

ON TWO NEW SPECIES OF *CLAUSIDIUM* (COPEPODA : CYCLOPOIDA)  
PARASITIC ON THE SHRIMP *CALLIANASSA*

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THE genus *Clausidium* includes seven species, *C. apodiforme* (Philippi) from the Mediterranean and Adriatic seas, *C. caudatum* (Say), *C. vancouverense* (Haddon), *C. dissimile* Wilson, *C. searsi* Wilson and *C. tenax* Humes, all from the North and South Americas and *C. senegalense* Humes from West Africa. The present record extends the distribution of the genus to the Indian Ocean and brings the total number of species known to nine.

Genus *Clausidium* Kossmann

*Clausidium*, Wilson, 1921, p. 425.

*Clausidium*, Light and Hartman, 1937, p. 173.

*Clausidium*, Humes, 1949, p. 93.

The genus possesses the following characters :—Body oval and much flattened ; first thoracic segment united with the head, second and third free, short, fourth and fifth covered by a dorsal plate, sixth segment narrow and partially visible ; abdomen one to three segmented, segmentation indistinct ; egg sacs short, eggs in several rows ; antenna one normal, seven segmented ; antenna two modified, four segmented, distal segments with long setae ; legs one to four biramous, with sucking discs, first pair highly modified, fifth leg uniramous, two segmented.

Male generally like the female, usually remaining attached to the female ; dorsal plate covering the fourth and fifth thoracic segments distally bilobed ; sixth segment with rudimentary legs ; abdomen three segmented ; appendages generally like those of female but the maxilliped modified as prehensile organs.

All the species so far recorded are parasites of the shrimp belonging to the genus *Callianassa*. The copepod is light red in colour and remains attached to the gills. In majority of cases the male remains attached to the abdomen of the female and does not relax its hold even on throwing the specimens into the fixing fluid. On superficial examination the male appears as a part of the female, very much like the swollen genital segment of *Caligus* spp.

*Clausidium travancoreense* sp. nov.

(Figs. 1-2)

**F e m a l e :**

Body oval, posterior part slightly narrower than the anterior, anterior border perfectly rounded. Dorsal surface with minute spines, more towards the peripheral parts. First thoracic segment with the head together slightly less than half the length

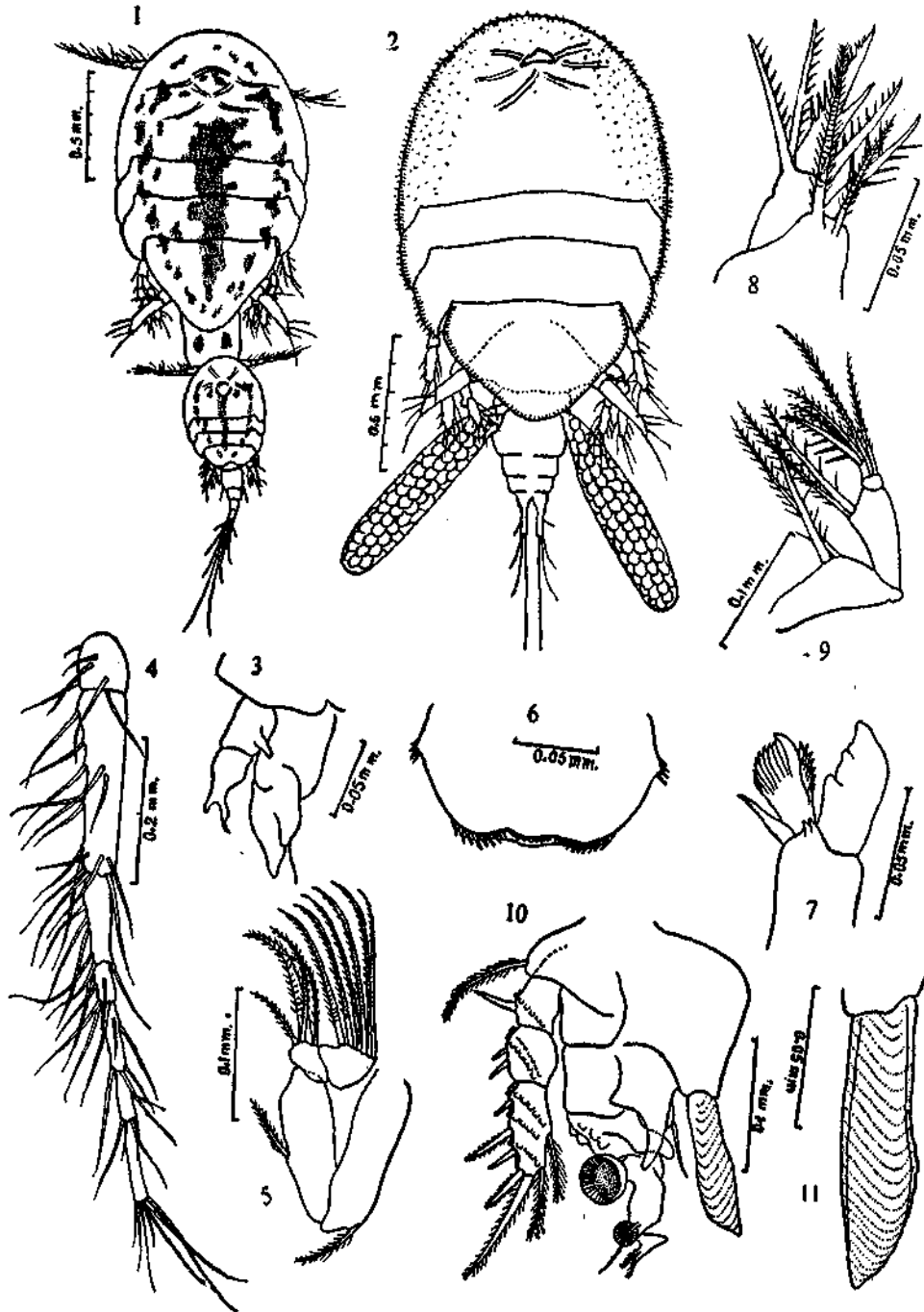


FIG. 1. *Clausidium travancorense* sp. nov. 1, male and female *in situ*. 2, female. 3, ventral view of abdomen showing appendages. 4, antennule. 5, antenna. 6, labrum. 7, mandible. 8, second maxilla. 9, maxilliped. 10, first leg. 11, same, blade like seta.

of the cephalothorax. Segments two and three narrow; posterior border of dorsal plate rounded and reaching the proximal part of the sixth thoracic segment. Sixth segment rectangular, longer than broad. Postero-lateral angles of first three segments produced and angular. Abdomen short, narrower than the sixth thoracic segment, segmentation indistinct and with two pairs of degenerate appendages. Basal part of caudal rami bulged, each with one small outer and three long apical setae. Ovisacs apically rounded.

First antenna with the second segment nearly equal to the next three segments combined, fourth segment shortest. Second antenna with the first two segments subequal, each with one seta, segments three and four short, former with four and the latter with six setae, all the setae pectinate, one on the third segment stouter than the others. Labrum about one and a half times as broad as long, with a pronounced lateral bulge carrying a row of short spines, distal border trilobed, lateral lobes with sharp spines and the median lobe with blunt teeth. Mandible with an elongated basal limp carrying two flattened processes, outer process flat, internally concave and with two to three blunt cusps, inner and distal borders of inner lobe serrated and the inner surface corrugated, outer border with a serrated accessory lobe; a conspicuous spine and two small teeth also present at the base of the inner lobe. First maxilla as in *C. senegalense* Humes. Second maxilla two segmented, first segment with three stout setae, two pectinate and one barbed; distal segment with a stout bifid spine, strongly barbed on one side, and two large barbed setae above and a similar one below. Maxilliped four segmented, first two segments subequal and similar, each with two setae, one of them stout and pectinate, and the other slender and plumose. Last two segments very small, third segment with two slender setae and the fourth with three setae, two of them large and one small, the large inner seta barbed.

First pair of legs modified for prehension. Basipodite very broad, rami three segmented, endopodite much flattened and modified and the segmentation indistinct. First segment of exopodite with one spine and an oblique row of tubercles, second segment with two spines and two rows of tubercles. First segment of endopod with one stout outwardly curved process and the second with an inwardly curved process and a seta, third segment narrow and with two suckers, first larger than second; apex with three setae, the two distal ones bent and pectinate. Inner blade like process arising from the inner corner of the basipodite almost reaching the level of the distal sucker of the endopod, distally tapering to a blunt apex, its surface with parallel lines or striations. Legs two to four with the following setal formula.\*

No. of the segment	Leg II		Leg III		Leg IV	
	Exo.	Endo.	Exo.	Endo.	Exo.	Endo.
1	1,0	S,1	1,0	S,1	1,0	S,1
2	1,1	0,2	1,1	0,2	1,1	0,2
3	8	2S,6	8	2S,6	9	2S,5

\*S represents suckers and the numbers represent the total number of spines and setae.

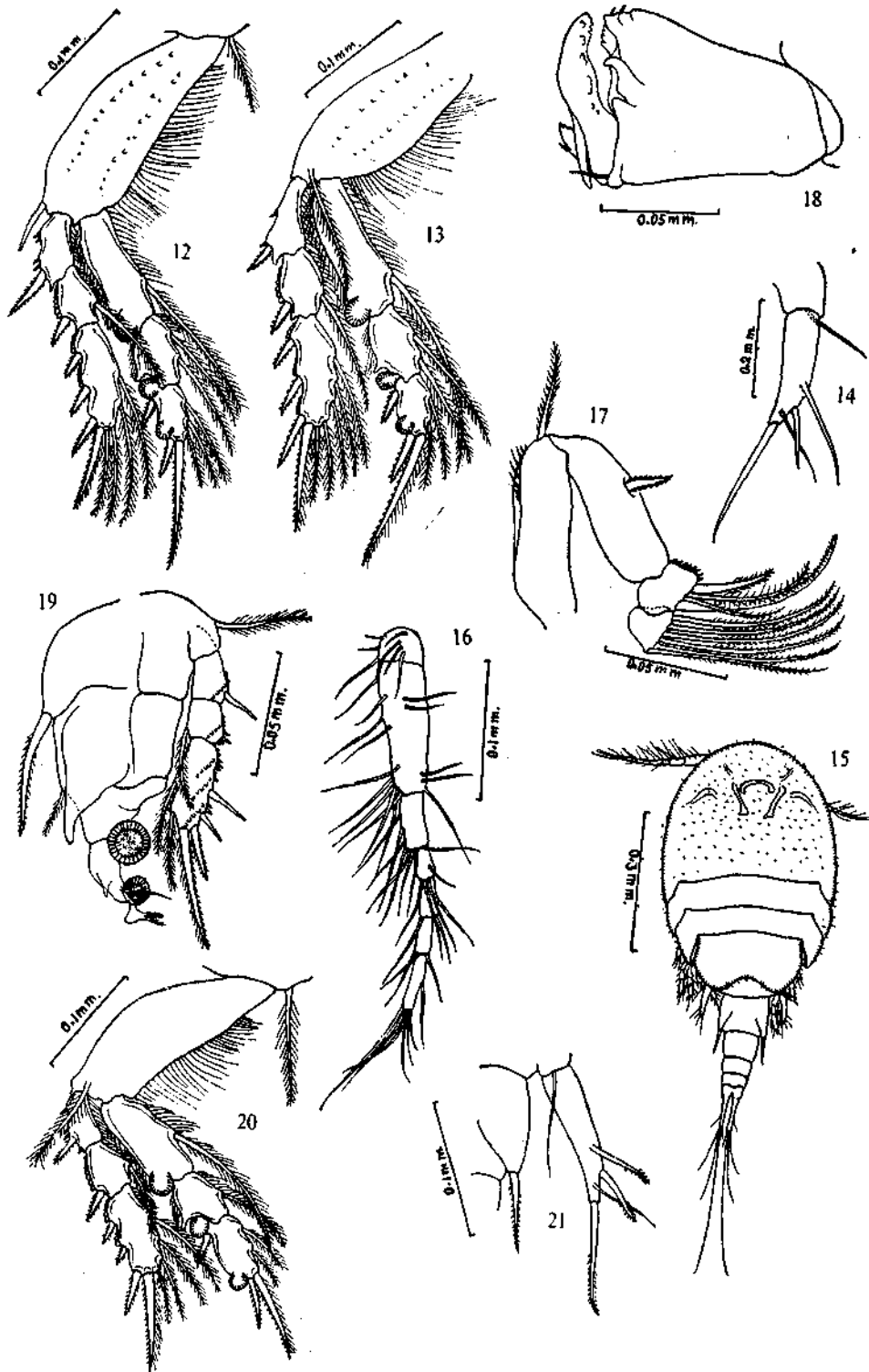


FIG. 2. *Clausidium travancorense* sp. nov. 12, third leg. 13, fourth leg. 14, fifth leg. 15, male. 16, antennule. 17, antenna. 18, maxilliped. 19, first leg. 20, fourth leg. 21, fifth leg.

Fourth leg differs from the others especially in the third segment of the exopod which carries five setae and four spines making in all nine ; the maximum in all the other species is eight.

Fifth leg uniramous and two segmented, first segment scarcely visible beyond the plate covering the fifth thoracic segment. Second segment nearly parallel sided, tapering to the tip, the outer edge with three stout spine setae and a slender hair, basal segment with a long slender seta.

#### Male :

Body oblong, dorsal surface more spiny than that of female. Cephalon and first peraeon segment together slightly more than half the length of cephalothorax ; dorsal plate twice as broad as long, posteriorly bilobed, not completely covering the fifth peraeon segment. Sixth peraeon segment squarish, with a pair of appendages. Abdomen three segmented, caudal furca as in female, but longer and more slender, distal setae very long.

First antenna as in female. Second antenna like that of female but the seta on the second segment modified into a serrated stout spine. Inner border of third segment spiny and one of the four setae very stout and transversely grooved, fourth segment with six long pectinate setae. Mandible and maxillae as in the female. Maxilliped greatly modified, with a large basal segment broadening distalwards, distal border irregular, its inner distal corner produced and toothed, the mobile process long, with five to six blunt teeth and its distal margin serrated. At the base of the mobile process is a toothed blade directed towards the tip of the mobile process and another elongated process pointing in the opposite direction.

First leg like that of female, but the second segment of exopod with an inner seta ; blade like process replaced by a stout pectinate seta and the third segment of endopod with a blunt median process. Legs two to four similar, very much like those of the female, third segment of exopod of fourth leg with only four setae. Fifth leg like that of female but more slender and the three stout setae distally pectinate.

Length of female 1.76 mm., male 0.95 mm.

#### Material

Seven males and seven females were obtained from the gills of *Callinassa maxima* M. Edwards, collected from the bar mouths of the Kayamkulam and Ashtamudi lakes, Kerala State.

#### Remarks

The males of all the species of *Clausidium* resemble closely that they provide very little help in specific diagnosis. The maxillipeds, however, show specific variation and its minute structure is important. The maxilliped of *C. travancorensis* sp. nov. is different from that of all the species known. In the shape of the mobile process and the toothed inner corner of the basal segment, it resembles that of *C. senegalense* Humes to some extent. But in the new species the basal segment is different in shape and at the base of the mobile process there are two processes which are absent in *C. senegalense*. In the latter character *C. tenax*, *C. apodiforme*, *C.*

*dissimile* and *C. caudatum* also differ from *C. travancorensis*. This basal process is present in *C. vancouverense* but in this species the maxilliped is otherwise totally different.

The female of *C. travancorensis* is much similar to that of *C. senegalensis* but the mandible is very much like that of *C. tenax*. Also the fifth leg of *C. senegalensis* is stouter than that of *C. travancorensis* and shows marked sexual dimorphism unlike as in the new species. The fifth leg of the new species is more or less like that of *C. apodiforme* and *C. dissimile*. The short abdomen and the presence of five setae on the third segment of the exopod of the fourth leg of the female and the maxilliped of the male distinguish *C. travancorensis* from all the known species.

*Clausidium chelatum* sp. nov.

(Figs. 3-4)

This species closely resembles *C. travancorensis* sp. nov. and in the following description the major differences alone are indicated.

**F e m a l e :**

Body roughly oblong, about one and a half times as long as broad. Dorsal surface very minutely but closely spiny, the spines being more closely packed at the peripheral region. First thoracic segment with the cephalon half as long as the cephalothorax and its postero-lateral corners acutely produced. Segments two and three subequal, their postero-lateral angles rounded or obtuse, those of third more so. Dorsal plate narrower than the third peraeon segment and reaching the middle of the sixth peraeon segment. Sixth peraeon segment twice as broad as long. Abdomen with a pair of rudimentary appendages. Caudal rami elongate triangular, each with one outer and four apical setae.

Antennae, mandible, maxillae and maxillipeds as in *C. travancorensis* but the bifid apical spine of second maxilla without barbs. Legs as in *C. travancorensis* but the blade like process of first leg different, its proximal third narrow and abruptly widening further on. Distal segment of exopod of fourth leg with only four inner setae and the distal segment of fifth leg very broad, basal width more than half the total length.

**M a l e :**

Body similar to that of female, but the anteromedian part slightly sinuous, with a conspicuous horse-shoe shaped thickening. Cephalon and first peraeon segment together equal to half the length of the cephalothorax. Second peraeon segment longer than third. Dorsal plate very short. Sixth segment rectangular, three times as broad as long. Abdomen two segmented, caudal rami with one outer and four apical setae.

First antenna as in female, second antenna modified, third and fourth segments partially fused, former with two long slender setae and two short but stout apically blunt processes, fourth segment with a very stout process and five setae, one of the setae very stout. Mandible and maxillae as in female. Maxilliped modified into a subchela. The basal segment or 'palm' short, with the inner corner produced

into a conical process or 'thumb'. Mobile process or 'finger' long, apically curved and trifid. Both thumb and finger with a row of strong cusps. At the base of the finger is an apically bifid process and at the base of the thumb two lobed crests.

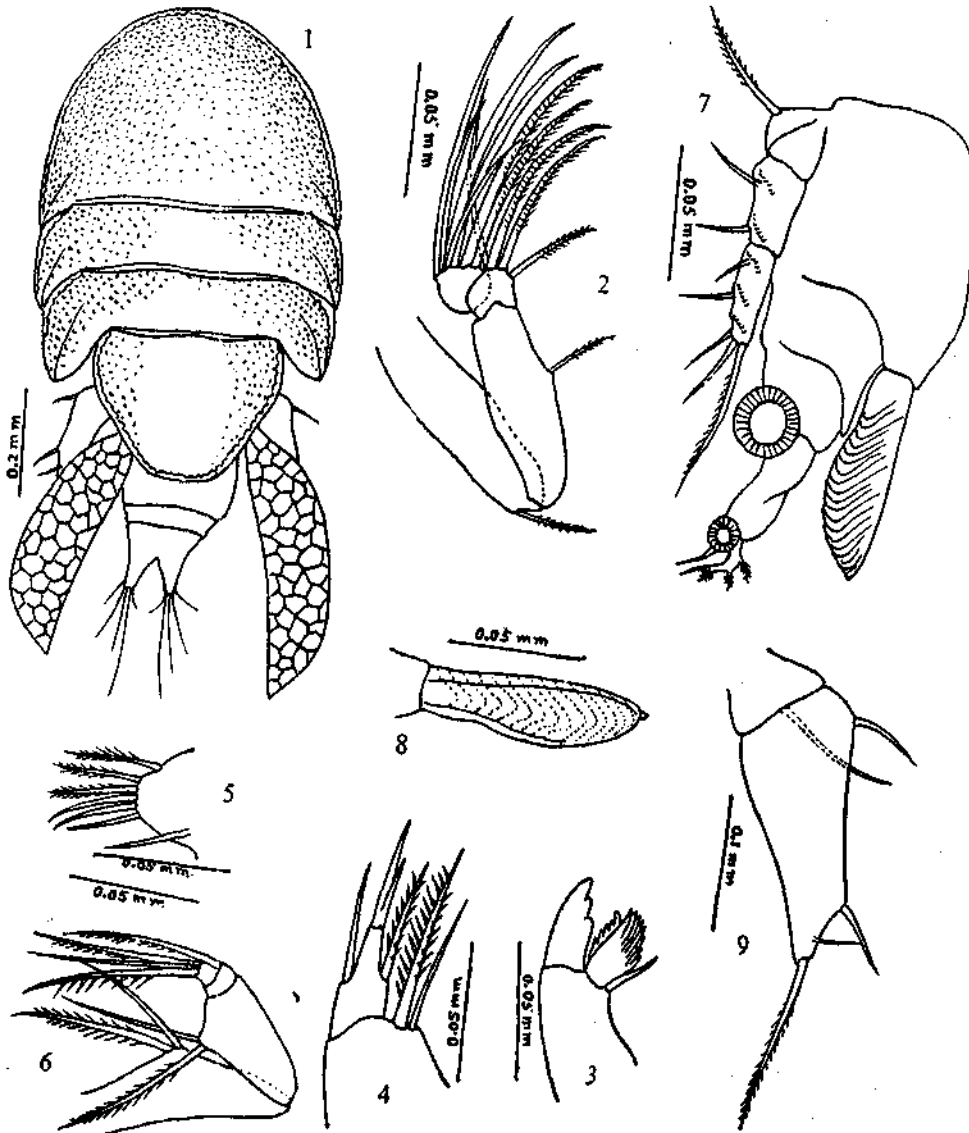


FIG. 3. *Clausidium chelatum* sp. nov. 1, female. 2, antenna. 3, mandible. 4, second maxilla. 5, first maxilla. 6, maxilliped. 7, first leg. 8, same, blade like seta. 9, fifth leg.

First leg narrower than in female, the stout seta of the endopod bent outwards. Fifth leg stout, its second segment four times as long as broad.

Length of female 1.1 mm., male 0.7 mm.

*Material*

Three males and two females from the gills of an unidentified species of *Callianassa* collected at Vizhingom.

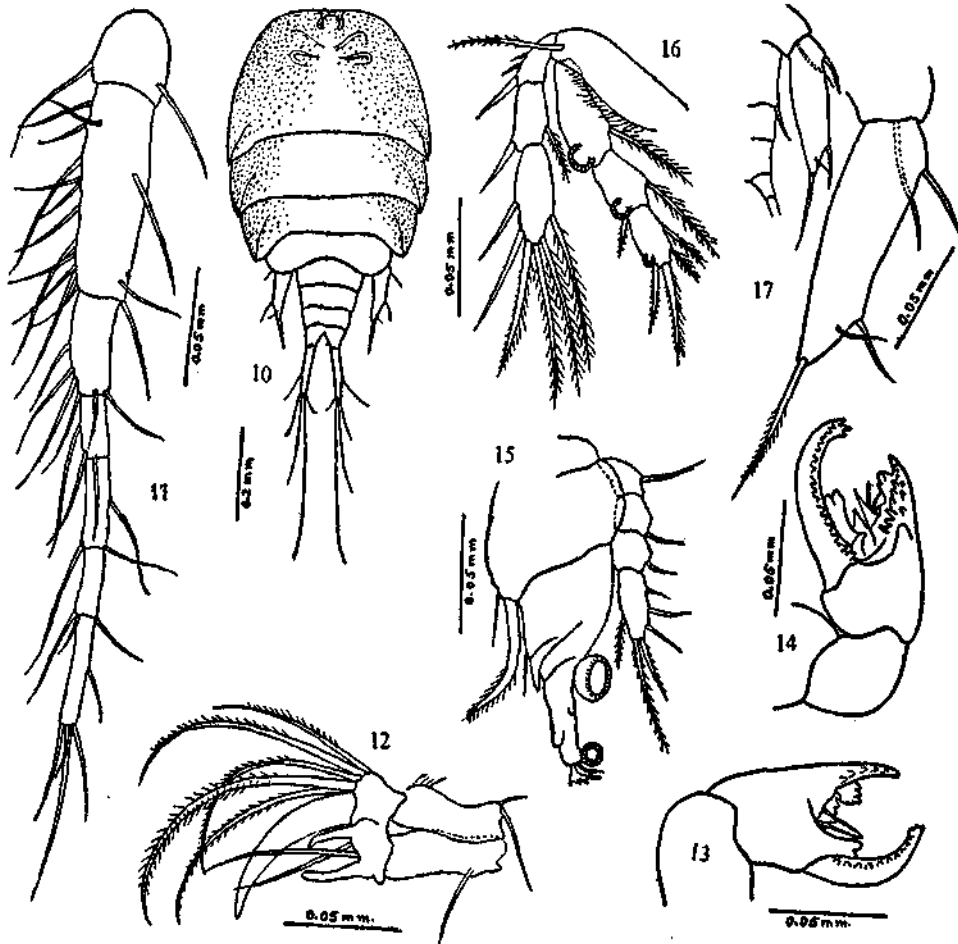


FIG. 4. *Clausidium chelatum* sp. nov. 10, male. 11, antennule. 12, antenna. 13, maxilliped, outer view. 14, same, inner view. 15, first leg. 16, fourth leg. 17, fifth leg.

*Remarks*

The female of *C. chelatum* differs from that of *C. travancorensis* in the more spiny cephalothorax, narrower dorsal shield and the apically pointed ovisacs. The differences are more pronounced in the male. The maxilliped of *C. chelatum* is different from that of all the known species. In the presence of a bifid process at the base of



the finger it remotely resembles *C. dissimile* Wilson. In *C. chelatum* the third segment of second antenna of male has two stout processes and the fourth one. A near approach to this is seen in *C. senegalense* but in the latter species the third segment has only one process.

## ACKNOWLEDGEMENTS

I am thankful to Dr. C. C. John, Professor of Marine Biology and Fisheries, University of Kerala, for helping me during the course of this study and also in the preparation of this paper. My thanks are also due to Shri K. R. Purushothaman Nair, S. N. College Marine Station, Quilon, who gave me specimens of the first species described above.

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\*The original not consulted.