

## Parasitic isopods of the family Cymothoidae from South Indian fishes

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In the present paper seven species of cymothoid isopods parasitic on the marine fishes of the Kerala coast are described. A preliminary diagnosis of three of them was published earlier (Pillai, 1954). Full descriptions of all the species are given below. The larval stages described were in all cases taken from the brood pouch. The present work forms part of a thesis for which the author was awarded the Ph.D. Degree by the Kerala University.

Genus *Agarna* Schi. & Mein.

*Agarna* Schi. & Mein., 1884 (Schioedte & Meinert, 1884, p. 329; Richardson, 1905, p. 243)

So far four species, *A. carinata* Schi. & Mein. (1884), *A. engraulidis* Barnard (1936), *A. malayi* Tiwari (1953) and *A. tartoor* Pillai (1954) have been recorded within the genus *Agarna*. Of these *engraulidis* belongs to *Livoneca* Leach (*vide infra*) and *malayi* belongs to *Indusa* Schi. & Mein. (*vide infra*). Thus only three species, including the new species described herein, remain within the genus.

*Agarna tartoor* Pillai

*Agarna tartoor* Pillai (1954, p. 16)

**MATERIAL.** A large number of specimens, including ovigerous females, were collected by the author from the gill chamber of *Opisthopterus tardoore* (Cuvier)\* caught at Trivandrum. Holotype, female, is deposited in the Indian Museum, Calcutta.

**FEMALE** (Figs. 1 A-G, 7 A). Body highly asymmetrical, hunched on one side. Cephalon small, hidden by the first peraeon segment, its anterior border rounded, without a rostral projection. First peraeon segment two and a half times as broad as long, antero-median part concave and antero-lateral parts expanded into large lobes, with slightly sinuous border, posterior border evenly rounded. Peraeon segments two to seven subequal, expanded on one side, producing the hunch characteristic of the genus. First three pairs of coxal plates dorsally visible, first and seventh segments without, and fourth with two pairs of, coxal plates, coxal plates of second segment large, almost oval, others narrow, third segment with the coxal plate of the shorter side much larger than the corresponding one. Pleon slightly immersed in peraeon, almost as broad as seventh peraeon segment, first

\* Referred to as *Opisthopterus tartoor* in Day's *Fishes of India*.

segment only partially visible, others subequal in length and breadth. Telson perfectly triangular, slightly longer than broad, sides converging to the acuminate apex, dorso-median carina prominent.

First antennae placed slightly apart at their bases, eight-segmented; second antenna nine- to ten-segmented. Incisor part of mandible pointed, molar obsolete, provided with a membranous, ciliated lamina, palp very stout, apparently three-segmented, segmentation incomplete. First maxilla, as usual, styloform, with

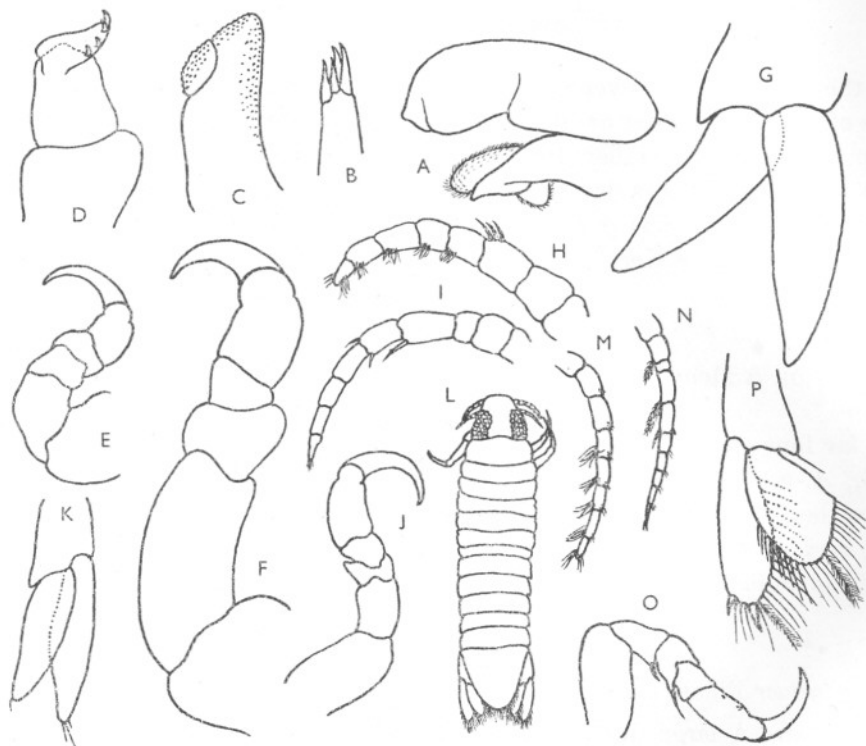


Fig. 1. *Agarna tartoor* Pillai. A-G, Female: A, mandible; B, first maxilla; C, second maxilla; D, maxilliped; E, first peraeopod; F, seventh peraeopod; G, uropod. H-K, Male: H, first antenna; I, second antenna; J, first peraeopod; K, uropod. L-P, Larva: L, larva, dorsal view; M, first antenna; N, second antenna; O, first peraeopod; P, uropod.

four apical hooks. Second maxilla conically produced beyond the distal segment, its surface rugose. Basal segment of maxilliped expanded at the outer distal part, terminal segment with an outer row of four hooks. Basis of first peraeopod large, merus and carpus short, subequal, dactylus only very slightly falcate. Seventh peraeopod with merus larger than carpus, produced at the outer distal part, dactylus as in first peraeopod. Uropod with broad, apically narrowing rami.

Length 25.0 mm.

Body white, turning yellow in alcohol.

**MALE** (Figs. 1 H-K, 2 I). Body symmetrical, regularly broadening to the seventh peraeon segment. Cephalon roughly triangular, with its anterior part slightly

deflexed ventralwards. First peraeon segment longest and narrowest, antero-median part slightly sinuous, antero-lateral corners produced, segments two to seven subequal in length. Coxal plates well developed, second and third large, fourth to seventh long and narrow. Pleon much narrower than peraeon, with subequal segments. Telson triangular, apex blunt.

First antenna eight-segmented, third segment with three stiff setae, segments four to eight with a bunch of setae at the lower distal part, apical segment with an upper row of three setae. Second antenna nine-segmented, third segment shortest, fourth with a lower distal seta, fifth with an upper and lower setae, apical segment with a bunch of setules. First peraeopod similar to that of female but more slender, dactylus slightly more falcate. Uropods as in female, exopod with three apical setules and endopod with one.

Length 12.0 mm.

Body white, with large dark chromatophores on cephalon and proximal part of telson.

LARVA (Fig. 1 L-P). Body long, with parallel sides. Cephalon as long as broad, anteriorly subtruncate, eyes large and well faceted. First peraeon segment longest, seventh shortest. Pleon as broad as peraeon. Telson slightly longer than broad, apically rounded.

First antenna eight-segmented, segments two to seven with an upper bunch of very small setules and segments four to eight with a lower bunch of olfactory setae. Second antenna nine-segmented, third segment, as in the male, very short, segments two and four with a plumose seta. First peraeopod with an outer distal spine on ischium and merus, carpus with two inner teeth. Uropods with broad, foliaceous rami, with plumose setae, endopod shorter but broader than exopod, which has two stout teeth.

Body white, with highly branched scattered chromatophores.

REMARKS. This species differs from *A. carinata* in the much expanded first peraeon segment, which hides the cephalon in dorsal view. Also the pleon is narrower than the peraeon and the telson is longer than broad, with an acuminate apex.

### *Agarna brachysoma* sp.nov.

MATERIAL. Several specimens were collected by the author from the gill chamber of *Pellona brachysoma* Bleeker caught at Trivandrum. Holotype, female, is deposited in the Indian Museum, Calcutta.

FEMALE (Figs. 2 A-H, 7 B). Body about two and a half times as long as broad and roughly parallel sided, less asymmetrical than in *A. tartoor* Pillai. First peraeon segment only moderately expanded. Cephalon anteriorly triangular and exposed in dorsal view. Peraeon segments generally like those of *A. tartoor*, coxal plates of second segment large and projecting. Pleon almost as broad as seventh peraeon segment and only very slightly immersed; first segment is not visible in dorsal view. Telson equal in length and breadth, triangular, apex somewhat drawn out but not so acute as in *A. tartoor*.

First antenna fairly stout, eight-segmented; second antenna slender, eight-

segmented, third segment longest. Mandible with curved apically pointed incisor, molar absent, palp stout, distinctly three-segmented. First maxilla as in *A. tartoor*; second maxilla with indistinctly separated apical segment carrying two hooks, distal part of the appendage prominently spiny. Maxilliped as in *A. tartoor* but the basal segment not distally produced, apical segment with only three hooks. Peraeopods as in *A. tartoor*. Uropods with the rami nearly oblong, less narrowed towards the apex.

Length 13.5 mm.

Body white.

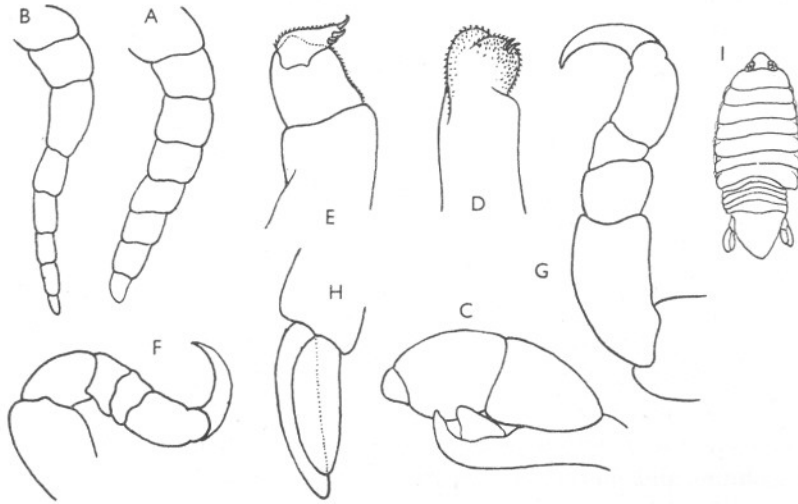


Fig. 2. *Agarna brachysoma* sp. nov. A, First antenna; B, second antenna; C, mandible; D, second maxilla; E, maxilliped; F, first peraeopod; G, seventh peraeopod; H, uropod; I, *A. tartoor* Pillai, male.

REMARKS. I was at first inclined to consider the specimens assigned to this species as small individuals of *A. tartoor*, but they showed constant specific differences, the chief among which are the partially exposed cephalon, the highly projecting coxal plates of the second peraeon segment and the apically blunt telson. There are recognizable differences in the cephalic appendages also.

#### Genus *Indusa* Schi. & Mein.

##### *Indusa malayi* (Tiwari)

*Agarna malayi* Tiwari (1953, p. 295, pl. iv, text-figs. 1-2)

*Indusa ophueseni* Pillai (1954, p. 15)

MATERIAL. Six specimens, including two ovigerous females, from the gill chamber of *Mugil ophueseni* Bleeker caught in the Kayamkulam lake (Kerala, India).

FEMALE (Figs. 3 A-G, 7 C). Body highly asymmetrical, slightly longer than broad. Cephalon small, twice as broad as long, roughly triangular, apex narrow but rounded. Eyes small, subdorsal. First peraeon segment slightly longer than

the other segments but narrowest, its anterior border nearly straight, antero-lateral corners produced into blunt processes slightly overreaching the eyes. Segments two to seven subequal in median length, one side of segments three to six much expanded, producing the characteristic vaulted appearance. Posterior coxal plates projecting as triangular processes. Pleon very short, slightly immersed in peraeon, broader than the seventh peraeon segment and telson, overlapped by the lateral parts of the seventh peraeon segment. Telson roughly rectangular, asymmetrical and almost twice as broad as long, with prominent median carina.

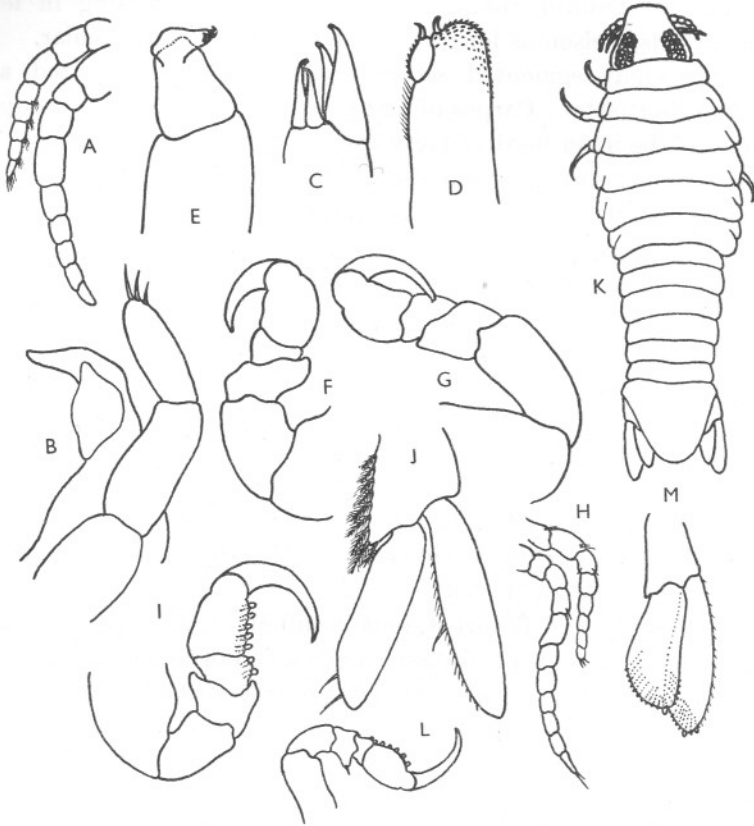


Fig. 3. *Indusa malayi* (Tiwari). A-G, Female: A, first and second antennae; B, mandible; C, first maxilla; D, second maxilla; E, maxilliped; F, first peraeopod; G, seventh peraeopod. H-J, Male: H, antennae; I, first peraeopod; J, uropod. K-M, Larva: K, larva, dorsal view; L, first peraeopod; M, uropod.

First antenna eight-segmented, last five segments each with a bunch of small setules. Second antenna longer and stouter than first, nine-segmented. Mandible with a well-produced, curved incisor process, palp very stout, three-segmented, distal segment with three stiff setae. First maxilla with four apical hooks, outer pair much shorter than inner. Second maxilla distally spiny, each of the distal lobes with one claw. Distal segment of maxilliped with three hooks. Basis of first leg large, carpus very short, dactylus only moderately curved. Seventh

peraeopod much longer than first, ischium cylindrical, dactylus curved. Uropods with flattened rami not overreaching the apex of the telson, exopod longer than endopod.

Length 15.0 mm.

Body white, with scattered faint chromatophores on the dorsal side.

MALE (Figs. 3 H-J, 4 K). Body elongated and symmetrical. Head triangular, with subtruncate anterior border, eyes large and dorsal. First peraeon segment anteriorly trisinuous, with the antero-lateral corners very slightly produced. First peraeon segment longest, others becoming successively shorter. Pleon not immersed, much narrower than peraeon, segments increasing in length and breadth backwards. Telson as long as broad, distal half semicircular.

First antenna eight-segmented, second antenna eleven-segmented, apical segment with two short setae. Carpus of first peraeopod with two and propodus with five tubercles on the inner border, dactylus long and strongly curved. Peduncle of uropod with an inner row of plumose setae, exopod slightly longer than endopod, with hairy inner border carrying a long seta, endopod with two distal setae.

Length 16.0 mm.

Colour as in female with the chromatophores more numerous and prominent.

LARVA (Fig. 3 K-M). Head as long as broad, with subtruncate anterior border, eyes small and reniform, with distinct ocelli. Peraeon slightly longer and broader than pleon, narrowing in both directions, segments subequal in length. Pleon segments subsimilar, slightly narrowing backwards. Telson longer than broad, apically rounded. Antennae as in male. Merus of first peraeopod with an outer distal spine, carpus with two and propodus with five tubercles, dactylus slender and only slightly curved. Rami of uropods highly flattened, endopod with one and exopod with two large tubercles, both rami with a row of tubercles representing the position of the setae.

REMARKS. According to Tiwari *A. malayi* differs from *A. carinata* in that each of the peraeon segments, except the first, carries a pair of coxal plates. In the species of *Agarna* the distribution of the coxal plates is as described by Richardson and is a generic character. That Tiwari's species does not show this is sufficient proof that it does not belong to *Agarna*. The description given by Tiwari clearly applies to the present specimens.

#### *Indusa pustulosa* Pillai

*Indusa pustulosa* Pillai (1954, p. 16)

MATERIAL. Four females, one ovigerous, from the branchial cavity of *Anodontostoma chacunda* (Ham. Buch.) caught in the Kayamkulam lake (Kerala, India). Holotype, female, deposited in the Indian Museum, Calcutta.

FEMALE (Figs. 4 A-F, Fig. 7 D). Body very much like that of *I. malayi*, but less hunched, almost twice as long as broad. Cephalon very small. First peraeon segment longer than in *I. malayi*, with sinuous anterior border, antero-lateral parts scarcely produced. Seventh peraeon segment much expanded on one side, reaching the anterior border of the fifth pleon segment. Pleon broader than telson, segments increasing in length backwards. Telson almost twice as broad as long,

distal border prominently bilobed, dorso-median carina very prominent and the dorsal surface with prominent pustules.

First antenna eight-segmented, distal segment with two setae. Second antenna eleven-segmented, subequal to first in length, but much more slender, just the reverse of what is seen in *I. malayi*. Mandible with very prominent incisor and molar lobes, palp very stout, first two segments subequal, third small. First maxilla with four apical hooks, inner pair smaller than outer. Distal lobes of second maxilla with two stout hooks each, borders with bunches of setules. Distal segment of maxilliped with three hooks. Peraeopods as in *I. malayi*, but comparatively stouter. Rami of uropods broader and longer than in *I. malayi*.

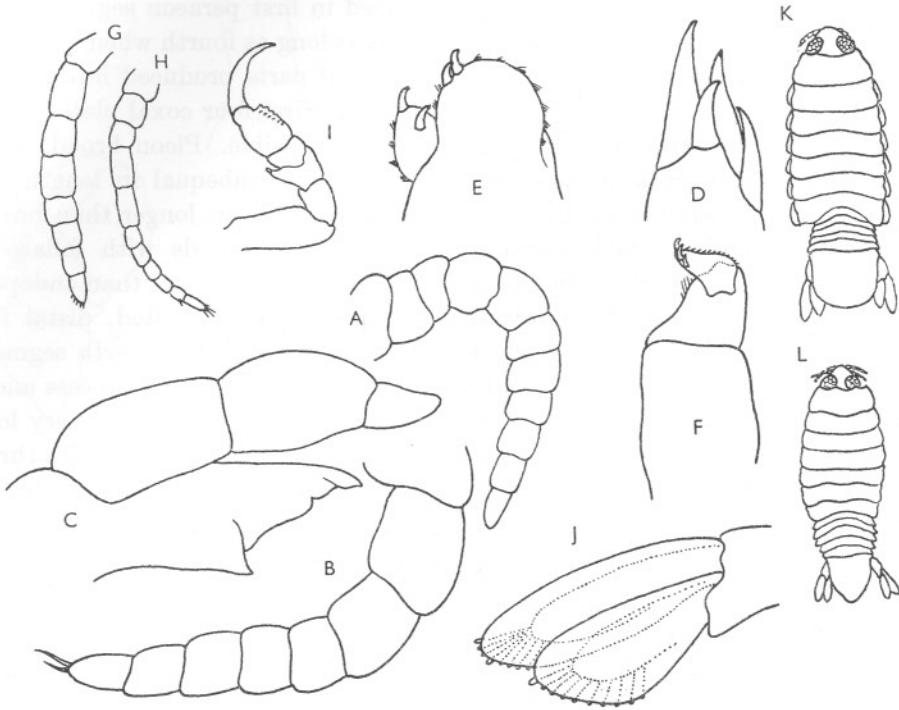


Fig. 4. *Indusa pustulosa* Pillai. A-F, Female: A, second antenna; B, first antenna; C, mandible; D, first maxilla; E, second maxilla; F, maxilliped. G-J, Larva: G, first antenna; H, second antenna; I, first peraeopod; J, uropod. K, *I. malayi*, male. L, *Livoneca circularis*, male.

Length 21.0 mm.

**LARVA** (Fig. 4 G-J). Body similar to that of the larva of *I. malayi*. First antenna eight-segmented, stouter but shorter than second, distal segment with a row of very short setules, second antenna eleven-segmented, penultimate segment with one and ultimate with four setae. Merus of first peraeopod with an outer tubercle and propodus expanded at the inner side and with a row of pustules, dactylus very long. Uropods broad, with the apical spines indicated by large tubercles and setae by small ones.

**REMARKS.** The prominent pustules on the dorsal side of the telson easily

distinguish this species from *I. malayi* and all the other species recorded within the genus. Compared to *I. malayi* the body is less hunched and also longer. There are other differences in the structure of the antennae, mandible and second maxillae.

Genus *Livoneca* Leach

*Livoneca engraulidis* (Barnard)

*Agarna engraulidis* Barnard (1936, p. 169, figs. 9a-c)

**MATERIAL.** Two females with empty brood pouch from the gill chamber of *Anchoviella zollingeri* Fowler, examined at Trivandrum.

**FEMALE** (Fig. 7 E). Body asymmetrical, right side much shorter than left. Cephalon small and triangular, slightly immersed in first peraeon segment, eyes dark and well developed. First peraeon segment as long as fourth when measured in the middle, narrower than others, antero-lateral parts produced into conical lobes reaching beyond the middle of the cephalon. First four coxal plates of the shorter side and first two of the longer side dorsally visible. Pleon broad, much broader than the seventh peraeon segment; segments subequal in length but progressively decreasing in width. Telson roughly triangular, longer than broad, distal border rounded, much narrower than pleon. Uropods with foliaceous apically pointed rami reaching the tip of the telson, exopod longer than endopod.

First antenna longer and stouter than second, eight-segmented, distal five segments with olfactory setae, second antenna eight-segmented, fourth segment with a prominent plumose seta. Mandible with a hook-like incisor process and a blunt molar, palp three-segmented. First maxilla with comparatively very long slender hooks. Inner lobe of second maxilla with four hooks and outer with three. Apical segment of maxilliped with three hooks, surface spiny. Propodus of first peraeopod with two knob-like teeth, dactylus very long and falcate, reaching the merus when closed. Carpus of seventh peraeopod very short, propodus with three blunt spines.

Length 7.0 mm.

**REMARKS.** Barnard's specimen was obtained from *Engraulis setirostris* and was doubtfully referred to *Agarna*. His surmise that it might be necessary to transfer it to *Livoneca* can now be substantiated. The slight enlargement of the first peraeon segment is the only character this species shares with those of *Agarna*.

*Livoneca circularis* Pillai

*Livoneca circularis* Pillai (1954, p. 17)

**MATERIAL.** Several specimens, including ovigerous females, from the branchial chamber of *Clupea leiogaster* (C.V.) caught at Trivandrum.

**FEMALE** (Figs. 5 A-G, 7 F). Body nearly circular, slightly asymmetrical and dorsally convex. Cephalon very much immersed and constricted in front of the eyes, which are well developed. Peraeon segments one to six equal in length when measured in the middle, first arched forwards, with the antero-lateral lobes rounded and remaining slightly apart from the cephalon. Fourth and fifth segments equal in length and breadth, broader than the other segments, seventh segment arched



backwards, its enlarged postero-lateral parts very much overlapping the pleon. All the coxal plates visible on the longer side, first three and the last alone visible on the shorter side. Pleon broader than seventh peraeon segment, very much immersed, segments subequal in length but successively narrowing backwards. Telson roughly triangular, narrower than the fifth pleon segment, apex faintly bilobed. Uropods short, not reaching the tip of telson, rami oblong, subequal in size.

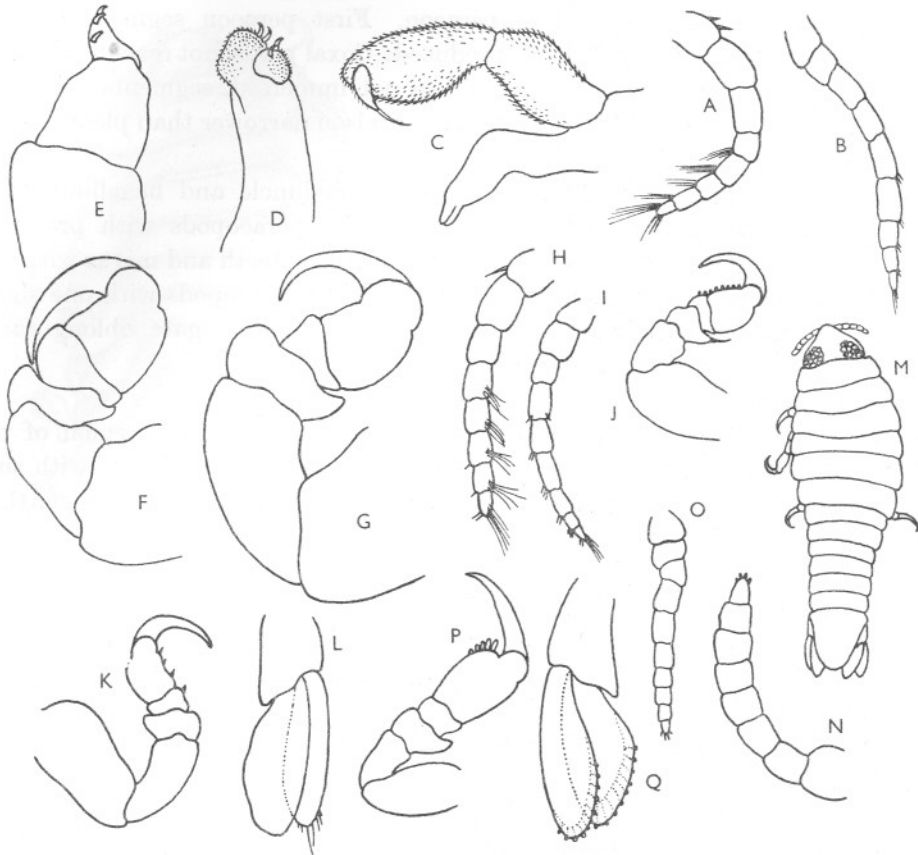


Fig. 5. *Livoneca circularis* Pillai. A-G, Female: A, first antenna; B, second antenna; C, mandible; D, second maxilla; E, maxilliped; F, first peraeopod; G, seventh peraeopod. H-L, Male: H, first antenna; I, second antenna; J, first peraeopod; K, seventh peraeopod; L, uropod. M-Q, Larva: M, larva, dorsal view; N, first antenna; O, second antenna; P, first peraeopod; Q, uropod.

First antenna eight-segmented, divisible into a three-segmented peduncle and five-segmented flagellum, first peduncular segment with two setae, each flagellar segment with a bunch of long sensory setae, last with four apical setae. Second antenna nine-segmented, last five segments with very small setules. Mandible with a bifid incisor process, molar absent, palp with spiny surface, third segment very small, with a long terminal seta. First maxilla with the usual four hooks. Second maxilla distally spiny, each lobe with two hooks. Distal segment of

maxilliped with three hooks. All the peraeopods constructed on the same pattern, with short stout segments, dactylus of first peraeopod long, reaching the merus when closed. Ischium of posterior peraeopods long, carpus very short, dactylus slender and more falcate.

Length 12.0 mm.

Body white, with scattered chromatophores on peraeon and pleon, more numerous on the posterior part of the body.

**MALE** (Figs. 4 L, 5 H-L). Body elongate oblong, cephalon almost triangular, with blunt apex, not immersed in peraeon. First peraeon segment longest, antero-lateral corners angular but not produced. Coxal plates not reaching beyond the posterior border of the segments. Pleon not immersed, segments subequal, narrowing backwards and laterally drawn out. Telson narrower than pleon, longer than broad.

First antenna eight-segmented, divisible into peduncle and flagellum as in female. Second antenna nine-segmented. Anterior peraeopods with propodus expanded and carrying six blunt teeth, carpus with two teeth and merus with one spine, dactylus long and falcate. Carpus of posterior peraeopods with one sharp spine and propodus with three spines. Uropods with elongate oblong rami, reaching the tip of the telson.

Length 12.0 mm.

**LARVA** (Fig. 5 M-Q). Body slender, expanded slightly at the region of the peraeon. Cephalon triangular, with well-faceted eyes, peraeon oblong, with subequal segments, pleon as long as peraeon, narrowing backwards, telson longer than broad, uropods reaching beyond the tip of telson.

First antenna stout, eight-segmented, apical segment with four tubercles. Second antenna ten-segmented, with four apical setules. Anterior peraeopods with highly expanded propodus carrying a row of five tubercles, dactylus only slightly falcate. Uropods with foliaceous rami carrying marginal tubercles.

**REMARKS.** *L. circularis* is a typical species agreeing with other species in the structure of the appendages but its nearly circular body distinguishes it from all the others.

#### Genus *Pseudirona* nov.

**DIAGNOSIS.** Body slightly asymmetrical, cephalon broadly triangular, with well-developed dorsally placed eyes. First three peraeon segments subequal in length, first segment antero-laterally produced into conical lobes, segments four to seven subequal in length and breadth, seventh segment considerably overlapping pleon. Coxal plates well developed and projecting. Pleon well immersed in peraeon, increasing in width backwards, fifth segment longest, first completely hidden by the peraeon. Telson as broad as pleon, transversely oblong, distal border rounded, prominently bilobed, dorso-median carina prominent. Uropods with flattened subsimilar rami.

Antennae very unequal. Mandible with three-segmented palp. First maxilla with one claw stout, second maxilla with four well-curved hooks. Maxilliped foliaceous and prominently setose. Peraeopods with merus and propodus in the

first two pairs, and merus in all the others, internally expanded. All the appendages with fine setules or spines.

Type species: *Pseudirona laeopsi* gen.nov., sp.nov.

AFFINITIES. This genus has the closest resemblance to *Irona* Schi. & Mein. The general shape of the peraeon, pleon and telson is very much like that of *Irona*, but in *Irona* the peraeon is usually more asymmetrical, with the coxal plates very much so. In *Irona* the posterior coxal plates are larger than the anterior ones

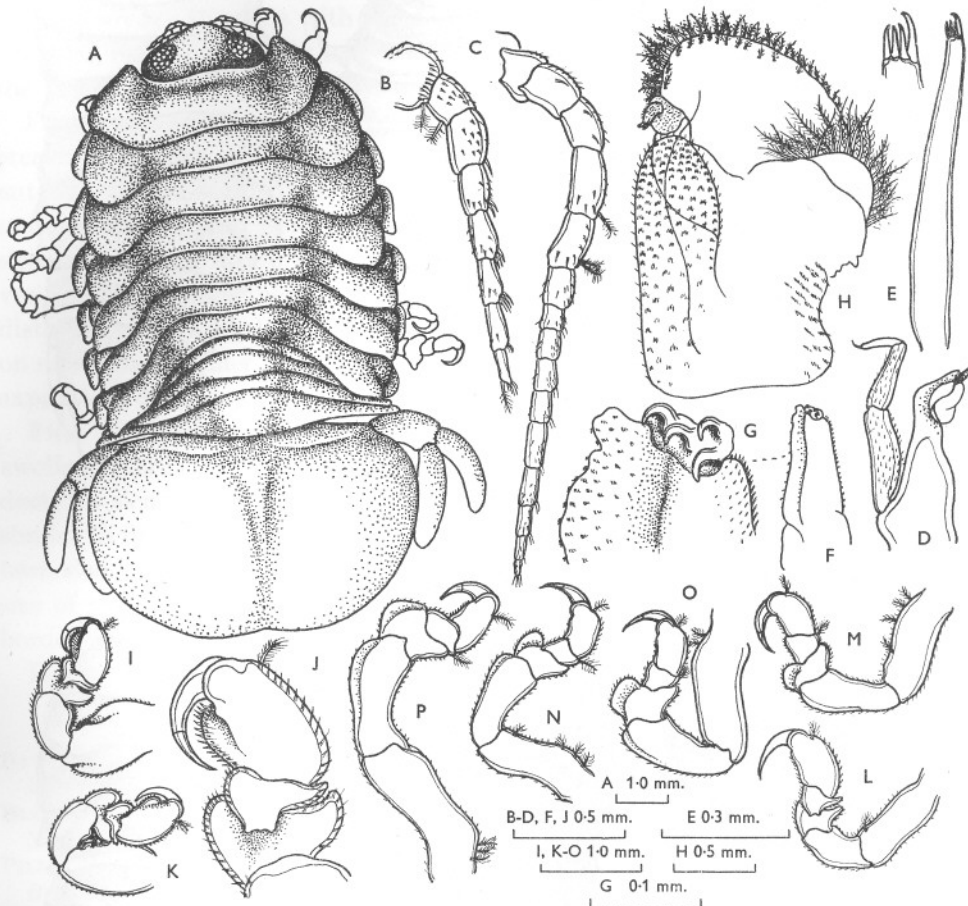


Fig. 6. *Pseudirona laeopsi* gen.nov., sp.nov. A, Female, dorsal view; B, first antenna; C, second antenna; D, mandible; E, first maxilla; F, second maxilla; G, same, tip enlarged; H, maxilliped; I, first peraeopod; J, same, tip enlarged; K, second peraeopod; L, third peraeopod; M, fourth peraeopod; N, fifth peraeopod; O, sixth peraeopod; P, seventh peraeopod.

while they are all subsimilar in *Pseudirona*. In *Irona* the uropods generally overreach the telson and the rami are apically narrowed, but it is not so in *Pseudirona*. The extremely spiny and setose appendages are quite unlike those of any other cymothoid.

**Pseudirona laeopsi** gen.nov., sp.nov.

**MATERIAL.** Two mature females from the gill chamber of two specimens of *Laeops macrophthalmus* (Alcock) dredged off Anjengo (Kerala, India) at a depth of 150 fathoms. Holotype, female, is deposited in the Indian Museum, Calcutta.

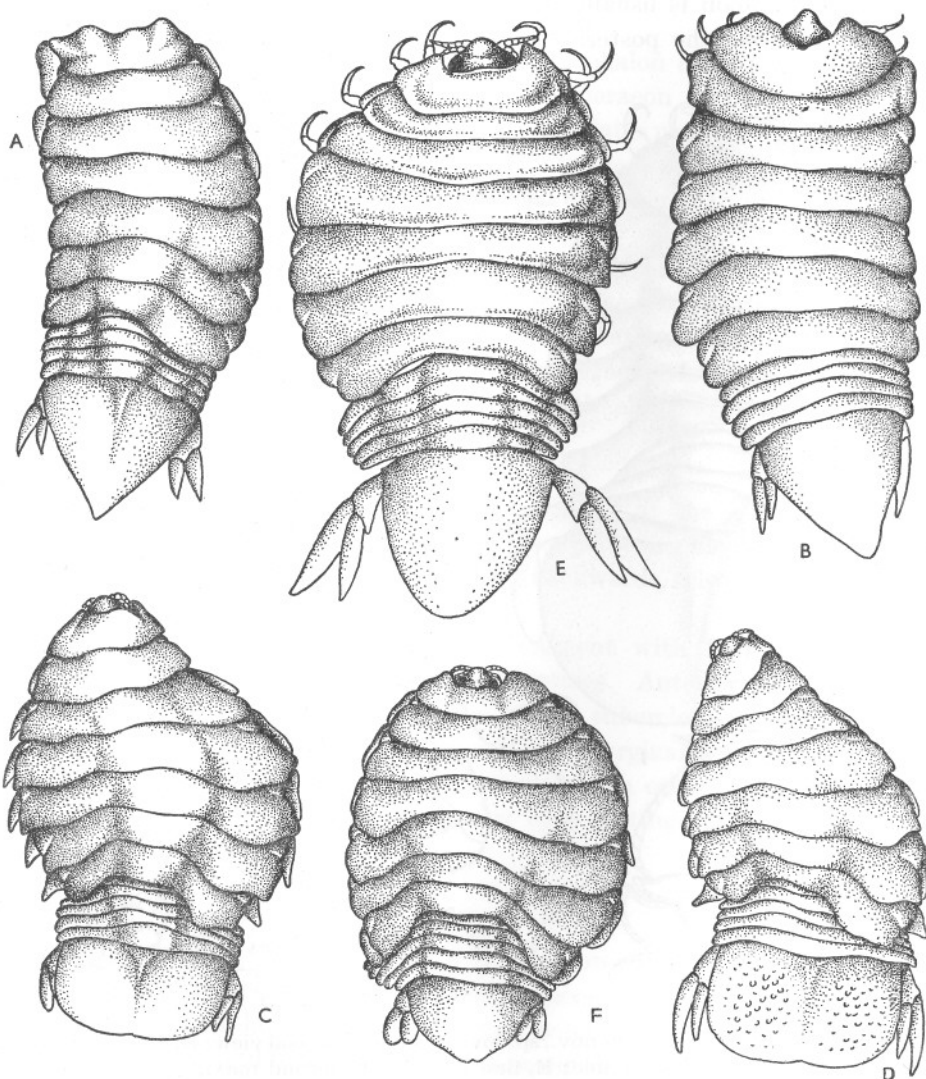


Fig. 7. A, *Agarna tartoor* Pillai, female. B, *A. brachysoma* sp.nov., female. C, *Indusa malayi* (Tiwari), female. D, *I. pustulosa* Pillai, female. E, *Livoneca engraulidis* (Barnard), female. F, *L. circularis* Pillai, female.

**FEMALE** (Fig. 6 A-P). Cephalon broadly triangular, one and a half times as broad as long, overlapped by the first peraeon segment; eyes large and dark, dorsal in position. First peraeon segment longest, antero-laterally produced into apically blunt processes reaching the level of the eyes on the longer side, segments two to four subequal in length and breadth, five to seven subequal, shorter than

four, seventh segment overlapping the lateral parts of pleon, on the shorter side almost reaching the hind border of the fifth pleon segment. Coxal plates prominent and projecting, decreasing in length backwards, none overreaching the posterior border of the segment. Pleon broadly triangular and well immersed in peraeon, first segment completely hidden under the seventh peraeon segment, segments markedly increasing in width backwards, fifth segment nearly as broad as telson. Telson very broad and roughly semicircular, with a postero-median incision making it prominently bilobed, dorsal carina very prominent, basal part with two transverse grooves. Uropods with short peduncle, rami elongate oblong and apically rounded, endopod slightly longer than exopod and stopping far short of the tip of the telson.

First antenna eight-segmented, basal segment stout, others successively decreasing in width, all the segments with stiff setules and sensory setae. Second antenna fifteen-segmented. Incisor process of mandible with lacinia mobilis, molar obsolete, palp well developed and spiny, first segment longest, third very slender, with an apical seta. First maxilla with four apical hooks, outer hook very stout, others subequal. Outer part of the surface of second maxilla spiny, distal segment irregular, armed with four strongly curved, stout claws mounted on raised bases, inner lobe with irregular border. Maxilliped with foliaceous setose expansion, distal segment small, with two hooks.

First peraeopod short and robust, borders of segments spiny, basis large and swollen, merus and carpus internally expanded, carpus immersed in merus, dactylus slender and strongly curved, with a distinct unguis. Second peraeopod similar to first, with the propodus less flattened. Peraeopods three to seven with basis slender, propodus without internal expansion, but merus expanded internally, size of this expansion increasing from third to seventh. All the legs with spiny border and with sensory setae.

Length 13.8 mm.

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