 5th peduncular segments of 2nd antenna subequal in length, former broader and the latter with the upper distal end slightly produced, flagellum about 2.5 times the length of peduncle, 35-segmented, calceoli present as on 1st antenna.

Free margin of upper lip rounded and strongly hirsute. Incisor process of mandible strongly dentate, lacinia mobilis narrow, upper margin cut into a row of teeth, spine row with 4 pectinate spines and a few bristles at their base, molar strongly dentate and with a plumose seta. Palp stout, 1st segment about $\frac{1}{3}$ the length of 2nd, 2nd oblong, distally with a row of pectinate spines on the sloping inner margin, 3rd segment slender, slightly curved and about $\frac{2}{3}$ as long as 2nd, apex and inner margin with strong pectinate spines, inner surface hairy. The small inner lobe of 1st maxilla with 3 apical plumose setae, outer lobe with hairy inner margin and 10 barbed spines on distal border.

First segment of palp $1/5$ shorter than 2nd, expanded at the outer distal part, 2nd segment oblong, apically rounded and armed with 8 short spines, inner border hairy. Inner lobe of 2nd maxilla smaller than outer, both lobes distally setose. Lower lip without inner lobes, outer lobes large and with short, blunt, mandibular processes. Inner plate of maxilliped not reaching end of 1st endopod segment, with 3 spine-teeth on distal border and a fringe of setae on inner margin, outer lobe not reaching end of 2nd endopod segment, endopod segments subequal in length, the slender 3rd segment distally produced over the 4th on the outside; ultimate segment spiniform, slightly curved and with a few barbs on inner margin.

Gnathopods subequal in size; basis of 1st about as long as next 3 segments combined, merus distally produced, carpus elongate-triangular, about $1/2$ length of basis, propodus oblong, poorly armed and subequal in length to carpus, inner border $1/3$ shorter than outer, palm oblique and defined by 2 spines. First 3 segments of 2nd gnathopod subsimilar to corresponding ones of the 1st, carpus triangular, inner distal part produced and lobe-like, distal margin serrate, propodus longer than carpus, palm slightly convex, defined by 2 spines, dactylus reaching palmar spines. Basis of first 2 peraeopods equal to combined length of next 2 segments, merus and carpus subequal in length, propodus as long as basis, dactylus curved and $1/2$ as long as propodus. Basis of 3rd peraeopod flattened, longer than broad, outer convex margin overlapping ischium at the distal part, remaining segments as in 1st peraeopod, but propodus longer than basis. Basis of peraeopod 4 much expanded proximally, inner surface with 3 or 4 plumose setae, that of 5th peraeopod about as long as broad, distal expansion of outer margin more prominent than in 3rd peraeopod, outer margin crenulate, remaining segments subsimilar to those of 3rd peraeopod, but dactylus with a row of minute spines on the proximal half of inner margin.

Uropods 1 and 2 subsimilar, 1st extending much beyond 2nd, its peduncle longer than inner ramus and strongly spiny, outer ramus $1/3$ shorter than inner, outer margin of inner and inner margin of outer ramus serrate, outer ramus unarmed on margins, apex in both faintly bifid and carrying strong spines. Outer margin of peduncle of 2nd uropod indistinctly serrate, rami as in 1st uropod. Peduncle of 3rd uropod about $1/2$ as long as rami, lower border serrate, rami subequal in length, lanceolate, apically drawn out and spine-like, margins with spines and plumose setae, outer ramus broader than inner at base.

Branchiae pleated and somewhat similar to those of *Atylus minikoi* (Walker, 1905).
Length 2.4 mm.

Female.- Second, 3rd and 4th coxae broader than in male.

Antennae shorter than in male and without calceoli. Flagellum of 1st antenna 13-segmented and about twice the length of peduncle. Flagellum of 2nd antenna $1/4$ longer than peduncle, 12-segmented, 1st segment nearly as long as the ultimate peduncular segment.

Lacinia mobilis of mandible feeble, palp slender, former spiniform, latter with a narrow 2nd segment, twice as long as 3rd, apical segment much narrower than in male and nearly straight. Second segment of palp of 1st maxilla obliquely truncate distally and saw-like, armed with a closely packed series of 7 sharp spine-teeth and with 3 short spines on outer apex.

Length 2.7 mm.

Discussion.- As pointed out in the introduction, the taxonomy of this genus requires urgent revision, since many of the species now listed under it possess characters which are nearly identical and differences of a clear cut nature are hard to find among them. According to J.L. Barnard (1969a), Pon-

togeneia Boeck (1871) possesses the following important characters: (1) accessory flagellum absent; (2) lower lip with small inner lobes, outer lobes not broadly separated; (3) inner lobe of 1st maxilla with 4 or more terminal or subterminal setae; (4) article 5 of gnathopods not lobate and slightly longer than article 6; (5) peraeopods 3 to 5 with segments 4 to 6 each not longer than segment 2, segment 4 slender.

A survey of the genus, however, shows that intergradations are common among its species with regard to most of these characters. For example, in *Pontogeneia minuta* Chevreux, 1908, J.L. Barnard (1959) has illustrated an accessory flagellum which is more than a fused process. Likewise, the lower lip of *Pontogeneia pacifica* Schellenberg, 1938 (see J.L. Barnard, 1970) is very similar to that of the present species: without inner lobes. The structure of the 5th article of the 2nd gnathopod is also highly variable. Though it is non-lobate in the type species, *P. inermis* (Kröyer, 1838) (see Sars, 1895), in others such as *P. longleyi* Shoemaker, 1933, *P. pacifica* and *P. minuta*, this segment carries an inner lobe as in the new species. The proportionate length of gnathopod segments 5 and 6 is also not a stable character, since it could be either subequal as in *P. rostrata* Gurjanova, 1938, or article 5 slightly longer than article 6 as in *P. inermis*, or the reverse as seen in *P. pacifica* and the present species. Similarly the relative length of articles 2 and 6 in peraeopods 3 to 5 is also variable as can be seen in *P. pacifica*, *P. rostrata* and *P. intermedia* Gurjanova, 1938, where article 2 is not as long as article 6. In *P. barnardi* sp. n. also, segment 6 is longer than segment 2 in peraeopods 3 to 5. Under the circumstances, the only criterion left is the number of setae arming the inner lobe of the 1st maxilla. The present species has, however, one seta less than the typical condition assigned to the genus. But, in the light of the high variability exhibited by the species of this genus, I doubt whether this subtle difference can be of much significance. *P. nasa* J.L. Barnard, 1969b, also has only 3 setae on the inner plate of 1st maxilla.

P. barnardi sp. n. appears to be closely related to *P. pacifica*. They more or less agree in the structure of the pleonal epimera 1 to 3, rostrum, antennae, lower lip and uropods. The gnathopods are also nearly identical, except that the 1st gnathopod of *P. pacifica* has on the inner margin of propodus a spine, absent in the new species; and the lobe on article 5 of the 2nd gnathopod of *P. barnardi* carries a row of short spines on the inner edge, in the place of the marginal hairs found in Schellenberg's species. Further, the distal border of this segment is irregularly dentate in the new species. Among the more important features characteristic of the present species may be mentioned the structure of 1st maxilla and the armature of the inner lobe of the maxilliped. As already pointed out, the inner lobe of the 1st maxilla in *P. barnardi* carries only 3 setae apically and the palp of this appendage is much flattened. The 2nd segment of the palp is only 1/5 longer than the 1st and is distally armed in the male with a row of submarginal spines. In *P. pacifica* this segment is nearly double that of the 1st in length and carries a row of spine-teeth and 2 spine-setae instead. In the female of the new species, however, the palp is more flattened than in the male, but the armature is subsimilar to that of the male of *P. pacifica* (see J.L. Barnard, 1970, fig. 64b). The total absence of setae on the outer border of the maxilliped inner plate is another character distinguishing *P. barnardi* from *P. pacifica*. The mandibular palp is also slightly different in these two species. It bears an outer pectinate seta on the 3rd article in Schellenberg's species, which is absent in *P. barnardi*. The spine row of the mandible consists of 4 spines in the new species against 3 in *P. pacifica*.

J.L. Barnard's illustration of the telson of *P. pacifica* shows that the lobes are distally truncate. This cannot be regarded as a case of abnormality, since Barnard had more than one specimen

in his collection. The telson of *P. barnardi* has its lobes distally rounded. To add to these differences, the dactylus of peraeopod 5 in the new species carries a row of minute spines near the base, which is absent in *P. pacifica*.

In the structure of the 1st antenna, mandibular palp and the female gnathopods, *P. barnardi* resembles *P. nasa*. However, the male gnathopods are different in the 2 species. The denticulation of the distal margin of article 5 of gnathopod 2, which I have observed in the males of the new species, are present in the females of *P. nasa*. Further, the distal margin of the 3rd pleon epimeron of *P. nasa* is serrate, whereas it is smooth in *P. barnardi*.

P. barnardi also shows some affinity to *P. rostrata*, particularly in the shape of the rostrum (as illustrated by Nagata, 1960), and in the structure of the accessory flagellum. But, in *P. rostrata* the 1st maxillary palp is much less flattened, and the gnathopods do not have any lobe on carpus. Moreover, pleonal epimera 1 to 3 of *P. rostrata* possess a minute tooth at their lower hind corner, and the hind margins of these segments are non-sinuate.

The new species is named after Dr. J.L. Barnard, in recognition of the splendid research carried out by him on the gammaridean amphipods.

Quadrivisio bengalensis Stebbing, 1907. Figs. 6, 7.

Quadrivisio bengalensis Stebbing, 1907: 159-161, pl. 7; Chevreux, 1913: 15, fig. 1; Chilton, 1921: 537, fig. 6; K.H. Barnard, 1935: 287; Schellenberg, 1938: 63-65; Nayar, 1959: 26-27.

Material.- A single male from lake Kayamkulam (Kerala, India).

Male.- Ocular lobes produced and rounded in front; eyes 2 pairs, dark-red, dorsal pair located near anterior margin of head, lateral ones apparently double and placed a little away from the free margin of the eye lobes. Pleon segments with a few dorsal setules, distal and lower borders of segments 1 to 3 convex, posterolateral corner tooth-like, 4th pleon segment about as long as 5th and 6th combined. Telson cleft to base, lobe roughly oval (right lobe missing), asymmetrically bifid at apex and armed with a cluster of spines, outer border with 2 slender setae almost in the middle. Coxae deep, first 3 nearly oblong, lower margins faintly crenate, each armed with a row of setules and with a strong spine at lower hind corner. Fourth coxa much broadened below, with a tooth-like prominence at lower hind corner, hind border excavate. Hind lobes of coxae 5 and 6 angularly produced below and deeper than the rounded front lobes.

First peduncular segment of 1st antenna with a row of characteristic spine-setae on upper proximal part and a spine on distal inner margin, 2nd segment shorter than 1st, 3rd segment less than 1/3 length of 2nd, flagellum 40-segmented, accessory flagellum 10-segmented. Second antenna with a prominent gland cone, peduncle very long, 4th segment stouter, but slightly shorter than 5th, with long setae on lower border, flagellum shorter than peduncle and 21-segmented.

Distal border of upper lip strongly hirsute and with a slight median prominence. Incisor process of mandible dentate, lower margin of lacinia mobilis faintly pectinate, spine row consisting of 7 pectinate spines, molar ridged, palp slender, 1st segment 1/2 as long as 2nd, 2nd subequal to 3rd in length, latter slender and with 2 long apical setae, inner margin of 2nd segment with 2 short pectinate setae. Entire inner margin of the conical inner lobe of 1st maxilla setose, outer lobe armed with 9 spines, 2nd segment of palp expanding distally and armed with 6 marginal teeth and an equal number of submarginal setae. Inner and distal borders of inner lobe of 2nd maxilla setose, outer

lobe apically rounded and with 2 rows of setae. Inner and outer lobes of lower lip irregularly rounded and faintly hirsute, latter also with a marginal row of spine-setae, mandibular processes short. Inner lobe of maxilliped nearly reaching distal end of 1st endopod segment, with 3 short teeth distally, outer lobe stopping short of the middle of 2nd endopod segment, 1st segment of palp less than 1/2 length of 2nd, 3rd segment elliptic, shorter than 2nd, inner surface hirsute and distal half of inner border with pectinate spines, dactyl 3/4 the length of preceding segment and with a pectinate inner margin.

First gnathopod much smaller than 2nd, basis as long as carpus and propodus combined, inner border of merus hirsute, carpus 1/4 longer than propodus, propodus oblong, proximal half of outer and distal half of inner margin with combs of short pectinate spines, palm very short, transverse, dactylus as long as palm. Second gnathopod massive, basis about 1/5 shorter than propodus, inner distal part of merus produced and pointed, distal margin concave, carpus internally lobe-like, propodus twice as long as broad, inner margin about 1/3 length of outer and crenate, palm oblique and irregular, defined by 2 short spines, with an irregularly truncate projecting lobe near finger hinge, dactylus massive, curved and reaching the palmar spines, armed with short setules along inner and outer borders. Basis of peraeopods 1 and 2 curved, propodus narrow and subequal in length to the slender carpus, dactylus small and with a nail. Basis of peraeopod 3 oblong-oval, inner and outer margins crenate, articles 4 to 6 subequal in length. Peraeopods 4 and 5 much longer than 3rd, basis much expanded proximally, margins crenate as in 3rd peraeopod.

Peduncle of 1st uropod longer than the longer outer ramus. Second uropod smaller than 1st, otherwise subsimilar and projecting as far behind as the latter. Third uropod extending far beyond others, rami much longer than peduncle, foliaceous, outer very slightly shorter and narrower than inner, both carrying strong marginal spines and fine setae.

Length 7.9 mm.

Discussion.- The specimen in my possession agrees closely with the description given by Stebbing (1907), except in the following respects. In my specimen the 2nd peduncular segment of antenna 1 is slightly shorter than 1st, whereas according to Stebbing this segment is longer than the 1st in the male. Further, he has described the flagellum of this appendage as subequal to the peduncle in length. In my specimen the flagellum of the 1st antenna is much longer than the peduncle and is 40-segmented. The fifth article of 2nd antenna in the male is considerably longer than the 4th according to Stebbing, but I find them to be subequal in length and straight. Segment 2 of the mandibular palp has 2 plumose setae which have not been observed by Stebbing. The third segment of the maxilliped palp is comparatively more expanded than shown by Stebbing and is hirsute on the inner surface. The inner margin of the 6th segment of gnathopod 1 is described as having "scale-like spinules". But in my specimen this segment carries transverse rows of small spines along its inner edge. The outer margin of the 6th segment of 2nd gnathopod is described by Stebbing as being smooth, whereas in my material there are groups of submarginal setae in the distal half of this border. Further, the palm of this appendage is defined by 2 prominent spines, not shown by Stebbing, and the massive dactylus impinges on these defining spines. According to Stebbing the rami of uropods 1 and 2 are equal, but they are clearly unequal in my specimen. Similarly, the foliaceous rami of the 3rd uropod are described as having "numerous little spines", whereas in my material the spines are strong.

Though Stebbing has not stated anything particular about the telson, he has illustrated it as being composed of dissimilar halves. The right half of the telson in my specimen is unfortunately missing, but the left half agrees generally with Stebbing's figure. Chilton (1921) expressed the view that Stebbing's figure of the telson relates to a slightly abnormal specimen. His own figure (fig. 6c) is,

however, that of a female in which the lobes are identical and in general shape remotely resembles the left half of Stebbing's figure, though with fewer spines.

I could not detect any denticles on the dorsal surface of the pleon segments of my specimen, as reported by Stebbing and Chilton. There are instead a few setules. K.H. Barnard (1935) observed that this character is a highly variable feature and hence this difference in my specimen may not be of much significance. However, unlike in Stebbing's material, the posterolateral angles of pleonites 1 - 3 are more prominently produced and tooth-like.

Another interesting feature noticed in the present material concerns the eyes. *Q. bengalensis* possesses typically 2 pairs of eyes, one pair being dorsal and the other lateral. Each lateral eye in my specimen, however, appears as if made of 2 portions due to the disappearance of some of the middle ocelli. It is relevant here to recall Chilton's observation that the eye of this species shows different characteristics during different stages of growth and the present variation may be considered, therefore, as representing a further stage in its modifications.

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LITERATURE CITED

- BARNARD, J.L., 1959. Estuarine Amphipoda. In: Ecology of Amphipoda and Polychaeta of the Newport Bay, California. Publ. Allan Hancock Found., occ. Pap., 21: 13-69, figs. 1 - 14.
- , 1969a. The families and genera of marine gammaridean Amphipoda. Bull. U.S. nation. Mus., 271: 1-535, figs. 1 - 173.
- , 1969b. A biological survey of Bahia de Los Angeles, Gulf of California, Mexico, IV. Benthic Amphipoda (Crustacea). Trans. S. Diego Soc. nat. Hist., 15: 175-228, figs. 1 - 30.
- , 1970. Sublittoral Gammaridea (Amphipoda) of the Hawaiian Islands. Smithsonian Contr. Zool., 34: 1-286, figs. 1 - 180.
- , 1971. Gammaridean Amphipoda from the deep-sea transect off Oregon. Smithsonian Contr. Zool., 61: 1-86, figs. 1 - 48.
- BARNARD, K.H., 1935. Report on some Amphipoda, Isopoda and Tanaidacea in the collections of Indian Museum. Rec. Indian Mus., 37: 279-319, figs. 1 - 21.
- BATE, C. SPENCE, & J.O. WESTWOOD, 1861 - 1868. A history of British sessile-eyed Crustacea, 2 vols. (London, John Van Voorst).
- BOECK, A., 1871. Crustacea Amphipoda borealia et arctica. Forhandl. vidensk. Selsk. Christiania, 1871: 83 - 280.
- CHEVREUX, E., 1908. Diagnoses d'Amphipodes nouveaux provenant des campagnes de la Princesse - Alice dans l'Atlantique Nord. Bull. Inst. océanogr. Monaco, 122: 1-8, 4 figs.
- CHILTON, C., 1921. Fauna of the Chilka Lake: Amphipoda. Mem. Indian Mus., 5: 521-558, figs. 1 - 12.
- GILES, G.M., 1890. Natural history notes from H.M.'s Indian marine survey steamer 'Investigator', Commander Alfred Carpenter, R.N., commanding, 15: Description of seven additional new Indian amphipods. J. As. Soc. Bengal, 59: 63-74, pl. 2.
- GURJANOVA, E., 1938. Amphipoda, Gammaroidea of Staukhu Bay and Sudzukhe Bay (Japan Sea). Rep. Japan Sea hydrobiol. Exped. zool. Inst. Acad. Sci. USSR, 1934, 1: 241-404, figs. 1 - 59.
- , 1951. Bokoplavy morej SSSR i sopredel'nykh vod (Amphipoda - Gammaridea). Opred. Faune SSSR, Akad. Nauk SSSR, 41: 1-1029, figs. 1 - 705.
- KRØYER, H., 1838. Grønlands amfipoder beskrevne af Krøyer. Kon. Danske vidensk. Selsk. naturvid. math. Afhandl., 7: 229-326, pls. 1 - 4.
- NAGATA, K., 1960. Preliminary notes on benthic gammaridean Amphipoda from the Zostera region of Mihara Bay, Seto Inland Sea, Japan. Publ. Seto mar. biol. Lab., 8: 163-182, pls. 13 - 17.
- NAYAR, K.N., 1959. The Amphipoda of the Madras Coast. Bull. Madras govt. Mus. (nat. Hist.), 6 (3): 1-59, pls. 1 - 16.

- PILLAI, N.K., 1957. Pelagic Crustacea of Travancore, 3: Amphipoda. Bull. centr. Res. Inst. Univ. Travancore, 5 (1): 29-68, figs. 1-18.
- RABINDRANATH, P., 1971. A new liljeborgiid amphipod (Crustacea) from Kerala, India. Biol. Bull., 140: 482-488, figs. 1-3.
- SARS, G.O., 1895. Amphipoda: An account of the Crustacea of Norway with short descriptions and figures of all the species, 1: i-viii + 1-711, pls. 1-240 + I-VIII.
- SCHELLENBERG, A., 1925. Crustacea, 7: Amphipoda. In: W. MICHAELSEN, Beiträge zur Kenntnis der Meeresfauna Westafrikas, 3: 111-204, figs. 1-27.
- , 1938. Litorale Amphipoden des tropischen Pazifiks. Kgl. Svenska Vetenskapakad. Handl., (3) 16: 1-105, figs. 1-48.
- SHOEMAKER, C.R., 1933. Two new genera and six new species of Amphipoda from Tortugas. Pap. Tortugas Lab., Carnegie Inst. Washington, 28: 245-256, figs. 1-8.
- STAPPERS, L., 1911. Crustacés malacostracés. Campagne Arctique de 1907, Duc d'Orléans, 7: 1-152, pls. 1-7.
- STEBBING, T.R.R., 1906. Amphipoda, 1: Gammaridea. Tierreich, 21: 1-806, figs. 1-127.
- , 1907. The fauna of the brackish ponds at Port Canning, Lower Bengal, 5: Definition of a new genus of Amphipoda and description of the typical species. Rec. Indian Mus., 1: 159-162, pl. 7.
- WALKER, A.O., 1904. Report on the Amphipoda collected by Professor Herdman at Ceylon, in 1902. Rept. Ceylon Pearl Oyster Fisheries, suppl. Rep., 17: 229-300, pls. 1-8.
- , 1905. Marine Crustaceans, 16: Amphipoda. The fauna and geography of the Maldive and Lacadive Archipelagos, 2 (1): 923-932, figs. 140-142, pl. 88.

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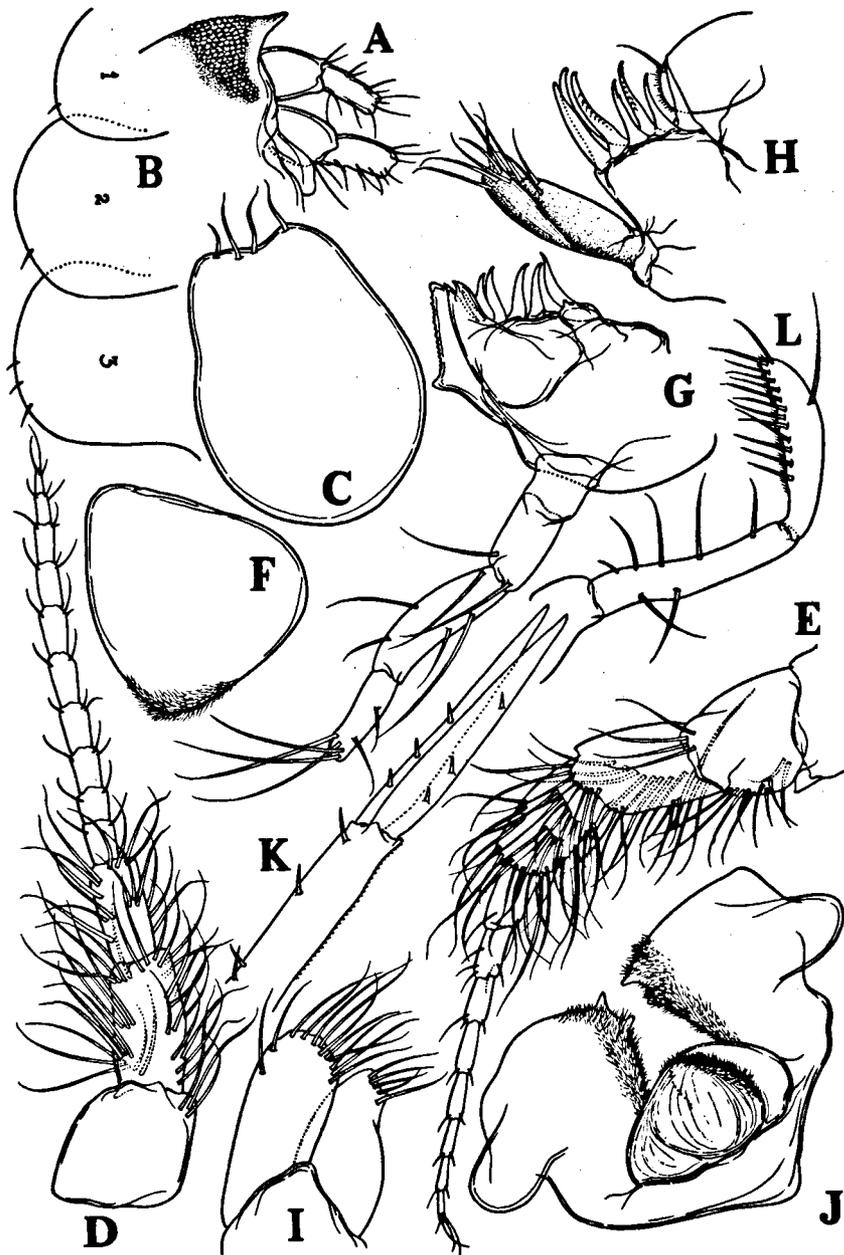


Fig. 1. *Perioculodes megapleon* (Giles, 1890). A - K, female, 3.6 mm: A, cephalon; B, pleonal epimera; C, telson; D, antenna 1; E, antenna 2; F, upper lip; G, mandible; H, maxilla 1; I, lower lip; K, uropod 3. L, male, 3.1 mm: mandibular palp.

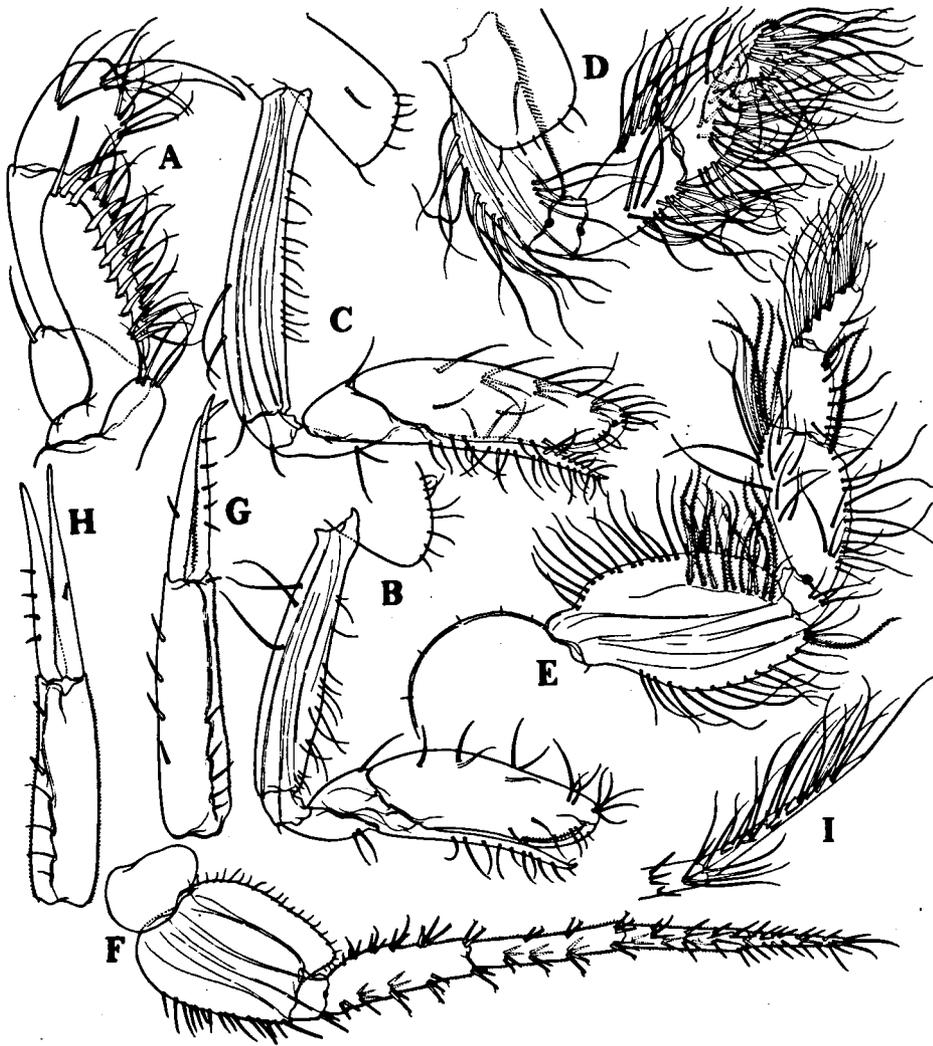


Fig. 2. *Perioculodes megapleon* (Giles, 1890). A-H, female, 3.6 mm: A, maxilliped; B, gnathopod 1; C, gnathopod 2; D, peraeopod 1; E, peraeopod 3; F, peraeopod 5; G, uropod 1; H, uropod 2. I, male, 3.1 mm: article 7 of peraeopod 5.

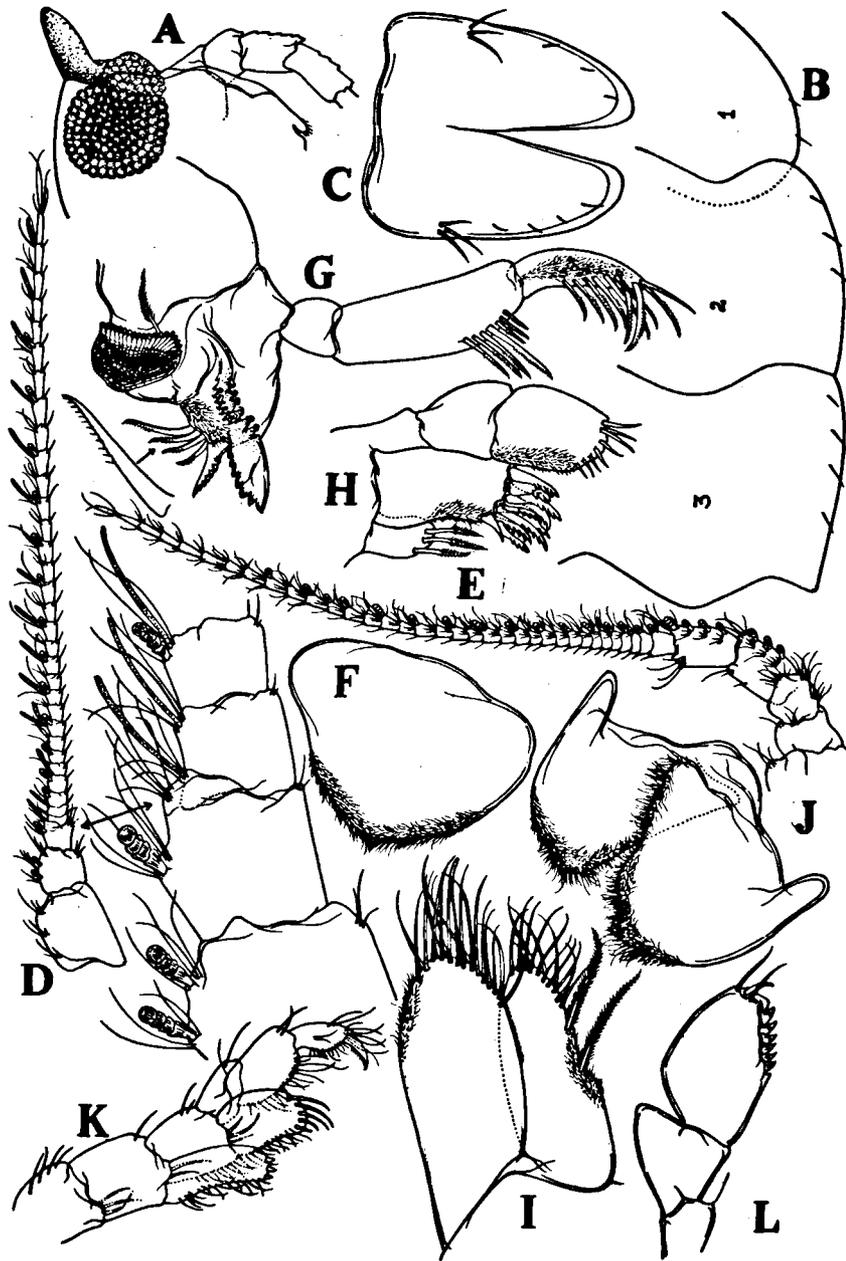


Fig. 3. *Pontogeneia barnardi* sp. n., A-K, holotype, male 2.4 mm: A, cephalon; B, pleonal epimera; C, telson; D, antenna 1; E, antenna 2; F, upper lip; G, mandible; H, maxilla 1; I, maxilla 2; J, lower lip; K, maxilliped. L, female, 2.7 mm: 1st maxillary palp.

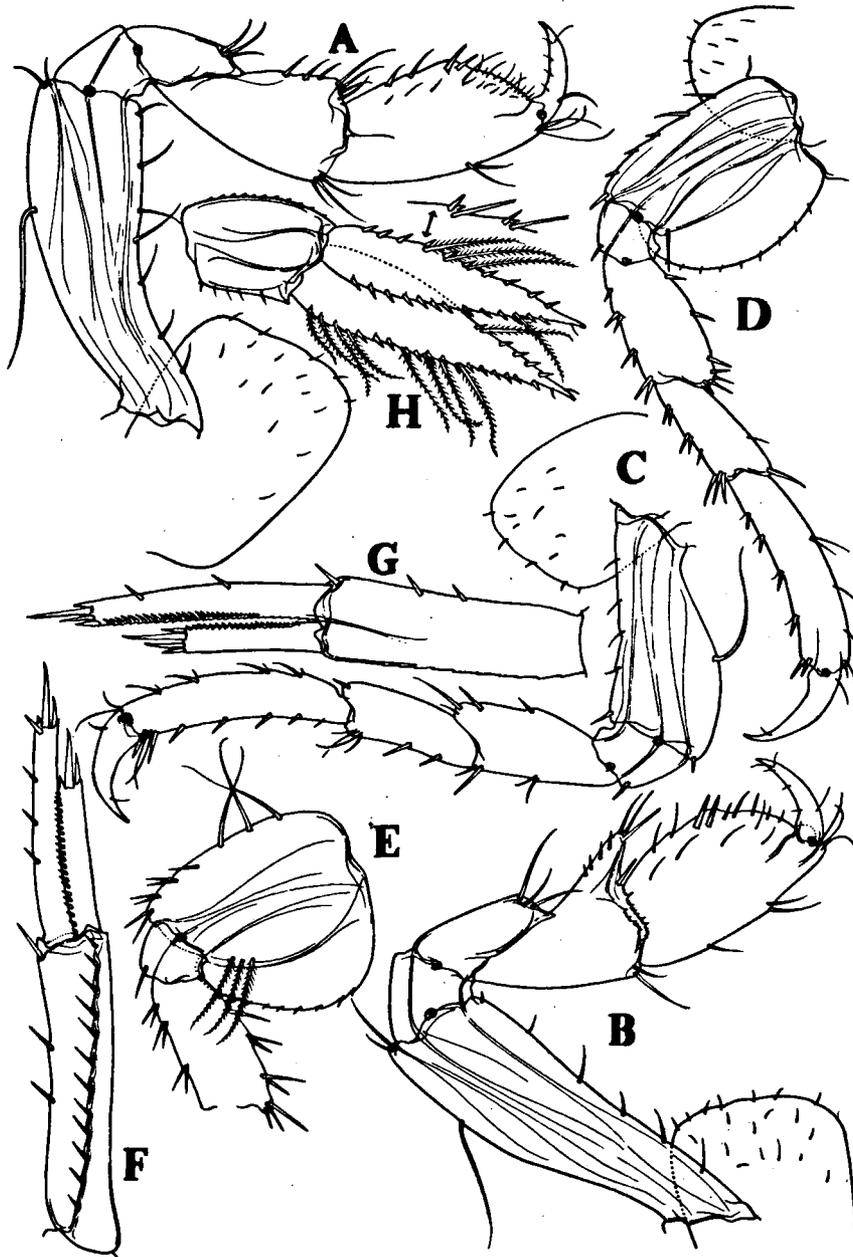


Fig. 4. *Pontogeneia barnardi* sp. n., holotype, male, 2.4 mm: A, gnathopod 1; B, gnathopod 2; C, peraeopod 1; D, peraeopod 3; E, articles 2 to 4 of peraeopod 4; F, uropod 1; G, uropod 2; H, uropod 3.

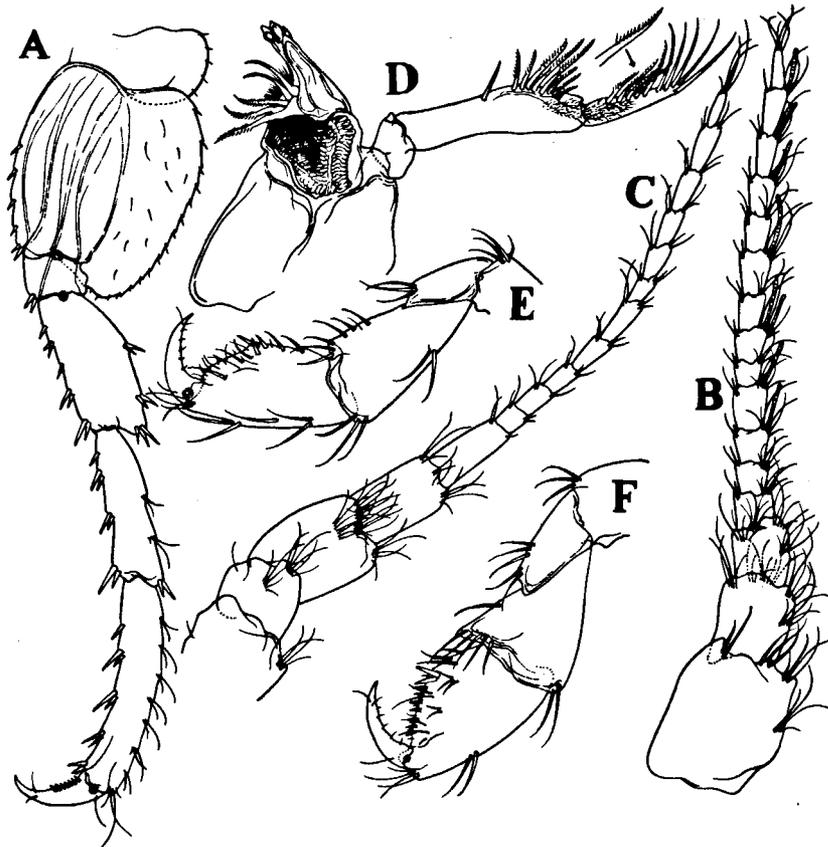


Fig. 5. *Pontogeneia barnardi* sp. n., holotype, male, 2.4 mm: A, peraeopod 5. B - F, female, 2.7 mm: B, antenna 1; C, antenna 2; D, mandible; E, gnathopod 1; F, gnathopod 2.

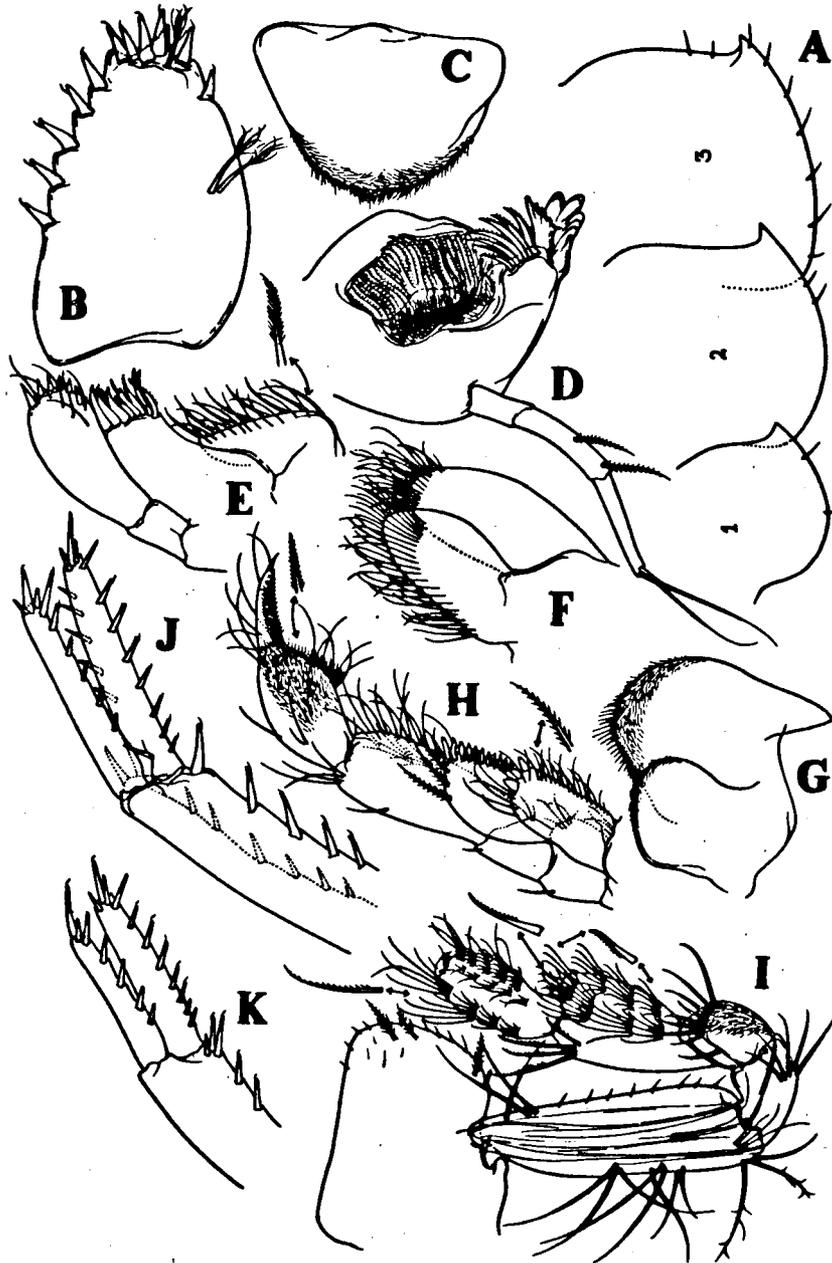


Fig. 6. *Quadrivisio bengalensis* Stebbing, 1907, male, 7.9 mm: A, pleonal epimera; B, telson (left lobe); C, upper lip; D, mandible; E, maxilla 1; F, maxilla 2; G, lower lip; H, maxilliped; I, gnathopod 1; J, uropod 1; K, uropod 2.

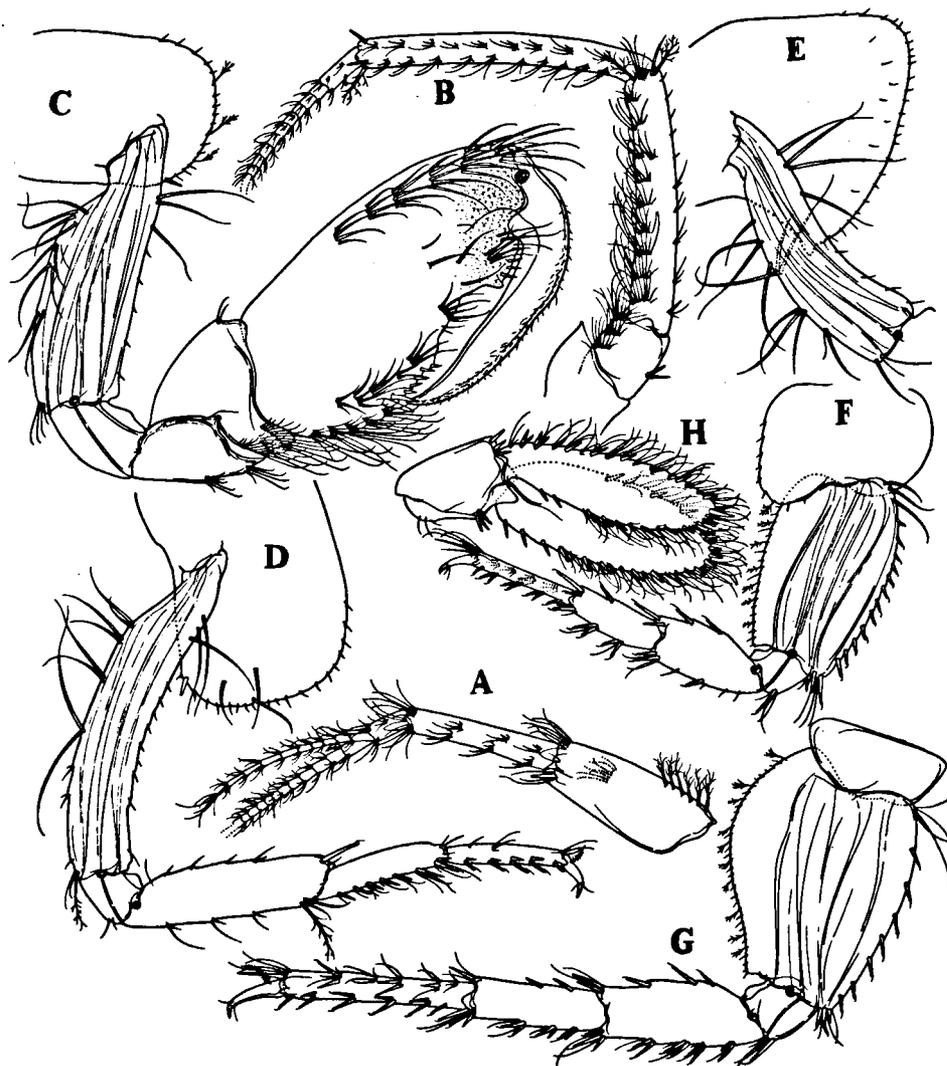


Fig. 7. *Quadrivisio bengalensis* Stebbing, 1907, male, 7.9 mm: A, antenna 1; B, antenna 2; C, gnathopod 2; D, peraeopod 1; E, peraeopod 2 (part); F, peraeopod 3; G, peraeopod 5; H, uropod 3.