

**COPEPODS PARASITIC ON SOUTH INDIAN FISHES FAMILIES  
LERNAEOPODIDAE AND NAOBRANCHIDAE**

By N. KRISHNA PILLAI

*Marine Biological Laboratory, Trivandrum-7*

THE present paper deals with the genera *Lernaeopoda*, *Thysanote*, *Charopinus*, *Clavellopsis*, *Clavellisa* and *Brachiella*, belonging to family Lernaeopodidae and *Naobranchia* belonging to Naobranchidae. In all twenty species are described, three of them without a specific name for want of sufficient material.

**Family LERNAEOPODIDAE**

Genus *Lernaeopoda* Blainville

*Lernaeopoda upenaei* sp. nov.

FIG. 1

*Material.* Several specimens, both females and males, from the inner surface of the opercle of *Upenaeus vittatus* (Forsk.) examined at Trivandrum.

*Female.* Body rather stout, gradually widening towards the hind end. Cephalothorax short, about a third of the length of the first maxillipeds. Head covered dorsally by a distinct carapace. Postero-median part of trunk produced into a small indistinctly bilobed genital process. Egg sacs stout, elongate-oblong and two-thirds as long as trunk.

First antenna four-segmented, first segment swollen, fourth segment longer than second, with three strong spines. Second antenna projecting far beyond the anterior border of head, exopod unsegmented, endopod three-segmented, third segment with three spines, chitinous covering rugose. Mandible short, with six large teeth. Maxilla bipartite, its palp with two spines. First maxillipeds long and slender, free except at the tip where they are joined to a vine glass-shaped bulla. Distal half of inner border of first segment of second maxilliped with a strong spine and two patches of small teeth, distal segment with a proximal spine, unguis strong and pointed, lower border just behind the unguis produced into two spines, one long and the other short. Posterior part of trunk with a pair of short distally attenuating processes starting from the ventral side and remaining ventral to the egg tubes.

Total length 3.3 mm., length of cephalothorax 1.0 mm., length of trunk 2.3 mm., length of egg sacs 1.5 mm., length of first maxilliped 1.9 mm.

*Male.* Body covered by a very loose moderately wrinkled covering. Cephalothorax subequal to trunk, the two connected by a fairly deep median part. Head dorsally covered by a large carapace. First antenna four-segmented, second segment with one and fourth with three spines. Exopod of second antenna with two

spines, endopod two-segmented, distal segment with two spines and a serrate lobe. Maxilla as in the female, but without the distal spines. Basal segment of first maxilliped with a rounded spiny lobe at the inner distal part, distal segment strongly curved. Basal segment of second maxilliped with a simple inner lobe, distal segment blunt. Anal laminae absent.

Total length 0.8 mm.

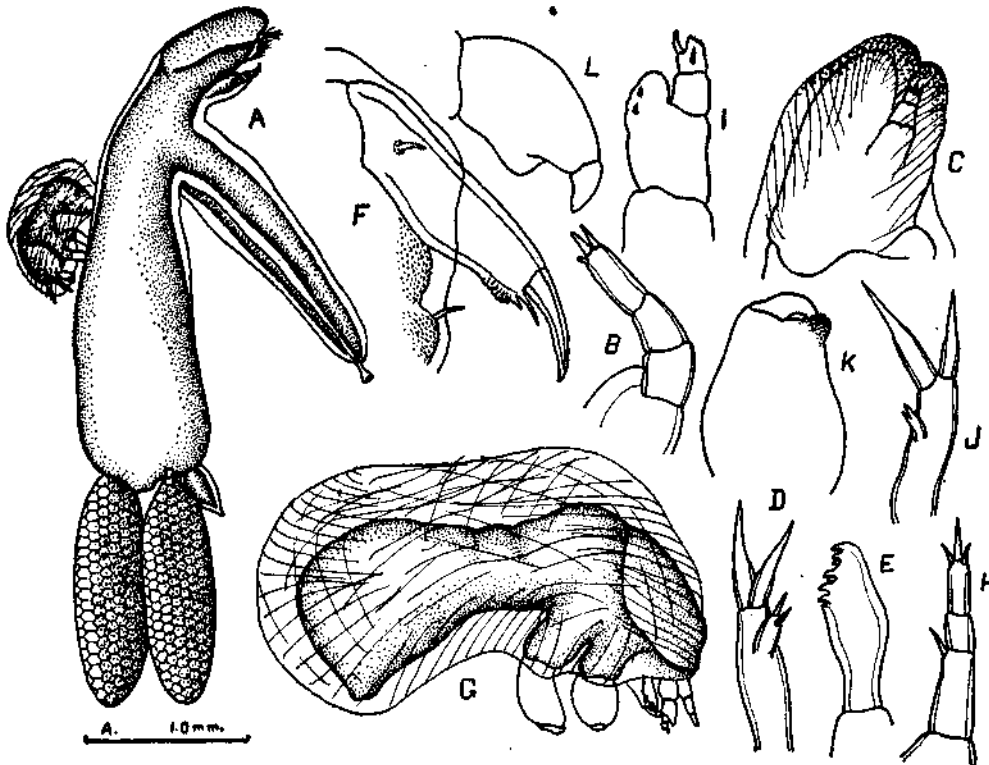


Fig. 1. *Lernaepoda upenaei* sp. nov. (a) female, lateral view; (b) first antenna; (c) second antenna; (d) maxilla; (e) mandible; (f) tip of second maxilliped; (g) male; (h) first antenna; (i) second antenna; (j) maxilla; (k) first maxilliped; (l) second maxilliped.

*Holotype* female and *allotype* male deposited in the Marine Biological Laboratory, Trivandrum.

#### Genus *Thysanote* Kroyer

*Thysanote* Wilson, 1915, p. 650.

According to Wilson genus *Thysanote* lacks genital process, abdomen and anal laminae. In all the species in the present collection there is a pair of postero-medial ventral processes distinct from the posterior trunk processes. These must be the anal laminae. There is also a small bilobed process, which appears to be

the genital process. The maxilla, as described by Wilson, is generally bipartite, but it may also be tripartite. The first antenna is distinctly four-segmented.

*Thysanote appendiculata* (Stp. & Lutk.)

FIG. 2

*Brachiella appendiculata* Stp. & Lutk., 1861, p. 419, pl. 15, f. 35.

*Brachiella appendiculosa* Bassett-Smith, 1898, p. 14, pl. 6, figs. 1-3.

*Thysanote appendiculata* Wilson, 1915, p. 650.

*Thysanote appendiculata* Kirtisinghe, 1935, p. 343.

*Thysanote appendiculata* Gnanamuthu, 1949, p. 259, figs. 1-3.

*Material.* Several specimens, females and males, from the gill arches of *Parasitromateus niger* (Bloch) examined at Trivandrum.

*Female.* Cephalothorax short and dorso-ventrally flattened, indistinctly demarcated from the trunk and slightly bent ventralwards, carapace distinct. Trunk widening backwards, with a pronounced bulge at the base of the first maxillipeds, posterior border with a very short genital process. Chitinous covering of body very slightly wrinkled.

First antenna four-segmented, basal segment swollen, distal segment with three spines and two blades. Second antenna biramous, exopod two-segmented and with an apical claw, endopod three-segmented and ending in a claw. Maxilla tripartite, outer spine small, palp with four spines, two of them comparatively small. Mandible with seven teeth, first two teeth alternating with subsidiary teeth. First maxillipeds stout, united only at the tip, bulla mushroom-shaped and flanked by wing-like thickenings. Each maxilliped with two pairs of digitiform processes originating from the middle of its ventral side. Palm of second maxilliped with a large conical tooth nearer to its base, dactylus with a long slender unguis, a small secondary unguis and a serrate lobe terminating in a well marked spine just below the secondary unguis. Posterior part of trunk with two pairs of lateral processes starting from the ventral side, ventro-median part with a pair of anal laminae exactly like the posterior processes but with more acute tip. Egg sacs cylindrical.

Total length 5.2 mm., length of cephalothorax 1.9 mm., length of posterior processes 1.4 mm., length of egg sacs 4.2 mm.

*Male.* Body indistinctly demarcated into a cephalothorax and trunk, latter narrowing towards the hind end. Head covered by a carapace. Chitinous covering loose and well wrinkled. First antenna four-segmented and slender, fourth segment with two spines and two blades. Second antenna biramous, exopod unjointed and lamellar, endopod two-segmented, distal segment with a spiny crest bounded below by a small claw and above by a long claw with a spine just below. First maxilliped with a stout basal segment having a spiny projection against which

the slender distal segment folds. Second maxilliped prominently curved, cylindrical and subchelate, second segment short but stout. Anal laminae claw-like.

Total length 0.8 mm.

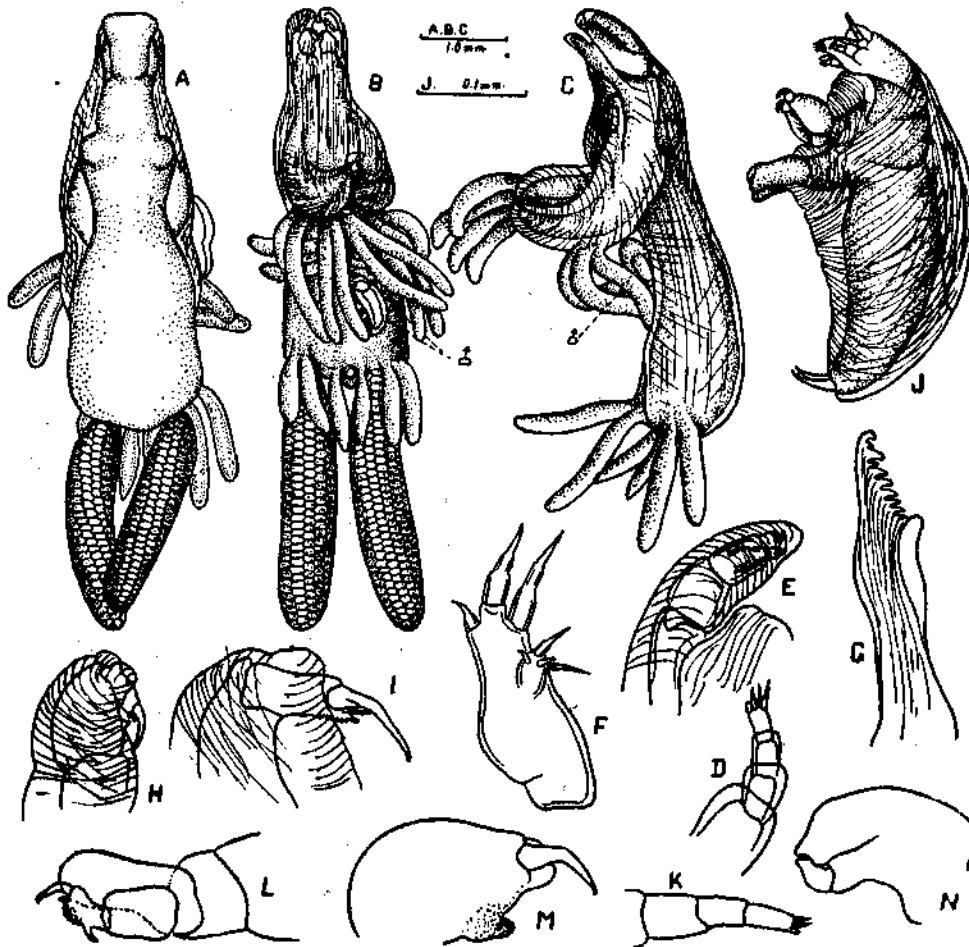


Fig. 2. *Thysanote appendiculata* (Stp. & Lutk.) (a) female, dorsal view; (b) same, ventral view; (c) same, lateral view; (d) first antenna; (e) second antenna; (f) maxilla; (g) mandible; (h) second maxilliped; (i) same, tip enlarged; (j) male; (k) first antenna; (l) second antenna; (m) first maxilliped; (n) second maxilliped.

*Thysanote longimanus* Wilson

FIG. 3

*Thysanote longimanus* Wilson, 1913, p. 257, pls. 47-48.

*Material.* A single female, with the male, from the inner surface of the opercle of *Carangoides malabaricus* (Bloch) examined at Trivandrum.

*Female.* Body demarcated into cephalothorax and trunk, gradually broadening towards the hind end, dorso-ventrally flattened and encased in a glistening sparsely wrinkled chitinous covering. Cephalothorax about twice as long as broad, with a pronounced bulge at the place of attachment of the first maxillipeds, carapace distinct, its anterior border convex. Postero-lateral parts of trunk continued into the fimbriate processes and the postero-median part produced into a large bilobed genital process. Body processes four pairs, first pair bifid and attached to the base of the first maxillipeds, second pair dichotomously branched twice and attached to the middle of the ventral side of the maxillipeds, the last two pairs at the postero-lateral corners of the trunk, dorsal pair with only one of the main branches secondarily branched. The secondary branching of the trunk processes obviously varies, but as observed by Wilson, not more than twice.

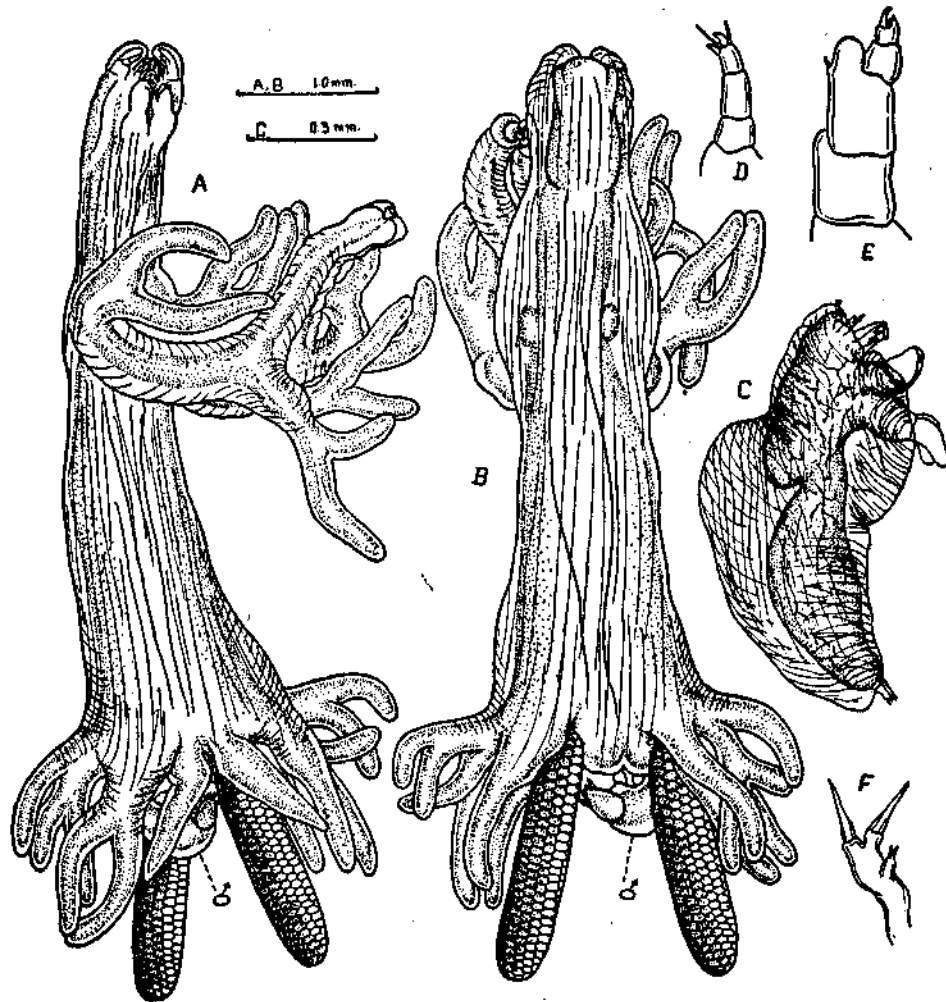


Fig. 3. *Thysanote longimanus* Wilson. (a) female, ventral view; (b) same, dorsal view; (c) male; (d) first antenna; (e) second antenna; (f) maxilla.

Second antenna projecting in front of the carapace. First maxillipeds very long, as long as the trunk, free except at the tip, bulla small and vine-glass shaped and flanked by wing-like thickenings. Postero-median part of body with a pair of lanceolate anal laminae ventral to the egg sacs. Egg sacs cylindrical and stout but comparatively short.

Total length 4.7 mm., length of cephalothorax 1.8 mm., length of trunk 2.9 mm., length of egg sacs 1.6 mm.

*Male.* Body demarcated into cephalothorax and trunk by a very pronounced dorsal incision producing a prominent waist, chitinous covering considerably detached from the body and producing a dorsal hump. First antenna four-segmented, fourth segment with two stout claws and two slender spines. Second antenna biramous, the unjointed exopod with a sharp tooth, endopod two-segmented, with two apical spines. Maxilla bipartite, palp with two spines. Anal laminae apically rounded and with two spinules.

Length 0.8 mm.

*Remarks.* The only specimen available was not dissected and hence the appendages could not be studied in detail. Though the branching of the fimbriate processes is slightly different from that in the type the pattern is the same. In the male the first antenna has two spines in addition to the two claws mentioned by Wilson. The end segment of the endopod of the second antenna has an additional spine and the exopod carries a spine. To my knowledge this species has not been described since it was discovered by Wilson from the West Indies.

*Thysanote decemfimbriata* sp.nov.

FIG. 4

*Material.* Two females, one with the male, from the inner surface of the opercle of *Polydora plebeius* (Broussonet) examined at Trivandrum.

*Female.* Body very clearly demarcated into a narrow cephalothorax and broad trunk, more or less as in *T. pomacanthi* (Kroyer). Cephalothorax cylindrical, about three times as long as broad, slightly dorso-ventrally flattened, carapace very prominent. Trunk abruptly broader than cephalothorax, longer than broad, with a shallow dorso-median groove making the dorsal side double convex, lateral sides nearly parallel, posterior border irregularly lobed and with a short bilobed genital process.

First antenna four-segmented, basal segment swollen, distal segment with two spines and two blades. Second antenna biramous, exopod broad, with a spine and a large flattened lobe, endopod two-segmented, distal segment with three spines, chitinous covering very sparsely rugose. Mandible short, with eleven teeth, small subsidiary teeth absent. Maxilla bipartite, with a large semicircular prominently spiny outer expansion, palp small, with two spines. First maxillipeds short and swollen, apically expanded into a hemisphere, bulla cup-like, with a long stalk. Basal segment of second maxilliped with a small process bearing a sharp spine, distal segment with two spines and bifid lower lobe.

Fimbriate processes attached to the base of the maxillipeds, composed of five pairs of elongated apically narrowed biramous processes thickly massed around the ventral and lateral parts of the anterior part of the trunk. Posterior trunk processes four pairs, short and apically narrowed and uniramous. Anal laminae

like the posterior processes but with slightly more rounded apex. Egg sacs large, only slightly shorter than the body, eggs comparatively small.

Total length 5.0 mm., length of cephalothorax 2.1 mm., length of trunk 2.9 mm., length of egg sacs 3.4 mm., length of anterior trunk processes 2.0 mm., length of posterior trunk processes 1.2 mm.

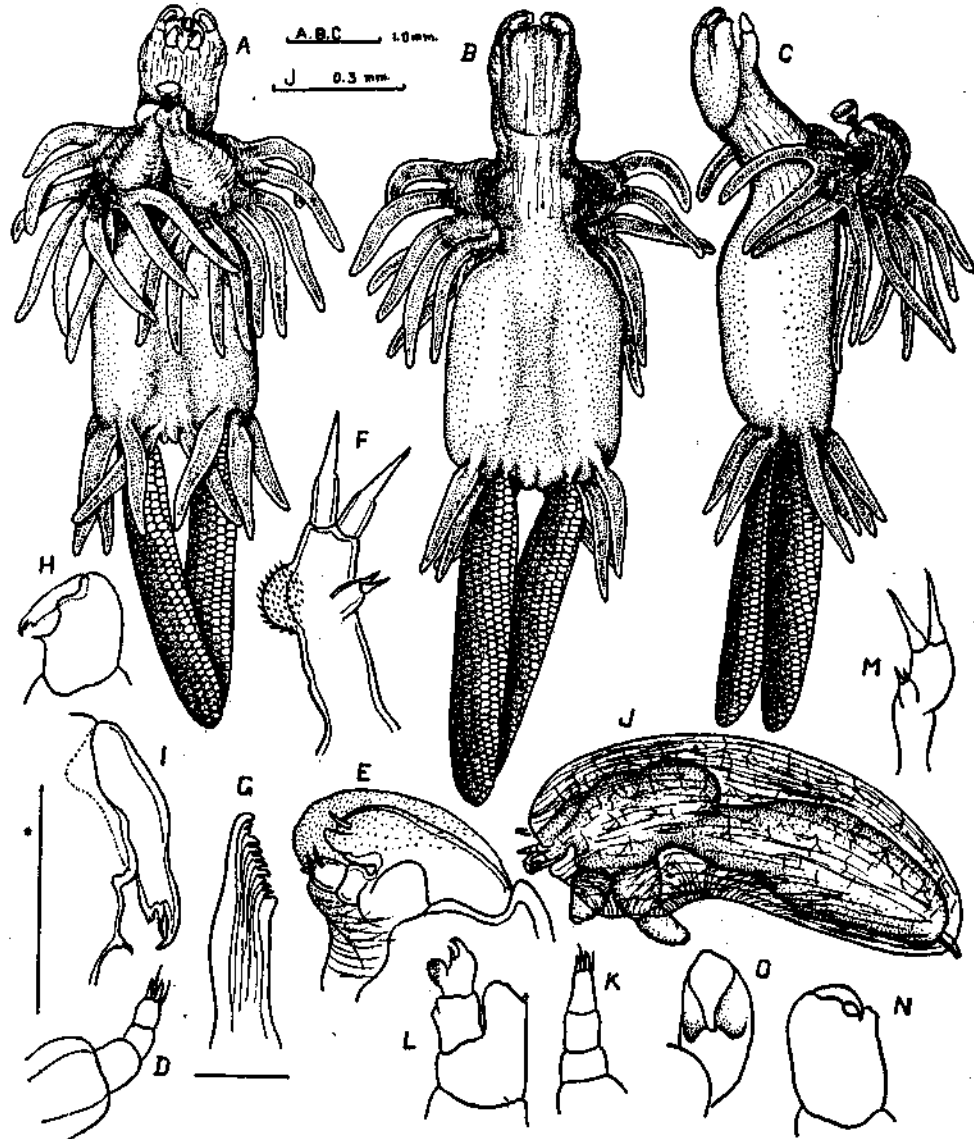


Fig. 4. *Thysanote decemfimbriata* sp. nov. (a) female, ventral view; (b) same, dorsal view; (c) same, lateral view; (d) first antenna; (e) second antenna; (f) maxilla; (g) mandible; (h) second maxilliped; (i) same, tip enlarged; (j) male; (k) first antenna; (l) second antenna; (m) maxilla; (n) first maxilliped; (o) second maxilliped.

*Male.* Body demarcated into cephalothorax and trunk by a prominent waist-like constriction. Trunk oblong, not narrowing backwards as in *T. appendiculata*. Carapace indistinct, chitinous covering loose and moderately wrinkled. First antenna as in female but basal segment not swollen. Second antenna biramous, exopod lamellate, with one spine, endopod two-segmented, distal segment with a large spiny lobe and two claws. Maxilla as in female, but without the outer lobe. Basal segment of first maxilliped squarish, its inner distal part produced into a lobe against which the curved distal segment works. Second maxilliped similar to first but larger. Anal laminae slender and spine-like.

Total length 1.0 mm.

*Holotype* female and *allotype* male are deposited in the Marine Biological Laboratory, Trivandrum.

*Remarks.* According to the key provided by Wilson (1915) the present species would come within the group characterised by thickly massed fimbriate processes. In *T. fimbriata* (Heller) the maxillipeds carry only three single processes. In *T. pomacanthi* (Kroyer) the posterior processes are more numerous than in the present species. The trunk processes of *T. lobiventris* (Heller) resemble those of the present but it has four pairs of anterior processes which are on the maxillipeds while there are five pairs in *T. decemfimbriata* originating from the base of the maxillipeds. Also each of these processes is dichotomously branched.

*Thysanote* sp.

FIG. 5

*Material.* A single female, with the male, from the posterior surface of the peduncle of the pectoral fin of *Chorinemus tala* Cuvier examined at Vizhingom.

*Female.* Body very indistinctly demarcated into cephalothorax and trunk. Cephalothorax about twice as long as broad, dorso-ventrally flattened, carapace distinct. Trunk considerably swollen, slightly longer than broad, dorsal side highly convex and ventral flat, length slightly more than width. Postero-median part of ventral side with a very small, triangular genital process carrying a pair of small spermatophores.

First pair of maxillipeds as long as trunk, completely free, bulla missing, each maxilliped with a semicircular enlargement where it contacts the cephalothorax. Anterior fimbriate processes four pairs, forming two bunches, each bunch having a common origin from the trunk just below the insertion of the maxilliped. Posterior processes four pairs, unbranched and laterally situated. Anal laminae like the posterior processes but apically rounded. Egg sacs longer than broad, eggs fairly large.

Total length 4.5 mm., length of cephalothorax 1.9 mm., length of trunk 2.6 mm., breadth of trunk 2.5 mm., length of first maxilliped 3.4 mm., length of egg sacs 3.8 mm.

*Male.* Body rather stout, demarcated into cephalothorax and trunk but without the waist characteristic of other species. Cephalothorax enlarged and anteriorly subtruncate. Trunk slightly narrowed at the posterior end. Anal laminae short and apically rounded. Chitinous covering close to the body flesh and only moderately wrinkled.



Total length 1.0 mm.

*Remarks.* There is very little doubt that this specimen constitutes a new species very much allied to *T. longimanus* Wilson in the extremely elongated first maxilli-

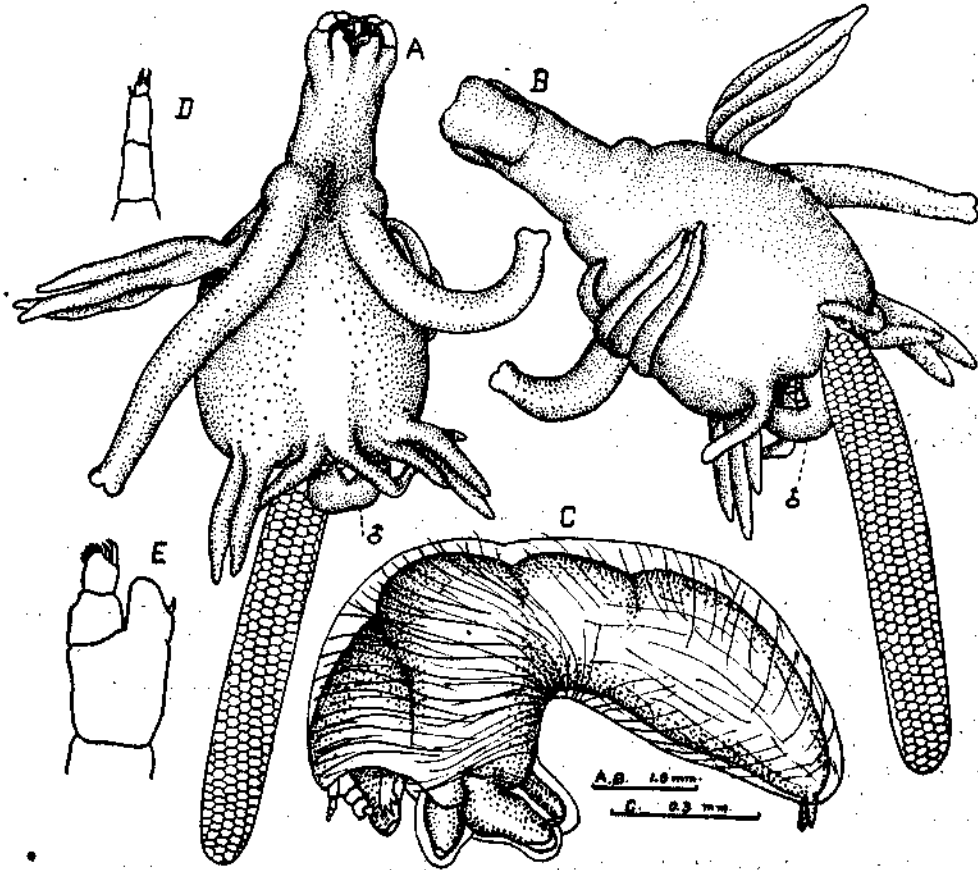


Fig. 5. *Thysanote* sp. (a) female, ventral view; (b) same, dorsal view; (c) male; (d) first antenna; (e) second antenna.

ped. But that is the only character it shares in common with Wilson's species. Until more material is obtained I do not want to name it.

#### Genus *Charopinus* Kroyer

#### *Charopinus dasyaticus* sp.nov.

FIG. 6

*Material.* Several specimens, one with the male, from the margin of the body of *Dasyatis (Amphotistlus) imbricatus* (Bloch and Sch.) examined at Quilon and Trivandrum.

*Female.* Cephalothorax long and fairly stout, nearly cylindrical, head swollen and dorsally covered by a distinct carapace. Trunk elongate pear-shaped, as long as cephalothorax, anteriorly narrowed and slightly flattened dorso-ventrally. Posterior border of trunk with a median apically bilobed genital process carrying a pair of foliaceous apically acute laminae.

First antenna two-segmented, basal segment proximally produced into a large membranous lobe, with one stout seta, distal segment with five spines. Second antenna with a large exopod carrying one spine, its surface rugose, endopod comparatively small and two-segmented, distal segment with two claws. Maxilla tripartite, palp stout, with two spines. Mandible with eight large teeth and three small ones. First maxillipeds about two-thirds as long as cephalothorax, completely free except at the tip where they are connected to a small rod shaped bulla flanked by two large semicircular wings, each maxilliped forming a semicircular expansion and the two together forming a cup with the bulla at its bottom. Basal segment of second maxilliped large, with a long inner spine, distal segment with a proximal

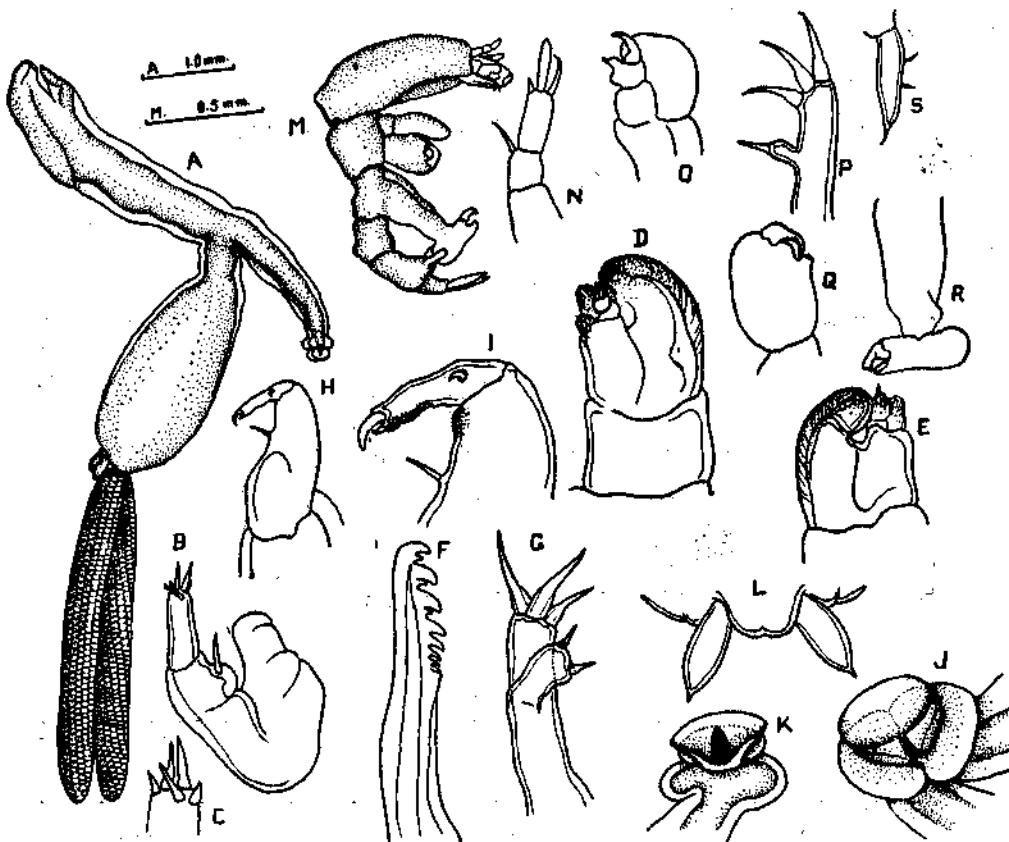


Fig. 6. *Charopinus dasyticus* sp. nov. (a) female, lateral view; (b) first antenna; (c) same, tip enlarged; (d) second antenna; (e) same, inner view; (f) mandible; (g) maxilla; (h) second maxilliped; (i) same, tip enlarged; (j) same, bulla; (k) same, one half of bulla; (l) caudal end of trunk; (m) male; (n) first antenna; (o) second antenna; (p) maxilla; (q) first maxilliped; (r) second maxilliped; (s) anal lamina.

seta, unguis claw-like and with a small secondary unguis, lower border of the segment and the distal inner border of the first segment spiny. Egg sacs slender, longer than trunk.

Total length 6.1 mm., length of cephalothorax 3.0 mm., length of trunk 3.1 mm., length of first maxilliped 1.7 mm.

*Male.* Body fully segmented. Head covered by a large carapace nearly as long as trunk. First two trunk segments carrying the maxillipeds comparatively stout, third segment small and without appendages, fourth segment longer than third, with a pair of dumbbell-shaped processes. Abdomen small. First antenna three-segmented, second segment with a long seta, third segment with a long seta, a short spine and a club-shaped process. Second antenna with a large laminate exopod and two-segmented endopod, distal segment of endopod with two stout claws. Maxilla tripartite, palp with one spine. First maxilliped three-segmented, second segment oblong, carrying a toothed process against which the dactylus closes. First segment of second maxilliped long, second segment placed at right angles to the first, third segment forming a perfect chela with the second. Anal laminae apically drawn out into a spine with two setae.

Total length 1.8 mm.

*Remarks.* The present specimens show very close resemblance to *C. markewitschi* Gussev even in the minute details of the appendages. However, it could be distinguished by the comparatively shorter first maxillipeds which are only two-thirds as long as the cephalothorax. In *C. markewitschi* the maxillipeds are longer than the cephalothorax. Also in the latter species the cephalothorax is shorter than the trunk, but just equal in the present species.

According to Shiino (1956, 1959) *C. markewitschi* closely resembles *C. pastinacae* (van Beneden). The description given by van Beneden and T. & A. Scott shows the two species different. I have not been able to consult Capart's (1951) paper. Hence the identification of this species is provisional.

Rangnekar's (1957) *Clavelloopsis dasyaticus* collected from *Dasyatis uarnac* appears to belong to *Charopinus* and probably may be the same as the present.

#### *Charopinus narcinae* sp. nov.

FIG. 7

*Material.* Several females from the gill arches of *Narcine timlei* (Bloch and Sch.) examined at Trivandrum.

*Female.* Cephalothorax stout and cylindrical, slightly shorter than trunk and bent dorsalwards, remaining at right angles to the latter. Head slightly swollen and dorsally covered by a carapace. Trunk elongate oblong, with the anterior end much narrowed, postero-median part of trunk produced into a short bilobed process. Posterior part of trunk with a pair of stout oblong, flat processes, each tipped with a small cusp. Egg sacs as long as trunk.

First antenna two-segmented, basal segment prolonged into a large irregular lobe with one distal seta, second segment with three large and two small spines. Second antenna biramous, rami with rugose border, exopod with one claw, endopod three-segmented, with two apical claws. Maxilla tripartite, inner spine small, palp stout, with two small spines. Mandible with eight large teeth, first three alternating with small ones. First maxillipeds long and slender, very slightly longer than

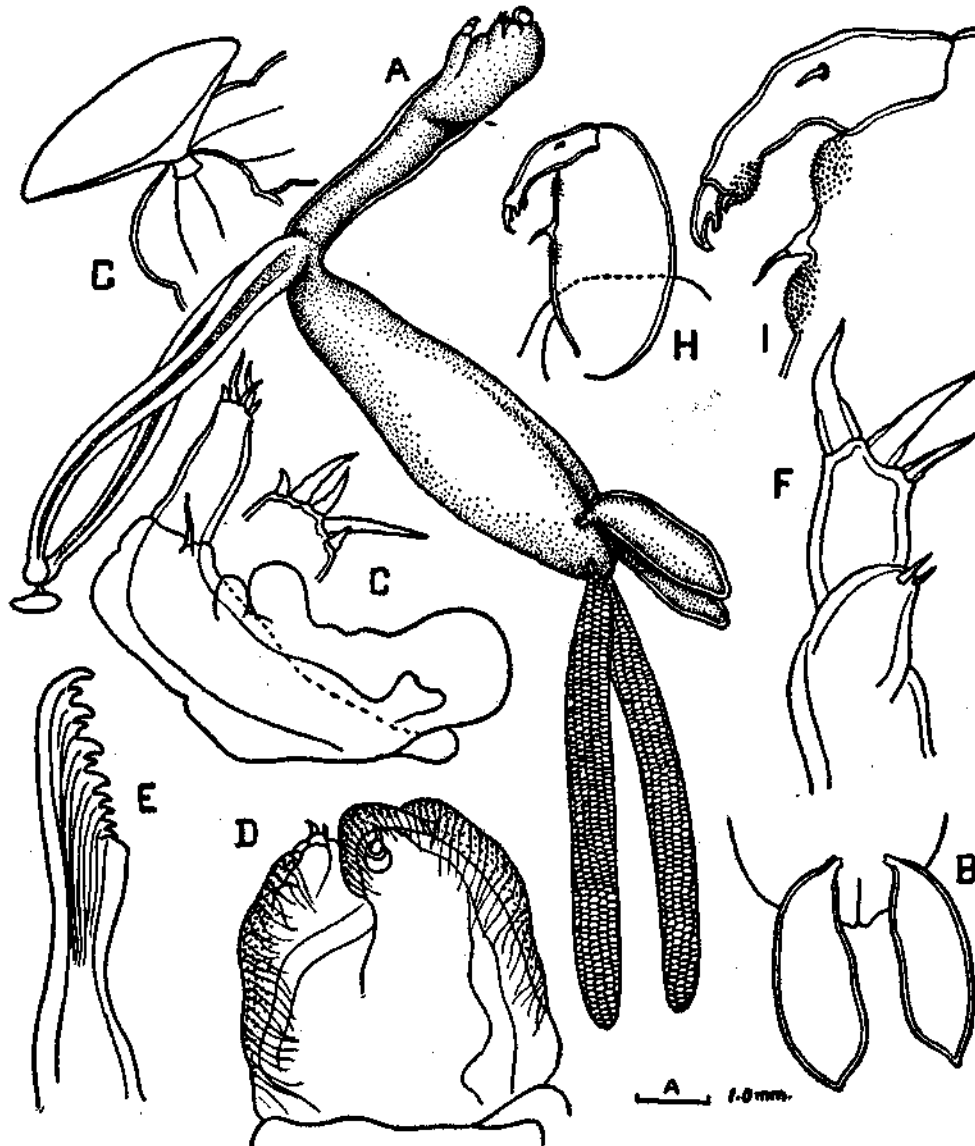


Fig. 7. *Charoptilus narcinae* sp. nov. (a) female; (b) caudal end of trunk; (c) first antenna; (d) second antenna; (e) mandible; (f) maxilla; (g) bulla; (h) second maxilliped; (i) same, tip enlarged.

the cephalothorax, free and united at the tip through an oblong saucer-shaped or boat-shaped bulla. Basal segment of second maxilliped with one spine, distal segment with a proximal spine, unguis claw-like and with a subsidiary spine, lower border spiny and produced into a spine at the base of the unguis, basal segment with a patch of denticles above and below this spine.

Total length 10.7 mm., length of cephalothorax 5.0 mm., length of trunk 5.7 mm., length of first maxilliped 6.7 mm., length of egg sacs 6.6 mm.

*Holotype* female deposited in the Marine Biological Laboratory, Trivandrum.

*Remarks.* The present species remotely resembles *C. dubius* Scott as described by Barnard (1955). Barnard describes the trunk processes as only slightly shorter than the trunk. In *C. narsinae* they are much shorter. The two species have the first maxillipeds longer than the cephalothorax and joined to a boat-shaped bulla. In *C. dubius* the distal segment of the second maxilliped is minute while it is of the normal size in *C. narsinae*.

#### Genus *Clavellopsis* Wilson

##### *Clavellopsis appendiculata* Kirtisinghe

FIGS. 8-9.

*Clavellopsis appendiculata* Kirtisinghe, 1950, p. 84, figs 40-43.

*Material.* Several females, one with the male, from the gill arches of *Chirocentrus dorab* (Forsk.) examined at Trivandrum.

*Female.* Cephalothorax cylindrical and bent backwards. Carapace about a quarter of the length of the cephalothorax and indicated by a mere dorsal swelling, its anterior border nearly subtruncate. Trunk pear-shaped, with a distinct dorso-ventral flattening and a dorso-median longitudinal groove. Chitinous covering of body prominently wrinkled and separated from the body flesh. Posterior part of trunk with a short genital process and two pairs of long cylindrical processes, ventral processes arising close together and the dorsal almost from the postero-lateral parts and hence wide apart. Egg sacs stout, elongate-oblong, as long as trunk and very slightly longer than the trunk processes.

First antenna four-segmented, basal segment flattened, second segment with a seta, fourth segment with one slender and three stout spines. Second antenna slightly curved and biramous, exopod unjointed and with an apical tooth, chitinous covering rugose along the border, endopod two-segmented, distal segment with two spines. Mandible with seven to eight large blunt teeth, first four teeth alternating with small subsidiary teeth, inner border behind the last tooth bulged. Maxilla bipartite, palp with two spines. First maxillipeds short but stout, completely fused and with a typical bulla mounted on a stout peduncle; glands prominent. Basal segment of second maxilliped stout, its inner border with a prominent tubercle carrying a stout spine, the border above and below the spine rugose, distal segment with a distinct unguis and secondary unguis, lower border behind the secondary unguis with closely packed denticles.

Total length 4.0 mm., length of cephalothorax 2.3 mm., length of trunk 1.7 mm., length of posterior processes 2.3 mm., length of egg sacs 2.0 mm.

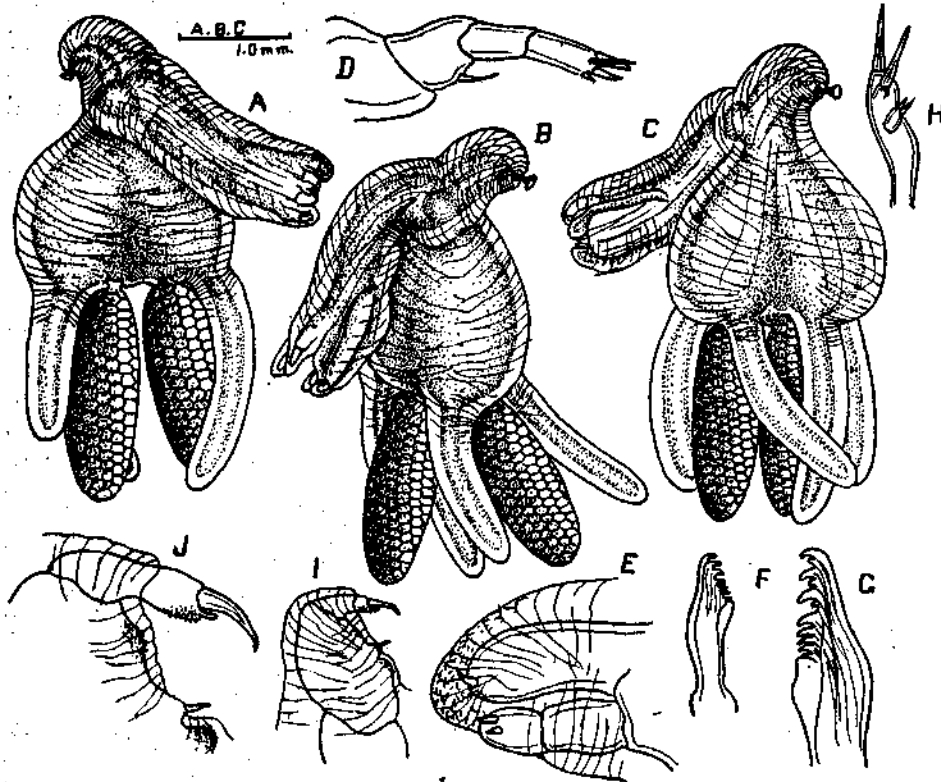


Fig. 8. *Clavellopsis appendiculata* Kirtisinghe. (a) female, dorsal view; (b) same, lateral view; (c) same, ventral view; (d) first antenna; (e) second antenna; (f) mandible; (g) same, tip enlarged; (h) maxilla; (i) second maxilliped; (j) same, tip enlarged.

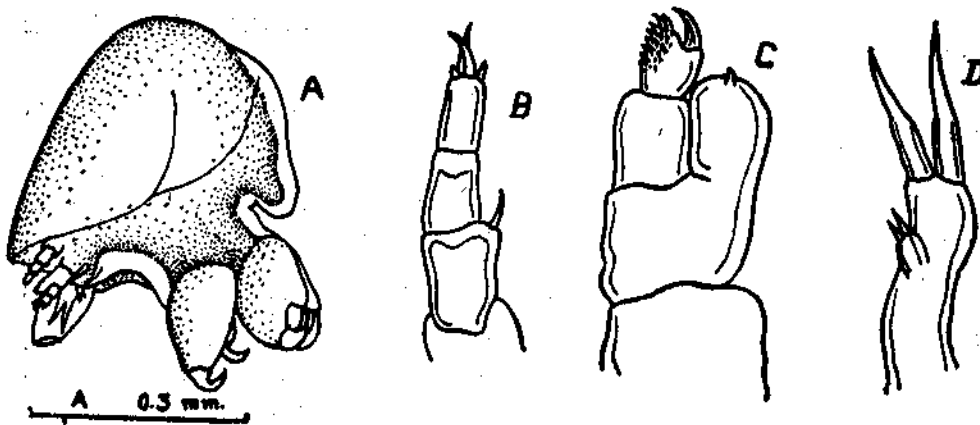


Fig. 9. *Clavellopsis appendiculata* Kirtisinghe. (a) male; (b) first antenna; (c) second antenna; (d) maxilla.

*Male.* Body antero-posteriorly compressed and dorsally convex, with a large but distinct carapace. Mouth tube and maxillipeds projecting. First antenna four-segmented, as in female, but the basal segment is not swollen. Second antenna biramous, the lamellate exopod with a distal tooth, distal segment of endopod with a stout claw, its inner surface spiny. Maxilla as in female. Basal segment of first maxilliped pyriform, that of second broad and produced into a lobe on the inner side, both maxillipeds with curved distal segment. Anal laminae absent, caudal lobe prominent and projecting.

Total length 0.4 mm.

*Clavellopsis bilobata* sp.nov.

FIG. 10

*Material.* Seven females, four with male, from the gill arches of *Nemipterus japonicus* (Bloch) examined at Trivandrum.

*Female.* Body short and plump. Cephalothorax cylindrical, about three times as long as broad and slightly inclined dorsalwards and remaining more or less in a line with the first maxillipeds. Basal part of cephalothorax housing the glands prominently bulged. Head with a small but distinct carapace, anteriorly rounded, with the second antenna visible beyond its anterior border. Trunk shorter than cephalothorax, transversely expanded and very slightly flattened dorso-ventrally, with a prominent ventro-median longitudinal gutter demarcating it into two nearly rounded lateral lobes, length half its breadth. Postero-median part of trunk produced into a stout rounded genital process. Body covered by a very loose, highly wrinkled chitinous covering.

First antenna four-segmented, basal segment flattened, second segment with a long seta, distal segment with four spines, two of them flattened and blade-like. Second antenna biramous, exopod unsegmented and carrying a distal claw, chitinous covering distally spiny, endopod two-segmented, distal segment with a large sub-apical claw. Maxilla bipartite, palp with two spines. Mandible comparatively short and with seven large and two small teeth. First maxillipeds short and united to form a cone, bulla vine glass-shaped and flanked by two wing-like expansions. Basal segment of second maxilliped with a blunt tooth on the inner side, distal segment with an unguis and a secondary unguis. Egg tubes short, roughly as long as the trunk.

Total length 2.2 mm., length of cephalothorax 1.3 mm., length of trunk 0.8 mm., breadth of trunk 1.3 mm.

*Male.* Body almost globular, with the chitinous covering considerably detached from the body flesh and prominently wrinkled, ventral side nearly flat. Body demarcated into a cephalothorax and trunk by a prominent dorsal constriction, carapace not visible. Trunk ending in a small caudal process, anal laminae absent. First antenna four segmented and slender, first segment not inflated, second segment without spine, fourth segment with three spines and one seta. Second antenna biramous, exopod unsegmented and lamellar, endopod two-segmented, second segment with a row of strong spines ending in a stout claw. Maxilla bipartite, palp with a single spine. Basal segment of first maxilliped with a single process against which the curved distal segment closes. Second maxilliped cylindrical and sub-chelate, smaller than first.

Total length 0.7 mm.

*Holotype* female and *allotype* male are deposited in the Marine Biological Laboratory, Trivandrum.

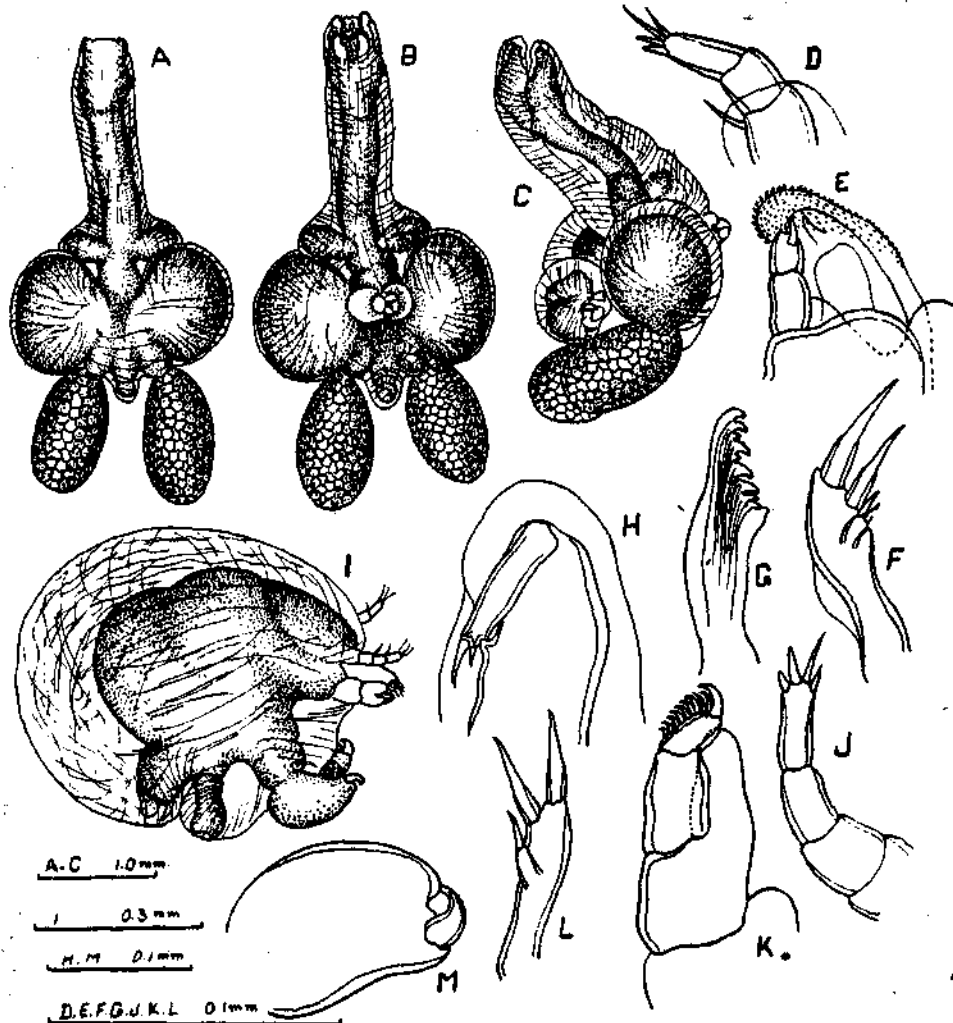


Fig. 10. *Clavellopsis bilobata* sp. nov. (a) female, dorsal view; (b) same, ventral view; (c) same, lateral view; (d) first antenna; (e) second antenna; (f) maxilla; (g) mandible; (h) second maxilliped; (i) male; (j) first antenna; (k) second antenna; (l) maxilla; (m) first maxilliped.

**Remarks.** *C. bilobata* sp. nov. closely resembles *C. sargi* (Kurz) as described by Shiino (1956) but in the latter the trunk is almost circular and the cephalothorax nearly straight. The present species shows the same characteristic bend of the cephalothorax seen in *C. branchiostegi* Yamaguti (1939) and both have the same type of maxillipeds and genital process. But in Yamaguti's species the trunk is transversely oblong and not bilobed as in *C. bilobata*.



Genus *Clavellisa* Wilson

*Clavellisa* Wilson, 1915, p. 693.

*Clavellisa* Gnanamuthu, 1947, p. 748.

In his definition of this genus Wilson observed that the female is without abdomen, anal laminae and genital or abdominal process. The present study has shown that the above observation is not correct. Gnanamuthu observed in *C. dussumieriae* a pair of vestigial appendages. I have been able to find these paired structures in all the species under study. It may be pointed out that Kurz (1877) observed vestigial structures in *C. emarginata*. Though, as Wilson has shown, he might have gone wrong in the interpretation of these vestiges, Wilson was not justified in denying their existence. I could find in my specimens vestiges of one or two paired structures on either side of the first maxillipeds, each consisting of a knob surmounted by a stiff seta. The identity of the anal laminae is certain, but what the others represent could not be said without studying the ontogeny.

Gnanamuthu observed that these vestigial structures are absent in the male. In all the males in my collection there are a pair of caudal lobes, undoubtedly the anal laminae and each lamina carries a stout spine. These spines are obviously homologous with the vestigial appendages of the female.

*Clavellisa emarginata* (Kroyer)

Fig. 11

*Anchorella emarginata* Kroyer, 1837, p. 287, pl. 3, f. 7.

*Clavella emarginata* Brian, 1906, p. 109, pl. 10, f. 3.

*Clavellisa emarginata* Wilson, 1915, p. 694.

**Material.** A single female, with the male, from the gill rakers of *Thrissocles malabaricus* (Bloch) examined at Trivandrum.

**Female.** Cephalothorax long and slender, nearly twice as long as trunk and originating almost from the middle of the dorsal side of the trunk and bent at right angles to the latter. Carapace distinct, bulging on the dorsal side of the head. Chitinous covering of body separated from the flesh by a comparatively narrow space. Trunk nearly chordate, anteriorly narrow and posteriorly emarginate, with a median longitudinal groove demarcating the dorsal side of the trunk into two lateral lobes. Egg sacs stout and oblong, slightly longer than trunk.

First antenna three-segmented, with an apical bunch of five long setae and two blades. Second antenna biramous, rami bent at right angles to the single segmented protopod, exopod unsegmented, distally trifid and with three spines, endopod two-segmented and terminating in a single spine. First maxillipeds shifted slightly to the ventral side of the anterior border of the trunk, bulla somewhat conical and vine glass-shaped. Second maxillipeds three-segmented, second segment large, with a curved claw nearer to its base, distal segment terminating in a sharp claw carrying a subsidiary basal spine, lower border behind the latter serrate, outer sur-

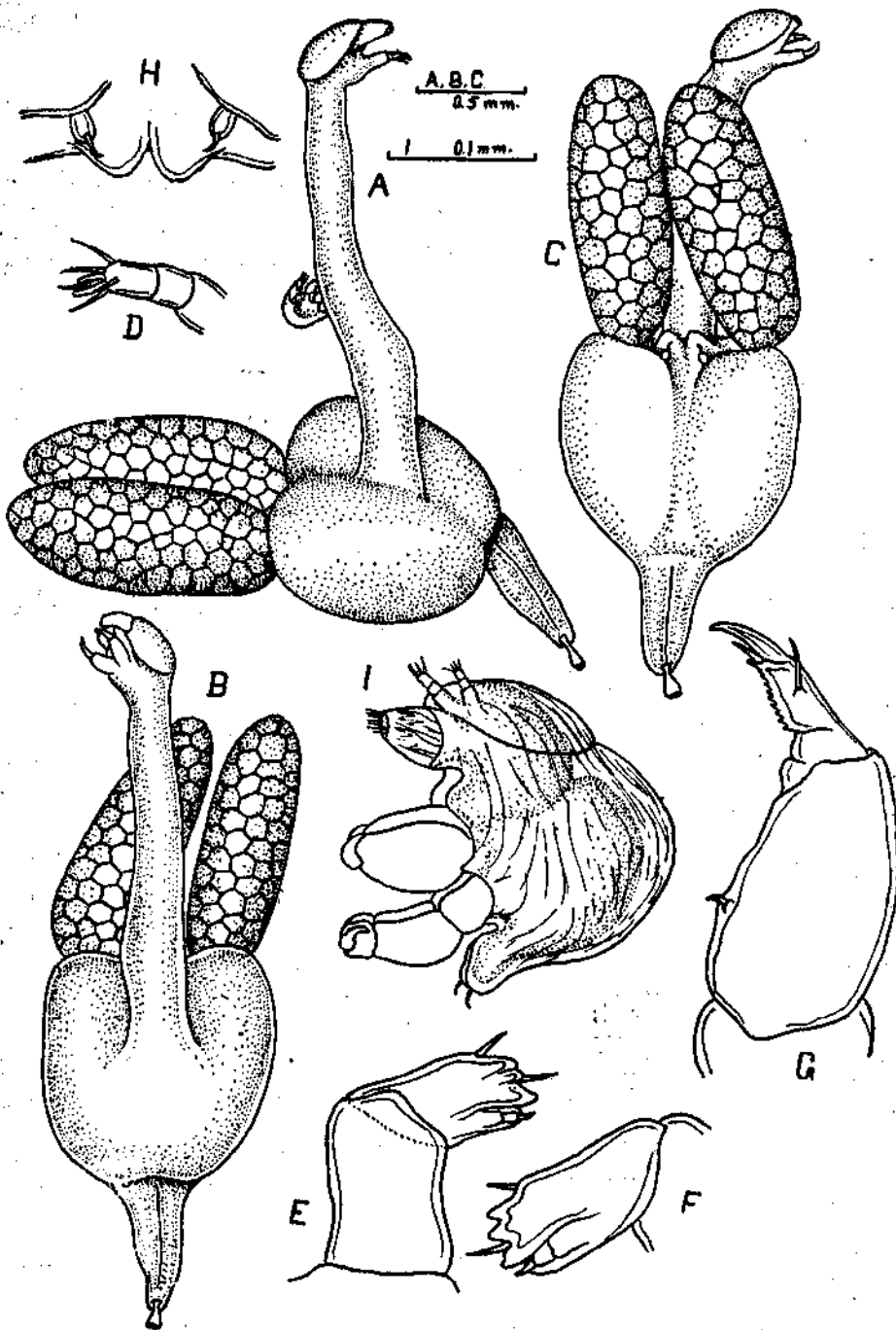


Fig. 11. *Clavellisa emarginata* (Kurz). (a) female, lateral view; (b) same, ventral view; (c) carapace, dorsal view; (d) trunk, posterior border; (e) first antenna; (f) second antenna; (g) maxilla; (h) second maxilliped.

face of dactylus with a stout seta. Postero-median part of trunk with a pair of anal laminae and a pair of vestigial appendages, latter composed of a globular base carrying a spine.

Length of cephalothorax 1.9 mm., length of trunk 1.1 mm., length of first maxilliped 0.6 mm., length of egg sacs 1.2 mm.

*Male.* Body dorsally arched and demarcated into a cephalothorax and trunk by a deep constriction, trunk prolonged into a long caudal process, chitinous covering detached from the flesh and prominently wrinkled. Carapace distinct. Maxillipeds apparently three-segmented, second pair longer and more slender than first. Anal laminae large, each carrying a spine.

Length 0.3 mm.

*Clavellisa dussumieriae* Gnanamuthu

FIG. 12

*Clavellisa dussumieria* Gnanamuthu, 1947, p. 748, figs. 1-7.

*Material.* A very large number of specimens from the gill arches and gill rakers of *Dussumieria hasselti* Bleeker examined at Trivandrum.

*Female.* Body demarcated into an extremely elongated slender cephalothorax and a transversely expanded, roughly oblong and dorsally bilobed trunk, the former starting from the centre of the dorsal side of the latter. Carapace distinct, the rest of the cephalothorax enveloped in a loose chitinous covering showing a few wrinkles towards its base. Trunk formed of two lateral swellings with the median connecting part comparatively shallow.

First antenna three-segmented, with an apical bunch of four setae and three spines. Second antenna biramous, protopod two-segmented, rami bent at an angle with the protopod, exopod one-segmented, carrying three spines, endopod two-segmented, with one spine and one tooth. Mandible with two large and two small spines. Maxilla with a partition, apically trifid, outer spine smaller, palp with one spine. First maxillipeds very short, fused into a semicircular lobe, bulla vine glass-shaped. Second maxillipeds two-segmented, first segment large and pyriform, with an inner basal tooth, second segment narrow, with a stout unguis and secondary unguis, lower border serrate, outer surface of second segment with a large seta. Anterior border of trunk with a pair of tubercles carrying a stiff seta, one on either side of the first maxillipeds. Posterior median part of trunk with a submarginal ventral pair of flattened contiguously placed anal laminae and a pair of cylindrical processes, each carrying a stout spine. Egg sacs reniform, attached by short but broad stalks.

Length of cephalothorax 2.4 mm., length of trunk 0.5 mm., breadth of trunk 1.2 mm.

*Male.* Body very much swollen, convex above and flat below. Carapace large and distinct. Body demarcated into a cephalothorax and trunk by a deep

dorsal constriction, trunk produced into a stout caudal prolongation. First antenna three-segmented, second segment with one and third with three spines. Second

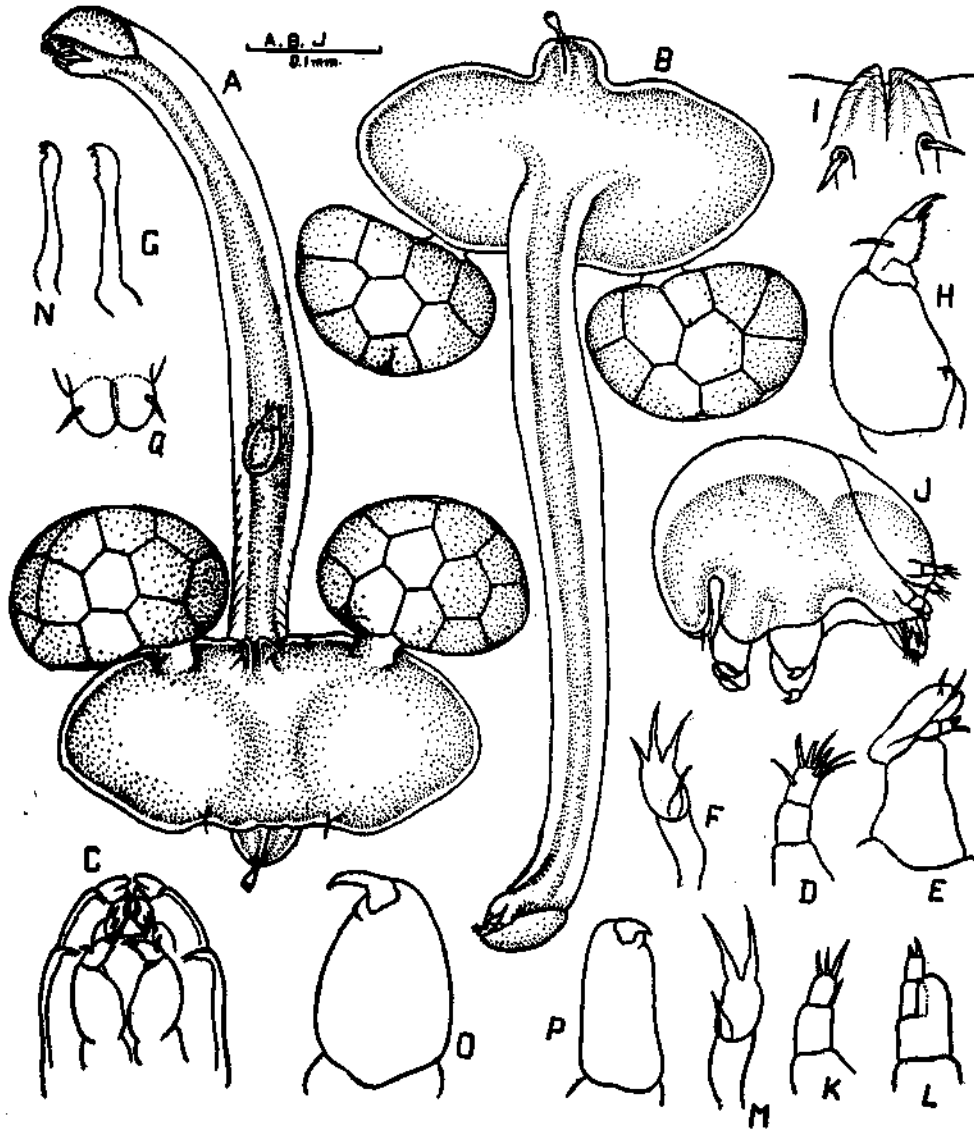


Fig. 12. *Clavellisa dussumieriae* Gnanamuthu. (a) female, ventral view; (b) same, dorsal view; (c) cephalon, ventral view; (d) first antenna; (e) second antenna; (f) maxilla; (g) mandible; (h) second maxilliped; (i) anal laminae; (j) male; (k) first antenna; (l) second antenna; (m) maxilla; (n) mandible; (o) first maxilliped; (p) second maxilliped; (q) anal laminae.

antenna biramous, protopod two-segmented, exopod a simple apically rounded lamina not separated from the protopod, endopod two-segmented, overreaching the exopod by its distal segment, latter with two spines. Mandible with two teeth.

Maxilla two-segmented, bipartite, palp with one spine. First maxilliped with a stout pyriform basal segment and a slender curved, distal segment. Second maxilliped with a cylindrical basal segment and a conical slightly curved distal claw. Anal laminae large, apically rounded, each carrying a lateral spine.

Length 0.3 mm.

*Remarks.* A detailed study has revealed some difference from the description given by Gnanamuthu. He has described a two-segmented protopod and two-segmented rami for the second antenna of the female. This appendage has a one-segmented protopod and exopod and a two-segmented endopod, the rami are bent at an obtuse angle with the protopod, almost exactly as shown by Wilson for *C. spinosa*. The maxilla figured by Gnanamuthu is very different from that of the present specimens. The anal laminae are two contiguously placed lobes and not a bilobed structure and the vestigial appendages are unjointed processes carrying a spine each.

According to Gnanamuthu the male lacks the anal laminae and the vestigial appendages. As already observed, in all the species, including the present, contained in my collection, the anal laminae are present. The spines they carry, in all probability, represent the vestigial appendages.

*Clavellisa chordata* Wilson

FIG. 13

*Clavellisa chordata* Wilson, 1915, p. 697.

*Material.* Seven females, four with males from the gill rakers of *Pellona indica* (*Euplatorygaster indica* Swainson) examined at Trivandrum.

*Female.* Cephalothorax one and a half times as long as trunk, comparatively stout and enveloped in a loose chitinous covering. Head not enlarged but dorsally covered by a distinct carapace. Carapace visibly narrowing forwards in the dorsal view. Anterior border of head with two and antero-lateral border with two pairs of short stiff setae. Trunk triangular, roughly equal in length and breadth, posterior border nearly straight and dorsally bilobed. Anterior part with a pair of fairly large tubercles surmounted by a stiff seta on either side of the first maxillipeds on the ventral side. Egg sacs small, slightly longer than broad, originating from the ventral side.

First antenna indistinctly four-segmented, terminal segment with two barbs and three setae. Basipod of second antenna indistinctly two-segmented, rami bent at right angles to the basipod, both indistinctly two-segmented, exopod with two spines and endopod with one. Maxilla distally swollen and bipartite, palp with a single spine. First maxillipeds completely fused, as long as trunk, bulla vine glass-shaped. Basal segment of second maxilliped stout, with a curved spine, distal segment with a long seta, unguis claw-like, lower border serrate, ending in a fairly large spine. Anal laminae well developed and overlapping, vestigial appendages formed of a stout basal prolongation carrying a spine.

Length of cephalothorax 1.6 mm., length of trunk 1.0 mm., breadth of trunk 0.9 mm., length of first maxilliped 0.5 mm.

*Male.* Body oblong, demarcated into a cephalothorax and trunk by a very shallow dorsal concavity, caudal lobe large. Carapace small but distinct. First

antenna four-segmented but the septa are indistinct, distal segment with four spines and one seta. Second antenna biramous, exopod with an outer cusp and endopod with two claws. Spines of maxilla comparatively very long, palp small, with a

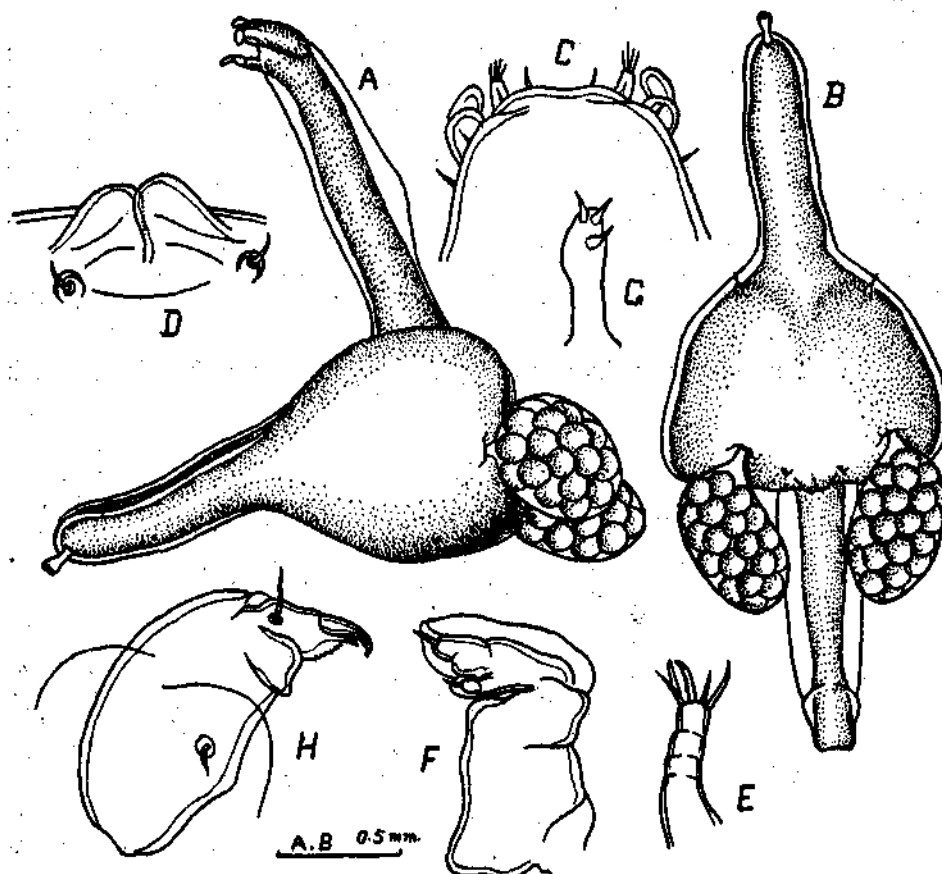


Fig. 13. *Clavellisa chordata* Wilson. (a) female, lateral view; (b) same, dorsal view; (c) same, ventral view; (d) first antenna; (e) second antenna; (f) same; (g) second maxilliped; (h) anal laminae; (i) male.

minute spine. First maxilliped with a squarish basal segment, distal segment fairly large. Second maxilliped cylindrical and slightly distorted, basal segment with a prominent lobe against which the claw-like distal segment folds. Anal laminae semicircular, each with a stout seta.

Total length 0.3 mm.

*Clavellisa ilishae* sp. nov.

FIG. 14

**Material.** Five females from the gill rakers of *Ilisha filigera* (Val.) and two from *Euplatygaster indica* (Swainson) examined at Trivandrum.

**Female.** Body demarcated into a transversely expanded trunk and a long slender cephalothorax, latter anteriorly swollen to form a prominent head covered

dorsally by a roughly squarish carapace. Cephalothorax about three times as long as trunk. Trunk transversely expanded, about twice as broad as long, with a shallow median longitudinal depression from the middle of which the cephalothorax starts.

First antenna indistinctly four-segmented, fourth segment with two spines and three blades. Second antenna biramous, protopod one-segmented, rami bent at right angles to the protopod, exopod with two spines and endopod with one. Mandible with three to four teeth. Maxilla bipartite, palp with one spine. First maxillipeds completely free, short and externally swollen, fused at the tips, bulla vine glass-shaped. Second maxilliped two-segmented, basal segment with an inner basal spine, distal segment internally serrate, unguis and secondary unguis distinct, second segment with an outer spine. Anterior border of trunk with two pairs of tubercles carrying a seta on either side of the maxillipeds. Posterior border with a pair of contiguous anal laminae and a pair of cylindrical processes carrying a spine, representing the vestigial appendages. Egg sacs large and pyriform.

Length of cephalothorax 1.9 mm., length of trunk 0.6 mm., breadth of trunk 1.0 mm.

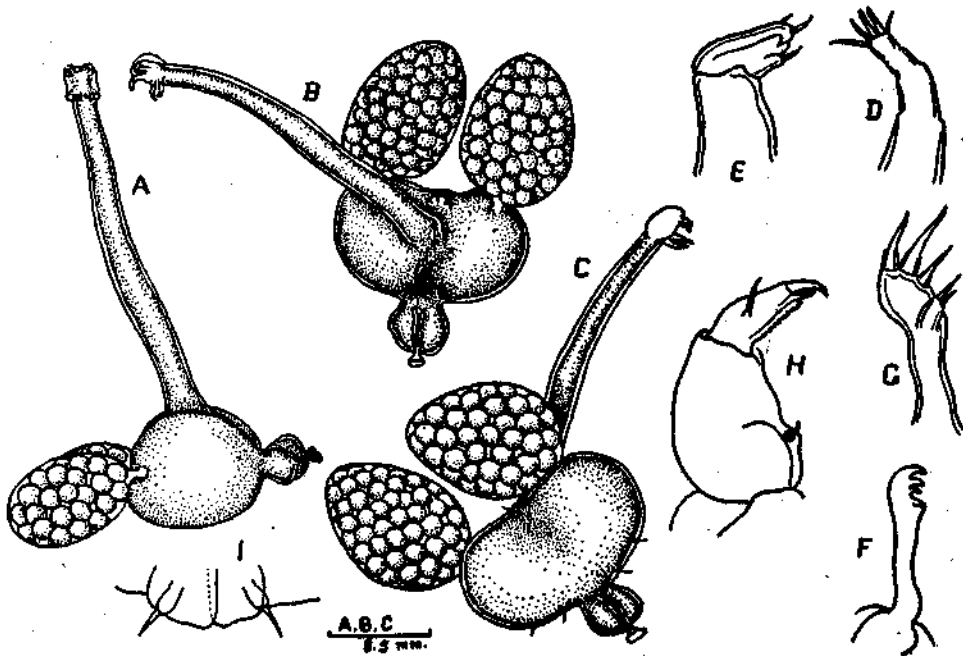


Fig. 14. *Clavellisa ilishae* sp. nov. (a) female, lateral view; (b) same, dorsal view; (c) same, ventral view; (d) first antenna; (e) second antenna; (f) mandible; (g) maxilla; (h) second maxilliped.

*Remarks.* In general appearance *C. ilishae* shows some resemblance to *C. dussumieriae*, but could be easily distinguished by the shape of its trunk which is laterally rounded and not angular as in the latter. The egg sacs in *C. ilishae* are pyriform while those of *C. dussumieriae* are reniform. In *C. dussumieriae* the first maxillipeds are fused but free in *C. ilishae*. *C. scombr*i (Kurz) resembles the present species in the long cephalothorax but differs in most of the other characters.

Genus *Brachiella* Cuvier*Brachiella thynni* Cuvier

FIGS. 15-16

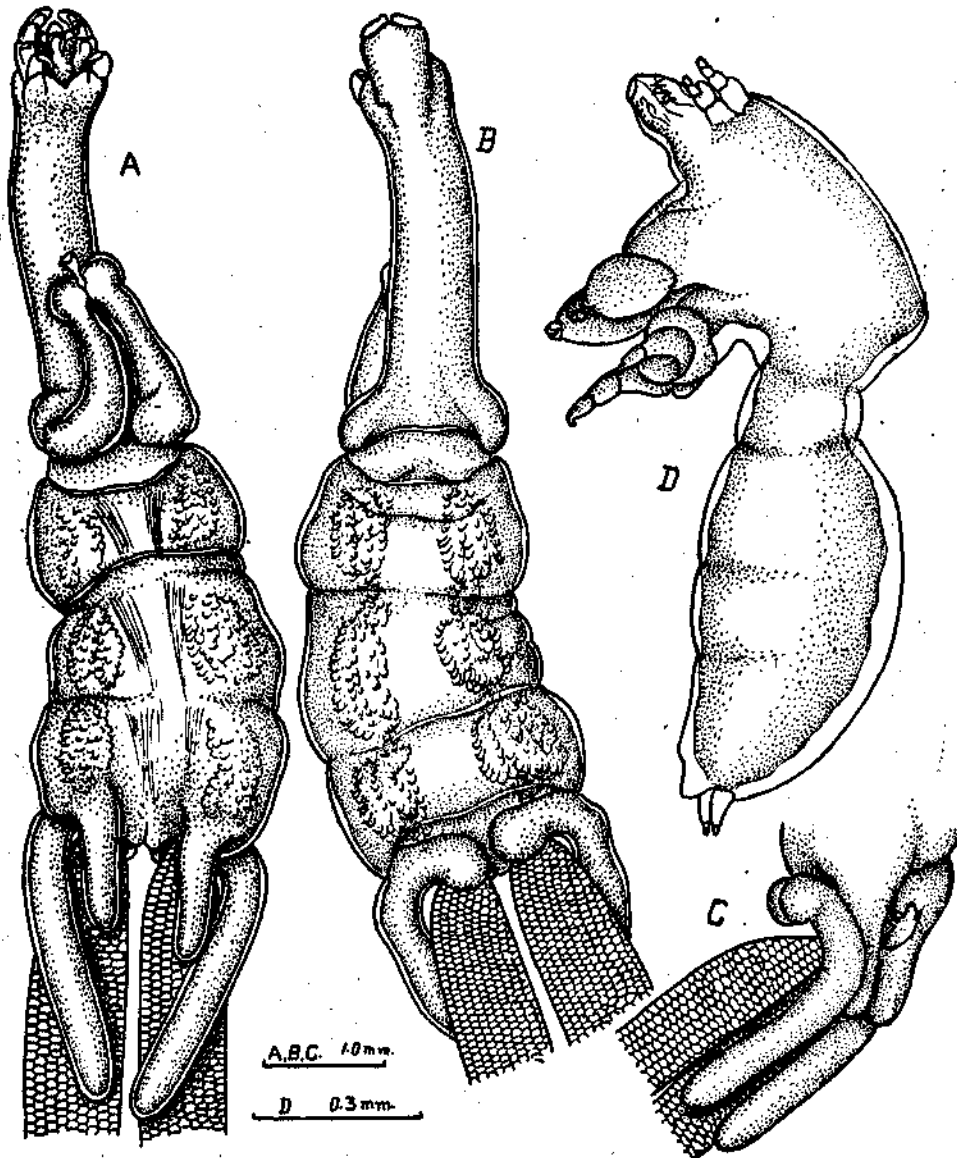
*Brachiella thynni* Shiino, 1956, p. 283, figs. 8-9.*Material.* Two females, with males, from the posterior side of the base of the pectoral fin of *Indocybium lineolatum* (Cuv.) examined at Trivandrum.

Fig. 15. *Brachiella thynni* Cuvier. (a) female, ventral view; (b) same, dorsal view; (c) same, posterior part of trunk; (d) male.



*Female.* Body clearly demarcated into a cephalothorax and trunk. Cephalothorax nearly cylindrical, as long as trunk and remaining in a line with the latter. Carapace distinct, anteriorly concave. Trunk swollen and enlarged, with a slight dorso-ventral flattening and indistinctly divided into three segments, postero-median part produced into a small bilobed genital process. Posterior trunk processes cylindrical and finger shaped, dorsal pair short and apically rounded, ventral pair

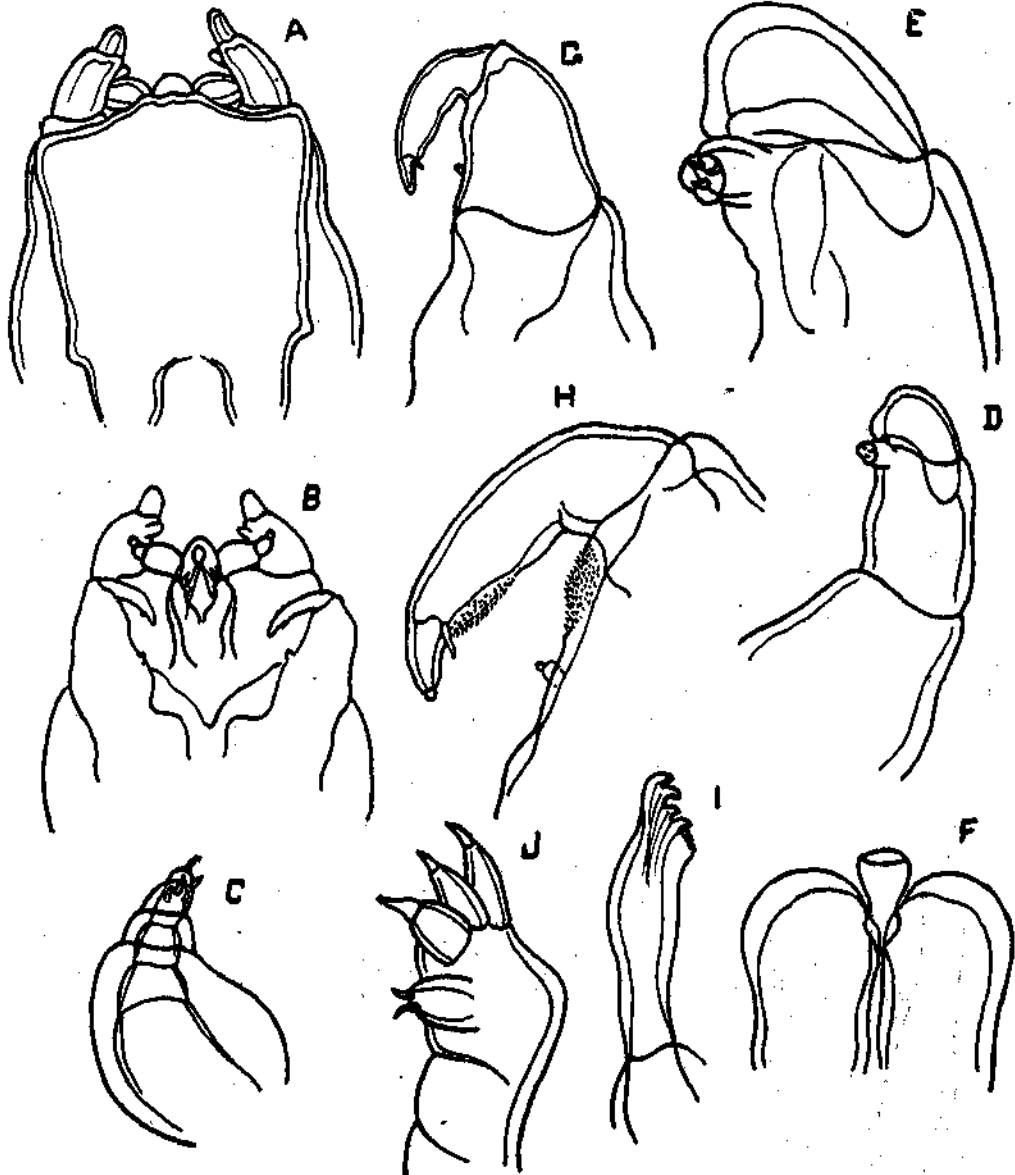


Fig. 16. *Brachiella thynni* Cuvier. (a) carapace, dorsal view; (b) same, ventral view; (c) first antenna; (d) second antenna; (e) same, tip enlarged; (f) first maxilliped; (g) second maxilliped; (h) same, tip enlarged; (i) mandible; (j) maxilla.

long, more than twice as long as the dorsal, with their base swollen, distally taking a characteristic curve around the egg tubes towards the dorsal side. Egg tubes longer than trunk, with comparatively small eggs.

First antenna four-segmented, covered by a very loose chitinous envelope, distal two segments with small spines. Second antenna projecting far beyond the anterior border of carapace, endopod small, two-segmented and with three spines, remaining at right angles to the rest of the appendage. Mandible with four large teeth followed by a row of five to six small closely packed spines. Maxilla stout, apically bifid, palp stout, with two small spines. First maxillipeds completely free, joined together at the apex, bulla vine glass-shaped. Second maxilliped placed a little behind the oral appendages, basal segment with a prominent cusp on the inner side followed by a patch of denticles, distal segment apically blunt and weak, with a small spine followed by a patch of denticles on the lower border.

Total length 8.7 mm., length of cephalothorax 3.6 mm., length of trunk 5.1 mm., length of egg sacs 4.8 mm.

*Male.* Male almost exactly as described by Shiino. Body demarcated into a cephalothorax and trunk by a distinct waist-like constriction. Trunk indistinctly divided into four segments. Posterior part of trunk produced below the anal laminae. Anal laminae two-segmented, conical and prominent.

Length 1.4 mm.

*Remarks.* The structure of the female appendages, division of the trunk into segments and the characters of the male reveal the identity of the present specimens. But there is pronounced difference in the comparative length and shape of the trunk processes. According to Shiino, they are subequal and lanceolate and Brian (1906) has illustrated them as equal and apically acuminate. Kirtisinghe, to whom I referred the matter, informed me that the trunk processes in no two specimens in his collection are exactly alike. Since this is the only difference I find in my specimens they are assigned to *B. thynni* Cuvier.

*Brachiella trichiuri* Gnanamuthu

FIG. 17

*Brachiella trichiuri* Gnanamuthu, 1951, p. 13, figs. 1-4.

*Material.* Several females and males from the buccal cavity of *Trichiurus savala* Cuvier, examined at Trivandrum. The parasite is more often found attached to the lower symphysis of the gill arches.

*Female.* Cephalothorax about three times as long as first maxillipeds, bent backwards, often describing a semicircle. Carapace distinct. Trunk pear-shaped, inflated, with a slight dorso-ventral flattening. Postero-median part of trunk produced into a fairly large apically rounded or indistinctly bilobed genital process. Posterior part of trunk produced into two pairs of long cylindrical processes, ventral pair slightly shorter than dorsal, both pairs originating postero-laterally and hence widely separated. Chitinous covering of body conspicuously wrinkled and very well detached from the body flesh. Egg sacs slender, longer than trunk.

First antenna four-segmented, basal segment enlarged, second with a large seta, fourth segment with three spines and two setae. Second antenna biramous, exopod broad and foliaceous, with spiny surface, endopod two-segmented and slender, with two spines. Maxilla bipartite, palp with two spines. Mandible comparatively short, distally expanded and cut into seven large and three small teeth. First maxillipeds short, free except at the tip, bulla vine glass-shaped and flanked by wing-like thickenings, basal glands very prominent. Second maxilliped with stout basal segment, with a stout spine and two spiny projections on the inner border, second segment slender and claw-like, with a long sharp unguis and a subsidiary claw, lower border with two patches of denticles.

Length of cephalothorax 2.3 mm., length of trunk 1.8 mm., length of posterior processes 1.9 mm., length of egg sacs 2.3 mm.

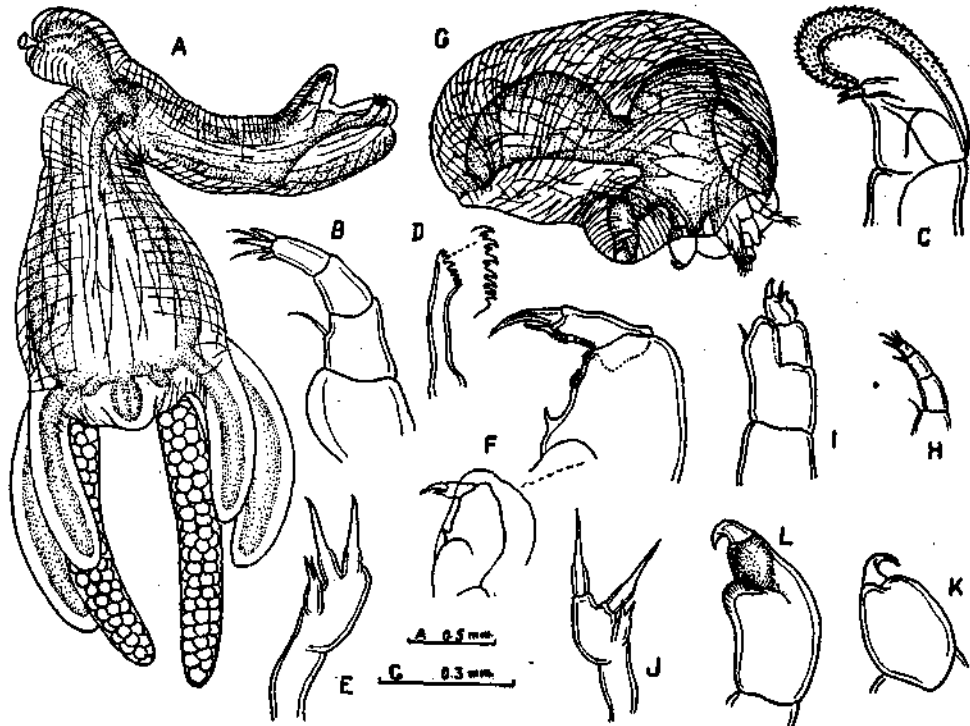


Fig. 17. *Brachiella trichiuri* Gnanamuthu. (a) female, lateral view; (b) first antenna; (c) second antenna; (d) mandible; (e) maxilla; (f) second maxilliped; (g) male; (h) first antenna; (i) second antenna; (j) maxilla; (k) first maxilliped; (l) second maxilliped.

**Male.** Body inflated and encased in a very loose prominently wrinkled chitinous covering, demarcated into a swollen cephalothorax and an elongated trunk by a pronounced waist, carapace prominent. First antenna four-segmented, first and third segments with one spine each, fourth segment with four spines. Second antenna biramous, protopod two-segmented, exopod laminate, with an outer spine, endopod two-segmented, distal segment with a serrate inner border and ending in a strong tooth, distal border with a spine and a stout claw. Maxilla and mandible as in female. First maxilliped with a strongly curved distal segment. Basal

segment of second maxilliped distally hollowed out, the lower part of the excavation forming a rounded projection against which the curved dactylus closes. Anal laminae absent.

Length 0.4 mm.

*Brachiella coryphaenae* Pearse

FIG. 18

*Brachiella coryphaenae* Pearse, 1952, p. 35, figs. 129-135.

*Material.* A large number of females from the gill filaments of *Coryphaena hippurus* Linn. examined at Vizhingom.

*Female.* Body bottle-shaped, perfectly smooth and devoid of the loose wrinkled covering characteristic of most of the other species. Cephalothorax as long as first maxillipeds, dorso-ventrally flattened and dorsally covered by a carapace which

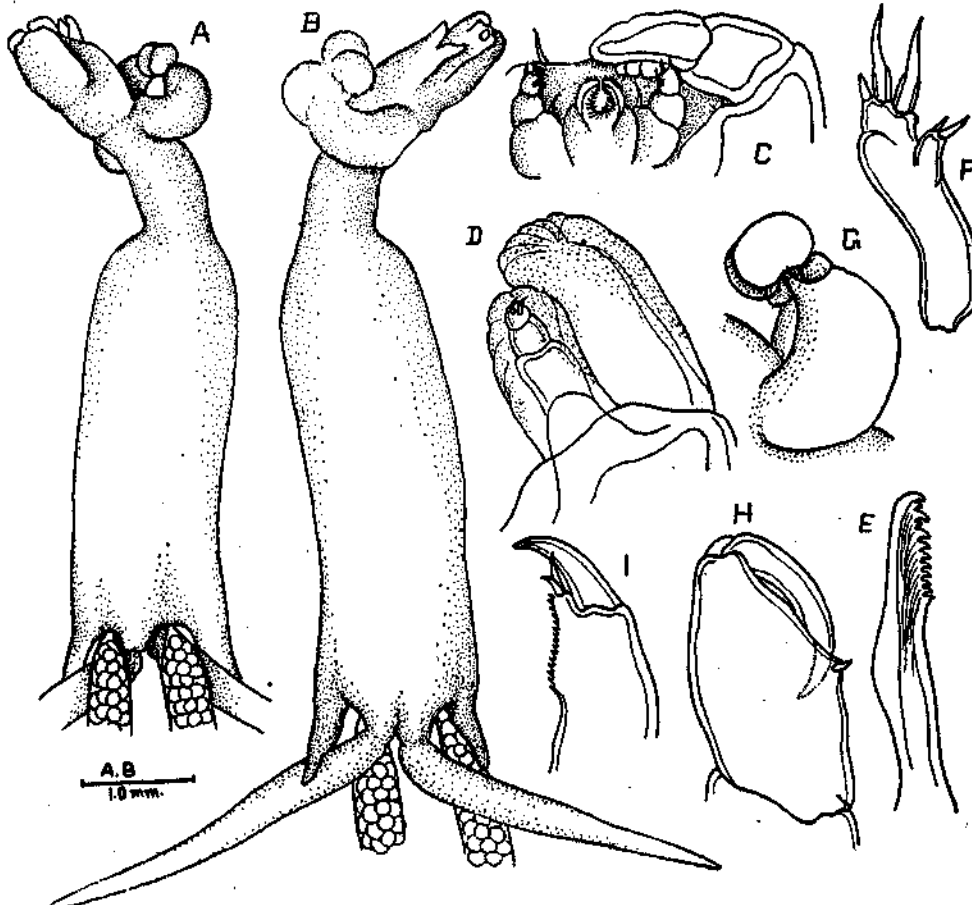


Fig. 18. *Brachiella coryphaenae* Pearse. (a) female, dorsal view; (b) same, ventral view; (c) carapace, ventral view; (d) second antenna; (e) mandible; (f) maxilla; (g) first maxilliped; (h) second maxilliped; (i) same, tip enlarged.

extends up to the middle of the dorsal side. Trunk anteriorly narrowed, as broad as cephalothorax, but further on showing an abrupt widening, posterior broad part parallel sided and extremely flattened dorso-ventrally. Postero-lateral corners drawn out into two short triangular dorsal processes and the postero-median part into two extremely elongated ventral processes, about eight times as long as the first pair. Genital process short, bilobed and dorsal to the ventral trunk processes. Egg sacs long, about one and a half times as long as the ventral trunk processes.

First antenna broad and stumpy, three-segmented, basal segment with one and distal segment with three spines. Second antenna biramous, exopod curving over the endopod and visible beyond the anterior border of the cephalothorax, endopod two-segmented, distal segment with two claws, chitinous covering of both rami rugose. Maxilla rather stout, tripartite, outer spine very short, palp with two dissimilar spines. Mandible rather strong, with ten large and two small spines, the number of spines on one mandible in the specimen dissected was less. First maxillipeds short and stout, free except at the tip, each maxilliped distally expanding into a semicircular disc with a similar thickening at its base. Anything like a bulla was not observed. Basal segment of second maxilliped with a spine in the middle of the inner side, distal segment strong, with a stout unguis and two subsidiary claws, lower anterior part of the segment with a patch of spines.

Total length 5.4 mm., length of cephalothorax 3.3 mm., length of trunk 4.1 mm., length of posterior processes 2.3 mm., length of egg sacs 6.9 mm.

*Remarks.* The present specimens show several differences from those described by Pearse. The first maxillipeds are nearly as long as the cephalothorax. The posterior trunk processes are more narrowing towards the tip. The maxilla has two spines on the palp and three at the tip. Pearse has described the maxilla as tripartite without mentioning anything about the palp; apparently he mistook the palp for a third apical spine. Similarly nothing is said about the spine on the inner border of the basal segment of the second maxilliped, the second segment has two spines in addition to the hook.

As observed by Pearse *B. coryphaenae* shows a remarkable resemblance to *B. insidiosa* Heller, but the absence of the neck-like part of the trunk easily distinguishes the latter. Moreover, in *B. insidiosa* it is the outer dorsal process of the trunk which is longer while the reverse is the case in *B. coryphaenae*.

#### *Brachiella albida* (Rangnekar)

FIG. 19

*Charopinus albidus* Rangnekar, 1956, p. 62, figs.

*Material.* Several females, one with the male, from the gill filaments of *Otolithus ruber* (Schn.) and *O. argenteus* Cuv., examined at Trivandrum.

*Female.* Cephalothorax roughly as long as first maxillipeds, stout and cylindrical, bent dorsalwards at right angles to the trunk and remaining in a line with the first maxillipeds. Head slightly swollen, dorsally covered by a distinct carapace. Trunk elongate pear-shaped, with slight dorso-ventral flattening, posterior part with two pairs of processes, anterior (dorsal) pair long and digitiform, slightly

tapering towards the tip and arising from the lateral margins, posterior pair triangular, apically pointed and placed close together below the egg sacs. Postero-medial part of trunk produced into a bilobed genital process. Egg sacs rather stout, slightly longer than the body. Body enclosed in a moderately wrinkled covering remaining close to the body flesh.

First antenna four-segmented, first segment somewhat enlarged, fourth segment with four stout spines. Second antenna biramous, exopod flattened, with rugose surface, endopod two-segmented, with two spines. Maxilla bipartite, palp with a single spine. Distal border of mandible with nine similar teeth and two smaller teeth. First maxillipeds cylindrical and long, united only at the tip, bulla slender and rod-like, getting fused with the skeleton of the gill filament. Second maxillipeds basally fused, indistinctly segmented, distal segment with a large unguis, with two long and two short spines on the lower border, chitinous covering terminating a little behind the distal segment as if cut off.

Total length 3.0 mm., length of cephalothorax 1.2 mm., length of trunk 1.8 mm., length of first maxillipeds 0.9 mm.

*Male.* Body clearly demarcated into a cephalothorax and trunk by a distinct narrow waist, covered by a moderately wrinkled covering not much detached from

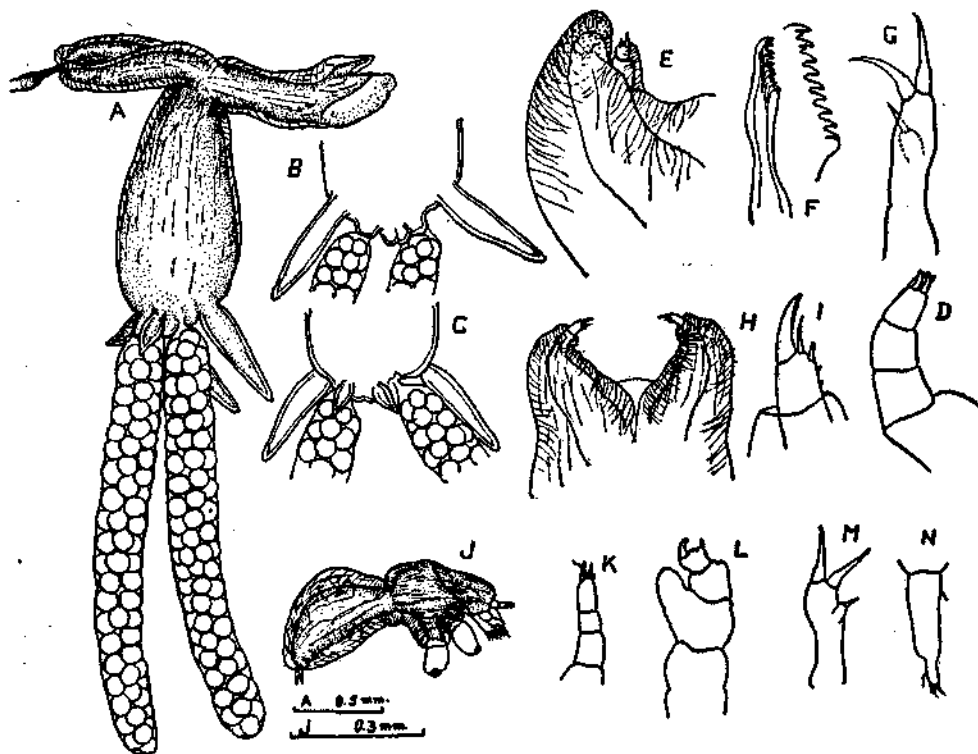


Fig. 19. *Brachiella albida* (Rangnekar). (a) female, lateral view; (b) posterior part of trunk, dorsal view; (c) same, ventral view; (d) first antenna; (e) second antenna; (f) mandible; (g) maxilla; (h) second maxilliped; (i) same, tip enlarged; (j) male; (k) first antenna; (l) second antenna; (m) maxilla; (n) anal lamina.

the body flesh. Carapace distinct. First antenna four-segmented, distal segment with four spines. Protopod of second antenna two-segmented, distal segment produced into a short exopod, endopod two-segmented, distal segment with two claws. Mandible and maxillae as in female. Maxillipeds projecting, first pyriform and second squarish. Anal laminae distally narrowed, with a total number of five small spines.

Total length 0.2 mm.

*Remarks.* The identity of this species is revealed by the male which Rangnekar did not obtain. According to her, each maxilliped has its own attachment process and there is no bulla, but her figure clearly shows that the maxillipeds are apically fused and carry a rod-shaped bulla, exactly as in the present specimens. In my specimens the number of spines on the palp of the maxilla and on the mandible shows difference from what has been described by Rangnekar.

*Brachiella otolithi* sp.nov.

FIG. 20

*Material.* A single female, with the male, from the gill arch of *Otolithus argenteus* Cuv. examined at Trivandrum.

*Female.* Cephalothorax long and slender, about one and a half times as long as trunk, flexed backwards and slightly arched forwards. Head not swollen but covered over by a distinct carapace. Trunk pear-shaped, slightly longer than broad, dorso-ventrally flattened and broadening backwards. Postero-median part of trunk produced into a comparatively long, cylindrical apically bilobed genital process. Posterior part of trunk with two pairs of finger-shaped processes, first pair arising from the postero-lateral parts of the trunk and hence far apart and the second pair from the ventral side on either side of the genital process and hence near each other, both pairs of the same length. Egg sacs as long as cephalothorax.

First maxillipeds short, as long as the genital process, completely fused, bulla mushroom-shaped and flanked by semicircular thickenings.

Length of cephalothorax 2.6 mm., length of trunk 1.4 mm., length of trunk processes 0.9 mm., length of egg sacs 2.3 mm.

*Male.* Body elongate cylindrical, narrowing backwards, demarcated into a large cephalothorax and a slender trunk by a distinct waist. Head covered by a distinct carapace, trunk indistinctly segmented. Chitinous covering loose and prominently wrinkled.

First antenna four-segmented, fourth segment with five spines. Second antenna with a two-segmented protopod, one-segmented exopod with a tooth and two-segmented endopod, distal segment of endopod with three spines. Maxilla bipartite, palp with one spine. First maxilliped pyriform and second cylindrical. Anal laminae large, three-segmented, with two spines.

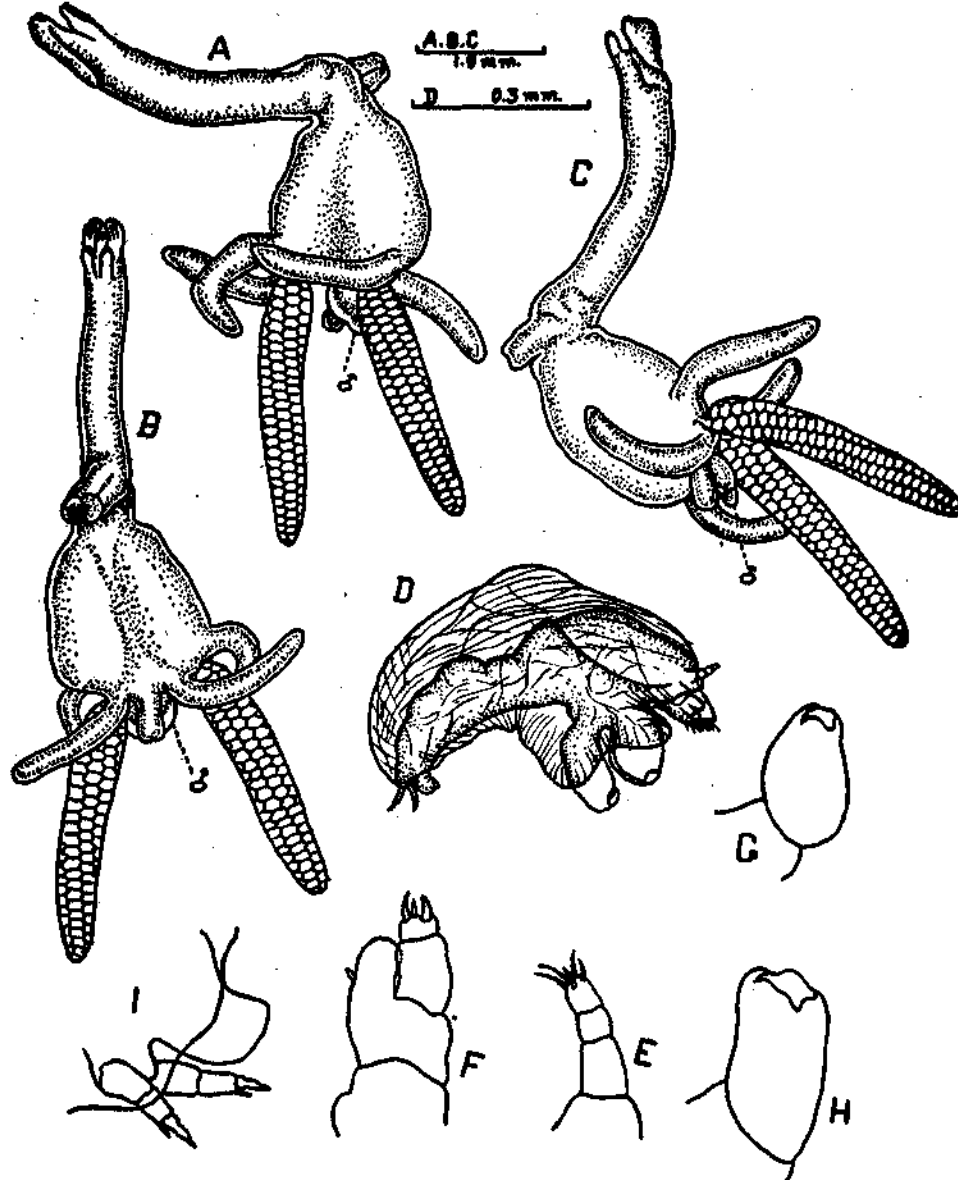


Fig. 20. *Brachiella otolithi* sp. nov. (a) female, dorsal view; (b) same, ventral view; (c) same, lateral view; (d) male; (e) first antenna; (f) second antenna; (g) first maxilliped; (h) second maxilliped; (i) posterior end of trunk.

Length 0.3 mm.

**Remarks.** *B. otolithi* sp. nov. comes in the group characterised by the presence of four similar body processes in the female. It resembles *B. appendiculata* (Kroyer), *B. hostilis* Heller and *B. sciaenophila* Heller. In *B. hostilis* the first maxilliped is wrinkled and in *B. sciaenophila* the ventral and dorsal processes of the trunk are at the same distance apart and the genital process is absent. The present species has the closest resemblance to *B. appendiculata* (Kroyer).



## Family NAOBANCHIDAE

Genus *Naobranchia* Hesse*Naobranchia variabilis* Brian

FIG. 21

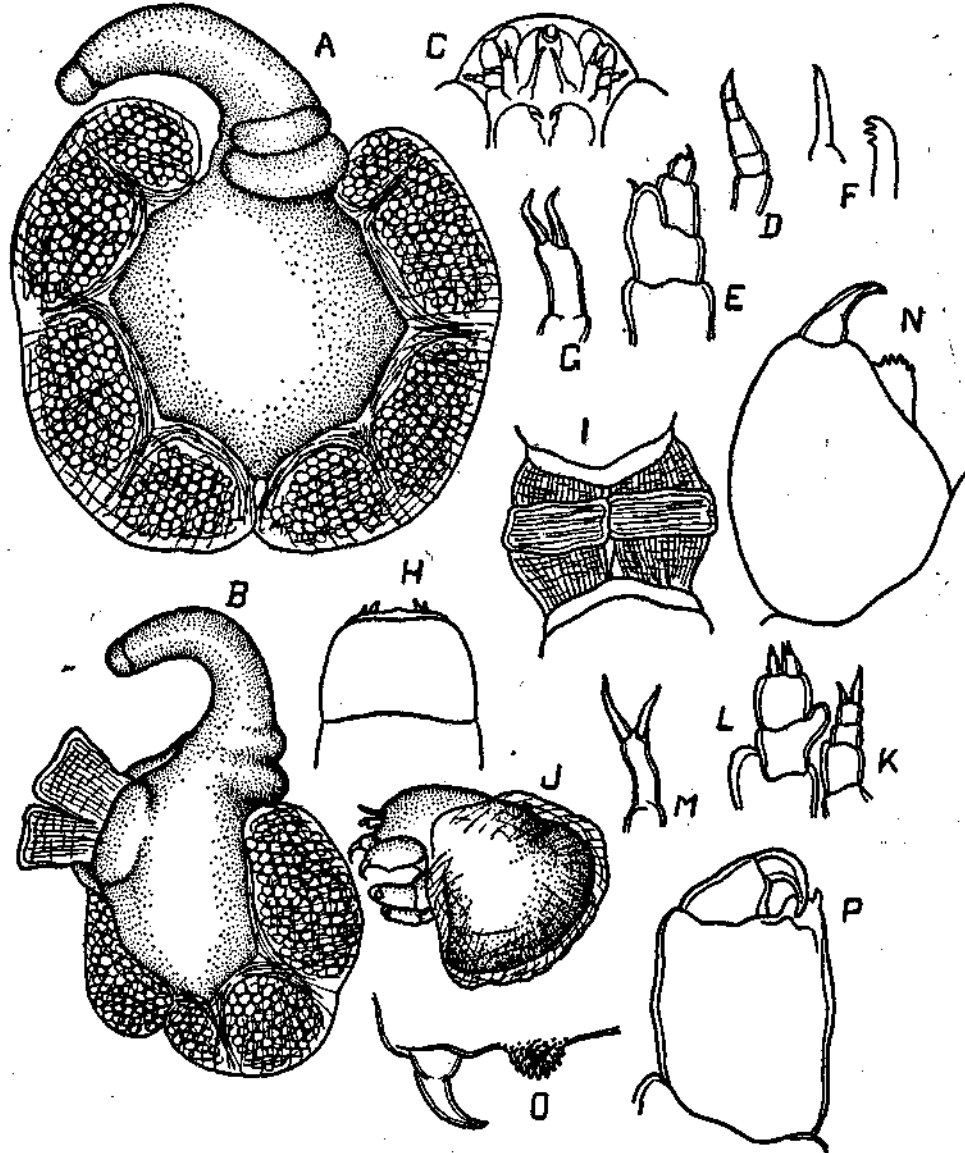
*Naobranchia variabilis* Brian, 1924, p. 57, figs. 60-65.*Naobranchia variabilis* Bere, 1936, p. 610, pl. 12, figs. 304-313.

Fig. 21. *Naobranchia variabilis* Brian. (a) female, dorsal view; (b) same, ventral view; (c) carapace, ventral view; (d) first antenna; (e) second antenna; (f) mandible; (g) maxilla; (h) carapace, dorsal view; (i) first maxilliped; (j) male; (k) first antenna; (l) second antenna; (m) maxilla; (n) first maxilliped; (o) same, tip enlarged; (p) second maxilliped.

*Material.* Six females, three with male, from the gills of *Lagocephalus inermis* (Schlegel) examined at Vizhingom.

*Female.* Body demarcated into a cephalothorax and trunk, cephalothorax shorter than trunk, nearly cylindrical and narrowing regularly forwards, head semi-circular in outline and demarcated by a distinct transverse septum, posterior part of cephalothorax just where it meets the trunk with two arcuate dorsal thickenings. Trunk roughly circular and completely encircled by the egg sacs which form two shoulder like rounded prominences antero-laterally. Egg sacs strengthened by three pairs of ribs.

First antenna five-segmented, fifth segment drawn out into a spine, third segment longest. Second antenna biramous, protopod two-segmented, exopod a mere continuation of the distal protopod segment and carrying one spine, endopod two-segmented, with one spine. Mandible with three teeth. Maxilla apically bifid, without palp. Second maxilliped with a stout basal and a small distal segment.

Length of cephalothorax 3.3 mm., length of trunk 2.5 mm., breadth of trunk 3.8 mm.

*Male.* Body arched dorsally, carapace indistinct, posterior part encased in a sparsely wrinkled covering. First antenna four-segmented, distal segment with two stout claws. Second antenna with two-segmented protopod, exopod small and endopod large and two-segmented. Mandible and maxillae as in female. Maxillipeds large, basal segment of first maxilliped pyriform, expanded into a toothed inner distal lobe, distal segment slightly falcate. Basal segment of second maxilliped squarish, with a toothed lobe, distal segment uncinat, with a clearly marked unguis.

*Remarks.* The present specimens so closely resemble those described by Bere that very little comment is called for. This species was originally recorded from the Atlantic coast of Morocco (Brian) and subsequently from the Gulf of Mexico (Bere). The present record extends its distribution to the Indian ocean.

*Naobranchia* sp.

FIG. 22

*Material.* Two females from the gills of *Chorinemus tala* Cuv. examined at Vizhingom.

*Female.* Cephalothorax only slightly shorter than trunk, cylindrical and slightly broadening backwards. Head not clearly demarcated but carapace faintly indicated. Anterior border of carapace with a pair of tubercles carrying a small hair. Posterior part of cephalothorax with two low transverse thickenings. Trunk roughly oblong, narrowing backwards, egg sacs long, with comparatively large eggs, extending far forwards nearly to the junction of the cephalothorax and trunk.

First antenna four-segmented, fourth segment with a spine. Second antenna stout and elongated, protopod two-segmented, exopod with two spines, endopod with a single claw. Second antenna with a large circular lobe overlapping its base

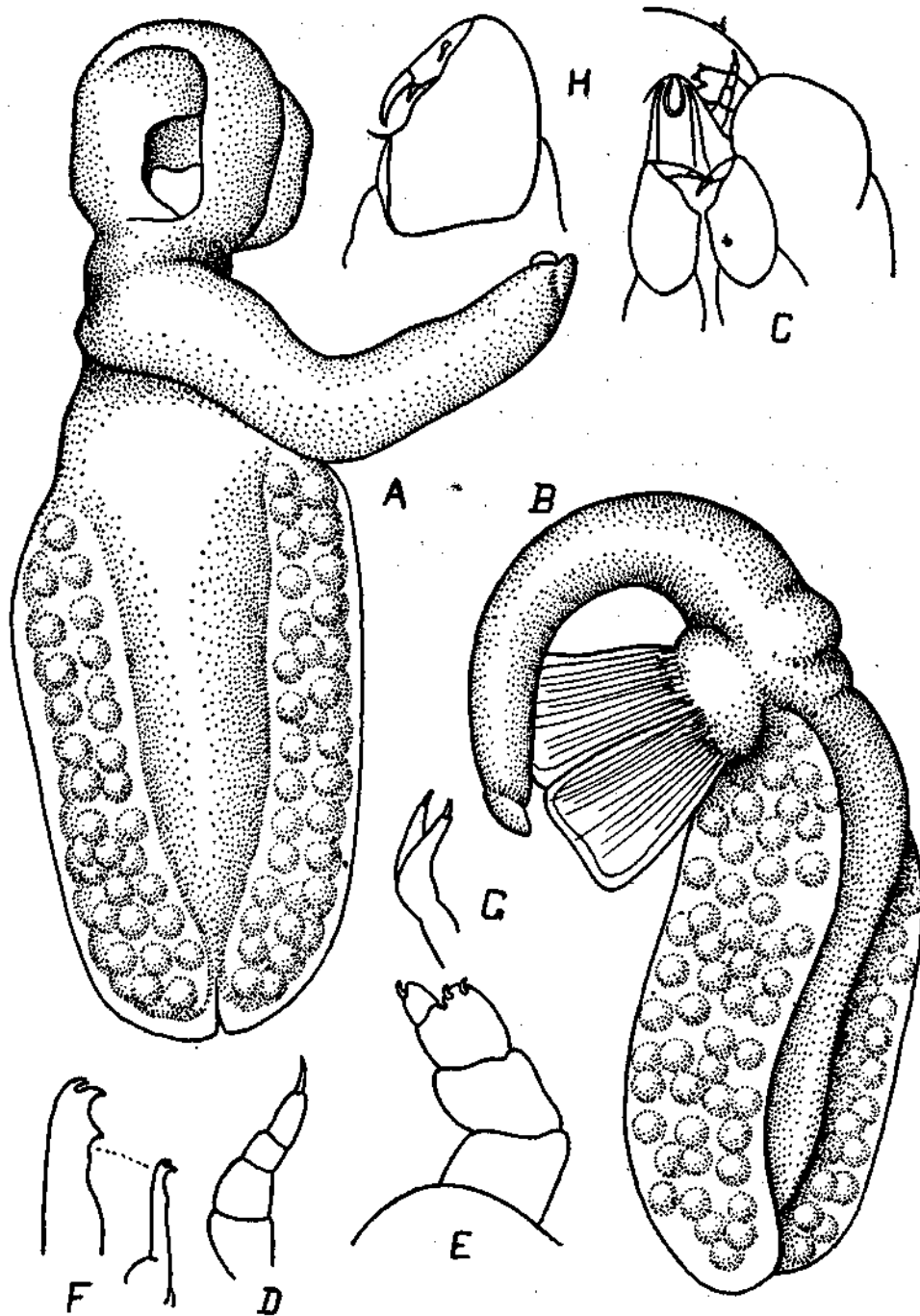


Fig. 22. *Naobranchia* sp. (a) female, ventral view; (b) same, lateral view; (c) carapace, ventral view; (d) first antenna; (e) second antenna; (f) mandible; (g) maxilla; (h) second maxilliped.

and slightly visible in the dorsal view. Mandible with three teeth, third tooth separated from the second by a long interval. Maxilla bipartite, palp absent. First maxillipeds large, ring like. Basal segment of second maxilliped stout, with an inner spine, distal segment with a proximal and a distal spine, unguis long.

- Total length 3.7 mm.

*Remarks.* The present species shows a general resemblance to *N. occidentalis* Wilson (1915) and *N. auriculata* Shiino (1958). The latter is a much more slender species and the former differs in the comparative extent of the egg sacs on the trunk, hardly reaching the middle of the trunk. In the relative extent of the egg sacs the present species is very close to *N. lizae* (Kroyer) with which it may be synonymous.

## REFERENCES

- BARNARD, K. H. 1955. South African Parasitic Copepods. *Ann. S. Afric. Mus.*, XLI : 223-312.
- BASSETT-SMITH, P. W. 1898. On some new parasitic copepods of fish. *Ann. Mag. Nat. Hist.* (7), I : 1-17.
- BENEDEN, G. J. VAN, 1851. Recherches sur quelques crustacés inférieures. *Ann. Sci. Nat. Zool.*, XVI : 71-131.
- BERE, R. 1936. Parasitic copepods from Gulf of Mexico fish. *Amer. Midl. Nat.*, XVII : 577-625.
- BRIAN, A. 1906. *Copepodi parassiti dei pesci d'Italia*, 1-187.
- GNANAMUTHU, C. P. 1947. *Clavellisa dussumieria* a clavelline copepod parasite. *Proc. Zool. Soc. London*, CXVII, 748-755.
- 1949. *Thysanote appendiculata* (Stp. & Lutk.) a lernaeopodid parasitic on the gills of the grey pomfret. *Rec. Ind. Mus.*, XLVII : 259-264.
- 1951. *Brachiella trichiuri* n.sp. a copepod parasitic in the mouth cavity of the ribbon fish. *Spolia Zeylan.*, XXVI : 13-15.
- HEEGAARD, P. E. 1947. Contributions to the phylogeny of the arthropoda. Copepoda. *Spolia Zool. Mus. Haunensis*, VIII : 9-227.
- HELLER, C. 1865. *Reise der Osterreichischen Fregatte Novara*, II : 1-280.
- KIRTISINGHE, P. 1935. Parasitic copepods from Ceylon. *Parasitology*, XXVII : 332-344.
- 1950. Parasitic copepods from Ceylon. *Ibid.*, XL : 77-86.
- KROYER, H. 1863. Bidrag til Kundskab om Snyltekrebsene. *Naturh. Tidsskr.*, II : 75-426.
- KURZ., W. 1877. Studien über die Familie der Lernaeopodiden. *Z. Wiss. Zool.*, XXIX : 38-428.
- PEARSE, A. S. 1952. Parasitic crustacea from the Texas coast. *Publ., Inst. Mar. Sci. Univ. Texas*, II : 6-42.
- RANGNEKAR, M. P. 1956. Parasitic copepods from the marine fishes of Bombay. *J. Univ. Bombay*, XXIV (n.s.) : 42-65.
- 1957. Copepod parasites of the families Argulidae, Caligidae, Dichelesthidae and Lernaeopodidae. *Ibid.*, XXVI (n.s.) : 8-20.
- SCOTT, T. & A. 1913. The British parasitic copepoda. *Ray Society*, 1-252.

- SHINO, S. M. 1956. Copepods parasitic on Japanese fishes. 12. Family Lernaeopodidae. *Rep. Fac. Fish. Pref. Univ. Mie*, II : 267-311.
- 1958. Two copepods of the family Naobrachidae parasitic on Japanese fishes. *Ann. Rep. Pref. Univ. Mie*, II : 114-119.
- 1959. Sammlung der parasitischen copepoden in der Präfekturuniversität von Mie. *Ibid.*, III : 334-374.
- STEENSTRUP, J. J. S. & LUTKEN, C. F. 1861. Bidrag til kundskab om det aabne havs Snyltekrebs og Lernaer. *Vid. Selsk. 5 Raekke Naturw. Math.*, V : 343-432.
- WILSON, C. B. 1913. Crustacean parasites of West Indian fishes and land crabs. *Proc. U.S. Nat. Mus.*, XLVI : 189-277.
- 1915. North American parasitic copepods belonging to the Lernaeopodidae with a revision of the entire family. *Ibid.*, XLVII : 565-729.
- YAMAGUTI, S. 1939. Parasitic copepods from fishes of Japan. Pt. 6. Lernaeopodidae. Vol. *Jubilee Prof. Yoshida*, II : 529-578.