

**A MISCELLANEOUS COLLECTION OF COPEPODS PARASITIC
ON SOUTH INDIAN FISHES**

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THIS is the concluding part of a taxonomic study of the piscicolous copepods of South India, which the author started in 1960. As far as possible each family was dealt with separately. But a few papers dealing with isolated genera or species were also published. The present paper describes sixteen species, left out of earlier publications, or collected subsequently. Three species are new and one is described without a specific name for want of sufficient material.

I take this opportunity to thank all those, too many to mention individually, who have helped me in various ways during the course of this study. But I must particularly mention Dr. S. M. Shiino, Prof. P. Kirtisinghe and Dr. Thomas, E. Bowman, for their generous response to my requests for advice and reference literature. My sincere thanks are due to Dr. S. Jones, Director, Central Marine Fisheries Research Institute, Mandapam Camp, South India, for helping in getting my papers published expeditiously.

Family Caligidae

Genus *Caligus* Muller

***Caligus quadratus* Shiino**

Caligus quadratus Shiino, 1959a, p. 8, figs. 3-5.

I have nothing to add to the detailed description given by Shiino. The above reference contains a full synonymy of this species.

Length of female 6.0 mm., of male 4.0 mm.

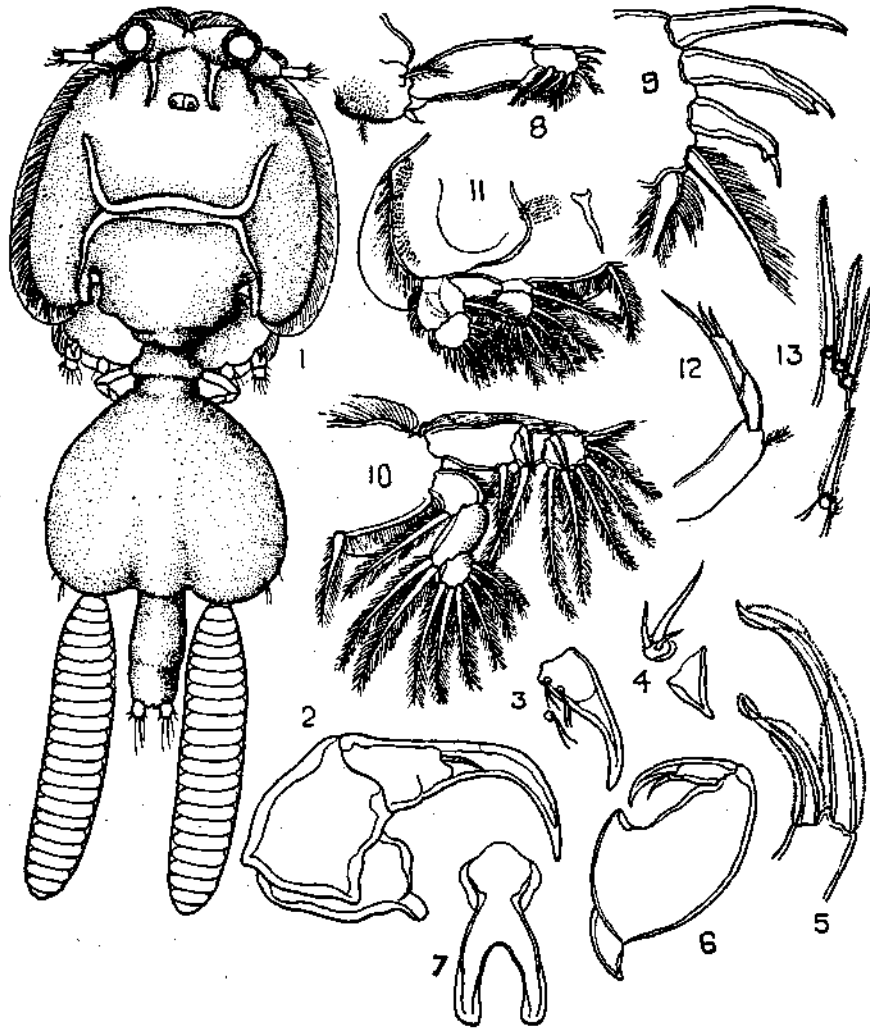
Several specimens were collected from the inner surface of the opercle of *Coryphaena hippurus* (Linn.) by the author at Trivandrum and Vizhingom.

***Caligus hamruri* n. sp. (figs. 1-13)**

Material: Several females were collected by the author from the inner surface of the opercle of *Priacanthus hamrur* (Forsk.) at Trivandrum. Holotype female is deposited in the Indian Museum, Calcutta.

Female: Carapace nearly circular, narrower in front. Frontal plates deep, with circular lunules. Dorsal transverse rib placed almost in the middle, cephalic area subequal to thoracic. Antero-lateral borders of carapace with a small

incision, postero-median lobe twice as broad as lateral lobes and projecting far beyond the latter. Fourth thoracic segment small, genital segment swollen, with short anterior neck-like part, postero-lateral parts rounded. Abdomen short, two-segmented, first segment twice as long as second. Egg tubes short but stout.



FIGS. 1-13. *Caligus hamruri* n.sp. 1. female, dorsal view; 2. antenna 2; 3. maxilla 1; 4. maxilla 2; 5. maxilliped 1; 6. maxilliped 2; 7. sternal fork; 8. leg 1; 9. same, tip enlarged; 10. leg 2; 11. leg 3; 12. leg 4; 13. same, tip enlarged.

First antenna of the usual type. Basal segment of second antenna with an apically rounded process. First maxilla slender and claw-like. Second maxilla comparatively very small, palp with three stout spines. Distal segment of first maxilliped longer than basal, claws with broad wings. Basal segment of second maxilliped with a large distally hollowed projection, distal segment with a long spine. Sternal fork with slightly diverging apically rounded limbs with broad wings.

Basal segment of first leg spiny, distal exopod segment with three claws, first claw pointed, second and third apically truncated, with an accessory spine reaching beyond the tip of the main claw, distal lower corner with a stout spine, plumose on the upper side. Second and third legs of the usual type. Fourth leg three-segmented, with four winged claws, distal claw much longer than the just previous. Anal laminae squarish.

Length 2.5 mm.

Remarks: This species closely resembles *C. priacanthi* Pillai (1961) but differs in several important characters. The genital segment is more swollen and the abdomen is longer and two-segmented. The outer claw of the first maxilliped is winged and not toothed as in *C. priacanthi* and the basal segment of the second maxilliped has a stout hollowed process. The claws of the distal exopod segment of the first leg are entirely different from those of *C. priacanthi* and those of the second leg are winged, not toothed as in *C. priacanthi*. The fourth leg also differs from that of *C. priacanthi*.

Family Euryphoridae

Genus *Gloiopotes* Stp. & Lutk.

Gloiopotes watsoni Kirtisinghe (figs. 14-15)

Gloiopotes watsoni Kirtisinghe, 1934, p. 167, figs. 1-17; Kurian, 1955, p. 108.

Length of female 9.1 mm., of male 10.5 mm.

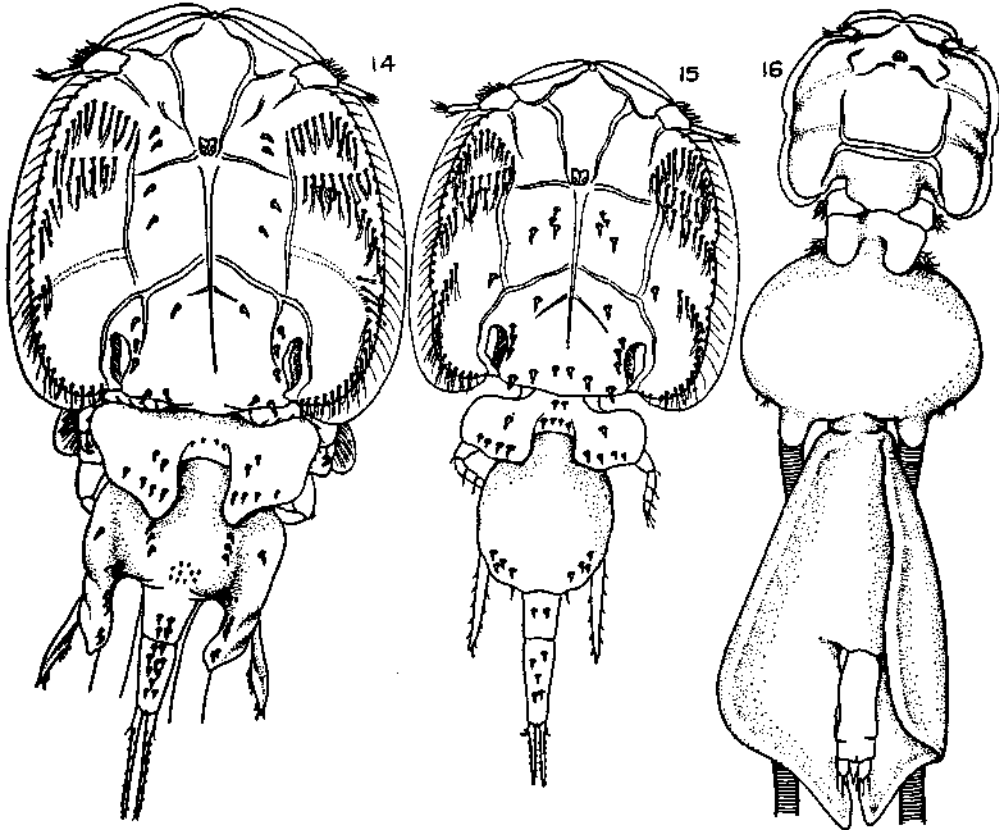
A very large number of specimens were collected by the author from the surface of the body of *Makaira indica* (Cuv.) at Vizhingom and from *Tetrapturus brevirostris* (Playfair) at Trivandrum.

Remarks: The present study has shown that Kirtisinghe's description of this species is slightly inaccurate. He has shown the carapace, especially that of the male, as strongly produced forwards. The basal spine of the exopod of the third leg was described as trifid and illustrated as bifid. He has shown the dorsal plates of the fourth thoracic segment as posteriorly rounded. Kirtisinghe, to whom I referred these points, informed me that the first two discrepancies were the result of oversight and that the dorsal plates of the fourth segment are produced, though not to the same extent as shown in my figures.

G. costatus Wilson, *G. ornatus* Wilson, *G. longicaudatus* (Marukawa) and *G. watsoni* Kirtisinghe so closely resemble one another that reliable distinguishing characters are hard to find. At any rate I cannot find any real difference between *G. watsoni* and *G. longicaudatus* as described by Shiino (1954). In the latter species Shiino has shown the dorsal plates of the fourth thoracic segment posteriorly rounded. If this is so it would constitute a real difference from *G. watsoni* as described here. But I suspect that, like Kirtisinghe, Shiino also failed to observe the thin and nearly transparent posterior extension. It must be remarked in this connection that, unless the dorsal plate is detached from the body and examined, its true shape cannot be observed easily. It is likely that *G. watsoni* Kirtisinghe may prove to be the same as *G. longicaudatus* (Marukawa).

Genus *Euryphorus* H. M. Edwards*Euryphorus nympha* H. M. Edwards (fig. 16)*Euryphorus nordmanni* Kirtisinghe, 1937b, p. 445, figs. 74-87.*Euryphorus nympha* Shiino, 1954, p. 284, figs. 5-6 ; 1959b, p. 350.

Length of female 11.3 mm.

Several specimens were collected by the author from the branchial cavity of *Coryphaena hippurus* (Linn.) at Vizhingom and Trivandrum.

FIGS. 14-16. *Gloiopotes watsoni* Kirtisinghe. 14. female, dorsal view ; 15. male, dorsal view ; 16. *Euryphorus nympha* H. M. Edwards, female, dorsal view.

Remarks: According to Shiino *E. nordmanni* Kirtisinghe is the same as *E. nympha* M. Edwards. In the structure of the various appendages my specimens closely resemble those described by Shiino. But in the general shape of the body they are more like the specimens described by Kirtisinghe from Ceylon. In the Japanese material the carapace is shown as almost circular with evenly rounded lateral borders. In my specimens the lateral borders are more straight, very much as in the Ceylon

specimens. Shiino has described the genital segment as circular, with a pair of crescentic posterior prolongations. In my specimens the genital segment is transversely ovate and distinctly broader than the carapace. The posterior processes are longer than broad and not crescentic. In this character also the present specimens resemble the Ceylon material. Shiino has stated that the abdomen is two-segmented. But a third segment is clearly visible in my specimens as well as in the Ceylon material. In my specimens the abdominal wings are apically narrowed and reach far beyond the anal laminae. They are shorter in the Japanese specimens. Kirtisinghe described these wings as laminate, sometimes saccular towards the ends. Neither this description nor the accompanying illustration gives a clear idea of its shape. The sacculation is clearly a distortion. Presuming that these differences are not of specific value I accept Shiino's view that *E. nordmanni* Kirtisinghe is synonymous with *E. nympa* M. Edwards.

Family Pandaridae

Genus *Pseudopandarus* Kirtisinghe

Pseudopandarus longus (Gnanamuthu) (figs. 17-39)

Pandarus longus Gnanamuthu, 1951a, p. 1245, figs. 23-44; Kurian, 1955, p. 114, f. 38.

Material: Several specimens were collected from the body surface of *Scoliodon sorrakowah* (Cuv.) at Quilon, Trivandrum and Vizhingom.

Female: Carapace roughly semicircular, hind margin concave and lobed, postero-laterally produced into long narrow lobes stopping short of the tip of the first pair of dorsal plates. Frontal plates prominent and projecting. Carapace with a marginal flange of spines visible antero-laterally. Dorsal plates of second thoracic segment roughly elliptic and obliquely placed, slightly overlapping the plates of the third segment, latter fused into a single semicircular plate with a narrow but deep postero-median incision. Dorsal plates of fourth segment also fused, with shallow and broad posterior incision. Genital segment large, as long as the rest of the body. Dorsal plate of sixth segment nearly circular, reaching far beyond the hind border of the genital segment. Abdomen two-segmented, distal segment squarish. Egg tubes longer than the body.

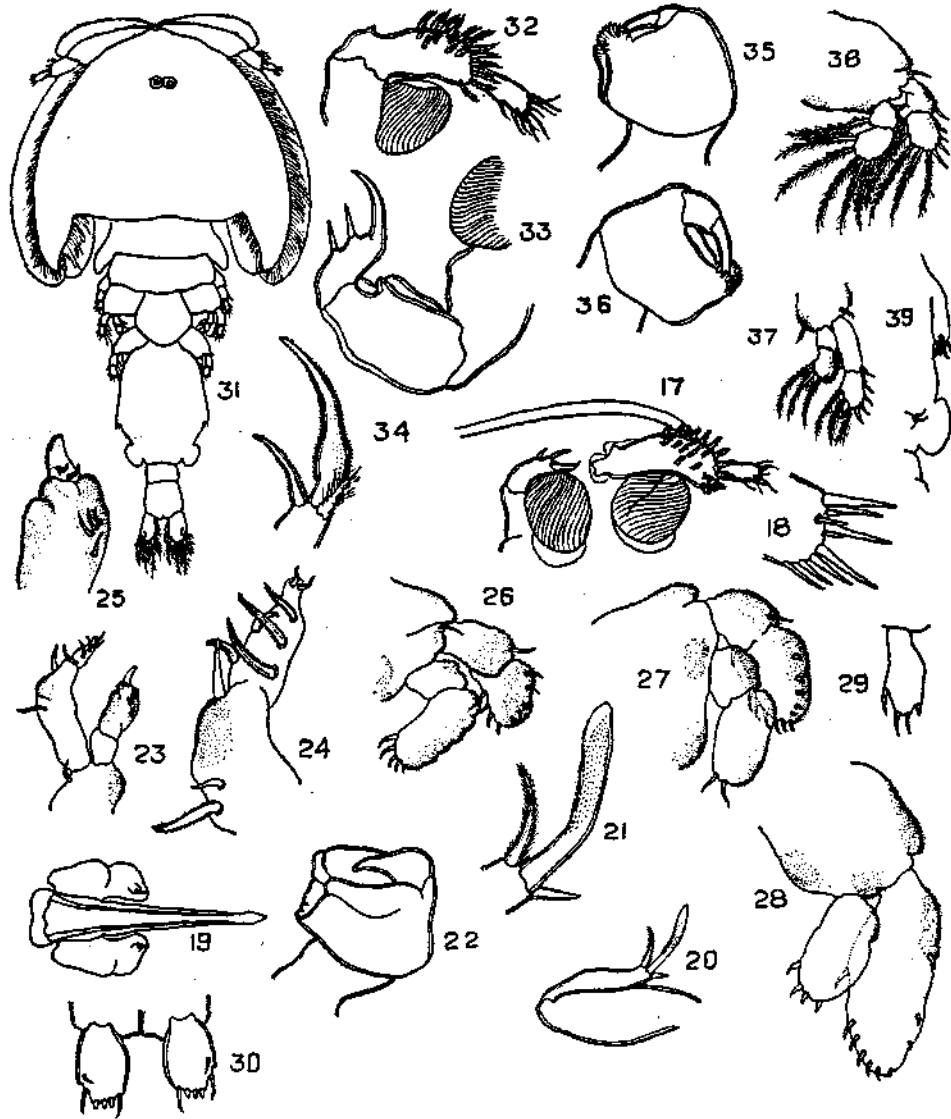
First antenna with stout strongly built, spiny basal segment. Second antenna three-segmented, third segment with two small spines and a long dactyliform third spine. Basal segment of first maxilliped stout, distal segment with three claws, inner claw long and pectinate, outer short and pointed, middle claw stout, with rows of denticles. Second maxilliped distorted. Legs as shown in the figure.

Length 4.9 mm.

Male: Carapace broader than long, with large postero-lateral prolongations and fairly broad membranous flange. Frontal plates prominent and projecting. Second trunk segment very broad, postero-laterally produced into long blunt processes. Third segment subequal to second in length and breadth, fourth longer than broad, much narrower than third. Genital segment longitudinally oblong, with two ear-

like postero-lateral lobes. Abdomen two-segmented, first segment small. Anal laminae with plumose setae.

First antenna with long plumose setae. Outer claw of first maxilliped with stiff hairs, middle claw spine-like, with serrate border. Distal segment of second maxil-



FIGS. 17-39. *Pseudopandarus longus* (Gnanamuthu). 17-30, female; 17. antennae 1 and 2; 18. tip of antenna 1; 19. oral tube and maxilla; 20. maxilliped 1; 21. same, tip enlarged; 22. maxilliped 2; 23. leg 1; 24. same, exopod; 25. same, endopod; 26. leg 2; 27. leg 3; 28. leg 4; 29. leg 5; 30. uropod; 31-39, male; 31. male, dorsal view; 32. antenna 1; 33. antenna 2; 34. maxilliped 1; 35-36, maxilliped 2; 37, leg 1; 38. leg 2; 39. legs 5 and 6.

liped closing between two corrugated pads on the basal segment. Legs with two-segmented rami carrying plumose setae.

Length 2.4 mm.

Remarks: *Pseudopandarus* Kirtisinghe differs from *Pandarus* Leach in the laminate nature of its uropods. If this character alone constitutes sufficient justification for the creation of a new genus *P. longus* Gnanamuthu will have to be transferred to *Pseudopandarus*. Apart from *Ps. longus*, the genus includes two species, *Ps. gracilis* Kirtisinghe (1950) and *Ps. scylli* Yamaguti and Yamasu (1959). These two species differ markedly from *Ps. longus* in the shape of the postero-lateral lobes of the genital segment and of the dorsal plate of the sixth segment. The male of both *Ps. gracilis* and *Ps. scylli* is unknown.

Genus *Perissopus* Stp. & Lutk.

Perissopus manuelensis Gnanamuthu (figs. 40-59)

Perissopus manuelensis Gnanamuthu, 1951b, p. 9.

? *Perissopus travancorensis* Kurian, 1955, p. 108, figs. 19-37.

Material: A large number of specimens were collected by the author from the outer surface of the body of *Scoliodon sorrakowah* (Cuv.) at Quilon.

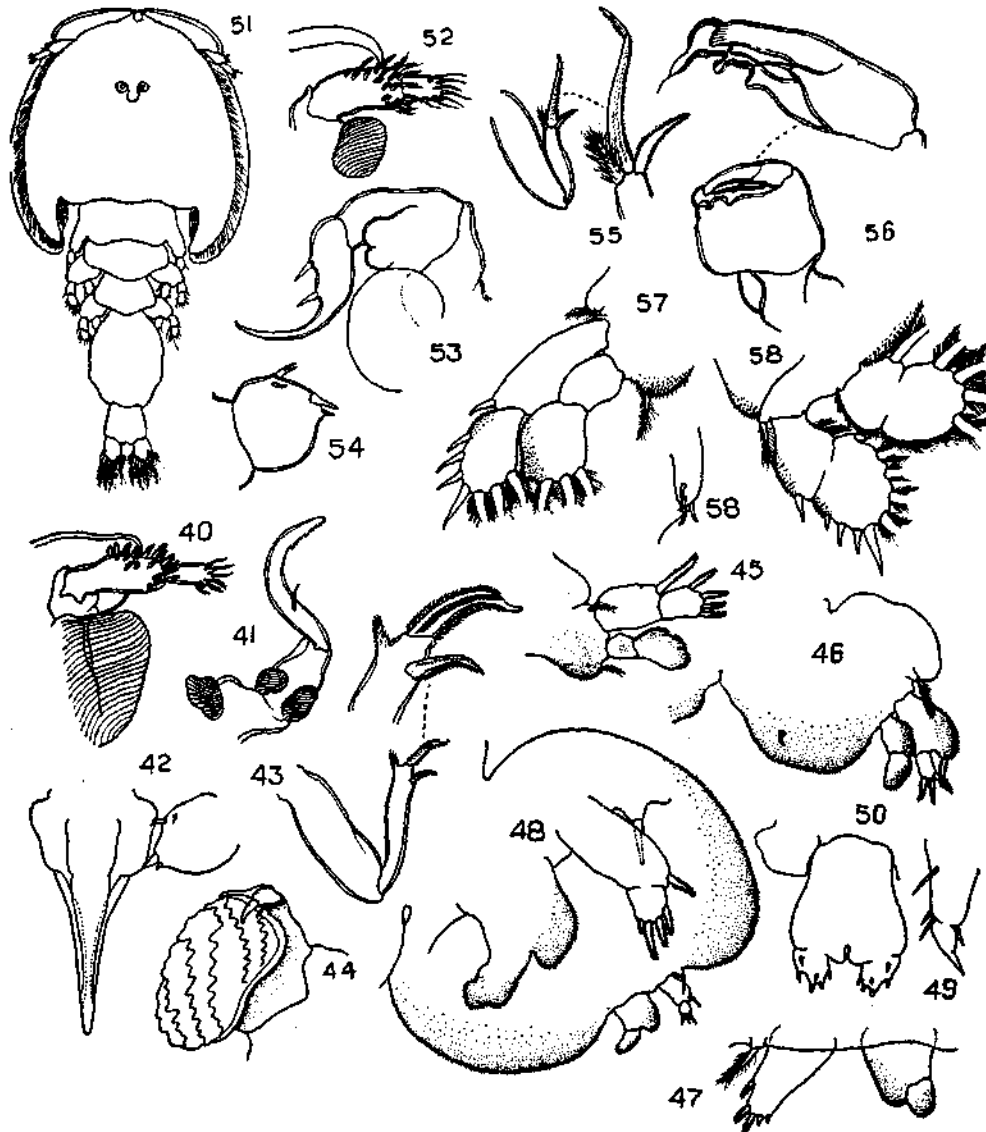
Female: Carapace roughly triangular, with the postero-lateral parts produced into blunt lobes overlapping the dorsal plates of the second trunk segment, posterior border concave and trilobed. Frontal plates small but projecting, with prominent median concavity. Dorsal plates of second trunk segment oblong, obliquely placed, with its distal inner border carrying a thin flange. Dorsal plates of third segment circular, not overlapping in the middle. Dorsal plates of fourth segment semicircular, overlapping in the middle and their hind border with thin flange. Genital segment posteriorly produced into two pairs of lobes, outer lobes small and apically pointed, inner lobes apically dentate and with a broad shallow incision separating them. Abdomen short and one-segmented, visible through the postero-median incision of the genital segment. Anal laminae small, with six small spines.

Basal segment of first antenna with strong pectinate spines. Distal segment of second antenna apically serrate, with the serrations directed backwards. Maxilla foliaceous. Distal segment of first maxilliped with three claws, inner claw with serrate margin, middle claw with three rows of teeth, outer claw small and pectinate. Basal segment of second maxilliped enlarged into a rough pad with raised edge, its surface roughened to fit exactly on to the rough surface of the body of the host, distal segment is a small claw with a strong spine. Legs with flattened elytra-like protopod, rami with segments distinct or fused to varying extent.

Length 4.4 mm.

Male: Carapace slightly longer than broad, with prominent membranous flange and frontal plates. Second trunk segment rectangular, with the postero-lateral processes slightly overreaching the processes of the carapace. Third segment

slightly narrower than second, fourth still narrower. Genital segment barrel-shaped. Abdomen one-segmented. Anal laminae large, with plumose setae.



FIGS. 40-59. *Perissopus manuelensis* Gnanamuthu. 40-50, female; 40. antenna 1; 41. antenna 2; 42. oral tube and maxilla; 43. maxilliped 1; 44. maxilliped 2; 45. leg 1; 46. leg 2; 47. rami of leg 3; 48. leg 4; 49. leg 5; 50. abdomen and anal laminae; 51-59, male; 51. male, dorsal view; 52. antenna 1; 53. antenna 2; 54. maxilla; 55. maxilliped 1; 56. maxilliped 2; 57. leg 1; 58. leg 4; 59. leg 5.

First antenna with plumose setae. Distal segment of second antenna with two spines and a long claw. Maxilla and first maxilliped as in female. Distal segment of

second maxilliped closing between two pads. All the legs biramous, with two-segmented rami carrying spines and plumose setae.

Length 2.1 mm.

Remarks: According to Kurian *P. travancorensis* Kurian (1955) differs from *P. manuelensis* in the dorsal plates of the third trunk segment not overlapping medially, in the absence of a lobe projecting into the median sinus of the genital segment and in the presence of two-jointed inner rami in the third and fourth legs. The first and third characters are variable. Regarding the second it should be pointed out that Gnanamuthu might have mistaken the abdomen for a lobe; there is no such lobe in my specimens. I can find no valid difference between the above two species.

The first maxilla, which both Gnanamuthu and Kurian described, was not observed. According to Wilson (1907) the first maxilla is absent in Pandaridae.

Family Anthosomidae

Lernanthropus shishidoi Shiino (figs. 60-62)

Lernanthropus shishidoi Shiino, 1955, p. 64, figs. 6-7.

Three females and one male were collected by the author from the gills of *Mugil cephalus* Linn. at Quilon, Kerala.

Remarks: Shiino has given a full discussion on the synonymy and an illustrated description of this species. I, therefore, include only figures of the entire animal to emphasise points of difference. The antennal lobe of the cephalon of the female is clearly indicated by deep lateral constrictions. Similarly the constriction demarcating the anterior division of the trunk from the posterior is also deeper than shown by Shiino. According to Shiino the rami of the fourth leg are subequal, but in my specimens the outer ramus clearly overreaches the inner and is more flattened. The same is true of the fourth leg of the male also.

Family Dichelesthiidae

Genus *Hatschekia* Poche

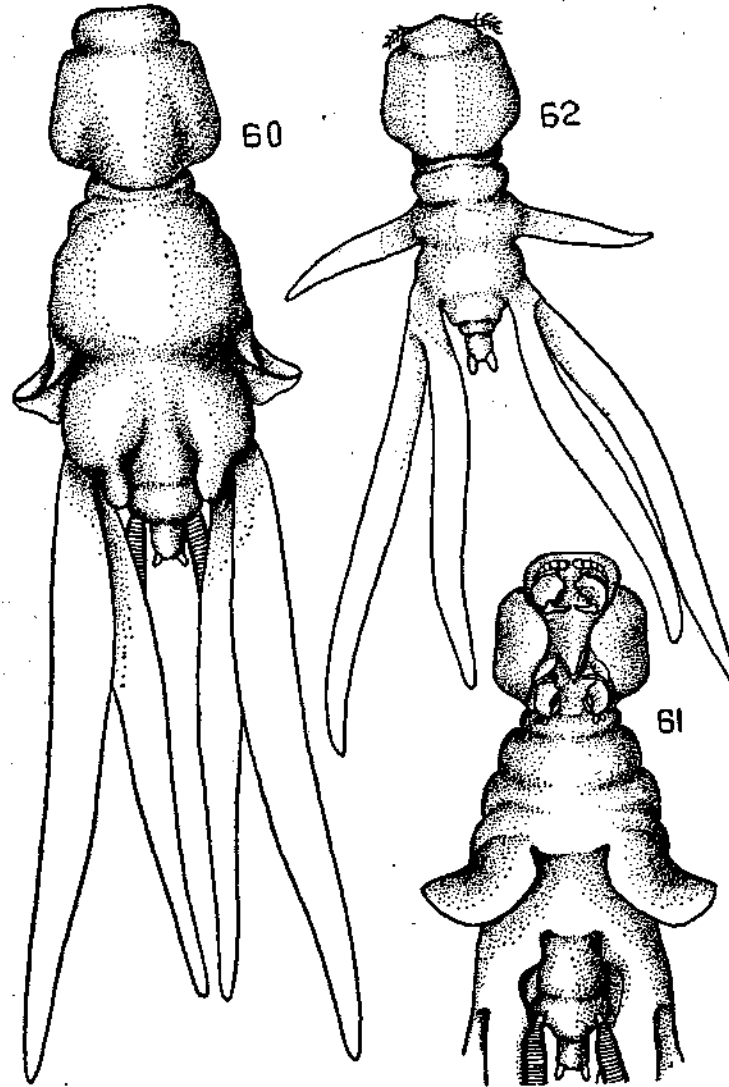
Hatschekia foliata Redkar, Rangnekar and Murti (figs. 63-73)

Hatschekia foliata Redkar et al. 1950, p. 39, figs. 8-14.

Material: Several females were collected by the author from the gills of *Nemipterus japonicus* (Bloch) at Trivandrum.

Female: Body elongate-oblong, extremely flattened and leaf-like. Carapace small but distinct, transversely oblong, its antero-median part produced into a bilobed process, lateral borders rounded. Dorsal surface of carapace with

four roughly squarish areas bounded by prominent ribs. Thoracic segments completely fused, but the position of the first two segments is indicated by two constrictions at the neck-like part between the carapace and trunk. Trunk broadest in the middle, caudal end broadly rounded. Genital segment ill-defined, much narrower than trunk and overlapping the abdomen. Abdomen very small, transversely rectangular. Egg sacs short, about half the length of the trunk.

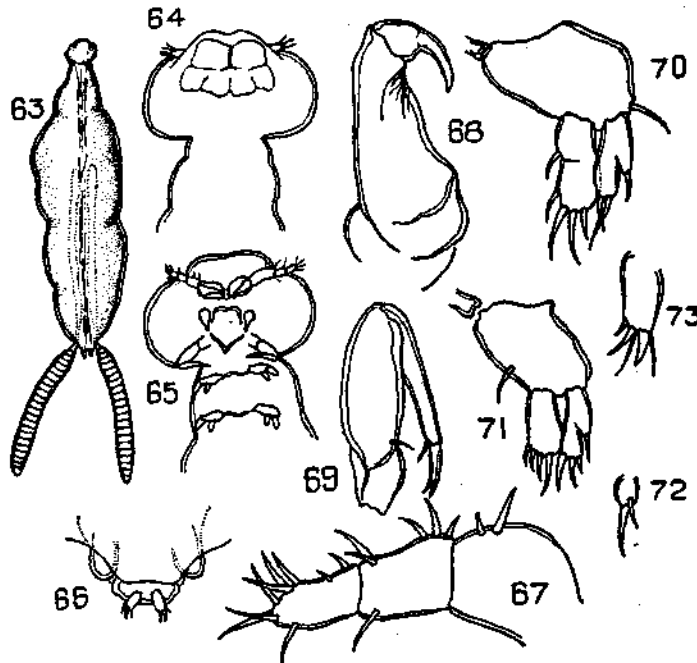


FIGS. 60-62. *Lernanthropus shishidoi* Shiino. 60. female, dorsal view; 61. same, ventral view; 62. male, dorsal view.

First antenna three-segmented, narrowing towards the apex. Second antenna with a large proximal segment, distal segment with a swollen base. Maxilla a small lobe with two spines. Second maxilliped four-segmented, first two segments stout,

last two slender, second and third segments subequal in length, former with a proximal spine and the latter with a distal spine, fourth segment very slightly uncinuate, with a minute accessory claw.

Basipod of first leg large, with a spine seta, exopod one-segmented, with a deep outer median incision and carrying one outer and two distal spines, endopod indistinctly two-segmented, with two inner and three distal setae. Basipod of second leg



Figs. 63-73. *Hatschekia foliata* Redkar et al. 63. female, dorsal view; 64. anterior part of body, dorsal view; 65. same, ventral view; 66. posterior part of body, dorsal view; 67. antenna 1; 68. antenna 2; 69. maxilliped 2; 70. leg 1; 71. leg 2; 72 maxilla; 73. uropod.

smaller than that of first, exopod similar to that of first but with an additional distal spine, endopod one-segmented, with four setae. Anal laminae comparatively large, with three spines and two setae.

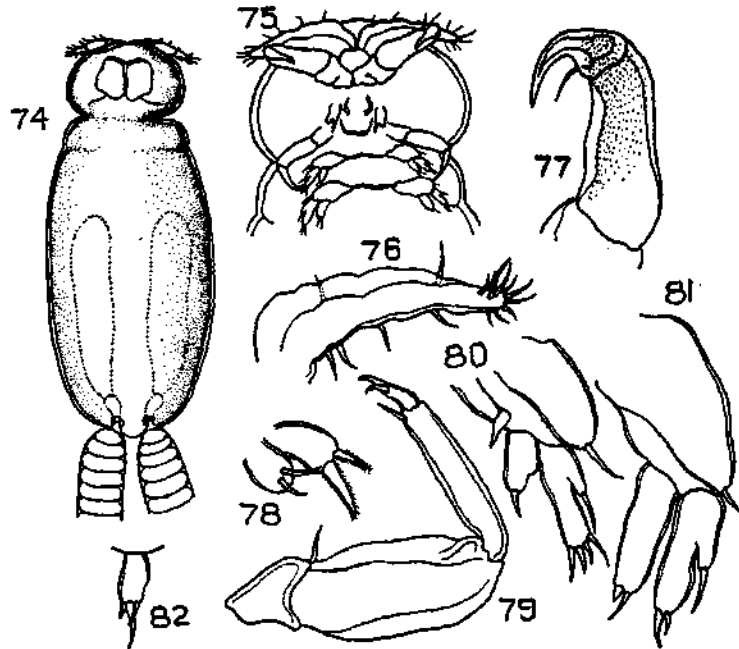
Length 2.4 mm.

Remarks: The triangular frontal sinus on the carapace mentioned by Redkar *et al.* is not present. The description of the trunk in the original account gives the impression that all the trunk segments are visible. Except for the first two limb-bearing segments, which are faintly visible, all the others are completely fused. Minor variations from the original description were observed in the appendages also.

Hatschekia sphyraeni n. sp. (figs. 74-82)

Material: A large number of females were collected by the author from the gills of *Sphyraena acutipinnis* Day at Trivandrum. Holotype female is deposited in the Indian Museum, Calcutta.

Female: Body elongate oblong, about three times as long as broad. Carapace transversely expanded, about one and a half times as broad as long. Antero-medial part of carapace slightly concave, dorsal surface with two longitudinally rectangular areas demarcated by prominent ribs. Lateral borders of carapace rounded, posterior border indistinct. Trunk demarcated from carapace by deep lateral incisions, neck absent, trunk segments completely fused except for indication of a segment just behind the second pair of legs. Abdomen indistinct, anal lamina small, with one long and two short spines. Egg sacs nearly as long as body.



FIGS. 74-82. *Hatschekia sphyraeni* n.sp. 74. female, dorsal view; 75. anterior part of body, ventral view; 76. antenna 1; 77. antenna 2; 78. maxilla; 79. maxilliped 2; 80. leg 1; 81. leg 2; 82. leg 3.

First antenna indistinctly five-segmented, narrowing towards the apex, distal end with a bunch of spines. Basal segment of second antenna subcylindrical, distal segment comparatively long and strongly curved, its basal bulge carrying a long spine. Maxilla two-lobed, inner lobe with two simple spines, outer with two pectinate spines. Second maxilliped four-segmented, basal segment short, second and third subequal in length but unequal in width, fourth segment short, with an accessory claw.

Legs two pairs, both biramous, rami one-segmented. Exopod with outer indentation, that of first leg with five and that of second with three setae. Endopod

of first leg smaller than that of second, both with two setae. Basipod of both legs with one seta, that of first leg with an additional spine.

Length 1.2 mm.

Remarks: This species shows a remote resemblance to *H. bifurcata* Yamaguti and Yamasu (1959) but differs in the spinulation of the first and second legs and also in the absence of the third and fourth legs. The first antenna of *H. bifurcata* is very different from that of *H. sphyraeni*.

Genus *Pseudocycnus* Heller

Pseudocycnus appendiculatus Heller (figs. 83-94)

Pseudocycnus appendiculatus Heller, 1865, p. 218, pl. 22, fig. 7; Bassett-Smith, 1898b, p. 368; Kirtisinghe, 1935, p. 339, figs. 10-28; Shiino, 1959c, p. 325, figs. 24-25.

Material: Several females were collected from the gills of *Euthynnus affinis* (Cantor) at Trivandrum and four females and two males from the gills of *Neothynnus macropterus* (Schlegel) at Vizhingom.

Female: Body slender and subcylindrical. Carapace longitudinally oblong, with prominent dorsal ribs. First trunk segment completely fused with head, second and third large and clearly demarcated, fourth segment fused with the rest of the trunk but forming two antero-lateral lobes on the long cylindrical part. Abdomen indistinct. Anal laminae half the length of the trunk.

First antenna three-segmented, each segment incompletely subdivided. Second antenna uncinata, third segment with two claws. Maxilla bilobed, exopod long, with two spines, endopod flat and laminate. Basal segment of first maxilliped flattened, second segment elongate S-shaped and distally expanded, with stout teeth and a large dentate unguis. Basal segment of second maxilliped moderately stout, distal segment short and apically bifid.

First leg vestigial. Second leg biramous, exopod stout with three teeth, endopod small with three teeth, both rami spiny. Third leg uniramous, with three teeth. Fourth and fifth legs setiform.

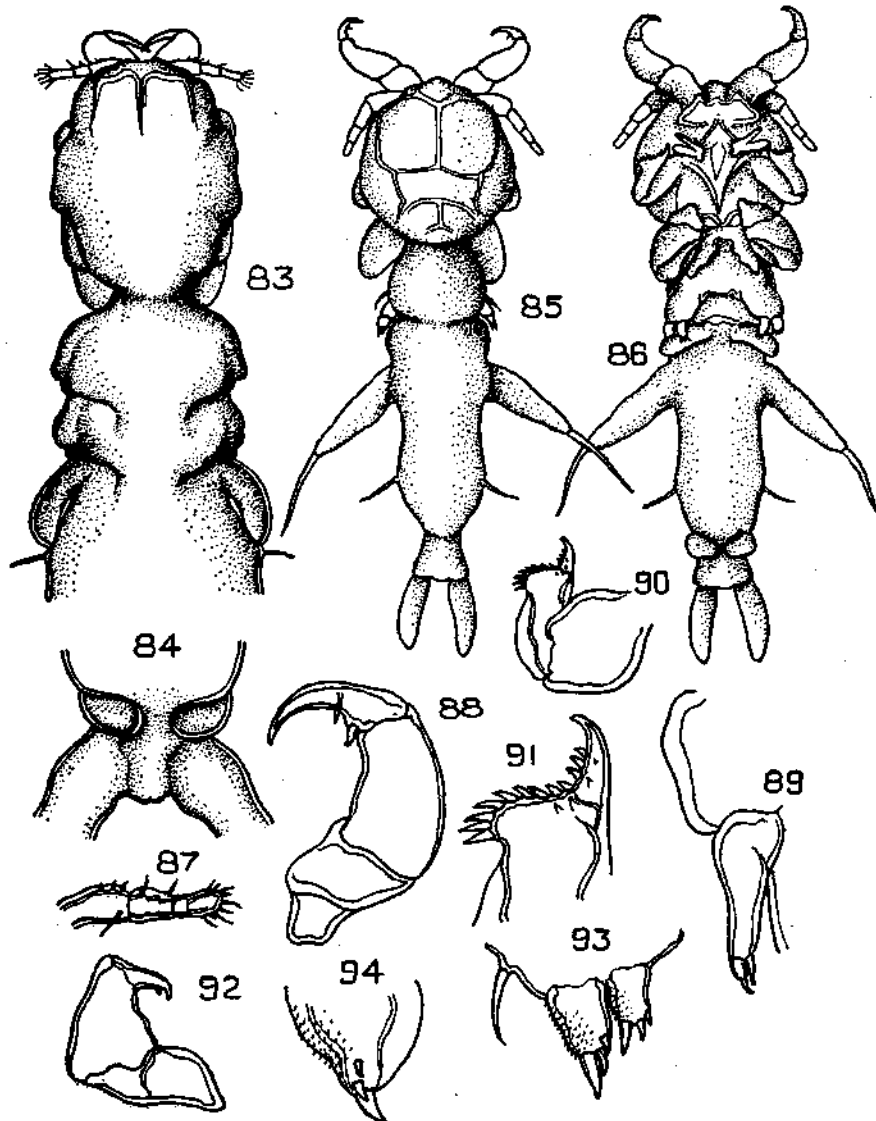
Length 6.7 mm.

Male: Body clearly divisible into a large carapace and a long trunk, the latter indistinctly divided into a thorax and abdomen. Carapace nearly circular with prominent dorsal ribs. First trunk segment not distinct, second large and pyriform, succeeding segments fused. Abdomen short, broadening distalwards. Appendages generally like those of female. First antenna with distinct segmentation. Fourth leg enlarged into a laterally directed process carrying a long spine. Anal laminae large and flat with an outer distal row of spines.

Length 2.7 mm.

Remarks: This species differs from *P. armatus* (Bassett-Smith) in its

longer carapace, more distinct trunk segments, longer and more slender anal laminae and in the apically flared and toothed first maxilliped. The male is very much



FIGS. 83-94. *Pseudocycnus appendiculatus* Heller. 83. female, anterior part of body, dorsal view; 84. posterior part of body, dorsal view; 85. male, dorsal view; 86. same, ventral view; 87. antenna 1; 88. antenna 2; 89. maxilla; 90. maxilliped 1; 91. same, tip enlarged; 92. maxilliped 2; 93. leg 1; 94. leg 2.

different from that of *P. armatus* in the general shape of the body and in the shape of the fourth legs and the anal laminae.

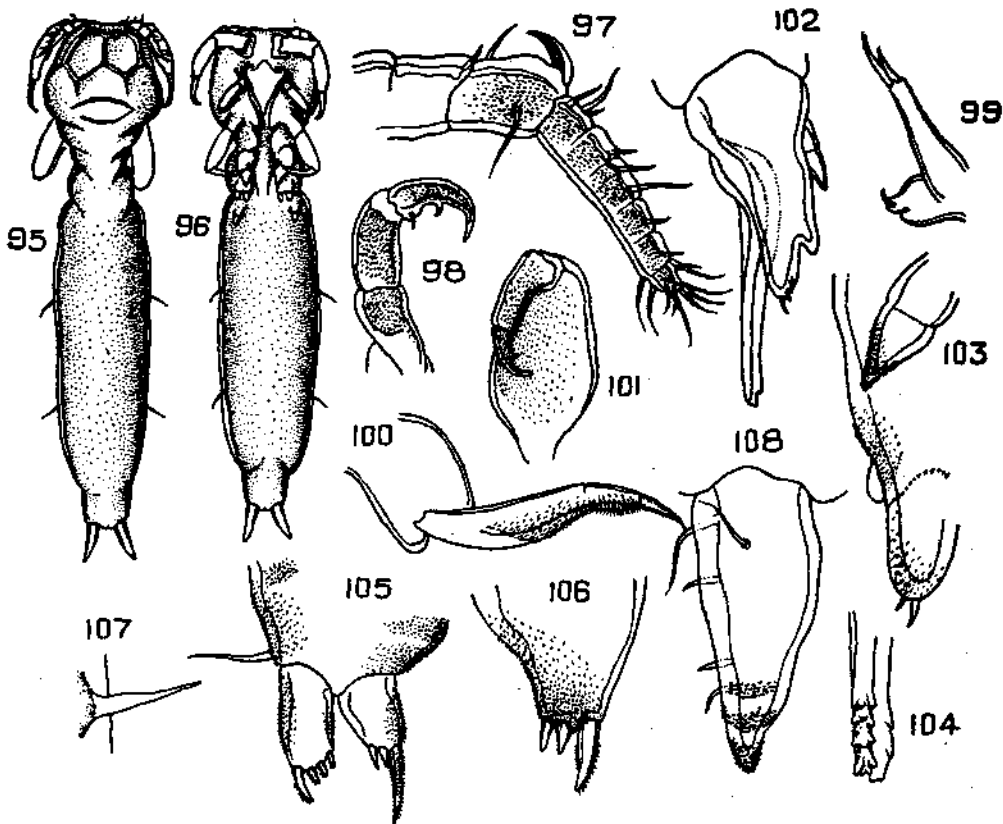
Pseudocycnus armatus (Bassett-Smith) (figs. 95-108)

Helleria armata Bassett-Smith, 1898a, p. 9, pl. 5, figs. 1-2.

Pseudocycnus armatus Kirtisinghe, 1935, p. 339; 1937a, p. 453, figs. 1-11; Kurian, 1961, p. 75, figs. 46-48.

Material: Several specimens, including males, were collected from the gills of *Indocybium guttatum* (Bloch and Schn.) at Trivandrum and Vizhingom.

Female: Body comparatively short and stout. Carapace roughly semi-circular, completely fused with the first trunk segment and postero-laterally produced into conical lobes. Second trunk segment large, third and fourth very indistinct,



FIGS. 95-108. *Pseudocycnus armatus* (Bassett-Smith). 95. male, dorsal view; 96. same, ventral view; 97. antenna 1; 98. antenna 2; 99. maxilla; 100. maxilliped 1; 101. maxilliped 2; 102. leg 1; 103. same, inner ramus; 104. same, tip of outer ramus; 105. leg 2; 106. leg 3; 107. leg 4; 108. anal laminae.

succeeding segments forming a large trunk. Third and fourth trunk segments with large blunt lateral processes. Abdomen distinct, but fused with the trunk. Anal laminae short and stout.

First antenna distinctly seven-segmented, second segment with a stout curved anterior process. Second antenna uncinata. First maxilliped distally narrow and spiny. Second maxilliped very stout, its basal segment forming a large inner lobe. First leg absent. Second leg biramous, third uniramous, second and third legs associated with a large circular spiny pad just external to the basipod. Fourth leg setiform.

Length 5.4 mm.

Male: Carapace nearly circular, fused with the first trunk segment. Second trunk segment forming a short neck, third and fourth segments fused with the succeeding segments. Abdomen squarish, anal laminae short and elongate conical. Appendages as in female, but first leg highly modified.

Length 2.4 mm.

Remarks: As already indicated this species differs from *P. appendiculatus* in several important characters and is a shorter but stouter species. Kirtisinghe described the male in detail but omitted details. I have, therefore, illustrated the male fully.

Family Chondracanthidae

Genus *Chondracanthus* De la Roche

Chondracanthus alatus Heller (figs. 109-120)

Chondracanthus alatus Heller, 1865, p. 175; Bassett-Smith, 1898a, p. 13; Kirtisinghe, 1956, p. 20.

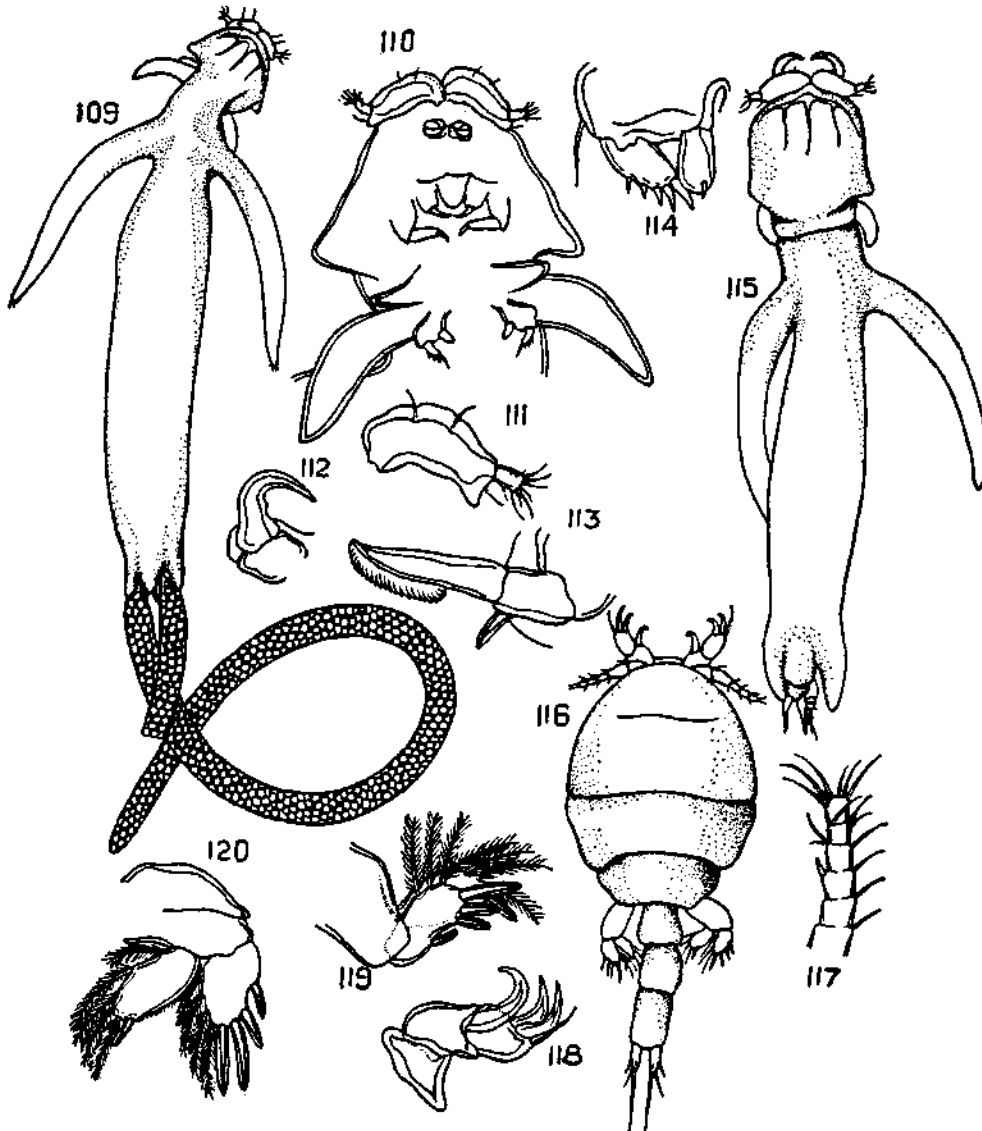
Pseudochondracanthus psettodes Kirtisinghe, 1950, p. 85, figs. 44-51.

Material: A very large number of specimens were collected from the gills of *Psettodes erumei* (Bloch) at Trivandrum.

Female: Body long and depressed, remotely fusiform. Head prominently asymmetrical, postero-laterally produced into triangular processes. Anterior border of head rounded, dorsal surface with three subparallel grooves starting from the anterior border. Trunk segments completely fused and not separated from the cephalon by a septum, with a prominent neck-like constriction. Anterior part of trunk with a pair of extremely elongated slender processes carrying three small apical teeth. Postero-lateral parts of trunk produced into blunt lobes on either side of the short abdomen. Abdomen indistinctly two-segmented, first segment fused with the trunk. Egg tubes longer than the body.

First antenna two-segmented, first segment highly flattened, with two setae on the anterior border, its distal lower corner produced, second segment short, with an apical bunch of spine setae. Second antenna two-segmented, second segment hook-like. Mandible with finely serrated curved blade. First maxilliped with a small, winged spine and a long stout spine with a serrate lobe on its lower side. Second maxilliped three-segmented, third segment very small. First leg biramous, rami one-segmented and carinate. Second leg biramous, protopod with

an outer seta, exopod stouter than endopod, with five spines, endopod with one spine. Anal laminae as long as distal segment of abdomen, with an outer seta and inner spine, apex drawn out and spine-like.



FIGS. 109-120. *Chondracanthus alatus* Heller. 109. female, dorsal view; 110. anterior part of body, ventral view; 111. antenna 1; 112. antenna 2; 113. maxilliped 1; 114. leg 1; 115. immature female, dorsal view; 116. immature male; 117. antenna 1; 118. antenna 2; 119. leg 1; 120. leg 2.

In the immature female cephalon is nearly symmetrical, trunk comparatively stout and clearly demarcated from the cephalon by a transverse septum, abdomen two-segmented. Posterior lobes of trunk long.

Length 6.0 mm.

Male: Body pyriform, with large cephalon and a posteriorly narrowing trunk showing indistinct segmentation. First antenna slender, setose and indistinctly segmented. Second antenna stouter than that of the female. Mandible with serrate borders. Maxilla a simple lobe with two setae. Maxillipeds as in female.

The immature male is a typical copepod with large ovate prosome and slender metasome. First antenna six-segmented. Second antenna three-segmented, second segment with one and third with two strong claws. Legs two pairs, both biramous, rami one-segmented with inner winged blunt spine and outer plumose setae.

Remarks: Heller's description of this species is inadequate and Kirtisinghe omitted details of the cephalic appendages. The head of the adult female has three parallel grooves and not one as stated by Kirtisinghe. What Kirtisinghe described as the cephalic barbs are only the postero-lateral corners of the cephalon. The immature female and male described here are of interest.

Chondracanthus trilobatus n. sp. (figs. 121-132)

Material: Several specimens were collected by the author from the gills of *Psettodes erumei* (Bloch) at Trivandrum. Holotype female and allotype male are deposited in the Indian Museum, Calcutta.

Female: Body elongate cylindrical, steadily narrowing towards the hind end, always twisted towards the right or left, depending on which side of the host it gets attached to. Head large and demarcated from the trunk by deep lateral constrictions, its antero-median part slightly produced and antero-lateral parts expanded into rounded lobes giving the head a pronounced trilobed appearance. Anterior part of trunk with a pair of elongate slender lateral processes similar to those of *C. alatus* Heller. Trunk nearly five times as long as head. Postero-lateral parts of trunk produced into a pair of distally rounded lobes, each carrying an outer seta. Abdomen one-segmented and as long as broad. Anal laminae long, with simple setae. Egg tubes shorter than trunk.

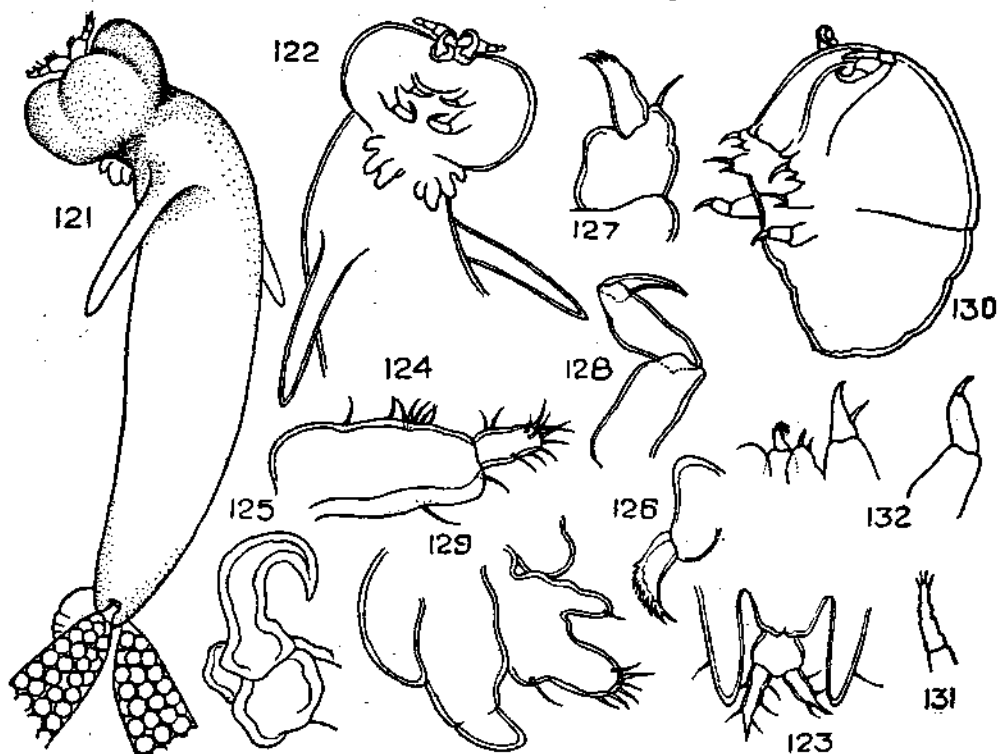
First antenna two-segmented and setose, basal segment moderately flattened. Second antenna with hook-like second segment. Distal blade of mandible serrated only on the lower side. Maxilla with two setae. First maxilliped with a seta and a curved apically serrated blade. Second maxilliped comparatively weak and subchelate. Legs two pairs, both biramous, but placed near each other and appearing as a four-lobed structure. First pair without setae, second pair with one seta on the inner lobe and several setae on the outer.

Length 3.4 mm.

Male: Body plump and indistinctly divided into subequal head and trunk. Abdomen not distinct. First antenna indistinctly five-segmented. Other appendages similar to those of female.

Remarks: *C. trilobatus* shows the closest resemblance to *C. alatus* Heller,

with which it is always associated. But the shape of the head and the nature and disposition of the legs distinguish it from all the known species.



FIGS. 121-132. *Chondracanthus trilobatus* n.sp. 121. female, dorsal view; 122. anterior part of body, ventral view; 123. posterior part of body, ventral view; 124. antenna 1; 125. antenna 2; 126. mandible; 127. maxilliped 1; 128. maxilliped 2; 129. legs 1 and 2; 130. male, lateral view; 131. antenna 1; 132. mouth parts.

Genus *Pseudochondracanthus* Wilson

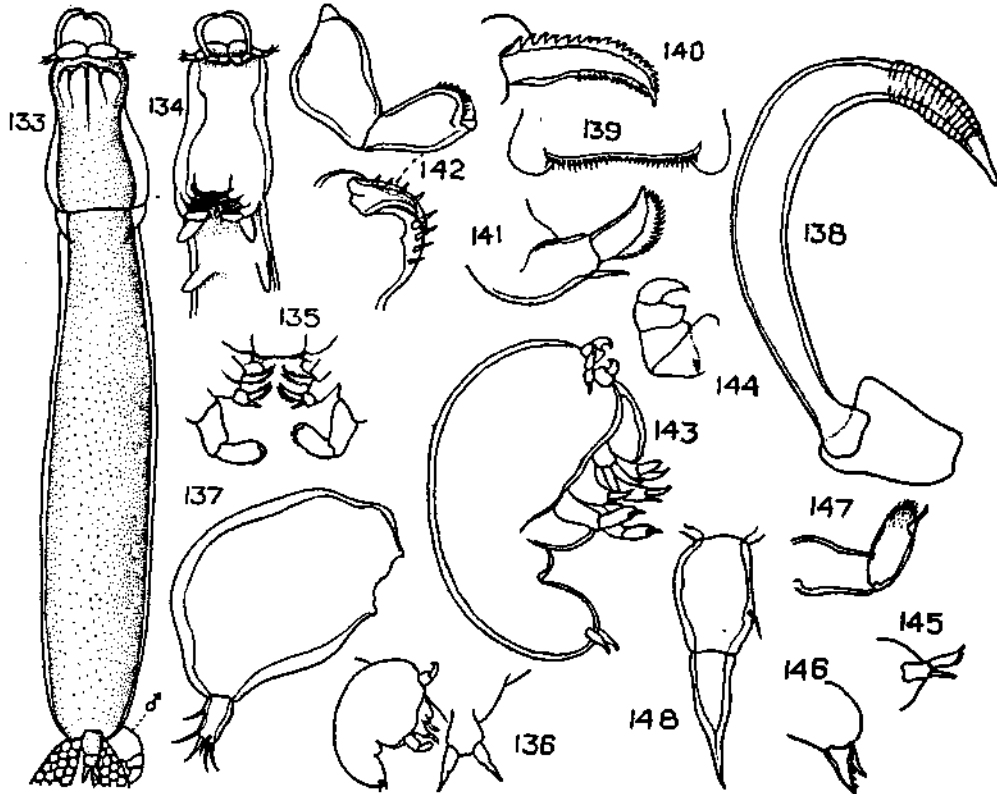
Pseudochondracanthus longitruncus Yamaguti (figs. 133-148)

Pseudochondracanthus longitruncus Yamaguti 1939, p. 541, pl. 40, figs. 62-65, pl. 41, figs. 66-71.

Material: Four females, with the male, were collected by the author from the gills of *Pseudorhombus arsius* (Ham. Buch.) at Trivandrum.

Female: Body long and subcylindrical, clearly demarcated into a cephalon and trunk. Anterior border of cephalon trilobed, with a low rostral elevation, lateral borders constricted at the anterior one-third, dorsal surface with five longitudinal ridges connected anteriorly by a transverse ridge. First trunk segment faintly demarcated, other segments completely fused into a long trunk, about three times the length of the cephalon. Abdomen short, two-segmented, slightly immersed in the trunk, anal laminae slightly longer than the distal abdominal segment.

First antenna two-segmented, basal segment highly flattened, distal segment short, with a few stiff setae. Second antenna two-segmented, distal segment very long and sickle-shaped, with the subapical part characteristically wrinkled. Upper lip with nearly straight spiny distal border. Distal segment of mandible with a long row of teeth on the lower border and a short row on the upper. First maxilliped two-segmented, distal segment with a high spiny crest on the ventral side, basal segment with a sharp spine. Second segment of second maxilliped distally expanded and spiny, third segment closing against this prominence. Legs two pairs, first leg biramous and second uniramous.



FIGS. 133-148. *Pseudochondracanthus longitruncus* Yamaguti. 133. female, dorsal view; 134. anterior part of body, ventral view; 135. mouth parts; 136. posterior part of body, ventral view; 137. antenna 1; 138. antenna 2; 139. upper lip; 140. mandible; 141. maxilliped 1; 142. maxilliped 2; 143. male, lateral view; 144. antenna 2; 145. mandible; 146. maxilliped 1; 147. maxilliped 2; 148. anal laminae.

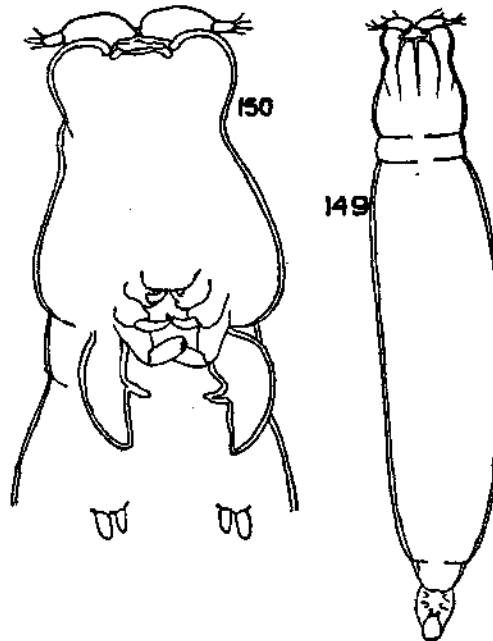
Length 3.0 mm.

Male: Body pyriform in dorsal view, not segmented. Uropods two-segmented, first segment with an inner spine. First antenna comparatively narrow. Second antenna short, three-segmented and pincer-like. Mandible and first maxilliped different from that of female, each with two blades. Third segment of second maxilliped very slender.

Remarks: The long trunk, the very characteristic dumbbell-shaped cephalon and the long sickle-shaped second antenna with the characteristic wrinkles show the identity of the present specimens, but the following differences were observed. The trunk expands slightly towards the posterior end. The abdomen is clearly two-segmented. Second antenna is comparatively longer. Yamaguti described the first leg as uniramous with a small lateral projection and the second leg as distinctly biramous. In my specimens the condition is just the reverse. The legs are simple laminae without any kind of armature. These differences, however, do not appear to have specific value.

***Pseudochondracanthus* sp. (figs. 149-150)**

Material: A single non-ovigerous female with the male was collected from the roof of the buccal cavity of *Plagusia* sp. at Trivandrum.



FIGS. 149-150. *Pseudochondracanthus* sp. 149. female, dorsal view; 150. anterior part of body, ventral view.

Length 2.1 mm.

Remarks: Since I have only a single specimen, probably not fully mature, I content myself with pointing out the salient characters. This species closely resembles *P. longitruncus* Yamaguti but differs as follows. The cephalon and the trunk are comparatively shorter and more plump. Abdomen is single-segmented and just indicated by a transverse partition. The first trunk segment is clearly defined. Second antenna, though sickle-shaped, is very short. Mouth parts are similar to those of *P. longitruncus*. The legs are exactly as described by Yamaguti for *P. longitruncus*. The first leg is a large lamina with an inner prolongation and the

second is small and clearly biramous. But for the different shape of the second antenna the description of *P. longitruncus* would apply to the present specimen.

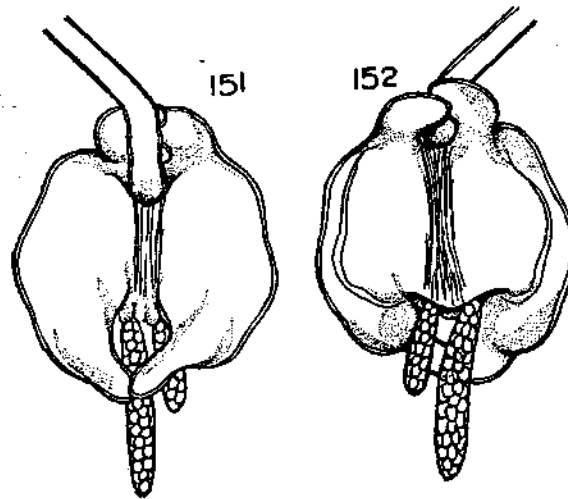
Genus *Medesicaste* Kroyer

Medesicaste penetrans Heller (figs. 151-152)

Medesicaste penetrans Barnard, 1955, p. 301, f. 31.

Material: A single ovigerous female, with the male, was collected from the buccal cavity of an unidentified species of *Trigla* at Trivandrum. The buried part of the body of the female was lost.

Remarks: The taxonomic status of this species was discussed by Barnard. I merely record its occurrence here and also figure the female in the dorsal and ventral views. Compared to the figure published by Barnard, the anterior processes of the



FIGS. 151-152. *Medesicaste penetrans* Heller. 151. genital segment of female, ventral view ; 152. same, dorsal view.

genital segment are more produced, clearly longer than broad and apically bent inwards and overlap below the long neck. The posterior processes are stouter than shown by Barnard and Heller (1865). In the single specimen obtained the egg sacs are slender and unequal, with comparatively large eggs.

SUMMARY

Sixteen species of piscicolous copepods belonging to various families are recorded. Three of them, namely, *Caligus hamruri*, *Hatschekia sphyraeni* and *Chondracanthus trilobatus* are new. Short notes on the other species are given. All the species are suitably illustrated.

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