

STUDIES ON THE FAUNA OF CURAÇAO AND OTHER
CARIBBEAN ISLANDS: No. 105.

CARIBBEAN BOMOLOCHIDAE
(Copepoda: Cyclopoida)

by

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	page	figures
Introduction	1	
<i>Bomolochus</i> Von Nordmann.	2	
<i>Bomolochus soleae</i> Claus	7	1-6, 7a-c
<i>Bomolochus concinnus</i> C. B. Wilson	20	8-10
<i>Bomolochus</i> ? spec.	29	11-14
<i>Holobomolochus</i> nov. gen.	35	
<i>Holobomolochus nothrus</i> (C. B. Wilson)	37	15, 17e
<i>Holobomolochus ardeolae</i> (Krøyer)	41	16, 17a-d, 18-20
<i>Holobomolochus attenuatus</i> (C. B. Wilson)	50	21-25
<i>Holobomolochus albidus</i> (C. B. Wilson)	60	26-29
<i>Holobomolochus scutigerulus</i> (C. B. Wilson)	68	7d, 30-36
<i>Dicrobomolochus</i> nov. gen.	80	
<i>Dicrobomolochus eminens</i> (C. B. Wilson)	82	37-39
<i>Orbitacolax</i> Shen	89	
<i>Orbitacolax analogus</i> nov. spec.	89	40-46
<i>Orbitacolax oniscoides</i> nov. spec.	101	47-53
<i>Acanthocolax</i> nov. gen.	113	
<i>Acanthocolax similis</i> nov. spec.	115	54-57
References	123	

The material on which the present report is principally based, was collected by Dr. J. H. STOCK, Zoological Museum of the University, Amsterdam, in Piscadera Bay, Curaçao, in 1958 and 1959, and kindly placed at my disposal some time ago. In the course of my study of this highly interesting material it became necessary to redescribe some of C. B. WILSON's fragmentarily known species of Bomolochidae. A re-inspection of some of WILSON's types has been made possible thanks to the generous co-operation of Dr. THOMAS E. BOWMAN, Associate Curator, Division of Marine Invertebrates, and Dr. ROGER F. CRESSEY, Associate Curator, Division of Crusta-

cea, both of the Smithsonian Institution (United States National Museum), Washington, U.S.A.

The bulk of the Piscadera Bay material, including all the types, is now in the collections of the Zoological Museum of the University, Amsterdam; some paratypes and duplicates are preserved in the collections of the Rijksmuseum van Natuurlijke Historie, Raamsteeg, Leiden. All the hosts have been identified by Dr. M. BOESEMANN, Rijksmuseum van Natuurlijke Historie, Leiden.

Bomolochus Von Nordmann, 1832

Parabomolochus VERVOORT, 1962: 31.

Diagnosis. *Females.* – Body cyclopoid, i.e., the cephalic somite, resulting from fusion of the head and the first thoracic somite, has the greatest diameter, the remaining thoracic somites gradually narrow in width. Cephalic somite with or without longitudinal groove. The rostral plate is visible between the antennular bases; it sharply curves ventrally and backward; its free margin may be slightly thickened and smooth or provided with two sharp, diverging rostral points. Some of the thoracic somites, that are normally developed, may be slightly swollen and backward produced, thus covering a part of the following somite. The genital complex results from fusion of abdominal somites 1 and 2 and may occasionally be fused with the fifth thoracic somite. The abdominal somites 3 to 5 are normally developed; the furcal rami are cylindrical or slightly narrowing. There are 5 marginal setae and one appendicular seta; setae 2 and 3 are lengthened and thickened. The antennule consists of an apparently three-segmented basal part and a three-segmented flagellum. On the basal plate there are, besides the normal, nude setae, 15 plumose sensory setae. The ventral surface of the basal antennular part is reinforced with chitinized plates, the finger-shaped prolongations of these plates enter into some of the sensory setae, fuse with their anterior wall or completely alter their shape. Sensory setae 1 and 2 are always completely free from such chitinized strips, but setae 3 to approximately 13 have such strips in their anterior walls. In seta 4 the chitinized strip reaches its maximal development, filling nearly the whole seta and sometimes completely

changing its character, and then forming either a curved hook or a forward projecting chitinized bar with curved apex. The antennal endopodite has longitudinal rows of fine spinules, some of these rows may be interrupted. There is invariably a pectiniform row of slender spinules, continuing on the lamelliform process. The maxillule has 4 setae. The maxillipede has a triangular basis and a strongly sigmoid claw with auxiliary tooth. There are three plumose setae, 2 on the basis and 1 near the insertion of the claw.

Though setation and spinulation of the legs varies slightly in the various species of *Bomolochus* (see Table 1), they have the following characters in common:

Leg 1. Both rami are strongly flattened; the segments of the exopodite are usually fused.

Leg 2. The endopodite is strongly flattened; there are 2 setae on the internal margin of the second endopodal segment.

Leg 3. The endopodite is normally developed, there is 1 seta at the internal margin of the second endopodal segment.

The external marginal spines of the exopodite of legs 2 to 4 are all flagellated; the anterior margin of each spine has several coarse spines or a fringe of fine spinules, running into a big spine or a spur at the end of that margin.

Leg 5 with short intermediate segment, free from the fifth thoracic somite. The apical segment of leg 5 is spatulate and has 3 terminal appendages, usually two setiform spines flanking a longer seta. There is one (short) spine at the external margin.

Males. – These are smaller than the females, though the body is still cyclopoid. The genital complex is large and usually also includes the third abdominal somite, telescoped into the complex. The number of plumose setae on the antennule may be different from that of the female, they are all normally developed. The maxillipedes are quite different from those of the female and are represented by large, chelate structures, comprising a large swollen basis and a long claw or digit; they attach the male to the female. The setation of the legs differs from that of the female (see Table 1); the first pair of legs is not so strongly deformed as in the female. The endopodite of leg 4 is 2-segmented. The intermediate segment of leg 5 is fused

with the fifth thoracic somite; the apical segment is spatulate and has two setae at its apex.

The majority of the species occurs in the gill chamber of fishes, being either attached directly to the gill filaments or to the epithelium at the inside of the operculum. Some species live in the nasal fossae of fishes.

Type species, by indication of the International Commission on Zoological Nomenclature (ANONYMUS, 1965): *Bomolochus soleae* CLAUS (1864: 374, pl. 35 figs. 16–20, pl. 36 fig. 28).

Further species:

- Bomolochus megaceros* HELLER (1865: 153, pl. 13 fig. 2)
Bomolochus unicirrus BRIAN (1902: 30, pl. 1 figs. 1–8)
Bomolochus concinnus C. B. WILSON (1911: 371, pls. 54, 55)
Bomolochus exilipes C. B. WILSON (1911: 377, pl. 58, text-fig. 10)
Bomolochus cuneatus FRASER (1920: 45, pl. 1 figs. 1–11)
Bomolochus decapteri YAMAGUTI (1936: 5, pl. 4 fig. 49, pl. 5 figs. 50–60)
Bomolochus tumidus SHIINO (1957: 417, figs. 3, 4)
Bomolochus hyporhamphi YAMAGUTI & YAMASU (1959: 92, pl. 1 figs. 12–21)
Parabomolochus psettobius VERVOORT (1962: 49, figs. 5–9)
Parabomolochus anonymus VERVOORT (1965: 3, figs. 1–6)
Parabomolochus mycterobius VERVOORT (1965: 11, figs. 7–14)
Parabomolochus globiceps VERVOORT & RAMÍREZ (1968: 141, figs. 1–6)

There is one doubtful species, viz., *Bomolochus xenomelanirisi* CARVALHO (1955: 144, pls. 1, 2). This species is closely related to, and probably identical with *Parabomolochus globiceps* Vervoort & Ramírez, 1968.

It is necessary to describe a new genus for those species of Bomolochidae that have previously been included in *Bomolochus* Von Nordmann, but that are not congeneric with *Bomolochus soleae* Claus.

In order to stabilize the nomenclature of the Bomolochidae as much as possible it appeared to be imperative to try and locate CLAUS' type of *Bomolochus soleae*. A search for these specimens in the collections of the Natural History Museum at Vienna, Austria (Naturhistorisches Museum, Wien), the most likely place of their preservation, proved to be fruitless. Dr. G. PRETZMANN, Curator of Crustacea at the Natural History Museum, Vienna, kindly informed

TABLE 1

SETATION OF LEGS 1-4 IN THE SPECIES OF *Bomolochus*

Setae in arabic, spines in roman numerals.
 (*B. renomelanirisi* Carvalho has not been included. - *B. unicolor* imperfectly known.)

	Females			
	Leg 1		Leg 2	
	endopodite	exopodite	endopodite	exopodite
<i>B. soleae</i> Claus	1+0.1+0.5	0+I.6+II	1+0.2+0.3+II	0+I.1+I.5+IV
<i>B. megaceros</i> Heller	1+0.1+0.5	6+II	1+0.2+0.3+II	0+I.1+I.5+IV
<i>B. unicolor</i> Brian	1+0.1+0.5	6		
<i>B. concinnus</i> C. B. Wilson	1+0.1+0.5	0+I.1+I.5+II	1+0.2+0.3+II	0+I.1+I.5+IV
<i>B. exilipes</i> C. B. Wilson	1+0.1+0.5	0+I.1+I.5+II	1+0.2+0.3+II	0+I.1+I.5+IV
<i>B. cuneatus</i> Fraser	1+0.1+0.0+5	6+II	1+0.2+0.3+II	0+I.1+I.5+IV
<i>B. decapteri</i> Yamaguti	1+0.1+0.5	6+II	1+0.2+0.3+I or II	0+I.1+I.5+IV
<i>B. tumidus</i> Shiino	1+0.1+0.5	6	1+0.2+0.3+II	0+I.1+I.5+IV
<i>B. hyporhamphi</i> Yamaguti & Yamasu	1+0.1+0.5	0+I.6+I	1+0.2+0.3+II	0+I.1+I.5+IV
<i>B. psettiobius</i> (Vervoort)	1+0.1+0.5	6+II	1+0.2+0.3+II	0+I.1+I.5+IV
<i>B. anonymus</i> (Vervoort)	1+0.1+0.5	6+II	1+0.2+0.3+II	0+I.1+I.5+IV
<i>B. mycterobius</i> (Vervoort)	1+0.1+0.5	6+II	1+0.2+0.3+II	0+I.1+I.5+IV
<i>B. globiceps</i> (Vervoort & Ramirez)	1+0.1+0.5	0+I.6+I	1+0.2+0.3+II	0+I.1+I.5+IV
Males				
<i>B. soleae</i> Claus	1+0.1+0.5+I	0+I.1+I.4+III	1+0.2+0.3+II	0+I.1+I.5+III
<i>B. megaceros</i> Heller	1+0.1+0.5+I	0+I.1+I.4+III	1+0.2+0.3+II	0+I.1+I.5+III
<i>B. psettiobius</i> (Vervoort)	1+0.1+0.5+I	0+I.1+I.4+III	1+0.1+0.3+II	0+I.1+I.5+III
<i>B. mycterobius</i> (Vervoort)	1+0.1+0.5	0+1.6+I	1+0.1+0.3+II	0+I.1+I.5+III
<i>B. globiceps</i> (Vervoort & Ramirez)	1+0.1+0.5+I	0+I.5+IV	1+0.1+0.3+II	0+I.1+I.5+III

TABLE 1 (Continued)

SETATION OF LEGS 1-4 IN THE SPECIES OF *Bomolochus*

Setae in arabic, spines in roman numerals.

(B. xenomelanirisi Carvalho has not been included. - *B. uniccirrus* imperfectly known.)

	Females			
	Leg 3		Leg 4	
	endopodite	exopodite	endopodite	exopodite
<i>B. soleae</i> Claus	1+0.1+0.2+II	0+I.1+I.5+III	1+0.1+0.1+I+I	0+I.1+I.5+III
<i>B. megaceros</i> Heller	1+0.1+0.2+II	0+I.1+I.5+III	1+0.1+0.1+I+I	0+I.1+I.4+III
<i>B. uniccirrus</i> Brian	1+0.1+0.2+II	0+I.1+I.5+III	1+0.1+0.1+I+I	0+I.1+0.5+III
<i>B. concinnus</i> C. B. Wilson	1+0.1+0.2+II	0+I.1+I.5+III	1+0.1+0.1+I+I	0+I.1+I.4+III
<i>B. eritipes</i> C. B. Wilson	1+0.1+0.2+II	0+I.1+I.5+III	1+0.1+0.1+I+I	0+I.1+I.4+III
<i>B. cuneatus</i> Fraser	1+0.1+0.2+II	0+I.1+I.5+III	1+0.1+0.1+I+I	0+I.1+I.4+III
<i>B. decapteri</i> Yamaguti	1+0.1+0.2+II	0+I.1+I.5+III	1+0.1+0.1+I+I	0+I.1+I.4+III
<i>B. tumidus</i> Shiino	1+0.1+0.2+II	0+I.1+I.5+III	1+0.1+0.1+I+I	0+I.1+I.4+III
<i>B. hyporhamphi</i> Yamaguti & Yamasu	1+0.1+0.2+II	0+I.1+I.5+III	1+0.1+0.1+I+I	0+I.1+I.4+III
<i>B. psittobius</i> (Vervoort)	1+0.1+0.2+II	0+I.1+I.5+III	1+0.1+0.1+I+I	0+I.1+I.4+III
<i>B. anonymus</i> (Vervoort)	1+0.1+0.2+II	0+I.1+I.5+III	1+0.1+0.1+I+I	0+I.1+I.4+III
<i>B. mycterobius</i> (Vervoort)	1+0.1+0.2+II	0+I.1+I.5+III	1+0.1+0.1+I+I	0+I.1+I.4+III
<i>B. globiceps</i> (Vervoort & Ramirez)	1+0.1+0.2+II	0+I.1+I.5+III	1+0.1+0.1+I+I	0+I.1+I.4+III
Males				
<i>B. soleae</i> Claus	1+0.1+0.2+II	0+I.1+0.5+III	1+0.1+I+I	0+I.1+0.5+II
<i>B. megaceros</i> Heller	1+0.1+0.2+II	0+I.1+0.5+III	1+0.1+I+I	0+I.1+0.5+II
<i>B. psittobius</i> (Vervoort)	1+0.1+0.2+II	0+I.1+0.5+III	1+0.1+I+I	0+I.1+0.5+II
<i>B. mycterobius</i> (Vervoort)	1+0.1+0.2+II	0+I.1+0.5+III	1+0.1+I+I	0+I.1+0.4+III
<i>B. globiceps</i> (Vervoort & Ramirez)	1+0.1+0.2+II	0+I.1+0.5+III	1+0.1+I+I	0+I.1+0.5+II

me that no specimens of Bomolochidae from Dr. C. CLAUS' collection are preserved there. CLAUS, at the time of the description of *Bomolochus soleae*, was a professor of Zoology at the University of Marburg (now Maribor in Yugoslavia) and if any material of his *Bomolochus soleae* has been preserved it would almost certainly be present in the collections of the Vienna Museum. It can therefore be concluded that CLAUS' type material of *Bomolochus soleae* is no longer extant, so that the indication of a neotype is desirable. I have selected as the neotype one of the female topotypic specimens of *B. soleae* mentioned below. The redescription of the neotype has been given as fully as possible because of frequent confusions between *B. soleae* and *B. confusus* STOCK (1953: 9, figs. 21-33) and the uncertainty concerning the antennular structure in *B. soleae*. The re-examination of topotypic material of *B. soleae* has again been made possible thanks to the generous co-operation of Dr. J. H. STOCK, who placed all the material of *B. soleae* and *B. confusus* from the collections of the Zoological Museum of the University, Amsterdam, at my disposal. The re-inspection of *B. soleae* brought forward the unexpected result that in antennular structure it agrees with the newly described genus *Parabomolochus* VERVOORT (1962: 31). The consequences thereof for some of the genera of Bomolochidae are discussed below.

Bomolochus soleae Claus, 1864 Figs. 1-6, 7a-c

Bomolochus soleae CLAUS, 1864: 374, pl. 35 figs. 16-20, pl. 36 fig. 28; P. J. VAN BENEDEN, 1871: 78, pl. 1 fig. 5; STOCK, 1953: 3, figs. 1-20; STOCK, 1955: 59; VERVOORT, 1962: 23; VERVOORT, 1963: 148; ANONYMUS, 1965: 88, 89.
Bomolochus soleae p.p. DOLLFUS, 1953: 336; YAMAGUTI, 1963: 12.

All specimens examined are from the Zoological Museum of the University, Amsterdam.

Co.100.135. Wadden Sea, (The NETHERLANDS), across entrance Scheer, from beacon Vogelzand in westerly direction, 12-14 m depth, 27.VII.1950. Four ovigerous females, 1.38-1.65 mm (1.51 mm); three non-ovigerous females, 1.21-1.27 mm (1.24 mm); three damaged females; three adult males, 0.78-0.87 mm (0.83 mm) and some juveniles. From the gills of *Solea solea* (L.). All specimens preserved in spirit.

Co.100.36. Wadden Sea, across entrance Scheer, from beacon Vogelzand in westerly direction, 12-14 m depth, 27.VII.1950. Three adult females and two adult males from the gills of *Solea solea*; dissected and mounted on slides.

Co.100.137. Wadden Sea, Lutjeswaard, northern side, 15.VII.1950. One adult female, 1.46 mm, from the gills of *Solea solea*. Preserved in spirit.

Co.100.245. Wadden Sea, Malzwin, haul from 400 m S.W. of buoy Black 3 till 500 m N.E. of buoy Black 3, 18–6 m depth, 25.VI.1954. One adult female of 1.56 mm length and a damaged female of 1.49 mm length. From the gills of *Solea solea*. Preserved in spirit.

Co.100.246. Wadden Sea, Malzwin, haul between buoys Black 2 and 3, 8–17 m depth, 25.VI.1954. Four adult females, partly ovigerous, 1.32–1.43 mm (1.37 mm), one juvenile specimen. From the gills of *Solea solea*. All specimens preserved in spirit.

Co.100.247. Wadden Sea, haul of 900 m between buoy Bolle Red 4 and Malzwin Black 5, 5–9 m depth, 25.VI.1954. Four adult females, 1.46–1.56 mm (1.51 mm), from the gills of *Solea solea*. All specimens preserved in spirit.

The following descriptions are based on a 1.44 mm long female and a 0.85 mm long male from Co.100.135. Both specimens have been dissected and the appendages mounted on slides; these are now preserved in the Zoological Museum of the University, Amsterdam. The female is here designated as the neotype.

Adult female. – The total length, measured from the apex of the rostral plate to the end of the furca, is 1.44 mm, the greatest diameter, at the cephalic somite, is 743 μ . The length of the cephalic somite is 297 μ (measured from the end of the rostral prominence), the diameter is 743 μ . For the remaining thoracic somites these figures are: 243 and 540 μ for the second; 203 and 405 μ for the third; 81 and 243 μ for the fourth, and 110 and 193 μ for the fifth thoracic somite. The genital complex is 165 μ long and 231 μ wide. For the remaining abdominal somites the figures of length and widths are: 83 and 154 μ for the third; 72 and 132 μ for the fourth and 72 and 105 μ for the fifth abdominal somite. The furcal rami are 61 μ long and have a maximal diameter of 44 μ . The longest furcal seta is 413 μ .

The general shape of the female is characterized by the very broad and swollen cephalic somite, the gradually narrowing thoracic somites, and the slender abdomen (Fig. 1a).

The head and the first thoracic somite are fused to form the cephalic somite, which has a distinctly reniform appearance. The anterior margin is very broadly rounded, only slightly depressed at the rostral base and with smoothly rounded lateral parts. Though the somite is distinctly swollen it does not cover the antennules completely; at inspection of the female from above the basal and terminal parts of the antennules are distinctly visible. Between the antennular bases a prominent rostral plate can be observed; its apex, in all specimens present, is truncate rather than rounded. The second thoracic somite is much wider than long, with rounded lateral parts, covering the coxal and basal portions of the second pair of legs, that are invisible from above. The second thoracic somite is distinctly produced anteriorly, covering a part of the cephalic somite. The third thoracic somite, though less wide than the second, is strongly swollen, particularly the lateral parts, that may even be set off, more or less, from the rest of the somite (Fig. 1a). The degree of swelling varies considerably in the various females examined and is dependent upon the condition of the ovaries. Part of the coxal portions of the third pair of legs are visible from above. The fourth thoracic somite is fairly short and much narrower than the third; the coxae of the fourth pair of legs are almost

completely exposed. Thoracic somite 5 is longer than the fourth and has, on both sides, rounded swellings, to which the fifth legs are attached.

The abdominal somites 1 and 2 are fused to form the genital complex, which is trapezoid in outline, with the genital orifices on the dorsal side. The exact shape of the somite can best be judged from Fig. 3d; three setae emerge from each genital opening. The communal base of the groups of three setae (the sixth pair of legs) is just visible in the genital opening (Fig. 2a). The third and fourth abdominal somites have about the same length, both gradually narrow caudally. The fifth abdominal somite is about as long as the furcal rami and narrows considerably caudally: the anal plate is squarish and distinctly visible dorsally. The caudal rami (Fig. 2b) are twice as long as wide and narrow very slightly caudally. Each ramus has five marginal setae and one appendicular (dorsal) seta. Setae 1, 4, 5 and the appendicular seta are fine and short; setae 2 and 3 are thickened and lengthened, particularly the second, which is nearly as long as the abdomen and twice as long as the third seta. The fifth seta inserts at one third the length of the external margin.

The ovisacs are elongated oval structures, composed of a moderate number of large eggs; they are about as long as the abdomen (Fig. 1a).

The antennules are composed of a proximal part, resulting from the fusion of three or four separate segments, and a three-segmented flagellum. The proximal portion is ventrally reinforced with chitinized plates and firmly attached to the ventral wall of the cephalic somite; its structure appears from Fig. 2c. There are 15 plumose, sensory setae, distributed in the usual fashion along the ventral border of the proximal portion. The setae 3 to 14 have a distinctly recognizable chitinized, finger-shaped bar fused to the anterior wall of each seta. This bar reaches its greatest development in seta 4, which is strongly curved and hook-shaped; it is scarcely visible in seta 14. In addition to the sensory setae there are 8 normal setae on the proximal part of the antennule, the position of which is illustrated in Fig. 2c. The number of setae on the segments of the flagellum is 3, 3, and 6, respectively.

The rostral plate, visible in dorsal aspect of the animal as a truncated structure between the antennular bases, strongly curves ventrally and backward; its free edge is produced into two diverging, sharp points (Fig. 1c).

The antenna (Fig. 4a) has a long, slender coxa and a short basis; the coxa has a single terminal seta. The endopodite, consisting of two fused segments, is folded over the coxa; it is covered with 6 longitudinal rows of fine, triangular spinules; three of these rows are also visible on the second endopodal segment. There is a strong spine near the fusion of both endopodal segments and three more, hooked setae and a fine, straight seta some distance from that point of fusion. The first endopodal segment has a longitudinal, pectiniform row of slender spinules, continuing on the lamelliform process.

Because of the opacity of the specimen I could not observe the structure of labrum and labium; the oral appendages have been described and figured from the dissected specimen.

The mandible (Fig. 1d) has a round, flattened basal portion by means of which the appendage is attached to the cephalic wall. The masticatory process is cylindrical; it carries a large, triangular tooth with sharp ventral edge, and a smaller, triangular, ventral tooth. The maxillule (Fig. 2f) is a small, rounded process, carrying a total of four setae, two of which are small. The paragnaths (Fig. 2e) are composed of a swollen basal portion and a bluntly pointed apical process. The proximal portion of the maxilla (Fig. 1e) is elongated; it carries a single endite. There are two

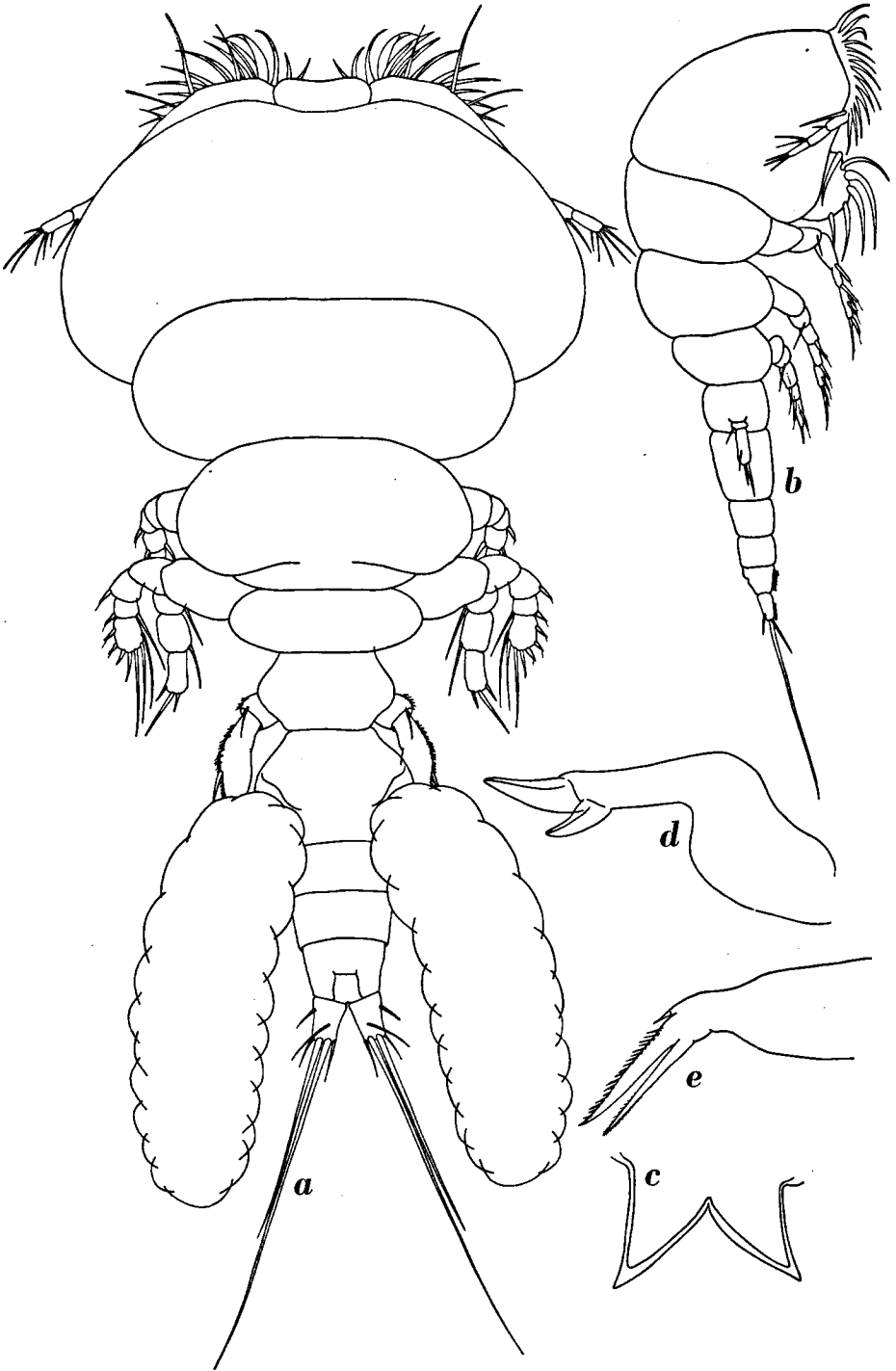


FIGURE 1. *Bomolochus soleae* Claus, adult ♀, neotype, from *Solea solea*. *a*, whole animal, dorsal view; *b*, whole animal, lateral view from right side; *c*, rostrum, ventral view; *d*, left mandible; *e*, left maxilla. — *a*, $\times 90$; *b*, $\times 55$; *c*–*e*, $\times 395$.



FIGURE 2. *Bomolochus soleae*, adult ♀, neotype, from *Solea solea*. *a*, right part of genital somite showing the genital slit and the right sixth leg; *b*, left furcal ramus, dorsal view; *c*, right antennule, ventral view; *d*, hollow process of ventral thoracic margin lateral of rostrum; *e*, left paragnath; *f*, left maxillule; *g*, left fifth leg. — *a*, *c*, *g*, $\times 220$; *b*, $\times 240$; *d*–*f*, $\times 395$.

strong spines on the endite, the proximal of which is slightly longer and considerably thicker; near the insertion of that spine there is a very small tooth or spinule.

The maxillipedes (Fig. 4b) are powerfully developed and placed laterally of the remaining oral parts. The short coxa attaches the maxillipede to the ventral cephalic wall; there is a single, crochet-shaped seta near the end of the coxa. The basis is large and triangular, with the apex directed frontally and there carrying a large, strongly sigmoid claw (endopodite) with a curved auxiliary tooth and a haired seta near its insertion. The basis, in addition to the claw, has two haired setae, the position of which appears in Fig. 4b.

The setal and spinal formula of the legs is:

	endopodite	exopodite
leg 1	1+0.1+0.5	0+I.6+II
leg 2	1+0.2+0.3+II	0+I.1+I.5+IV
leg 3	1+0.1+0.2+II	0+I.1+I.5+III
leg 4	1+0.1+0.1+1+I	0+I.1+I.5+III

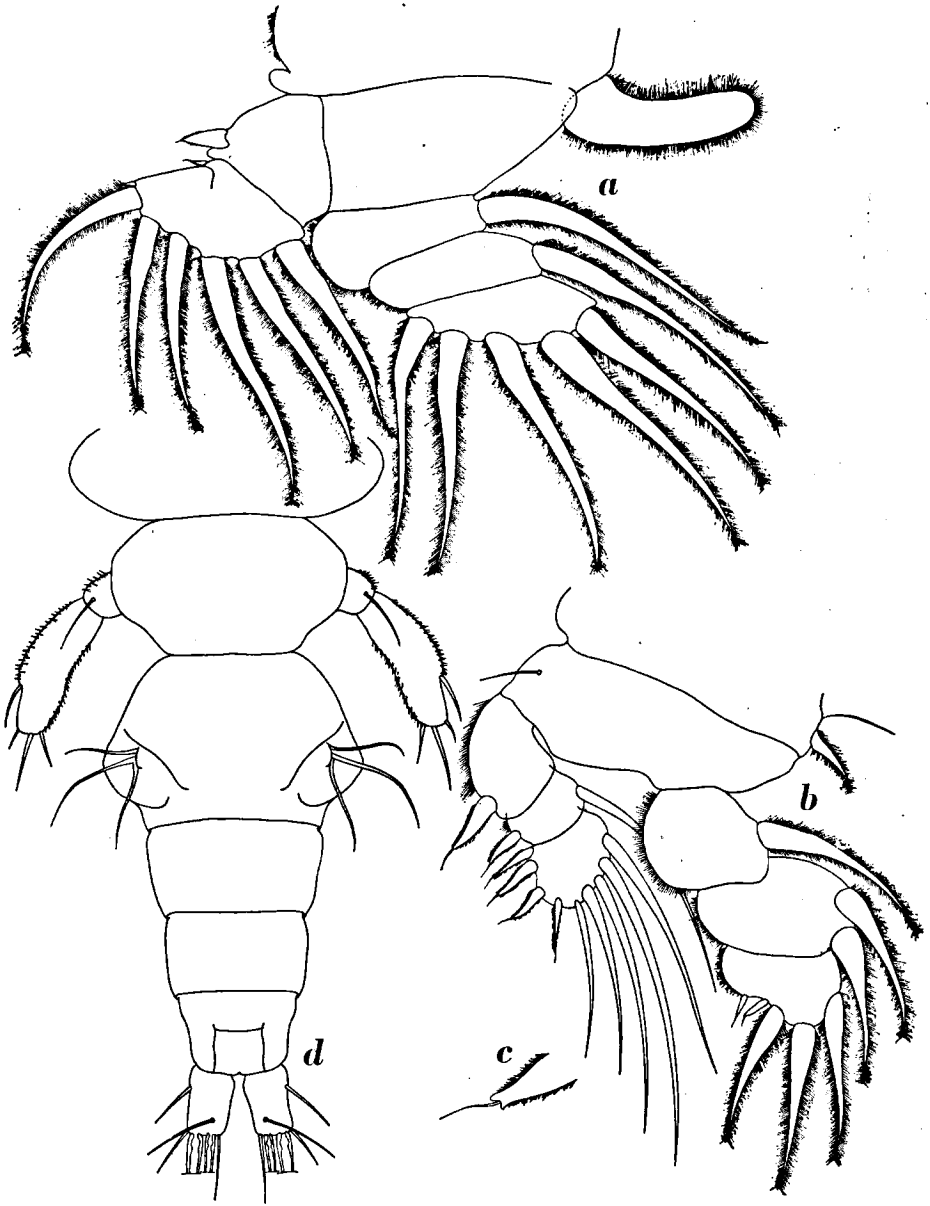


FIGURE 3. *Bomolochus soleae*, adult ♀, neotype, from *Solea solea*. *a*, leg 1; *b*, leg 2; *c*, apex of external marginal spine of first exopodal segment of leg 2; *d*, abdomen, dorsal view, egg sacs removed. — *a*, *b*, × 220; *c*, × 550; *d*, × 180.

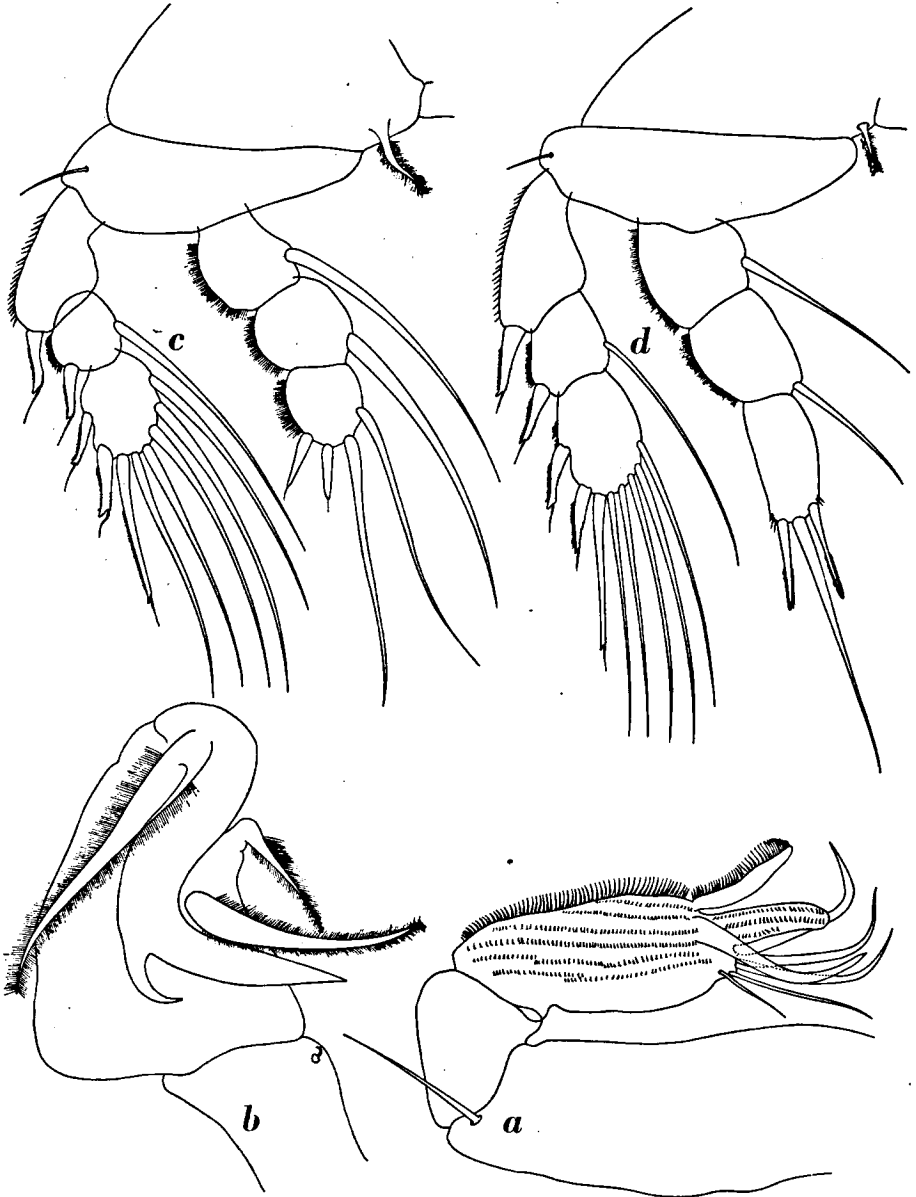


FIGURE 4. *Bomolochus soleae*, adult ♀, neotype, from *Solea solea*. a, left antenna; b, right maxillipede; c, leg 3; d, leg 4. - a, b, × 395; c, d, × 220.

Coxa, basis, endo- and exopodite of the first pair of legs (Fig. 3a) are strongly flattened. The coxa has a haired, lamelliform process at its internal margin; the external margin is hairy. The exopodite is two-segmented; the first segment has a single strong external marginal spine, bearing a fine flagellum. The second exopodal segment, which has the indications of being composed of two fused segments, has two small external marginal spines and a total of six strongly plumose setae. The endopodite has three segments; segment 1 and 2 are externally hairy and each have an internal marginal, strongly plumose seta. The third endopodal segment has 5 plumose setae.

Legs 2 to 4 have the following points in common. The internal margin of the coxa has a short, plumose seta; the external margin of the basis has a fine, nude seta. Exo- and endopodites are 3-segmented. All external marginal spines are flagellated; the frontal margin of each spine is hairy, the caudal margin is toothed. The end of the frontal margin of each spine is produced and forms a blunt projection (spur) above the insertion of the flagellum; on the caudal side the produced part is much smaller.

The endopodite of leg 2 (Fig. 3b) is strongly flattened; the setae are strongly plumose and the two short spines at the apex of the third segment are flagellated.

The endopodites of legs 3 (Fig. 4c) and 4 (Fig. 4d) are normally developed. The two spines on the third endopodal segment of leg 3 are flagellated. On the third endopodal segment of leg 4 there are two non-flagellated, strong spines flanking a fairly long spiniform seta.

The fifth legs (Fig. 2g) consist of a short intermediate segment and a much longer, spatulate terminal segment. The intermediate segment has a single fine seta near the distal margin; its external border is spinulose. The terminal segment has three terminal appendages, viz., two spiniform setae flanking a slender and longer intermediate seta. The apices of the flanking setae are hairy. There is a fourth hairy seta or setiform spine at the external margin of the terminal segment, inserting at two-thirds the length of that margin. Both in- and external margins of the terminal segment are spinulose.

Adult *male*. — The total body length is 850 μ , the greatest diameter, at the cephalic somite, is 286 μ . The cephalic somite is 264 μ long and 286 μ wide. For the remaining thoracic somites these figures are: 94 and 204 μ for the second; 83 and 165 μ for the third; 77 and 116 μ for the fourth and 55 and 110 μ for the fifth thoracic somite. The genital complex, comprising the third abdominal somite, is 143 μ long and 138 μ wide; the fourth abdominal somite 66 μ long and 77 μ wide and the fifth abdominal somite 55 μ long and 66 μ wide. The caudal rami are 39 μ long and 28 μ wide. The longest furcal seta is 280 μ long.

The general shape of the body (Fig. 5a, b) differs considerably from that of the female; the cephalic somite is only very slightly wider than long. The thoracic somites gradually narrow and have scarcely developed epimeral parts, so that the coxal portions of the legs are exposed.

The head and the first thoracic somite are fused to form the cephalic somite; the shape of this cephalic somite can best be seen in Fig. 5a. Anteriorly there is a slightly narrowed rostral portion, rounded frontally and distinctly visible between the basal parts of the antennae. Laterally to the rostral plate there are two semi-circular platelets, firmly attached to the ventral wall of the cephalic somite and covering the basal parts of the antennules. The cephalic somite is fairly flat, as appears

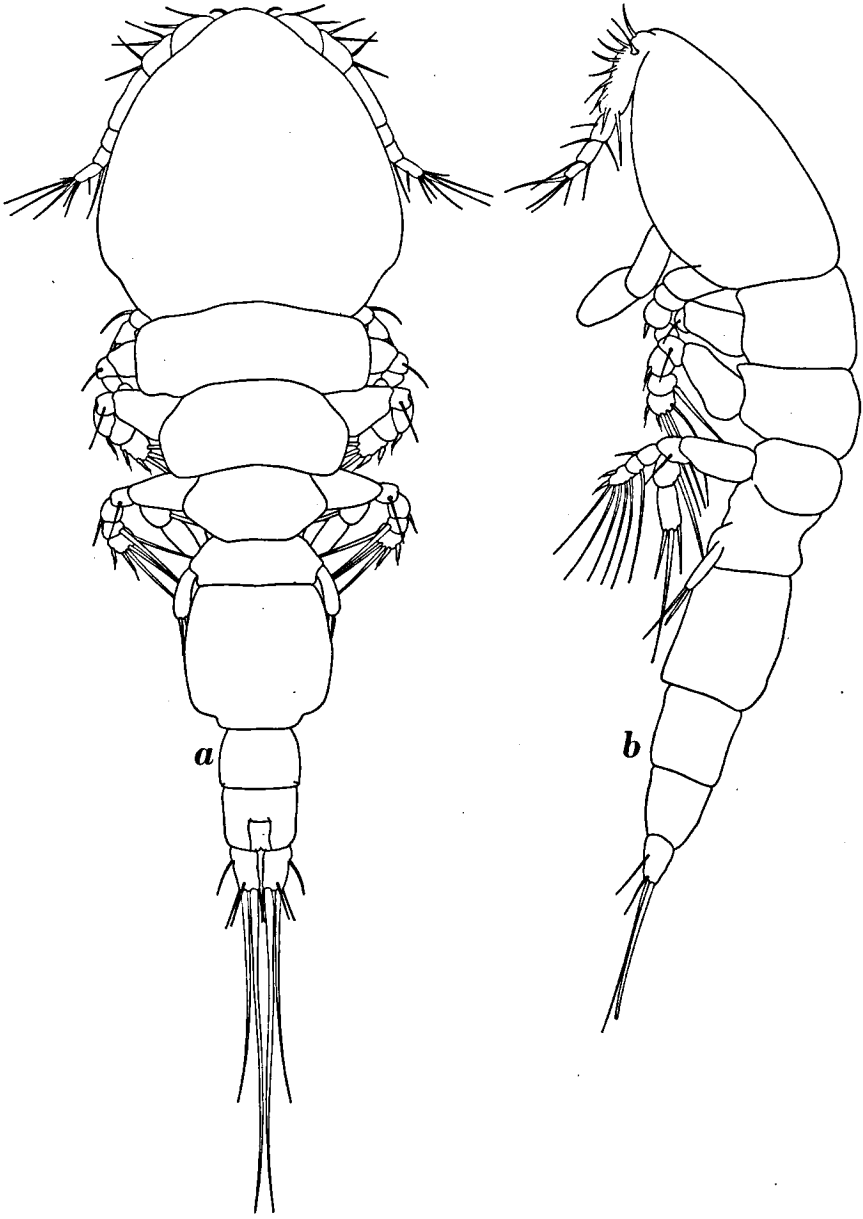


FIGURE 5. *Bomolochus soleae*, adult ♂, from *Solea solea*. a, whole animal, dorsal view; b, whole animal, lateral view from left side. - a, b, × 135.

from the lateral view of the animal (Fig. 5b); posteriorly it is slightly but distinctly constricted.

The lateral walls of the second thoracic somite are cut off squarely, those of the third thoracic somite are broadly rounded. The fourth thoracic somite is narrow; laterally it is produced to form rounded prominences. The fifth thoracic somite is trapezoid; the intermediate segment of the fifth pair of legs is fused with the somite.

The genital complex, resulting from fusion of the first and second abdominal segments, is a more or less squarish structure with slightly swollen walls. The third abdominal somite is completely telescoped into the genital somite and just visible at the caudal end of the genital complex. No genital orifices have been observed. The fourth and fifth abdominal somites have about the same length; on the fifth somite there is a small, square anal plate, distinctly visible in dorsal view.

The furcal rami narrow slightly and are longer than wide; the arrangement of the setae is as in the female (Fig. 6a).

The antennule is five-segmented; in the complete animal the antennules are almost completely visible in dorsal view. The first to third segments have a total of 15 plumose setae of nearly uniform appearance; there are 3 of such setae on the first, 11 on the second and 1 on the third segment. In addition there are 3 normal setae on the second and one seta on the third segment. The second antennular segment is large and probably has resulted from the fusion of several smaller segments. The number of setae on the remaining antennular segments is: 1 on the fourth and 4 on the fifth. The arrangement of the setae is illustrated in Fig. 6b.

The antennae (Fig. 6c) are as in the female but smaller, the pectiniform row of spinules on the endopodite and the lamelliform process is composed of slender, long spinules. The oral appendages are as in the female though correspondingly smaller. The maxillipede, however, is differently shaped and present as a large, chelate structure (Fig. 7a). The coxa is a short, cylindrical process, attaching the maxillipede to the ventral cephalic wall. The basis is large and strongly swollen; there is a deepened portion, set with two rows of fine spinules, into which fits the long claw. There are two setae at the middle of the internal margin of the basis. The endopodite is represented by a strong, curved digit, which carries 2 setae at the base of the internal margin. The rest of the internal margin is set with fine, lamellar teeth.

The setal and spinal formula of legs 1 to 4 is:

	endopodite	exopodite
leg 1	1+0.1+0.5+I	0+I.1+I.4+III
leg 2	1+0.2+0.3+II	0+I.1+I.5+III
leg 3	1+0.1+0.2+II	0+I.1+0.5+III
leg 4	1+0.1+1+I	0+I.1+0.5+II

Leg 1 (Fig. 6d) has an external seta at the basis; the internal margin is spinulose. One of these spinules is enlarged to form a short, conical, flagellated spine. The internal margin of the coxa and the strongly developed intercoxal plate are spinulose. The external marginal spines of the exopodite are flagellated.

The legs 2 to 4 have a strongly spinulose, bilobed intercoxal plate. All external marginal spines of the exopodite are flagellated.

The second leg (Fig. 6e) has a short, conical, flagellated spine at the internal coxal margin; the second endopodal segment has two internal marginal setae.

The third leg (Fig. 7b) has a plumose seta at the internal margin of the coxa.



FIGURE 6. *Bomolochus soleae*, adult ♂, from *Solea solea*. *a*, left furcal ramus, dorsal view; *b*, left antennule, ventral view; *c*, left antenna; *d*, leg 1; *e*, leg 2; *f*, left part of fifth thoracic somite and left fifth leg. — *a-f*, × 395.

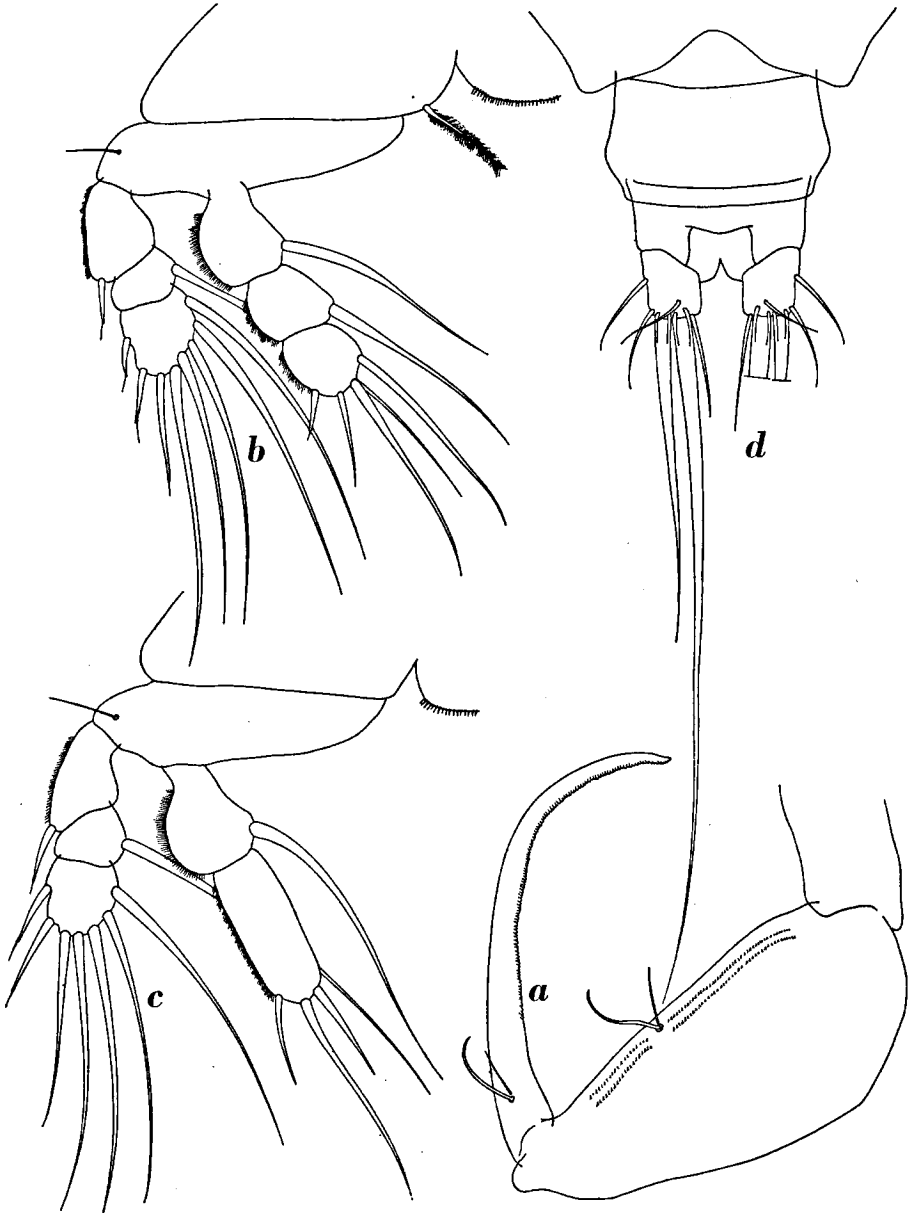


FIGURE 7. a-c, *Bomolochus soleae*, adult ♂, from *Solea solea*. a, maxillipede; b, leg 3; c, leg 4. - d, *Holobomolochus scutigerulus* (C. B. Wilson), adult male from *Upeneus maculatus* (Bloch); abdomen, dorsal view. - a-d, $\times 395$.

There is no seta at the internal coxal margin of the fourth pair of legs; the endopodite is two-segmented (Fig. 7c).

The fifth pair of legs is composed of a single, slightly curved, spatulate segment; the intermediate segment has fused with the fifth thoracic somite. There are two setae at the apex of the segment; part of the internal margin is hairy (Fig. 6f).

Remarks. — A revision of the then known species of the family Bomolochidae Claus, 1875 (VERVOORT, 1962) made it imperative to designate a new type for the originally monotypic genus *Bomolochus* Von Nordmann, 1832. The species originally attributed to this genus by VON NORDMANN, *Bomolochus parvulus* VON NORDMANN (1832: 135) was very briefly and insufficiently characterized, and never figured; it might, after its eventual rediscovery on the type host *Amphacanthus rivulatus* (Cuvier) (= *Siganus spinus* (L.)) from the Red Sea even prove to belong to a different family. An application was therefore submitted to the International Commission on Zoological Nomenclature in 1963 (VERVOORT, 1963), requesting the Commission to suppress, under its plenary powers, all previous type indications or selections (including WILSON's (1911: 366) invalid indication of *Bomolochus bellones* Burmeister, 1835, as the type of *Bomolochus*) and to designate as the type-species of that genus the species *Bomolochus soleae* Claus, 1864. My reasons for doing so were the accurate description of *Bomolochus soleae* published by STOCK (1953), including a description of the male, and the aberrant condition of the antennule in *Bomolochus bellones*, which species I have designated as the type-species of the new genus *Parabomolochus* VERVOORT (1962: 31). *Parabomolochus* was described to include such species of Bomolochidae that combine a peculiar antennular structure (*i.e.*, reinforcement of some of the sensory setae of the antennule with chitinized strips and modification of seta 4) with certain details of oral appendages and legs. I was at that time perfectly satisfied that *Bomolochus soleae* was sufficiently characterized by STOCK's description and demonstrated the normal antennular structure allotted to the genus *Bomolochus* (VERVOORT, 1962: 9). The International Commission on Zoological Nomenclature subsequently designated as the type of *Bomolochus* Von Nordmann, 1832, the species *Bomolochus soleae* Claus, 1864, putting aside, at the same time, all previous type indications or selections. I have since

received Dr. STOCK's material of Bomolochidae for further study, including his topotypic material of *Bomolochus soleae* listed above. I was very surprised and greatly dismayed when on inspection of STOCK's slides the antennular structure of *Bomolochus soleae* proved to agree completely with that of the type of *Parabomolochus*, viz., *Bomolochus bellones*. A further inspection of STOCK's material proved that his specimens of *Bomolochus soleae* without any doubt are congeneric with *Bomolochus bellones*, whilst at the same time there can also be no doubt as to its conspecificity with CLAUS' *Bomolochus soleae*. An inspection of CLAUS' drawings even reveals the presence of chitinized strips in some of the antennular setae in CLAUS' specimen (CLAUS, 1864, pl. 35 fig. 16). The identity of the hosts, too, makes it unlikely that CLAUS' and STOCK's specimens belong to different species: no other species of Bomolochidae has ever been found in the gill chamber of *Solea solea* (L.).

Consequently there is no possibility to keep *Bomolochus soleae* apart from the other species of Bomolochidae with which it agrees in antennular structure; such species must be united in the genus *Bomolochus* Von Nordmann, 1832, (of which *Bomolochus soleae* is the type-species) and the genus *Parabomolochus*, type-species *Bomolochus bellones* Burmeister, 1835, becomes a subjective synonym of *Bomolochus* Von Nordmann, 1832. The consequences of this action are that the majority of the species previously brought to *Bomolochus* (vide VERVOORT, 1962: 11) must be removed from *Bomolochus* and united in a separate genus. This genus will be described below as *Holobomolochus* nov. gen., type-species *Bomolochus nothrus* C. B. Wilson, 1913. It is possible now to give more concise characteristics of some of the genera of Bomolochidae.

Bomolochus concinnus C. B. Wilson, 1911 Figs. 8–10

Bomolochus concinnus C. B. WILSON, 1911: 371, pls. 54, 55; SEWELL, 1949: 157; STOCK, 1955: 59; CARVALHO, 1958: 50; CAUSEY, 1960: 326; VERVOORT, 1962: 27; YAMAGUTI, 1963: 11, pl. 5 fig. 2.

Parabomolochus concinnus, PILLAI, 1967: 262, figs. 11, 12.

Bomolochus nitidus C. B. WILSON, 1911: 374, text-fig. 8, pls. 56, 58 fig. 201; BERE, 1936: 582; HEEGAARD, 1947: 199, pl. 25 fig. 192; SEWELL, 1949: 157; PEARSE, 1952: 196; STOCK, 1953: 12; CARVALHO, 1955: 143; CARVALHO, 1958: 50; CAUSEY, 1960: 326; YAMAGUTI, 1963: 12, pl. 3 fig. 3.

Bomolochoides nitidus VERVOORT, 1962: 30.

Parabomolochus nitidus PILLAI, 1967: 258, figs, 9, 10.

Bomolochus mugilis PEARSE, 1952: 194, figs. 14-17; VERVOORT, 1962: 92.

Specimens received from the U.S. National Museum and labelled: "*Bomolochus nitidus* Wilson, Beaufort, N. C. 1906, C. B. Wilson, Bur. of Fisheries), alc. 2 ♀ (over), Gills of *Mugil cephalus*". A slightly damaged, female specimen, total length (minus furcal ramus) 1.81 mm, is here designated as the holotype. This specimen has been figured; the appendages of the left side have been removed, stained and mounted. The rest of the specimen has been mounted as a canada-balsam slide. In addition fragments of a second specimen were found between the labels; these fragments have also been mounted.

Description of the female holotype. — The furcal rami of this specimen are missing; the antennules are slightly damaged. The total length, without furcal rami, is 1.81 mm; the complete specimen must have measured about 1.82 mm. The greatest diameter, at the cephalic somite, is 1.05 mm. The cephalic somite is 581 μ long and 1,053 μ wide; for the remaining thoracic somites these figures are: 297 and 810 μ for the second, 270 and 567 μ for the third, 189 and 338 μ for the fourth and 95 and 257 μ for the fifth thoracic somite. The genital complex is 162 μ long and 282 μ wide; for the remaining abdominal somites these figures are: 81 and 182 μ for the third, 68 and 169 μ for the fourth and 95 and 149 μ for the fifth (anal) somite.

The general shape of the body (Fig. 8a) is cyclopoid, with the thoracic somites gradually diminishing in width and none of the somites backward produced. The abdomen is short. The head and the first thoracic somite are fused to form the cephalic somite. This somite is about twice as broad as long, with the sides very broadly rounded and slightly backward produced. Frontally it is distinctly incised between the distal parts of the antennules, the rounded incision continues backward as a deepened zone in the mid-dorsal line. A distinct longitudinal carina, serving the attachment of muscles, can be seen through the tegument to continue backward from the attachment of the rostral plate. There is another small incision of the cephalic margin on both sides of the mid-dorsal line, near the insertion of the antennules. The rostral plate is a conspicuous structure between the basal antennular parts; its exact shape appears best from Fig. 8a; the apex is slightly incised. The plate curves downward and backward and terminates in a strong, bifid rostrum (Fig. 8c). The rostral points are strongly chitinized and sharply pointed.

The thoracic somites 2 and 3 are visible dorsally as fairly narrow structures with broadly rounded sides, covering a considerable portion of the coxae of the legs. Thoracic somite 4 is considerably smaller than the preceding somite; the sides are squarish, so that the whole segment is more or less trapezoid. The fifth thoracic somite is narrow; its sides are squarish and bear the fifth legs. The genital complex, resulting from fusion between the first two abdominal somites, is slightly wider than long; the sides are broadly rounded. The genital flaps are visible on the latero-caudal part of the complex; they are rounded with three hairs or setae protruding from each genital orifice. Abdominal somites 3 and 4 are of equal length and cylindrical; the fifth (anal) segment narrows distinctly caudally. The anal flap is visible on the dorsal surface of the somite; it is broadly rounded. No hairs or spinules have been observed on the abdominal somites. Judging from WILSON's drawings (1911, pl. 56 fig. 177) the furcal rami have been slightly shorter than the anal somite. Though WILSON figures a total of four setae for each furcal ramus it is likely that five marginal setae and one appendicular seta have been present. Setae 1, 4 and 5 must have

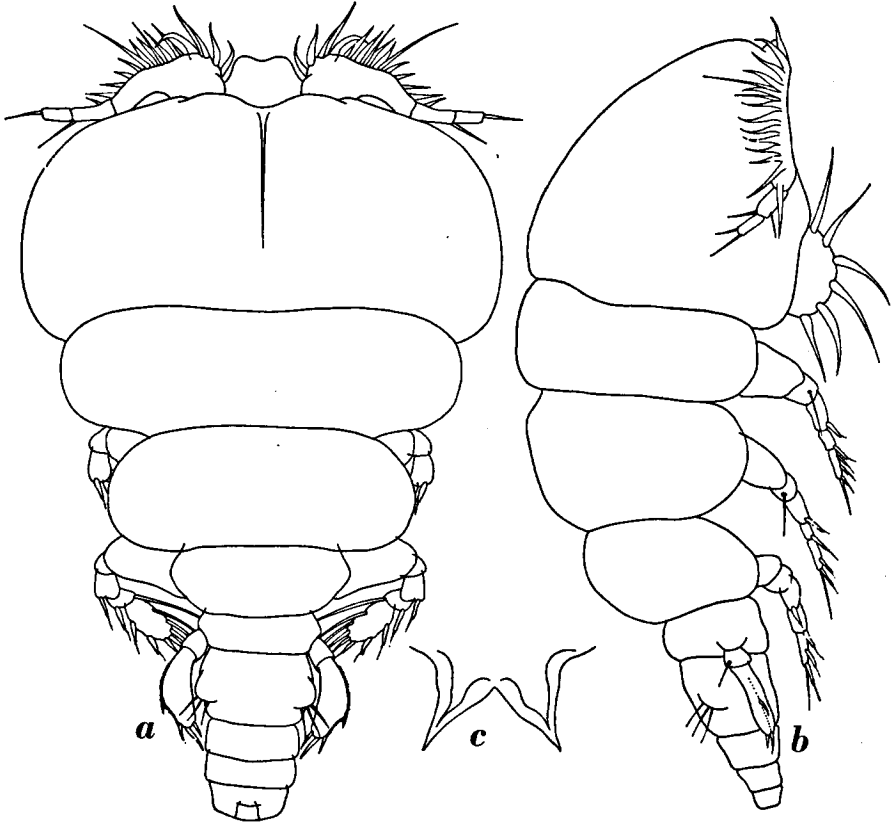


FIGURE 8. *Bomolochus concinnus* C. B. Wilson, adult ♀, holotype, from *Mugil cephalus*. *a*, whole animal (without furcal rami), dorsal view; *b*, whole animal (without furcal rami), lateral view from right side; *c*, rostrum, ventral view. — *a*, *b*, $\times 55$; *c*, $\times 395$.

been short, with the fifth inserting in the upper third of the lateral furcal margin. Setae 2 and 3 were lengthened and thickened, the second being the longest, reaching the length of the abdomen.

The antennules (Fig. 9a) are damaged in the holotype, the last segment (third segment of the flagellum) is absent. They are short, only slightly surpassing the cephalic somite and characterized by an almost perpendicular bent in the basal part and a strongly diverging (three-segmented) flagellum. The basal part of the antennules, which is strongly reinforced with chitinized plates, carries the usual 15 plumose, sensory setae. Of these the setae 3 to 5 are strongly modified and placed on a more or less isolated, prominent portion of the antennule. The modification reaches its greatest development in seta 4, represented by a strongly chitinized, curved hook;

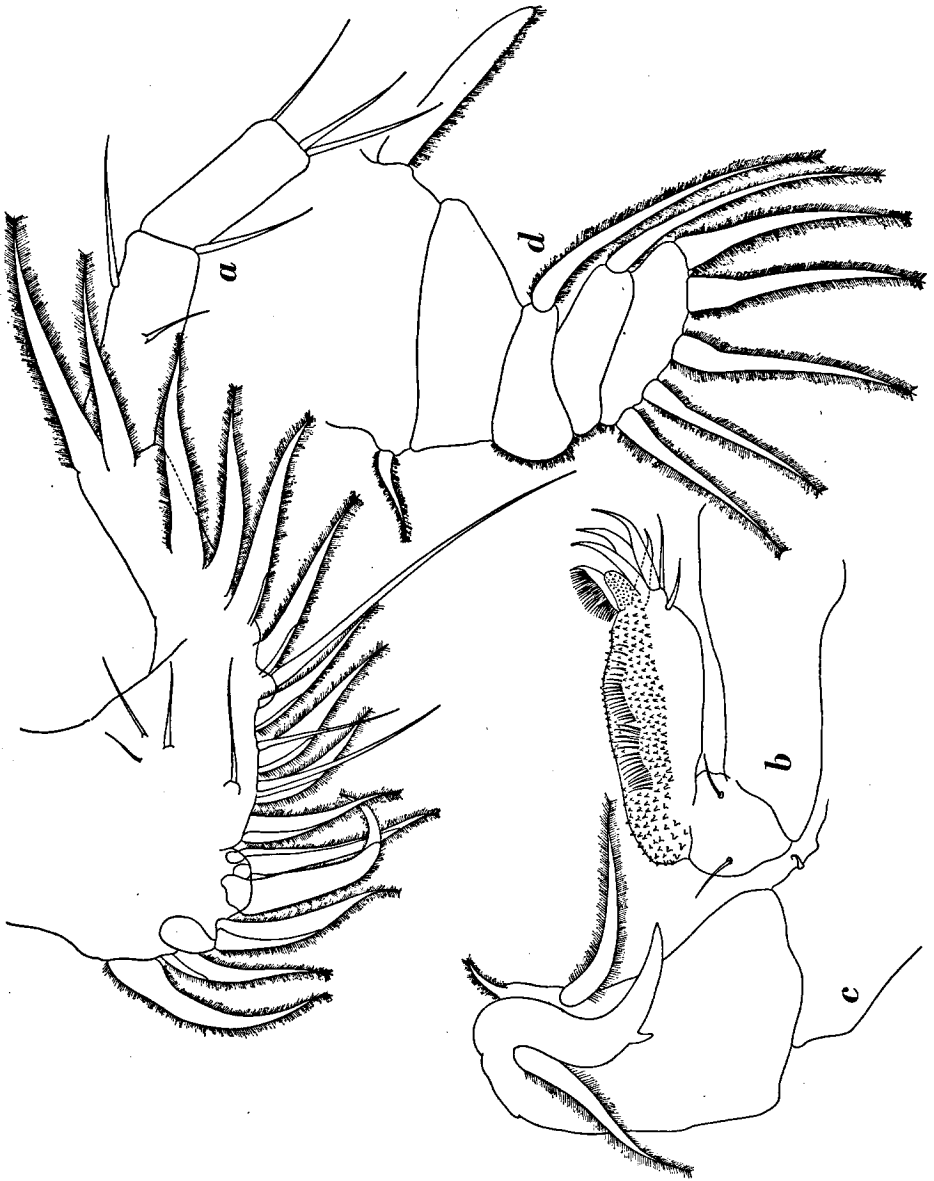


FIGURE 9. *Bomolochus concinnus*, adult ♀, holotype, from *Mugil cephalus*. a, right antennule, ventral surface; b, left antenna; c, right maxillipede; d, leg 1 (without exopodite). — a, c, $\times 220$; b, $\times 240$; d, $\times 135$.

the apical part only shows the original sensory structure. Setae 3 and 5 are less strongly modified; these setae are reinforced by dagger-shaped chitinized projections of the antennular plates. Less extremely developed chitinized strips are also visible in the frontal part of setae 2 and 6 to 11. In addition to the "sensory" setae there are three normal marginal setae and a total of four small, additional setae. In my specimen three setae occur on the two segments of the flagellum; more setae may have been present, particularly on the second segment of the flagellum.

The antenna (Fig. 9b) is of the usual structure, with the endopodite folded over the coxa. The basis is short and has two setae. The two endopodal segments are fused; the second is represented as a short, stubby process. The whole of the endopodite is covered with fairly long, obtusely pointed spinules. In addition there is a longitudinal, pectiniform row of slender, acicular spinules, continuing on the lamelliform process. There is one notably strong, curved spine near the line of fusion of the endopodal segments. The apical part of the endopodite has three strongly developed, hooked spines and two short setae.

Unfortunately the structure of labrum and labium could not be studied. The cutting edge of the mandible (Fig. 10a) narrows considerably; at the apex there is a large, triangular tooth with a sharp edge; near its insertion there is a second, much smaller triangular tooth. The maxillule (Fig. 10a) is a small, globular structure with four setae, three of which are strong. The paragnaths (Fig. 10a) are present between maxillule and maxilla; they are clavate structures with swollen basal portion and drawn out in a finger-shaped prolongation. On the maxilla (Fig. 10a) two haired teeth have been observed; these teeth have almost the same size and length. The maxillipedes (Fig. 9c) occupy the usual position lateral to the remaining oral appendages. The coxa is large and cylindrical; it has a small seta near the insertion of the basis. The basis is large and triangular; the endopodite is represented by a strongly sigmoid, short claw with a small auxiliary tooth. In addition there are three plumose setae, the position of which appears from Fig. 9c; one of the setae is very small.

The setal and spinal formula in the legs is (setae in arabic, spines in roman numerals):

	endopodite	exopodite
leg 1	1+0.1+0.5	?
leg 2	1+0.2+0.3+II	0+I.1+I.5+IV
leg 3	1+0.1+0.2+II	0+I.1+I.4+III
leg 4	1+0.1+0.1+1+I	0+I.1+I.4+III

The coxa of leg 1 (Fig. 9d) has a strongly hairy, internal plate. There is a plumose external seta near the articulation between coxa and basis. The basis is trapezoid and has no appendages. Unfortunately the exopodite is missing on both sides, but according to WILSON's drawing (1911, pl. 56 fig. 179) it must have been flattened, with all the exopodal segments fused. The usual 6 plumose marginal setae must have been present; the external margin has at least one strongly developed spine. The endopodite is greatly flattened.

The legs 2 to 4 all have three-segmented exo- and endopodites. The coxa has a single plumose, internal seta; the external margin of the basis has a fine hair. The third exopodal segments have a deep incision, nearly dividing the segment into two separate parts. The external marginal spines on the exopodite all terminate in a flagellum. The external margin of each spine is set with a pectiniform row of fine

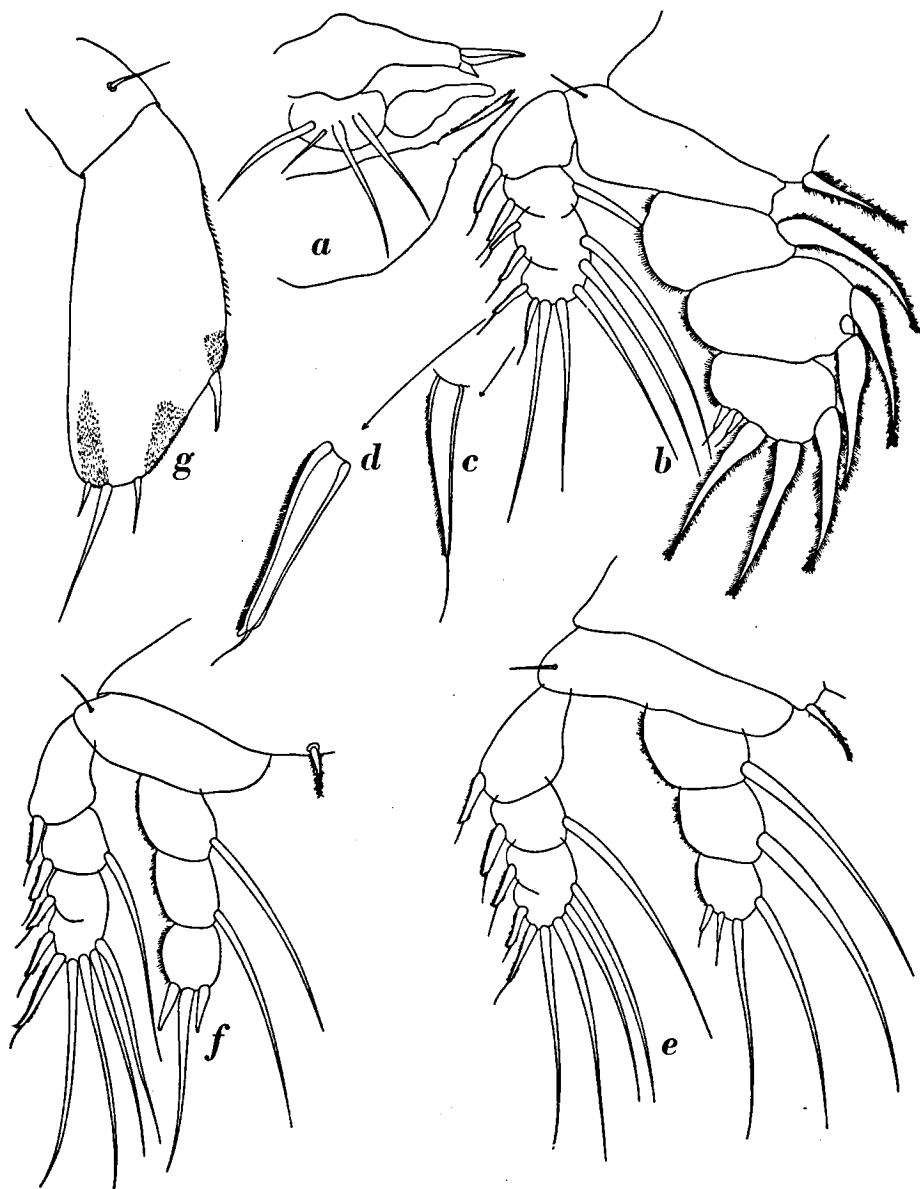


FIGURE 10. *Bomolochus concinnus*, adult ♀, holotype, from *Mugil cephalus*. *a*, left oral appendages; *b*, leg 2; *c*, *d*, terminal and external marginal spines of third exopodal segment of leg 2; *e*, leg 3; *f*, leg 4; *g*, right fifth leg. — *a*, × 240; *b*, *e*, *f*, × 135; *c*, *d*, × 550; *g*, × 220.

spinules or hairs, gradually increasing in size near the apex and running into a distinct spur at the extreme apex. Part of the internal margin may be hairy.

The second leg (Fig. 10 b-d) is characterized by strong flattening of the endopodite. There are two setae at the internal margin of the second endopodal segment.

The endopodite of leg 3 (Fig. 10e) is normally developed; there is one seta at the internal margin of the second segment. The endopodite of leg 4 (Fig. 10f) is normally developed and 3-segmented; the apical segment has two short spines flanking a much longer spiniform seta.

The fifth legs (Fig. 10g) are fairly long, reaching the middle of the third abdominal segment. The intermediate segment is short and cylindrical, bearing a single seta. The apical segment is large, the internal margin is straight and nude; the external margin, which is swollen, has a short spine at about two thirds its length from the apex. The proximal margin (above the insertion of the spine), is set with small spines; the apical part is hairy, the hairs extending on the segment. There are three apical appendages: the median spiniform seta is flanked by two short spinules. Part of the surface of the segment, above the insertion of the two innermost appendages, is hairy.

No ovisacs are present on the holotype, but two damaged ovisacs were found between the labels in the tube. Judging from the condition of these fragments and WILSON's drawing (1911, pl. 56 fig. 177) they must have been oval structures, about twice as long as the abdomen.

Remarks. — A comparison of the present specimen with WILSON's (1911: 374, pl. 56, pl. 58 fig. 201, text-fig. 8) description and drawings shows the following differences:

Cephalic somite. The incision of the cephalic somite and the deepened groove on the somite are not figured or described by WILSON.

Rostrum. Though a distinct rostral plate is figured in WILSON's drawing (1911, pl. 56 fig. 177), the incised apex is not shown and no mention is made of the bifid rostral point.

Genital somite. This is described by WILSON (1911: 374) as having "strongly convex sides". In the holotype the sides are moderately swollen but the genital plates are semi-circular.

Antennules. These, according to WILSON (1911: 374) are "sparcely armed with short setae, large and flattened at the base, smaller and hair-like towards the tip". In his illustration (pl. 56 fig. 178) the proximal part of the antennule is provided with 21 setae that could pass as "sensory" setae, in addition to 4 normal steae. Only 15 sensory setae are present in the holotype (the number usually found in the Bomolochidae); these have the structure agreeing with the type of *Bomolochus* Von Nordmann, 1832, viz., *B. soleae* Claus, 1864.

Antennae. There is a considerable difference in the structure of the antennae, that are figured by WILSON (1911, text-fig. 8) as being covered with numerous fine spinules. The pectiniform spinules are scarcely larger than the remaining spinules. In the holotype the acicular spinules of the pectiniform row are long and slender; the remaining spinules are widely spaced, bluntly pointed and present in reduced numbers.

Maxillule. There are 3 setae according to WILSON's description (1911: 374), but four are present in the holotype, one of these being small.

Maxilla. WILSON (1911, pl. 58 fig. 201) figures the claw without auxiliary tooth and with one seta; in the holotype the claw has a distinct auxiliary tooth and three setae are present.

Leg 1. The internal marginal seta on the first endopodal segment is not figured by WILSON (pl. 56 fig. 179).

Leg 2. The second endopodal segment is figured with one internal seta (2 in the holotype); the third endopodal segment with a total of 2 setae (2 small spines and 3 setae in the holotype).

Leg 3. The figures of leg 3 and leg 4 have been changed; the third leg being pl. 56 fig. 182. No setae are figured on the coxa and basis.

Leg 4. No setae are figured on coxa and basis.

The legs 2 to 4 are figured by WILSON as having 4-segmented exopodites. In the holotype the third exopodal segments are deeply incised without having an extra articulation.

Leg 5. The spinule at the external margin is not figured by WILSON (pl. 56 fig. 183); the appendage is figured as being completely nude; in the holotype it has hairy patches.

This species was made the type of a new genus, *Bomolochoides* VERVOORT (1962: 29) chiefly on account of the large number of sensory setae recorded on the antennules by C. B. WILSON. The inspection of WILSON's material has now definitely shown that in antennular structure *B. nitidus* confirms to the type of *Bomolochus*, *B. soleae* Claus. Indeed, there are no fundamental structural differences between *B. nitidus* and *B. soleae* upon which a generic distinction could be based.

Consequently the genus *Bomolochoides* Vervoort, 1962, is untenable.

ble and must be withdrawn, the more so since the other species attributed to *Bomolochoides*, *Bomolochus scutigerulus* C. B. Wilson, 1935, must be transferred to *Holobomolochus* (see p. 80).

The type host of *B. nitidus* is *Mugil cephalus* L., the type locality is Beaufort, North Carolina, U.S.A. The (two) specimens were obtained from the gills. WILSON gives the length of the species as 2.22 mm; the overall length of the holotype was certainly not more than 1.85 mm. The species has subsequently been recorded from *Strongylura timuca* (Walbaum) by BERE (1936: 582), captured in Lemon Bay, west coast of Florida, U.S.A. BERE's material has been inspected and redescribed by PILLAI (1967: 258, figs. 9, 10), which author (PILLAI, 1967: 262, figs. 11, 12) also redescribed *Bomolochus concinnus* C. B. WILSON (1911: 371, pls. 54, 55). PILLAI found considerable differences between BERE's specimens of *B. nitidus* and WILSON's original description, as a result of which he expressed strong doubts as to the correctness of BERE's identification. He believes BERE's specimens to belong to *B. concinnus* Wilson, 1911, a species recorded from *Strongylura marina* (Walbaum) (= *Tylosaurus marinus*) at Beaufort, North Carolina. A comparison of WILSON's (1911: 371, pls. 54, 55) and PILLAI's (1967: 262, figs. 11, 12) descriptions of *B. concinnus* with the present account of *B. nitidus* shows no consistent differences between the two species. WILSON originally figured the two species with slightly different cephalic somites (slightly trapezoid and covering a portion of the basal parts of the antennules in *B. concinnus*; fairly broad, with rounded sides and leaving the antennules free for observation from above in *B. nitidus*), but the differences are much less distinct if PILLAI's figure of the cephalic somite (fig. 11) is compared with my Figure 8a. WILSON originally (1911: 367) also used characters of the mandible and maxilla to discriminate between the two species, but the "simple and smooth mandible and second maxilla" (= maxilla) in *B. nitidus* are, in the holotype, undistinguishable from those of *B. concinnus*. In fact, there are no consistent differences in the appendages between *B. nitidus* and *B. concinnus*. The small differences in shape of cephalic somite and thorax are probably largely due to development of the gonads or curvature of the body. I am inclined,

therefore, to consider both species as synonymous. I indicate the trivial name *B. concinnus* C. B. Wilson, 1911, as having priority over *B. nitidus* C. B. Wilson, 1911; the synonymy of *B. concinnus* has been given above.

Bomolochus nitidus as described by PILLAI (1967: 258, figs. 9, 10) also belongs in this species; it only differs by the presence of an extra marginal spinule on the external exopodal margin of leg 1.

Bomolochus mugilis PEARSE, (1952: 194, figs. 14–17) was described from Alligator Harbour and from the same host (*Mugil cephalus* L.) as *B. nitidus* C. B. Wilson. Both description and drawings are inaccurate; the inspection of the holotype (U.S. National Museum, no. 93728), a slide, unmistakably shows its identity with *B. nitidus*.

Bomolochus? spec.

Figs. 11–14

Piscadera Bay, CURAÇAO, 9.XII.1958. From the orbit of *Stegastes chrysurus* (C. & V.), captured in canaster. One adult male, 858 μ long. Leg. J. H. Stock, no. 120 a.

The following description is based on the specimen mentioned above, which, after its external appearance had been figured, has been dissected and the appendages mounted in Berlese.

Adult *male*. – Total length 858 μ ; the greatest diameter, at the thoracic somite, is 451 μ . The length of the cephalic somite, including the rostrum, is 264 μ ; the diameter is 451 μ . For the remaining thoracic somites these figures are: 121 and 396 μ for the second; 105 and 341 μ for the third; 105 and 187 μ for the fourth, and 66 and 132 μ for the fifth thoracic somite. The genital complex is 138 μ long and has a diameter of 154 μ . The fourth abdominal somite has a length of 50 μ and is 94 μ wide; the anal somite is 28 μ long and 77 μ wide. The furcal rami are 17 μ long (free, visible part) and have basally a diameter of 22 μ . The longest furcal seta is 121 μ .

The general shape of the body can best be judged from Fig. 11a; the cephalothorax is fairly broad, broadly rounded anteriorly and truncate caudally; the abdomen is short. The head and the first thoracic somite are fused to form the cephalic somite: this forms a flat, semi-circular structure, with smoothly rounded frontal and lateral borders. The rostrum, placed on a short prominence, is strongly attached to the cephalic somite and forms a broadly rounded, slightly elevated projection interrupting the smooth, circular line of the cephalothorax. At the base of the rostral prominence, near the insertion of the antennules, a pair of tubercles, one on each side of the rostrum, is visible (Fig. 11a). The caudal margin of the cephalic somite is slightly concave; the latero-caudal end of the cephalic somite is drawn out in a blunt point. The second and third thoracic somites are dorsally visible as

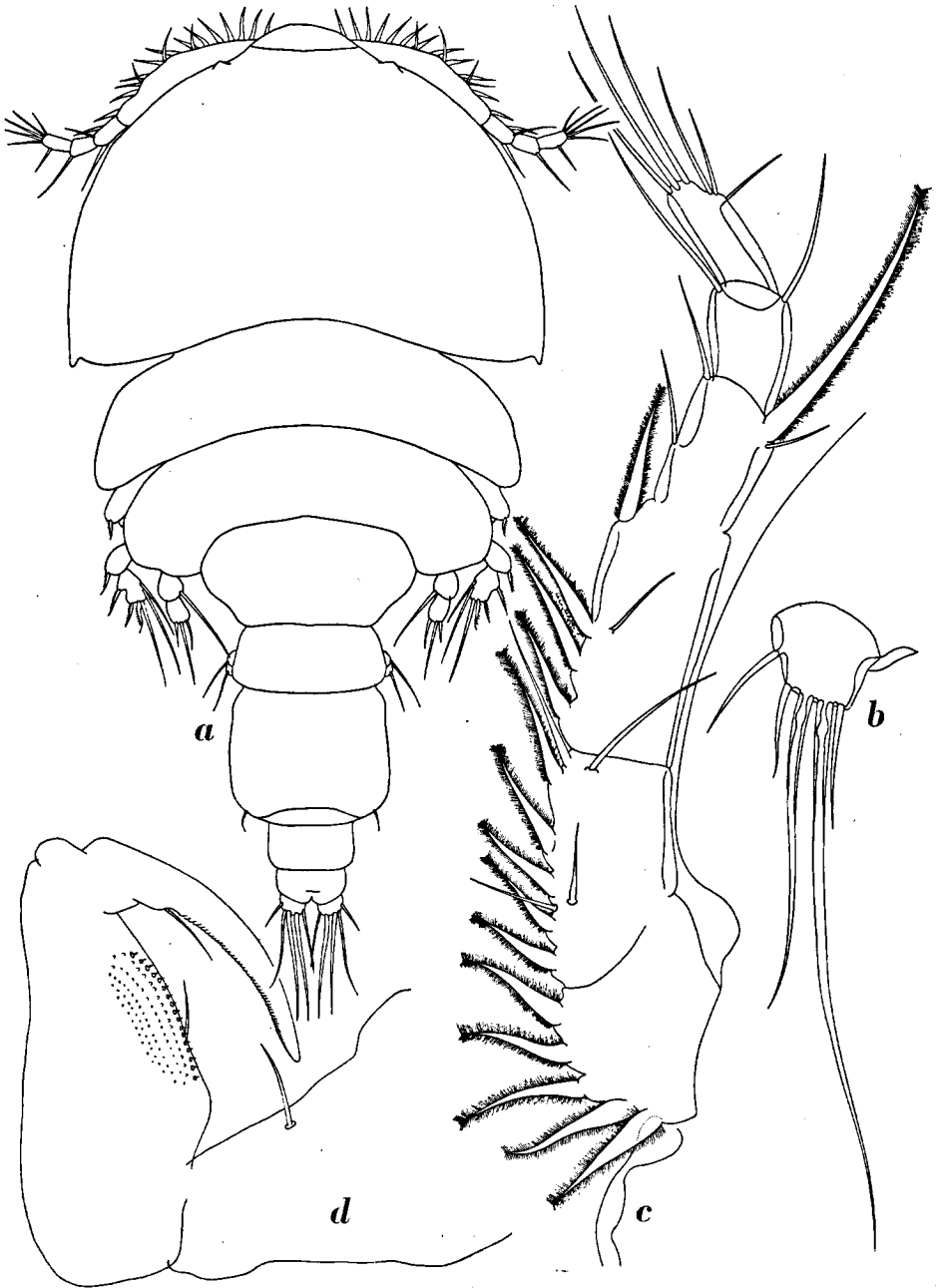


FIGURE 11. *Bomolochus* spec., adult ♂, from *Stegastes chrysurus*. a, whole animal, dorsal view; b, left furcal ramus, dorsal view; c, left antennule, ventral view; d, left maxillipede. - a, $\times 135$; b, $\times 395$; c, d, $\times 550$.

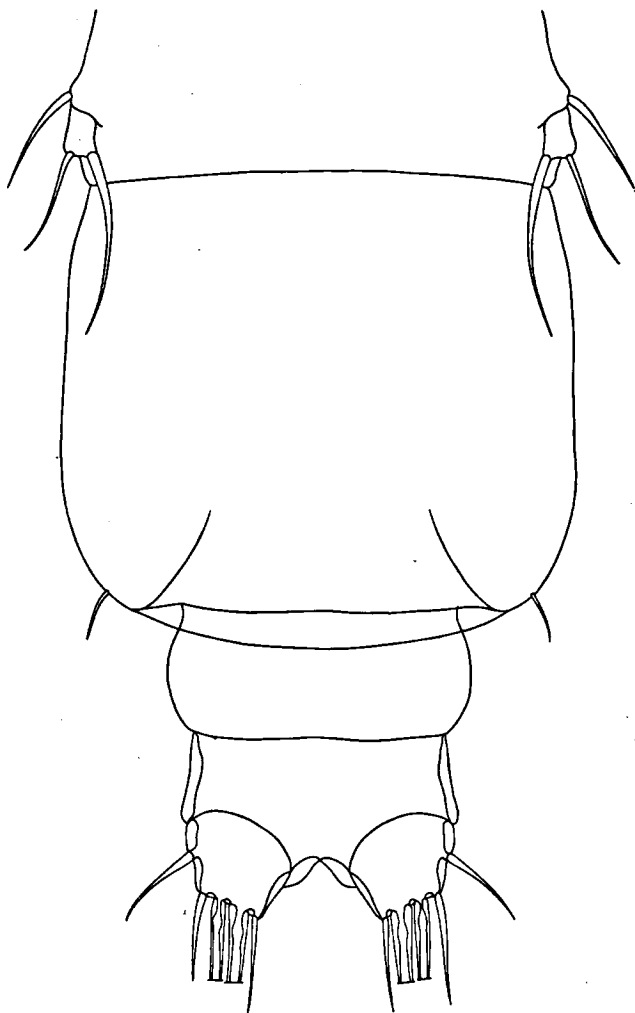


FIGURE 12. *Bomolochus* spec., adult ♂, from *Stegastes chrysurus*; abdomen and fifth pair of legs, ventral view. — × 395.

semi-lunar strips; the epimeral parts of the second somite are obtusely pointed; those of the third somite are bilobated. The fourth thoracic somite is much smaller than the third. The fifth thoracic somite is a narrow, cylindrical somite; the intermediate segment of the fifth pair of legs has fused with the somite, forming, on each side, a raised shoulder, serving the attachment of the fifth legs. The genital complex is a large, barrel-shaped structure, resulting from fusion of the first and second

abdominal somites and apparently including the third somite, which is either completely fused with the complex or telescoped into it. The fourth abdominal somite is small and cylindrical; its sides are rounded. The anal somite is slightly shorter than the fourth; its caudal border is bilobed and covers a fraction of the furcal rami. The anal plate is nearly straight. The furcal rami, viewed ventrally, are slightly broader than long (Fig. 11b). There are five marginal setae; the appendicular seta has not been observed. Setae 1, 4, and 5 are short and fine; the second and third setae are elongated and thickened, the second being the longest.

In ventral aspect the elongated oval genital flaps are distinctly visible; one seta protrudes from the genital slit on each side (Fig. 12).

The antennules are distinctly visible from above, projecting besides the cephalic somite. They are 6-segmented and are attached to the ventral surface of the cephalic somite just behind the rostral base. The setation of the antennule appears from Fig. 11c: there are 15 plumose sensory appendages and a number of normally developed setae. Fourteen plumose sensory setae are arranged along the frontal margin of the antennule and are of equal size. The fifteenth, placed at the caudal end of the fourth antennular segment, is much larger. The third antennular segment is large and may result from fusion of several smaller segments. There are 3 normal setae on the fourth, 2 on the fifth and 6 on the sixth segment.

The antenna has the shape characteristic of the family Bomolochidae (Fig. 13a). The coxa is long and strong, the end has a fine seta. The basis is short. The endopodite is composed of two fused segments and folded over the coxa. The endopodite is elongated into a finger-shaped process; the longitudinal rows of fine, acicular spinules observed on the endopodite continue on the finger-shaped process. In addition there is a lamelliform process, set with a pectiniform row of slender spines, continuing for some distance on the endopodite. Near the insertion of the lamelliform process there is a curved, strong hook. The apex of the endopodite carries three hooked spines or spiniform setae; in addition there are two straight setae of unequal length.

In my preparation of the mouth parts they are, with the exception of the maxilla, in such an unfavourable position that they could not be figured. The mandible has the usual cylindrical masticatory process, armed with two triangular teeth with sharp edges; both teeth are of greatly differing size. The maxillule has three setae. The shape of the paragnath could not be observed. The maxilla (Fig. 13b) has a single strong lobe, armed with three strong spines and a short seta. The maxillipede (Fig. 11d) is chelate; it inserts laterally of the other oral appendages (Fig. 14a). The coxa is more or less conical, with a thick base and narrowing near the apex; there is a single seta at its internal margin. The basis is only moderately swollen; the internal margin has a single seta and a cushion of strong spinules. The claw (endopodite) is fairly short, with the basal portion more or less separate from the rest of the claw and there with a single seta. The internal margin of the claw is set with scale-shaped teeth.

The rami of legs 1 to 4 are all 2-segmented. The legs have the following setal and spinal formula:

	endopodite	exopodite
leg 1	1+0.6+I	0+I.4+IV
leg 2	1+0.4+I	0+I.4+IV
leg 3	1+0.2+I	0+I.3+IV
leg 4	1+0.I+1+I	0+I.3+III



FIGURE 13. *Bomolochus* spec., adult ♂, from *Stegastes chrysurus*. *a*, left antenna; *b*, right maxilla; *c*, leg 1; *d*, leg 3. — *a-d*, × 550.



FIGURE 14. *Bomolochus* spec., adult ♂, from *Stegastes chrysurus*. *a*, left part of cephalic somite, ventral view; *b*, leg 2; *c*, leg 4. - *a*, $\times 135$; *b*, *c*, $\times 550$.

Leg 1 (Fig. 13c) has a very strong, plumose seta at the internal corner of the coxa and an even stronger seta at the external corner of the basis. The intercoxal plate is spinulose. The internal wall of the basis is also spinulose. The external marginal spines of the exopodite have strong outer edge spinules; they are flagellated. The second endopodal segment distinctly results from fusion between two separate segments; it has 5 normal setae and a short spine at the external margin.

The legs 2 to 4 have the following points in common. The intercoxal plate is spinulose. The internal corner of the coxa (with the exception of leg 4) has a plumose seta. The seta at the external corner of the basis is long and nude. The internal margin of the basis has a distinct, obtuse spine. The external marginal spines of the exopodites have one or two very big, triangular outer edge spines; the terminal spine has several fairly big teeth along its outer margin.

Leg 2 (Fig. 14b) has the external margin of the endopodite hairy; the second endopodal segment has three setae, one setiform spine and a short spine.

Leg 3 (Fig. 13d) also has the external margin of the endopodite hairy; the second segment has two setae and a spine.

Leg 4 (Fig. 14c) has the internal margin of the endopodite nude; the second segment has at the apex a strong seta flanked by two spines.

The fifth pair of legs (Fig. 12) has the intermediate segment fused with the fifth thoracic somite; the shoulder carries a single fine seta. The free segment is short and squarish; it has two setae: the internal seta is long and thick, the external seta is fine.

Remarks. — I have been unable to identify this specimen with any of the described males of the family Bomolochidae. Though in its oral parts this specimen is a distinct Bomolochid Copepod, it is unique by the two-segmented condition of the first to fourth pairs of legs. This condition suggests that the specimen is not fully mature, though the development of the abdomen, particularly the genital somite, suggests that it is fully developed. In the presence of a single seta projecting from the genital slit it approaches the condition observed in certain males of the Taeniacanthidae.

Holobomolochus nov. gen.

Articolax p.p. C. B. WILSON,¹ 1908:433.

Diagnosis. — *Females.* The body is cyclopid, i.e., the cephalic somite, which results from fusion of the head and the first thoracic somite, has the greatest diameter, while the remaining thoracic somites narrow gradually. The cephalic somite occasionally has a longitudinal furrow, terminating under the rostral plate. Rostral plate ventrally and backward curved, usually without sharp points.

Some of the thoracic somites may be considerably swollen as a result of the development of the ovaries, they may cover part of the following somite. The genital complex results from fusion between the first and second abdominal somites; the third abdominal somite is usually telescoped into the complex. The abdominal somites 4 and 5 are normally developed; the caudal rami are as in *Bomolochus*. The antennules differ considerably from those of *Bomolochus* because of the absence of ventral, chitinized plates. As a result all fifteen sensory setae are normally developed, though the fourth may have a slightly elevated base and be more strongly curved laterally. The endopodite of the antenna is corrugated by the presence of a large number of fine, blunt teeth, that may occasionally be arranged in longitudinal rows. The lamelliform process has a pectiniform row of slender spinules, continuing for some distance on the endopodite. The spine at the base of the lamelliform process may be considerably enlarged. The maxillule has 3 or 4 setae. The maxillipede has the same structure as that of *Bomolochus*, but the auxiliary spine on the claw may be absent and the claw may be slender. One of the setae on the basis may be absent.

The legs 1 to 4 have 3-segmented exo- and endopodites; the setation of the legs varies slightly, as also appears from Table 2. There are the following communal characters:

Leg. 1 Both rami are strongly flattened; the segments of the exopodite are fused.

Leg 2. There are two setae at the internal margin of the second endopodal segment; the endopodite is either flattened or normally developed.

Leg 3. There are 2 setae at the internal margin of the second endopodal segment (with the exception of *Holobomolochus acutus* (Gnanamuthua), which species is imperfectly known); the endopodite is flattened or normally developed.

The external marginal spines of the exopodite of legs 2 to 4 are all flagellated; the external margin is either spinulose or toothed, terminating in a big tooth or spur.

Leg 5 is as in *Bomolochus*.

The males of *Holobomolochus* show the same modifications as are also observed in the males of *Bomolochus*. The body is cyclopid, the

plumose setae of the antennule are normally developed and the maxillipedes are large claws. The endopodite of leg 4 is 2-segmented. The second endopodal segment of leg 3 probably has 2 internal setae in all males of *Holobomolochus* (only 1 in *Bomolochus*). For the rest the details of the legs of the males so far described are so unreliable that it is unnecessary to tabulate their characters.

Type species, by present designation: *Bomolochus nothrus* C. B. WILSON (1913: 195, pls. 19, 20). This species has recently been redescribed and figured by PILLAI (1967: 251, figs. 5, 6); the male is described by WILSON (1913: 197) but the information concerning the setation of the legs contained in WILSON'S description and figures is incorrect.

Further species:

- Bomolochus ardeolae* KRØYER (1864: 294, 300, pl. 11 fig. 3)
Bomolochus attenuatus C. B. WILSON (1913: 198, pl. 21)
Artacolax palliucus C. B. WILSON (1913: 20, pls. 22, 23)
Bomolochus albidus C. B. WILSON (1932: 382, pl. 23 figs. c-j)
Bomolochus acutus GNANAMUTHU (1948: 18, figs. 1-3)
Bomolochus confusus STOCK (1953: 9, figs. 21-33)

***Holobomolochus nothrus* (C. B. Wilson, 1913) Fig. 15, 17e**

Bomolochus nothrus C. B. WILSON, 1913: 195, pls. 19, 20; SEWELL, 1949: 157; PEARSE, 1952: 12; PEARSE, 1952a: 194, 196; VERVOORT, 1962: 22; YAMAGUTI, 1963: 12, pl. 5 fig. 1; PILLAI, 1967: 251, figs. 5, 6.

Piscadera Bay, Curaçao, 1.XII.1958. From the inside of the operculum of *Abudefduf saxatilis* (L.), captured in canasters. Eight adult and partly ovigerous females, 1.92-2.40 mm long (2.13 mm). Leg. J. H. Stock, no 100.

Piscadera Bay, CURAÇAO, 26.I.1959. From the inside of the operculum of *Abudefduf saxatilis*, captured in canaster. Two adult, ovigerous females, 2.04 and 2.08 mm long. Leg. Stock, no 176.

Remarks. - This species has recently been redescribed after one of WILSON'S syntypes by PILLAI (1967: 251, figs. 5, 6). The present specimens generally agree with PILLAI'S description, though they are slightly smaller (PILLAI, ♀, 2.4 mm; present ♀♀, 1.92-2.40 mm).

I have figured the antennules (Fig. 15a) in more detail than has been done by PILLAI (1967, fig. 5 no. 3). The basal part, which

TABLE 2

SETATION OF LEGS 1-4 IN THE SPECIES OF *Holobomolochus*

Setae in arabic, spines in roman numerals.

(*Bomolochus gazzae* Shen, 1957, has not been included; this species belongs to *Nothobomolochus* Vervoort, 1962. —
H. ardeolae, *H. attenuatus* and *H. acutus* are imperfectly known.)

	Females			
	Leg 1		Leg 2	
	endopodite	exopodite	endopodite	exopodite
<i>H. nothrus</i> (C. B. Wilson)	1+0.1+0.5	0+I.1+I.5+III	1+0.2+0.3+II	0+I.1+I.5+IV
<i>H. ardeolae</i> (Krøyer)	2+0.1+0.5	6+III	1+0.2+0.2+II	0+I.1+I.5+III
<i>H. attenuatus</i> (C. B. Wilson)	1+0.1+0.5	6	1+0.2+0.3+II	0+I.1+I.4+III
<i>H. pallencus</i> (C. B. Wilson)	1+0.1+0.5	0+I.1+I.4+III	1+0.2+0.3+II	0+I.1+I.5+IV
<i>H. albidus</i> (C. B. Wilson)	1+0.1+0.5	0+I.1+I.5+II	1+0.2+0.3+II	0+I.1+I.5+IV
<i>H. acutus</i> (Gnanamuthu)	1+0.1+0.5	1+0.6	1+0.2+0.3+I	0+I.1+III.6+III
<i>H. confusus</i> (Stock)	1+0.1+0.0+5	0+I.3+I.3+0	1+0.2+0.3+II	0+I.1+I.5+IV

TABLE 2 (Continued)

SETATION OF LEGS 1-4 IN THE SPECIES OF *Holobomolochus*

Setae in arabic, spines in roman numerals.

(*Bomolochus gazzae* Shen, 1957, has not been included; this species belongs to *Noihobomolochus* Vervoort, 1962. - *H. ardeolae*, *H. attenuatus* and *H. acutus* are imperfectly known.)

	Females			
	Leg 3		Leg 4	
	endopodite	exopodite	endopodite	exopodite
<i>H. nothrus</i> (C. B. Wilson)	1+0.2+0.2+II	0+I.1+I.5+III	1+0.1+0.1+1+I	0+I.1+I.5+III
<i>H. ardeolae</i> (Krøyer)	1+0.2+0.2+III	0+I.1+I.6+III	1+0.1+0.1+1+I	0+I.1+I.5+I
<i>H. attenuatus</i> (C. B. Wilson)	1+0.2+0.2+II	0+I.1+II.6+II	1+0.1+0.1+1+I	0+I.1+I.5
<i>H. pallencus</i> (C. B. Wilson)	1+0.2+0.2+II	0+I.1+I.5+III	1+0.1+0.1+1+I	0+I.1+I.5+III
<i>H. albitus</i> (C. B. Wilson)	1+0.2+0.2+II	0+I.1+I.5+III	1+0.1+0.1+1+I	0+I.1+I.5+III
<i>H. acutus</i> (Gnanamuthu)	1+0.1+0.2+II	0+I.1+I.5+III	1+0.1+0.1+1+I	0+I.1+I.3+III
<i>H. confusus</i> (Stock)	1+0.2+0.2+II	0+I.1+I.5+III	1+0.1+0.1+1+I	0+I.1+I.5+III

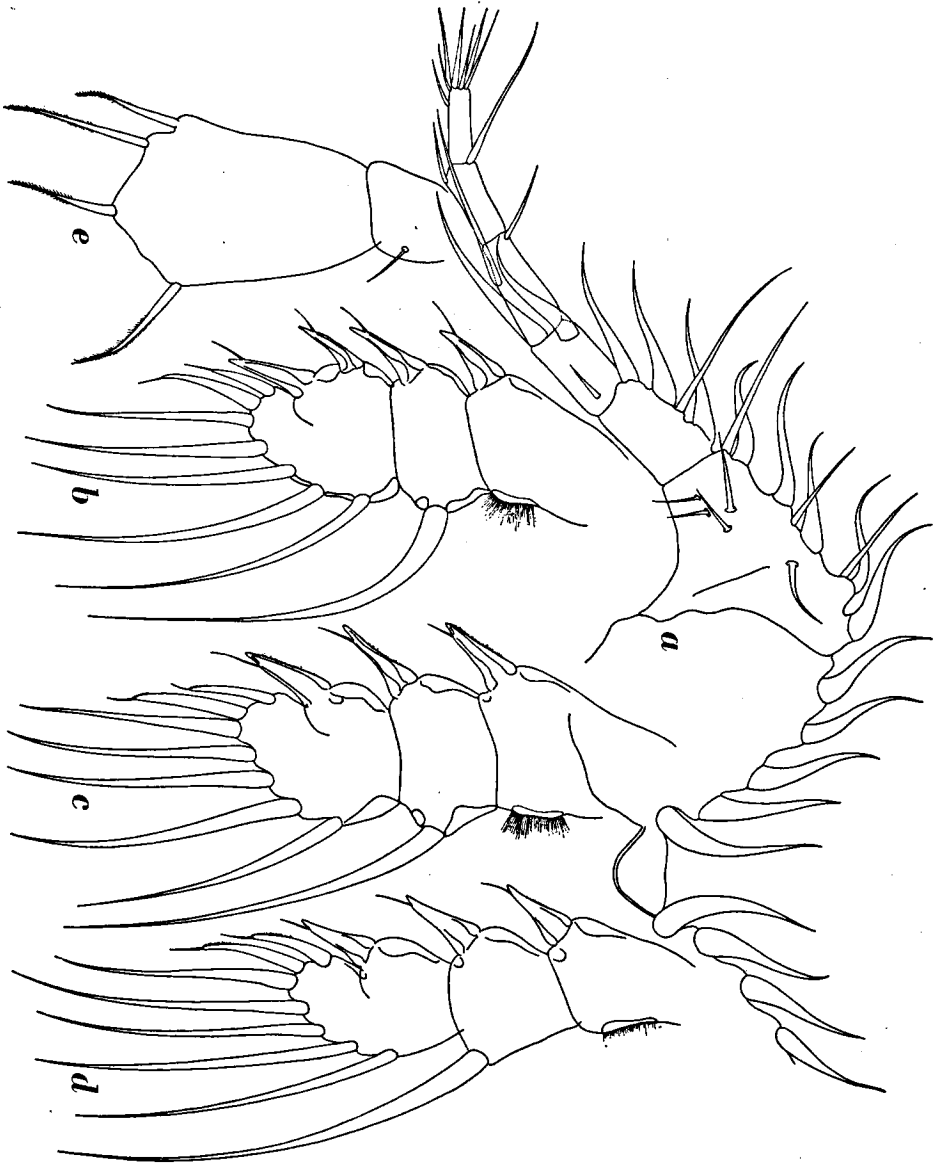


FIGURE 15. *Holobomolochus nothrus* (C. B. Wilson), adult ♀, from *Abudefduf saxatilis*. *a*, right antennule, ventral view; *b*, exopodite of leg 2; *c*, exopodite of leg 3; *d*, exopodite of leg 4; *e*, leg 5. - *a*, × 135; *b-e*, × 220.

supports the sensory setae, is strongly curved; at the curvature it is distinctly frontally produced, the setae 6 and 7 are placed on the curved tip. They have, nevertheless, the same shape and size as the remaining marginal sensory setae (with the exception of seta 15, which is very large). The basal antennular portion is composed of four well separated parts; the line dividing the first and second parts has the character of a chitinized ridge; the second part itself is probably composed of several smaller parts. There are the usual 15 plumose, sensory setae in addition to four normal marginal setae. There are five additional setae on segment 2 and one on segment 4. The "flagellum" is 3-segmented, with 2, 2, and 7 setae, respectively. One of the setae on the first segment of the "flagellum" is plumose and cannot be distinguished from the sensory setae of the basal portion.

The rostral plate is visible between the basal parts of the antennule; the free margin is curved downward and backward. Its edge is thickened and has no rostral points.

This species clearly belongs in the genus *Holobomolochus* Vervoort, 1962, on account of its antennular structure and setation of the legs (Fig. 15 b-d). It is closely related to *Holobomolochus ardeolae* (Krøyer, 1864).

The type host is *Abudefduf saxatilis* (L.), the type locality Montego Bay, Jamaica. An additional specimen was obtained from the gills of *Ogcocephalus vespertilio* (L.) at Port Aransas, Texas (PEARSE, 1952). It appears to be fairly common in Piscadera Bay, Curaçao, occurring exclusively on *Abudefduf saxatilis* (L.)

Holobomolochus ardeolae (Krøyer, 1864)

Figs. 16, 17a-d, 18-20

Bomolochus ardeolae KRØYER, 1864: 294, 300, pl. 11 fig. 3; BASSETT-SMITH, 1899: 442; YAMAGUTI, 1939: 198; SHIINO, 1957: 42; VERVOORT, 1962: 18.

Artacolax (*Bomolochus*) *ardeolae*, C. B. WILSON, 1908: 434; SEWELL, 1949: 157.

Artacolax ardeolae, C. B. WILSON, 1911: 363, pl. 52, pl. 53 fig. 146; SEWELL, 1949: 157; STOCK, 1953: 12; YAMAGUTI, 1963: 13, pl. 1 fig. 1.

Piscadera Bay, CURAÇO, 9.XII.1958. From the inside of the operculum of *Stegastes chrysurus* (C. & V.), captured in canasters. Two adult, ovigerous females, 1.80 and 2.00 mm long. Leg. J. H. Stock, no. 120.

The following description is based on the 2.00 mm long female. The oral appendages and legs of the left side have been removed and mounted after the specimen had been figured.

Adult *female*. — Total length (from apex of the rostrum to end of the furca) 2.00 mm; greatest diameter, at the cephalic somite, 1.20 mm. The cephalic somite is 594 μ long and 1.88 μ wide; for the remaining thoracic somites these figures are: 270 and 905 μ for the second, 230 and 689 μ for the third, 189 and 365 μ for the fourth and 162 and 311 μ for the fifth thoracic somite. The genital complex is 203 μ long and 284 μ wide; for the remaining abdominal somites these figures are: 149 and 216 μ for the third, 122 and 203 μ for the fourth and 81 and 176 μ for the fifth somite. The furcal rami are 54 μ long and 61 μ wide at the base. The longest furcal seta is 365 μ . The ovisacs are 972 μ long and 351 μ wide.

The general shape of the body is characterized by the strongly swollen condition of the cephalic somite, which is more than twice as wide as long, the swollen condition of the third abdominal somite and the fairly short abdomen (Fig. 16a). The head and the first thoracic somite are fused to form the cephalic somite. This somite is a swollen structure, slightly more than twice as long as broad, with flattened, rounded lateral portions, a deep mid-dorsal groove, widening near the rostral base, and a flattened anterior portion. In dorsal aspect the groove is distinctly visible; strong bundles of muscles insert on both sides of the groove, running from their place of insertion at the inside of the cephalic somite to the basal portions of the antennules. Only the basal parts of the antennules are visible from above. The anterior part of the cephalic somite is flattened and slightly concave between the antennular bases; the rostral plate is visible between the basal parts of the antennules as a semicircular structure (Fig. 17a) its free edge is thickened and not curved backward. No rostral points have been observed. The second thoracic somite is a narrow strip with rounded sides; the epimeral portions are scarcely developed so that the coxal parts of the second pair of legs are exposed. The third thoracic somite is less broad than the second; its sides are broadly rounded. The third somite is distinctly backward produced, as appears best in lateral view of the animal (Fig. 16b); the degree of production, however, varies in the two specimens examined. In both specimens only a fraction of the fourth thoracic somite is covered. This fourth somite is a small, shield-shaped structure, completely exposing the coxae of the fifth pair of legs. The fifth abdominal somite is trapezoid and longer than the preceding somite. Laterally it has distinct shoulders serving the attachment of the fifth legs (Fig. 18a).

The genital somite results from fusion between the first two abdominal somites; it is slightly wider than long and barrel-shaped. The genital slits are visible on the latero-dorsal parts of the complex; three setae protrude from each of the openings (Fig. 18a). Abdominal somites three and four have about the same shape and taper only very slightly. The anal somite is short and tapers distinctly; the anal operculum is straight. The furcal rami (Fig. 16c) are about as long as wide; each ramus has five marginal setae and one appendicular (dorsal) seta. The marginal setae 2 and 3 are lengthened, the second being the longest.

The ovisacs are about as long as the abdomen (including the fifth thoracic somite); they contain a reduced number of large eggs.

The antennules (Fig. 17a) are remarkably short and characterized by strong flexion of the basal parts. In dorsal view of the animal these flexed basal parts only are visible, forming two conical structures in front of the cephalic somite on both sides

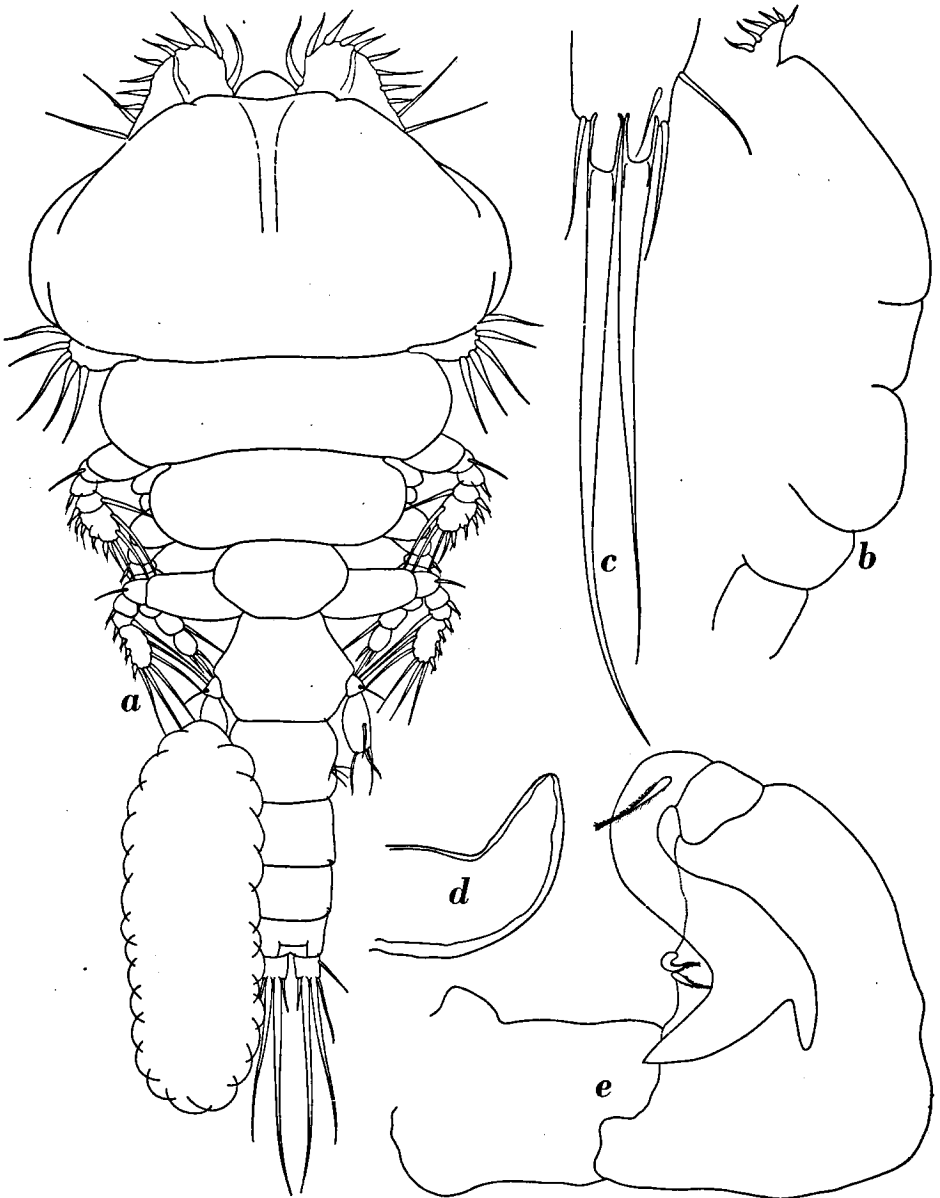


FIGURE 16. *Holobomolochus ardeolae* (Krøyer), adult ♀, from *Stegastes chrysurus*. *a*, whole animal, dorsal view; *b*, outline of back in lateral view of animal; *c*, right furcal ramus, dorsal view; *d*, right paragnath; *e*, left maxillipede. — *a*, *b*, × 55; *c*, × 135; *d*, × 315; *e*, × 240.



FIGURE 17. *a-d*, *Holobomolochus ardeolae*, adult ♀, from *Stegastes chrysurus*. *a*, rostral plate and right antennule, ventral view; *b*, right antenna; *c*, left mandible, slightly turned; *d*, left maxilla, internal surface. - *e*, *Holobomolochus nothrus* (C. B. Wilson), adult ♀, from *Abudedefduf saxatilis*; left maxillipede. - *a*, $\times 135$; *b-d*, $\times 395$; *e*, $\times 240$.

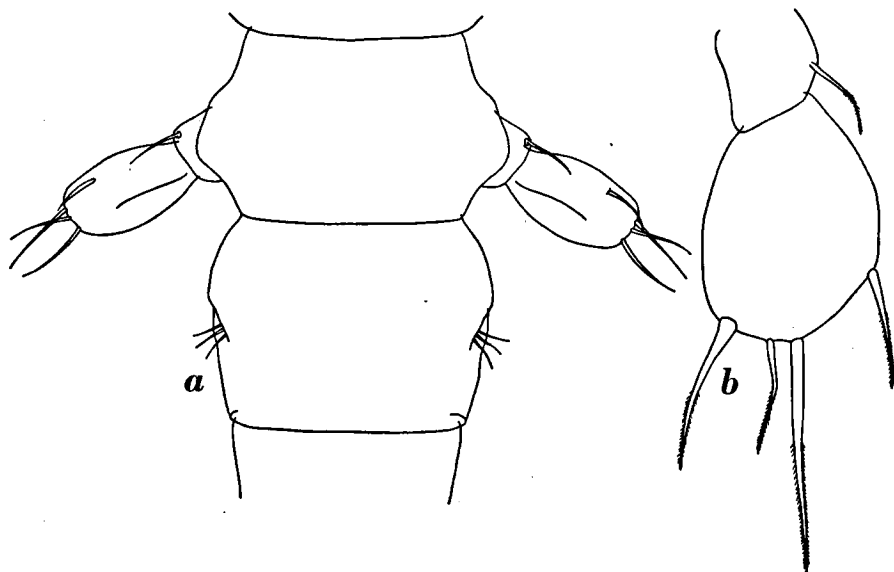


FIGURE 18. *Holobomolochus ardeolae*, adult ♀, from *Stegastes chrysurus*. *a*, fifth abdominal somite and genital somite, dorsal view; *b*, right fifth leg. — *a*, × 135; *b*, × 220.

of the rostral plate. Each antennule is composed of a three-segmented basal part and a three-segmented "flagellum". The first segment of the antennule is large and has a number of internal chitinized lamellae, radiating from the place of attachment of the segment to the cephalic somite in the direction of the margin. A particularly strong lamella reaches the margin between the fifth and sixth sensory setae; the fifth seta inserts on the highest part of the segment. The basal portion of the antennule carries the customary 15 sensory setae; these setae diminish in size from the first to the fifth seta, to increase in size again from the fifth to the fifteenth. In addition to the sensory setae there are four normally shaped marginal setae and a total of five small, normal setae on the basal part of the antennule. The number of setae on the three segments of the flagellum is 2, 2, and 6, respectively; the first seta on the flagellum appears to be sensory and cannot be distinguished from the sensory setae on the basal portion.

The antenna (Fig. 17b) has a long coxa and a very short basis; a single seta occurs on the coxa near the articulation with the basis. The endopodite is composed of two fused segments and is folded over the coxa. A distinct lamelliform process inserts near the point of fusion of the two endopodal segments; it has a pectiniform row of fine spinules, continuing for some distance on the endopodite. The endopodite is completely covered with small, slightly curved spinules, also continuing on the finger-shaped prolongation of the second endopodal segment. A strong, curved claw inserts near the base of the lamelliform process on the endopodite. In addition there

are four strong, hooked spines and a seta, inserting on the second endopodal segment.

The structure of labrum and labium could not be studied in detail. The mandible has an elongated mastigatory process, bearing two large teeth, each with a sharp, crenulated edge. The teeth are of unequal size; the largest is to be found at the end of the process, the smaller tooth has an oblique position. The maxillule is a small, rounded structure, carrying two very strong setae and one smaller seta. The paragnaths are club-shaped appendages, the apical part is elongated like a finger, carrying a circumferential carina (Fig. 16d). The maxilla (Fig. 17d) has a single, slender lobe, carrying two strong teeth and a fine seta. The teeth are much elongated; the upper tooth being toothed at the apex, the other is hairy. The maxillipedes (Fig. 16e) have the usual shape and occupy a lateral position. The coxa is short and thick; no seta could be observed. The basis is large and triangular; the internal margin has two small, hairy setae inserting close together. The claw (endopodite) is large and strongly sigmoid. The apical portion, which is very acutely pointed, is set off perpendicularly from the rest of the claw; this portion of the claw, which also supports the auxiliary tooth, is notably swollen. A single seta occurs on the base of the claw. The extreme basal part of the claw is separated from the rest of the claw by a distinct hinge.

The legs 1 to 4 have the following setal and spinal formula:

	endopodite	exopodite
leg 1	1+0.1+0.5	6+IV
leg 2	1+0.2+0.3+II	0+I.1+I.5+IV
leg 3	1+0.2+0.2+II	0+I.1+I.5+III
leg 4	1+0.1+0.1+1+I	0+I.1+I.5+III

Leg 1 (Fig. 19a). The endopodite is not so much enlarged as is customary in the genus *Holobomolochus*. There is an indication of separation of the segments of the exopodite, though very incomplete. The appendage at the internal margin of the coxa is distinctly setiform and densely hairy. The seta at the external margin of the basis is short and thick. The external corner of the coxa is hairy.

Leg 2 (Fig. 19b). The coxa has a thick, short, plumose seta at the internal corner; the external corner is hairy. The seta at the external margin of the basis is fine and nude. The spines at the external margin of the exopodite are flagellated; the apical two spines in addition have a spur. The second endopodal segment has two setae; the endopodite itself is flattened.

Leg 3 (Fig. 20a). The seta at the internal margin of the coxa is long and hairy; the external coxal margin is hairy. The seta at the external margin of the basis is fine and nude. All the external marginal spines of the exopodite are flagellated; the outer margin of each spine is spinulose and terminates in a spur; the inner margin is hairy. The endopodite is flattened and enlarged, with two setae at the internal margin of the second segment.

Leg 4 (Fig. 20b, c). No seta has been observed at the internal margin of the coxa; the external corner of that segment is hairy. The seta at the external basal margin is fine and nude. All external marginal spines of the exopodite are flagellated; the outer margin of each spine is spinulose and terminates in a spur; the inner margin is hairy.

Leg 5 (Fig. 18b). The intermediate segment is short and cylindrical; there is a single fine seta at the external margin. The free apical segment is broadly oval and

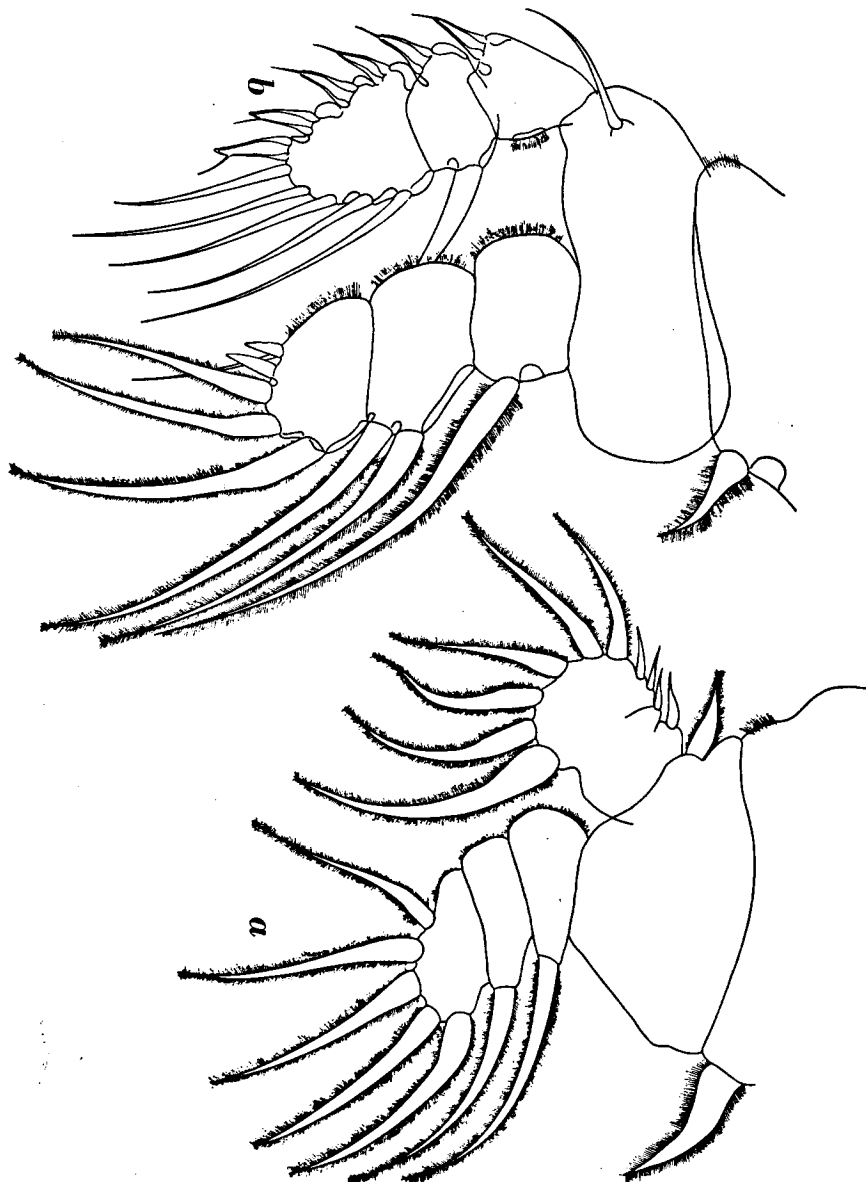


FIGURE 19. *Holobomolochus ardeolae*, adult ♀, from *Stegastes chrysurus*. a, leg 1; b, leg 2. — a, × 135; b, × 220.

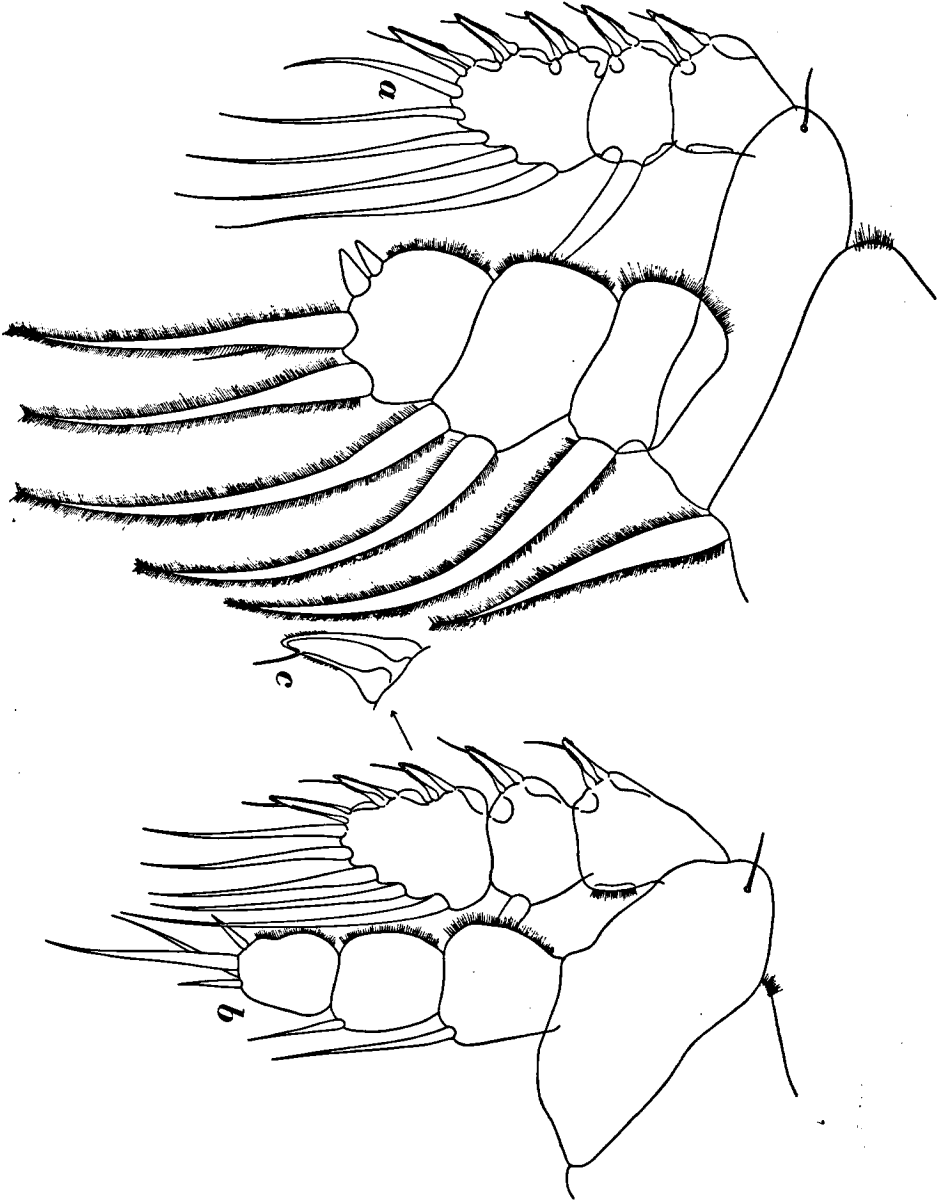


FIGURE 20. *Holobomolochus ardeolae*, adult ♀, from *Stegastes chrysurus*. a, leg 3; b, leg 4; c, first external marginal spine of third exopodal segment of leg 4. — a, b, × 220; c, × 550.

carries four marginal appendages, the position and shape of which appears clearly in Fig. 18b. In the animal the position of the free segment is slightly oblique in comparison to the length axis of the animal, so that at superficial examination of the terminal segment it appears much less broad.

Remarks. — This species was originally described by KRØYER (1864: 294, 300, pl. 11 fig. 3) from a single specimen from New Orleans, Louisiana, U.S.A., found on the gills of *Belone ardeola* Cuvier & Valenciennes (= *Strongylura timuca* (Walbaum)). The female specimen is described by KRØYER as being slightly worn ("slet"); the figures, consequently, may to some extent represent reconstructions. The size of the specimen is given as $\frac{3}{4}$ mm (about 1.6 mm). The identification of my specimen with KRØYER's species is based on the general conformity of the shape of the body (the large cephalothorax and the short abdomen), the agreement in structure of the antennule and conformity in the structure of the external marginal spines of the exopodites of legs 2 to 4. Though KRØYER describes the strong flexion of the basal portion of the antennule, it does not appear from his figure (pl. 11 fig. 3a) of the whole animal; it is, nevertheless, quite evident from his figure of the antennule (pl. 11 fig. 3b). His figure of the legs (pl. 11 fig. 3d, representing either the second or the third pair) clearly shows the spured condition of the external marginal spines of the exopodite. There is, however, no conformity in the structure of the fifth legs, that are figured and described by KRØYER as being 3-segmented, with the terminal segment spinulose and with 3 marginal setae. It seems likely, however, that KRØYER's figure is either incorrect (as is his figure of the maxilla, pl. 11 fig. 3c, described as the first pair of legs) or is based on a specimen in which the apical segment of leg 5 was folded. KRØYER's specimen appears to have had a much more swollen cephalothorax, probably due to the greater development of the ovaries. The third thoracic somite probably completely covered the fourth.

An additional specimen of *Holobomolochus ardeolae* has been described by C. B. WILSON (1911: 363, pl. 52, pl. 53 fig. 146) as *Artacolax ardeolae* from La Jolla, California, U.S.A., taken from the gills of *Hypsypops rubicundus* (Girard). This female specimen measured 2.4 mm (according to WILSON's description; taken from

the figure, pl. 52 fig. 138, its length would be only 2.2. mm) and has the same characteristic shape of body. In WILSON's specimen the abdomen is even shorter and the third thoracic somite completely covers the fourth. The antennule has the strong flexure of its basal portion. There is general agreement in the shape of the oral appendages and legs, though in detail there are differences in setation, probably due to incorrectness of WILSON's drawings. WILSON's single specimen is in the U.S. National Museum, Washington, where it is registered under no. 38597; it has not been inspected.

Holobomolochus ardeolae (Krøyer, 1864) is very near to *Holobomolochus nothrus* (C. B. Wilson, 1913), so much so that both species can easily be confused. The differences between both species have been listed below:

General shape of the body. In *H. nothrus* the cephalothorax is not as strongly swollen as in *H. ardeolae*; the body is more "cyclopid" and less "tadpole-like".

Antennules. In *H. nothrus* the antennules are longer and project beyond the sides of the cephalic somite; the flexion of the basal part is less extreme. The plumose sensory setae are of uniform shape and length. In *H. ardeolae* the antennules are very short, and do not surpass the cephalic somite. The flexion of the basal antennular portion is extreme; the sensory setae are smallest at the top of the curved part.

Legs. The external marginal spines of the exopodites in the two species are differently shaped, as appears clearly from a comparison of the figures representing the exopodites of legs 2 to 4 in *H. nothrus*, with Figures 19 and 20, representing the legs 2 to 4 in *H. ardeolae*. The apical segment of leg 5 in *H. nothrus* is angular and fairly narrow; in *H. ardeolae* it is broadly oval.

***Holobomolochus attenuatus* (C. B. Wilson, 1913)**

Figs. 21-25

Bomolochus attenuatus C. B. WILSON, 1913: 198, pl. 21; WILSON, 1935: 335; WILSON, 1937: 29, SEWELL, 1949: 157; PEARSE, 1952: 12; PEARSE, 1952a: 194, 196; CAUSEY, 1953: 7; CAUSEY, 1960: 325; VERVOORT, 1962: 19; YAMAGUTI, 1963: 11, pl. 3 fig. 1.

Specimen received on loan from the U.S. National Museum and labelled "*Bomolochus attenuatus* Wilson, gills of *Scorpaena plumieri*, Montego Bay, Jamaica, Aug. 6, 1910. Acc. 58400. C. B. Wilson gift. U.S. Nat. Mus. 43511. 1 ♀ Type". This specimen, the holotype, is a 2.28 mm long adult female, in fair condition and with one of the ovisacs present. It has been figured and the appendages of the right side have been removed and mounted. The rest of the specimen, still in good condition, has been mounted as a Canada-Balsam slide.

Piscaderá Bay, CURAÇAO, 9.XII.1958. From the inside of the operculum of *Scorpaena plumieri* Bloch, taken from canasters. 33 ovigerous females, total length 2.16–2.44 mm (2.30 mm). Leg. J. H. Stock, no. 117.

Piscadera Bay, CURAÇAO, 16.XII.1958. From the inside of the operculum of *Scorpaena plumieri*, taken from canasters. Four ovigerous females, total length 2.16–2.28 mm (2.22 mm). Leg. Stock, no. 133.

Description of the female holotype. – The total length, from the end of the furcal rami to the frontal apex of the cephalic somite, including the rostral plate, is 2.28 mm; the greatest diameter, at the end of the cephalic somite, is 860 μ . The cephalic somite is 500 μ long and 860 μ wide; for the remaining thoracic somites these figures are: 176 and 675 μ for the second, 242 and 567 μ for the third, 135 and 324 μ for the fourth and 149 and 243 μ for the fifth somite. The genital complex is 257 μ long and 257 μ wide; for the remaining abdominal somites these figures are 257 and 176 μ for the third, 230 and 149 μ for the fourth and 162 and 135 μ for the fifth thoracic somite. The furcal rami are 122 μ wide and have a diameter of 54 μ at the base. The longest furcal seta is 608 μ . The ovisacs are 2.2 mm long and have a diameter of 160 μ .

The general shape of the body is distinctly cyclopoid (Fig. 21a), strongly contracted behind the fourth thoracic somite and with a long and slender abdomen. The head and the first thoracic somite are fused to form the cephalic somite; this is almost semi-circular, with rounded latero-caudal portions and with the extreme frontal part very slightly produced and truncated. The rostral plate is distinctly visible in dorsal view between the basal parts of the antennules; it appears as a broadly incised structure, curving ventrally and caudally, terminating in two sharp, diverging rostral points (Fig. 22a) visible through the tegument (Fig. 23a). There is no longitudinal median thickened ridge or deepened groove; the tegument of the cephalic somite is very thin and transparent. The second thoracic somite is visible dorsally as a fairly broad band with rounded edges, the flattened endopodite of the second pair of legs is visible laterally of the edge of the second thoracic somite which consequently, at superficial examination, may appear to be much broader than in reality it is. The third thoracic somite is slightly swollen dorsally, the swelling is produced backward on both sides of the median line and covers a small portion of the fourth thoracic somite; the exact shape appears in Fig. 21a, b. The fourth thoracic somite is slightly smaller than the preceding somite and has produced lateral parts with rounded extreme tips; the coxal and basal parts of the fourth pair of legs are exposed. The fifth thoracic somite is distinctly trapezoid.

The first and second abdominal somites are fused to form the genital complex (Fig. 23b); this somite is almost hexagonal in outline. The genital slits are visible on the latero-dorsal surface of the complex and are almost straight. Three setae are seen to protrude from each genital opening; they insert on a short, rounded

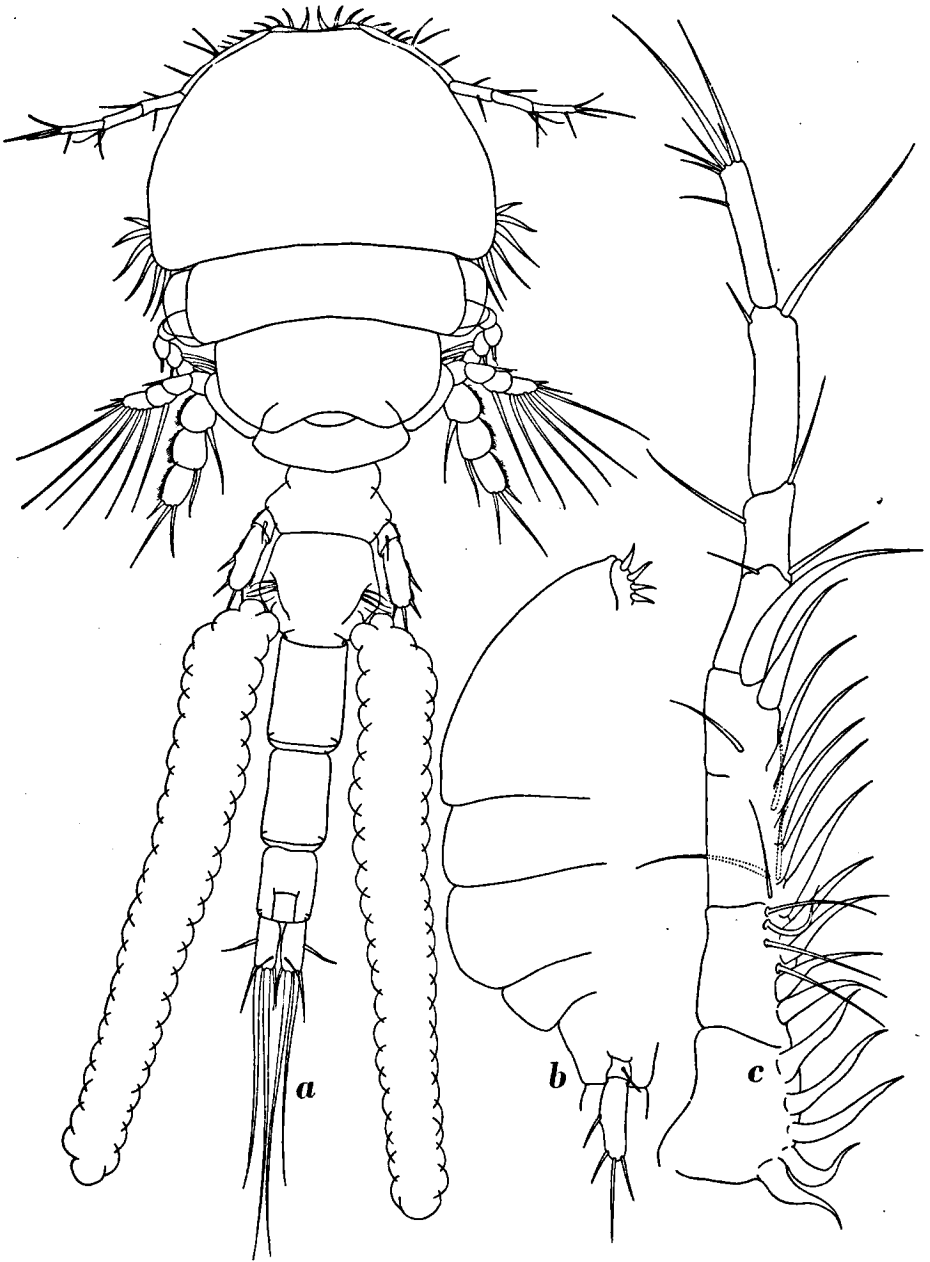


FIGURE 21. *Holobomolochus attenuatus* (C. B. Wilson), adult ♀, holotype, from *Scorpaena plumieri*. *a*, whole animal, dorsal view; *b*, whole animal, outline of back in lateral aspect; *c*, right antennule, ventral view. — *a*, *b*, × 55; *c*, × 220.



FIGURE 22. *Holobomolochus attenuatus*; adult ♀; holotype, from *Scorpaena plumieri*. *a*, left part of cephalic somite, ventral view; *b*, left furcal ramus, dorsal view; *c*, left antenna; *d*, left mandible, slightly turned; *e*, maxillule; *f*, left maxilla; *g*, left maxillipede. — *a*, *g*, × 135; *b*, × 220; *c*–*f*, × 395.

tubercle (sixth leg) visible through the tegument. The third and fourth thoracic somites are cylindrical; the third is slightly longer than the fourth. The anal somite too is a cylindrical structure and has an almost straight anal operculum. The furcal rami (Fig. 22b) are about twice as long as wide, with straight external and slightly swollen internal margins. There are 5 marginal setae and one appendicular seta on each ramus. Setae 1, 4, and 5 have the same length and are fairly short. Setae 2 and 3 are lengthened, the second being the longest. The furcal rami are completely nude.

The ovisacs, in the holotype, are extremely slender, being 2,200 μ long, which is only slightly shorter than the total body length; the diameter is 160 μ .

The antennules (Fig. 21c) are just visible in dorsal aspect of the holotype; they are fairly long, with the "flagellum" projecting far besides the cephalic somite. Each antennule has a 3-segmented basal part and a 3-segmented terminal part (flagellum). There are indications that the third segment of the basal portion is composed of two fused parts; the first segment of the flagellum (the fourth in the series) may also be composed of two parts. There are 15 almost equally developed setose setae on the basal portion of the antennule, the fifteenth seta only, is slightly enlarged. None of these setae has chitinized strips or parts. In addition there are four normal setae on the ventral aspect of segment 2, 2 setae on the ventral aspect of segment 3 and 3 on the dorsal aspect of that segment. The number of setae on the three segments of the flagellum is 4, 2, and 7, respectively.

The antennae and oral appendages occupy the usual position (Fig. 22a); the antennae are long and slender, the maxillipedes have comparatively short coxae and do not reach the lateral margins of the cephalic somite.

The antenna (Fig. 22c) has a long and slender coxa, the basis is fairly short. There is one seta at the articulation between basis and coxa, apparently inserting on the former. The endopodite is folded over the coxa; it is composed of two fused segments, the second being elongated to form a finger-shaped processus. Both are covered by densely packed, longitudinal rows of fine, needle-like spinules, continuing on the second segment up to the apex. In addition there is a pectiniform row of longer spinules, continuing on the lamelliform process, which is slightly shorter than the second endopodal segment. At the base of the lamelliform process a huge, curved hook inserts on the endopodite. In addition there are four more curved hooks and a short seta, inserting near the line of fusion of the two endopodal segments. The labrum is covered with fine, short spinules, particularly concentrated in two reniform areas, one on each side of the mid-ventral line. The cutting edge of the mandible is placed at the end of an elongated process, it is armed with a large, dagger-shaped tooth with sharp edges and a slenderer, though slightly shorter, setiform spine or tooth (Fig. 22d). The maxillule (Fig. 22e) is a small, rounded lobe with two heavy setae and one much shorter, fine seta. The paragnaths are small, heavily chitinized, curved structures, with the swollen base firmly attached to the tegument of the ventral body wall. The curved apex has a hyaline, chitinized carina. The maxilla (Fig. 22f) is armed with two heavy teeth, one of which is pointed, particularly heavy and set with some small spinules. The remaining tooth is smaller and spinulose at the apex.

The short coxa of the maxillipede (Fig. 22g) has a single seta. The basis is shaped like a flattened, triangular segment; the median margin carries two short, plumose setae inserting closely together. The claw is strongly sigmoid and provided with a large, sharp, additional spine. There is one plumose seta on the claw, inserting close to the, more or less separate, basal part of that claw.

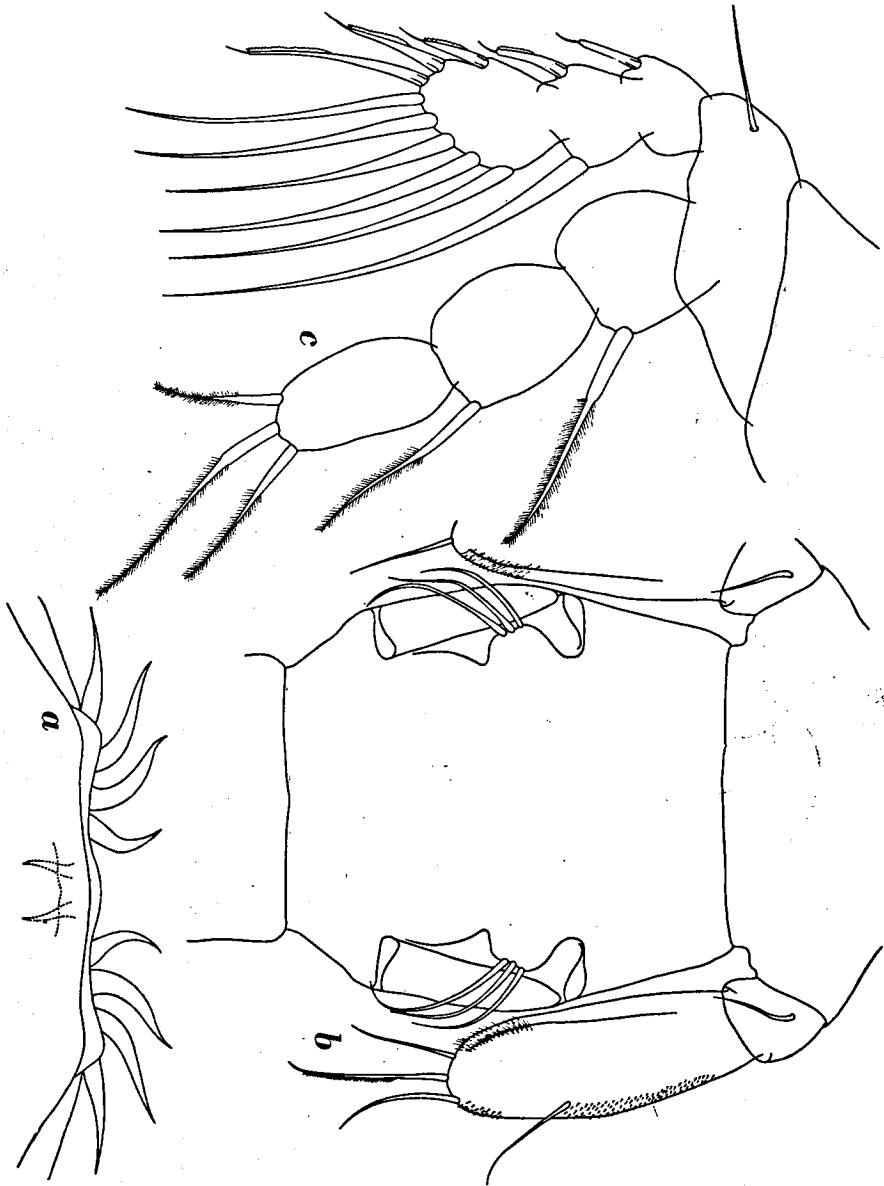


FIGURE 23. *Holobomolochus attenuatus*, adult ♀, holotype, from *Scorpaena plumieri*.
a, frontal part of cephalic somite, dorsal view; b, fifth thoracic somite and genital
complex, dorsal view; c, leg 4. - a-c, × 220.

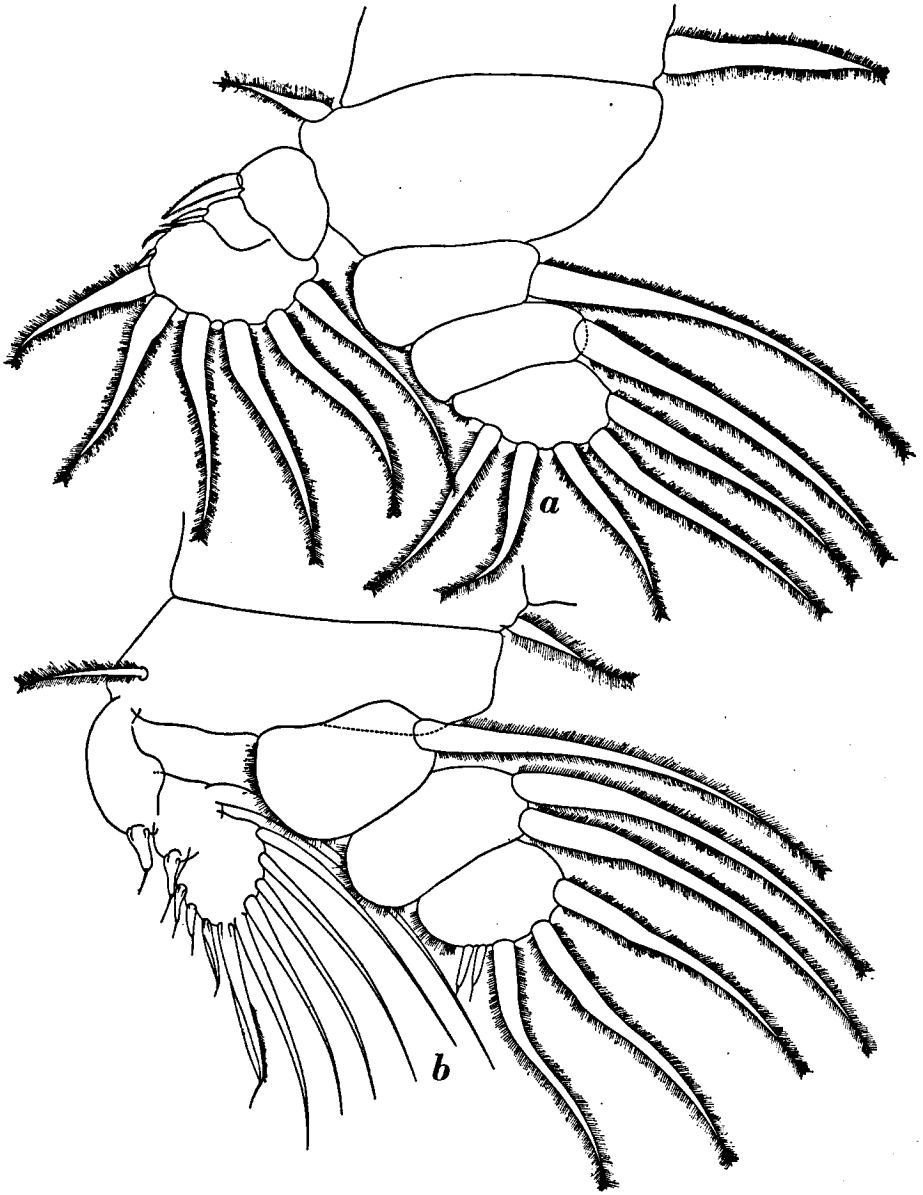


FIGURE 24. *Holobomolochus attenuatus*, adult ♀, holotype, from *Scorpaena plumieri*.
a, leg 1; b, leg 2. - a, b, × 220.

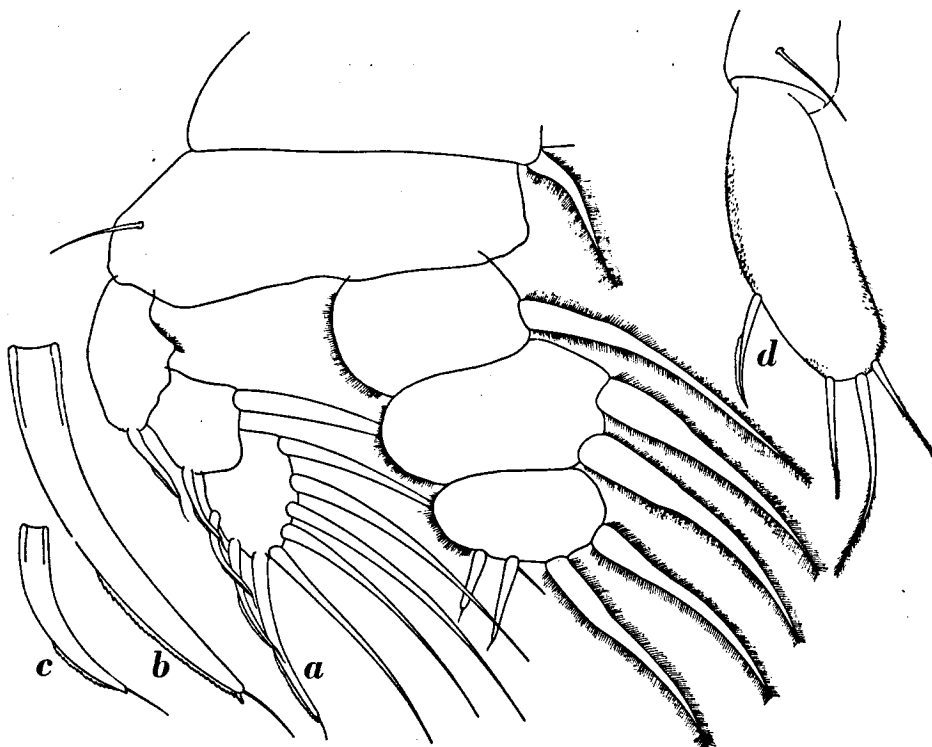


FIGURE 25. *Holobomolochus attenuatus*, adult ♀, holotype, from *Scorpaena plumieri*. a, leg 3; b, terminal exopodal spine of leg 3; c, first external marginal spine of exopodite of leg 3; d, left fifth leg. — a, d, $\times 220$; b, c, $\times 550$.

The first to fourth pairs of legs have the following spinal and setal formula:

	endopodite	exopodite
leg 1	1+0.1+0.5+0	0+I.0+I.6+III
leg 2	1+0.2+0.3+II	0+I.1+I.5+IV
leg 3	1+0.2+0.2+II	0+I.1+I.5+III
leg 4	1+0.1+0.1+1+I	0+I.1+I.5+III

Leg 1 (Fig. 24a). The internal margin of the coxa has a more or less modified, strongly plumose seta. At the external margin of the basis there is a short, strongly hairy seta. The segments of the exopodite are only partially fused, lines of fusion are still distinctly visible. Some of the spines at the external margin are small and almost setiform. The external margin of the endopodite is strongly hairy.

Leg 2 (Fig. 24b). There is a hairy seta at the internal margin of the coxa and the external margin of the basis. All the external marginal spines of the exopodite are flagellated; the two distal spines have a finely serrated hyaline lamella running

along part of their outer edge. The endopodite is flattened, with the external margin strongly hairy. The two short spines at the end of the endopodite are flagellated.

Leg 3 (Fig. 25a-c). A seta occurs at the external margin of the basis and the internal margin of the coxa. The external marginal spines of the endopodite are curved and flagellated; all outer edges have hyaline lamellae. The endopodite is flattened with hairy external margin; the two spines at the end of the endopodite, though flagellated, are fairly long and slender.

Leg 4 (Fig. 23c). No setae occur at the internal margin of the coxa; the external margin of the basis has a single seta. The external marginal spines of the exopodite are fairly long and slender; all are flagellated. With the exception of that on the first exopodal segment they are all provided with a hyaline lamella along the outer edges. The endopodite is normally developed and 3-segmented. The setae at the internal margin of the segments 1 and 2 are fairly short and almost spiniform. Three appendages occur at the apex of the third segment: two shorter spiniform setae flank a longer spine or seta. All appendages on the endopodite are hairy.

The fifth legs (Figs. 23b, 25d) consist of a short, cylindrical intermediate segment, bearing a single seta, and a slightly reniform terminal segment. The external margin of the terminal segment is hairy and has a single setiform spine with a finely serrated hyaline lamella along its outer edge. This setiform spine inserts at about two thirds the external margin from the apex. The apex of the segment has three setae, two of which are short and flank a longer seta. The terminal part of the internal margin is also hairy.

Remarks. - A comparison of the present description with WILSON's (1913: 198, pl. 21) description and figures shows the following differences:

Furcal rami. Only four setae are figured by WILSON (pl. 21 fig. 28) on each ramus; the internal seta and the appendicular seta have been overlooked.

Antennules. Though the antennules are not figured in detail only 12 plumose (sensory) setae are visible in WILSON's figure (pl. 21 fig. 28) of the whole animal.

Antenna. The large claw inserting near the lamelliform process is figured by WILSON (1913, pl. 21 fig. 29), but only 2 hooked spines are figured (4 being present).

Mandible. Only one appendage is mentioned on the cutting edge, 2 being in reality present.

Maxilla. This appendage is said to terminate in a single, smooth spine. Two of such spines are present and both are set with small spinules.

Maxillipede. The two setae at the internal margin of the basis are figured and described as spines.

Legs. There are small differences in the setation and spinulation of the legs, notably the first, second and fourth legs. The fifth legs are not described or figured.

The type host is *Scorpaena plumieri* Bloch, the type locality Montego Bay, Jamaica. Additional specimens have been recorded from the gills of *Scorpaena agassizii* Goode & Bean (Dry Tortugas, Fla., U.S.A., C. B. WILSON, 1935), from the gills of *Cheilichthys annulatus* (Jenyns) (San Francisco, Ecuador, C. B. WILSON, 1937), from the body cavity of *Lophius* spec. (Bahia Honda, Panama, C. B. WILSON, 1937), from the gills of a *Lophius*-like fish (Port Utria, Colombia, C. B. WILSON, 1937), from the gills of *Priacanthus arenatus* Cuvier & Valenciennes (PEARSE, 1952) and from the gills of *Gymnachirus texae* (Günther) (Port Aransas, Texas, U.S.A., PEARSE, 1952).

Holobomolochus attenuatus is very closely allied to *Holobomolochus palleucus* (C. B. WILSON, 1913: 200, pls 22, 23) recently redescribed by PILLAI (1967: 247, figs. 3, 4) from paratypes as *Bomolochus palleucus*. The general shape of the body is identical, though in *H. palleucus* the cephalothorax seems to be strongly swollen, with the second thoracic somite almost as wide as the cephalic somite. The swollen condition of the cephalothorax, however, may be largely brought about by strong development of the ovaries. There is also general conformity in the structure of the appendages, so much so that I would have been inclined to unite both species but for the following (small) differences:

Maxillule. PILLAI emphatically describes and figures four setae on that appendage; only three are present in the holotype of *H. attenuatus*.

Paragnaths. These appendages in *H. attenuatus* seem to be more strongly curved than they have been figured by PILLAI (1967, fig. 3 no. 6) in *H. palleucus*. This, however, may be largely due to differences in position during observation.

Maxillipede. No setose seta seems to be present at the base of the claw in *H. palleucus*.

Leg 1. Only 5 plumose setae occur at the exopodite of *H. palleucus*

(PILLAI, 1967: 251, fig. 4 no. 1). Six of such setae are present in *H. attenuatus*.

Leg 6. Four setae are present in *H. palleucus* (cf. PILLAI, 1967, fig. 3 no. 9), three of such setae occur in *H. attenuatus*.

H. palleucus has exclusively been found on the gills of *Scorpaena plumieri* Bloch in June and July, 1910; the type locality is Montego Bay, Jamaica. The type lot is in the U.S. National Museum, registered under no. 42252.

The specimens from Piscadera Bay, Curaçao, collected by Dr. STOCK, are in perfect agreement with the description of the holotype. Because of the great resemblance of *H. attenuatus* with *H. palleucus* some specimens from each lot have been inspected very carefully. They all appeared to belong to *H. attenuatus* because of the following particulars:

1. Three setae occur on the maxillule of all specimens examined, agreeing with the number observed in the holotype.
2. The claw of the maxillipede has a distinct, basal, setose seta.
3. The exopodite of leg 1 has 6 plumose setae in all specimens studied.
4. Three setae are present on the sixth legs of all specimens referred to *H. attenuatus*.

Holobomolochus albidus (C. B. Wilson, 1932)

Figs. 26-29

Bomolochus albidus C. B. WILSON, 1932: 282, pl. 23 figs. c-j; PEARSE, 1952, 196; STOCK, 1953: 12, figs. 45-47, YAMAGUTI, 1963: 11.

Five adult, partly ovigerous females, labelled "*Bomolochus albidus* Wilson, Woods Hole, Mass., 5 July 1923. Gill chamber of *Lophius piscatorius*. U.S. nat. Mus. no. 59770 (acc. no. 109492)". Total length of the specimens 1.53-1.55 mm (1.54 mm).

Two adult, non-ovigerous females, labelled "*Bomolochus albidus* Wilson, Woods Hole, Mass., 15 Aug. 1950. From *Lophius piscatorius* Linn. Coll. + don. A. S. Pearse. U.S. Nat. Mus. no. 91200 (acc. no. 188021)". These females measure 1.03 and 1.22 mm total length, respectively. The specimens are much shriveled and of a brownish colour; they may have been dried out, which accounts for the great reduction in length.

The following description is based on a 1.55 mm long, non-ovigerous female; this specimen has been dissected and the appendages mounted in "Berlese".

Adult *female*. – The total length, measured from the tip of the rostral plate to the end of the furca, is 1.55 mm; the greatest diameter, at the cephalic somite, is 716 μ . The cephalic somite, including the rostral plate, is 446 μ long and 716 μ wide. For the remaining cephalic somites these figures are: 189 and 513 μ for the second; 176 and 405 μ for the third; 77 and 215 μ for the fourth and 121 and 160 μ for the fifth thoracic somite. The genital complex is 165 μ long and 182 μ wide. The third abdominal somite is 121 μ long and 138 μ wide; the fourth 99 μ long and 132 μ wide, and the fifth 88 μ long and 61 μ wide. The furcal rami are 72 μ long and have, at the articulation with the anal somite, a diameter of 44 μ . The longest furcal seta is 578 μ long. The egg sacs are 990 μ long and 170 μ wide.

The general shape of the body is cyclopoid, with broadly rounded, fairly wide cephalic somite and the remaining somites gradually diminishing in width (Fig. 26a). The lateral parts of the thoracic somites are broadly rounded, the incisions between the various somites of the thorax are fairly deep, so that part of the coxae of the legs are exposed. The fifth thoracic somite is particularly long and slender; the abdomen is long.

The head and the first thoracic somite are fused to form the cephalic somite. The anterior portion of the cephalic somite is broadly and evenly rounded with frontally the rounded prominence of the rostral plate, visible between the basal portions of the antennules. The lateral parts of the cephalic somite are slightly swollen and project slightly beyond the ventral margin of the somite. In lateral view the back appears to be smoothly curved (Fig. 26b). Thoracic somites two and three have about the same length; the lateral parts are broadly rounded. The third thoracic somite is distinctly backward produced, particularly the latero-caudal parts, covering a small portion of the fourth thoracic somite. The mode of production of the third somite varies slightly in the specimens inspected and apparently depends upon the condition of the ovaries. The fourth thoracic somite is visible as a narrow, rounded strip in the dorsal aspect of the animal. The fifth thoracic somite, in this, as well as in the other specimens, is elongated, with latero-caudally a pair of very distinct "shoulders", serving the attachment of the fifth legs.

The genital complex, resulting from fusion of the first two abdominal somites, is almost globular, with broadly rounded sides (Fig. 29a). The genital openings are visible on the dorso-lateral side and are covered by a small flap. Three setae project through each genital slit (Fig. 28f) and are seen to insert on a communal base (leg 6). The third abdominal somite is cylindrical; the fourth is slightly swollen. The cylindrical fifth (anal) somite has a distinct, straight anal plate. The furcal rami narrow very slightly and are almost parallel; they are nearly twice as long as wide (Fig. 26d). Each ramus has 5 marginal setae and one dorsal (appendicular) seta. Setae 2 and 3 are lengthened, particularly the second.

The egg sacs are elongated, sausage-shaped structures, composed of a very large number of small eggs (Fig. 26c).

The antennules are visible in dorsal view of the animal, only a small strip of the basal portion is covered by the cephalic somite. Between the basal portions of the antennules the rostral plate curves downward and backward; the free margin is provided with two sharp, conical rostral points with swollen bases (Fig. 27a).

Each antennule is composed of a 3-segmented basal part and a 3-segmented

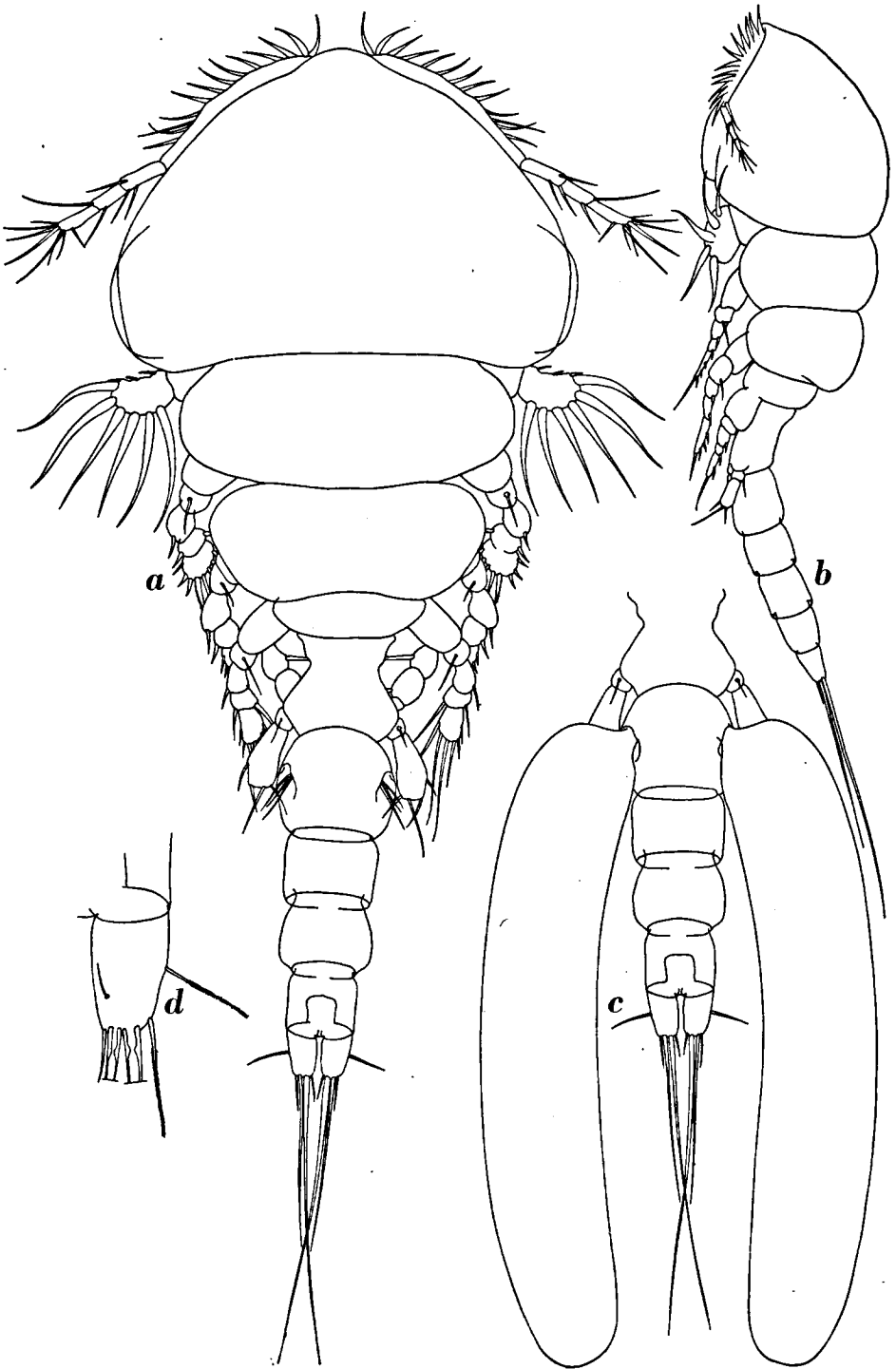


FIGURE 26. *Holobomolochus albidus* (C. B. Wilson), adult ♀, from *Lophius piscatorius* L. *a*, whole animal, dorsal view; *b*, whole animal, lateral view from left side; *c*, abdomen with egg sacs, dorsal view; *d*, right furcal ramus, dorsal view. — *a*, *c*, × 90; *b*, × 55; *d*, × 240.

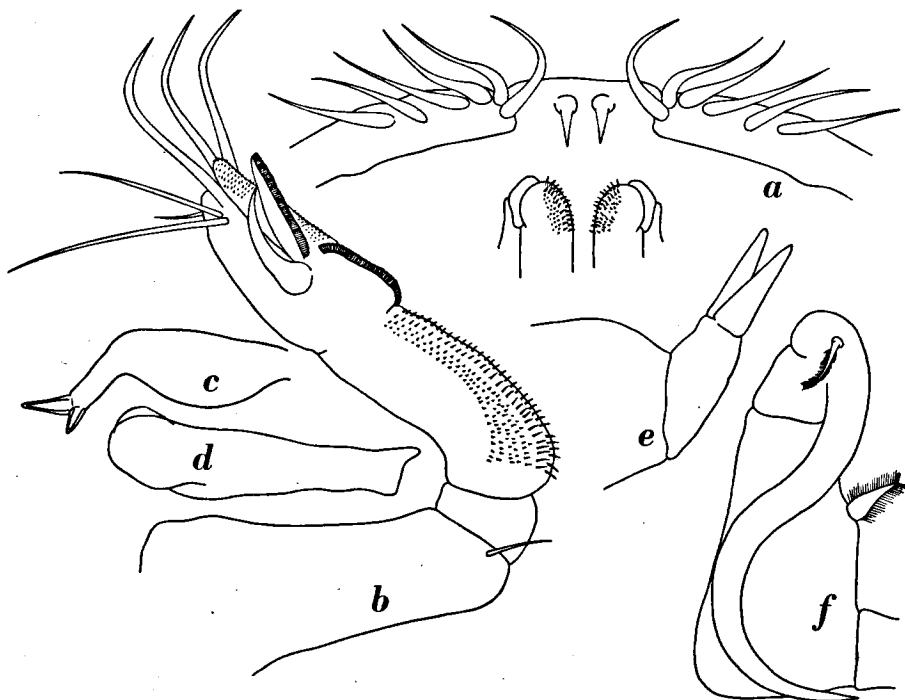


FIGURE 27. *Holobomolochus albidus*, adult ♀, from *Lophius piscatorius*. *a*, frontal part cephalic somite, ventral view; *b*, right antenna; *c*, mandible; *d*, paragnath; *e*, maxilla; *f*, maxillipede. — *a*, 240; *b-f*, × 395.

flagellum. In this species there are no chitinized plates covering the basal part of the antennules, so that its structure is not obscured; the first antennular segment only seems to be attached to the cephalic somite. There are 15 plumose (sensory?) setae on the antennular base, five on each segment. All plumose setae are normally developed; the fourth plumose seta has no chitinized structures but it is folded backward. In addition there are some normal setae, the position of which is indicated in Fig. 29b. The number of normal setae on the flagellum is 3, 3, and 6, respectively.

The antennae (Fig. 27b) in this species, are large, with big, strongly developed coxae and a long, thick endopodite. There is a fine seta at the end of the coxa; the basis is short. The endopodite is remarkable by the presence of a distinct line of fusion between both endopodal segments. There is a distinct lamelliform process on the second endopodal segment, covered by a pectiniform row of slender spinules. This row of spinules continued on a slightly raised part or lobe of the second endopodal segment. A strong spine occurs near the insertion of the lamelliform process. The finger-shaped prolongation of the second endopodal segment is short, reaching

only slightly beyond the insertion of the three hooked, spiniform setae. In addition to these hooked setae there are three normal setae. The first endopodal segment is partly covered with longitudinally arranged rows of long, acute spinules, continuing on the finger-shaped process. The longitudinal arrangement of the spinules is obscured on the basal part of the endopodite.

I could not observe the oral appendages in situ, as they were covered by the large antenna in all specimens. The caudal margin of the labrum was seen to cover the mandibles, but I could not observe its structure.

The cutting edge of the mandible (Fig. 27c) has two triangular teeth with sharp edges, placed at the end of an elongated part of the mandible. The paragnath (Fig. 27d) is clavate, with slightly swollen apical portion, bearing a hyaline lamella. The maxillule is a rounded lobe, carrying 2 strong setae and one finer seta. The maxilla (Fig. 27e) has two strong, triangular teeth, that are apparently nude.

The maxillipedes (Fig. 27f) occupy the usual position laterally of the oral parts. They are remarkable by the elongated, only slightly triangular basis and short coxa. There is a very long, S-shaped claw without auxiliary tooth and inserting on a separate, short segment apparently articulating with the basis. In addition there is a fine, plumose seta at the base of the claw and a short, spinulose, triangular seta halfway the internal margin of the basis.

The legs have the following setal and spinal formula:

	endopodite	exopodite
leg 1	1+0.1+0.5	0+I.1+I.5+II
leg 2	1+0.2+0.3+II	0+I.1+I.5+IV
leg 3	1+0.2+0.2+II	0+I.1+I.5+III
leg 4	1+0.1+0.1+1+I	0+I.1+I.5+III

Leg 1 (Fig. 28a). The internal corner of the coxa has a flattened, hairy seta with slightly thickened base. There is a small seta at the external corner of the basis. The three exopodal segments are distinctly separate. Both exo- and endopodite are not so extremely flattened as is usual in this genus; moreover, they are not so strongly laterally produced.

Legs 2 to 4 have 3-segmented exo- and endopodites. There is a hairy seta at the internal corner of the coxa and a fine, nude seta at the external corner of the basis. The external marginal spines on the exopodites are incised at the apex and carry a fine flagellum; the external margin is finely spinulose. The apical spine at the exopodite is also flagellated; its external margin is set with large, triangular teeth.

Leg 2 (Fig. 28 b-d) The endopodite is enlarged and flattened; there are two setae at the internal margin of the second endopodal segment; the apical segment has three strongly plumose setae and two short spines.

Leg 3 (Fig. 28c). The endopodite, as in leg 2, is enlarged and flattened; there are two setae at the internal margin of the second endopodal segment, but the apical (third) endopodal segment has 2 setae and 2 spines.

Leg 4 (Fig. 28d). The endopodite is lengthened; the setae at the internal margin of endopodal segments 1 and 2 are spiniform. The third endopodal segment has two short spines flanking a longer, setiform spine. No seta has been observed at the internal corner of the coxa.

The intermediate segment of leg 5 has a single, fine seta. The apical segment is spatulate and carries 4 marginal setae, the position of which appears from Fig. 28e.

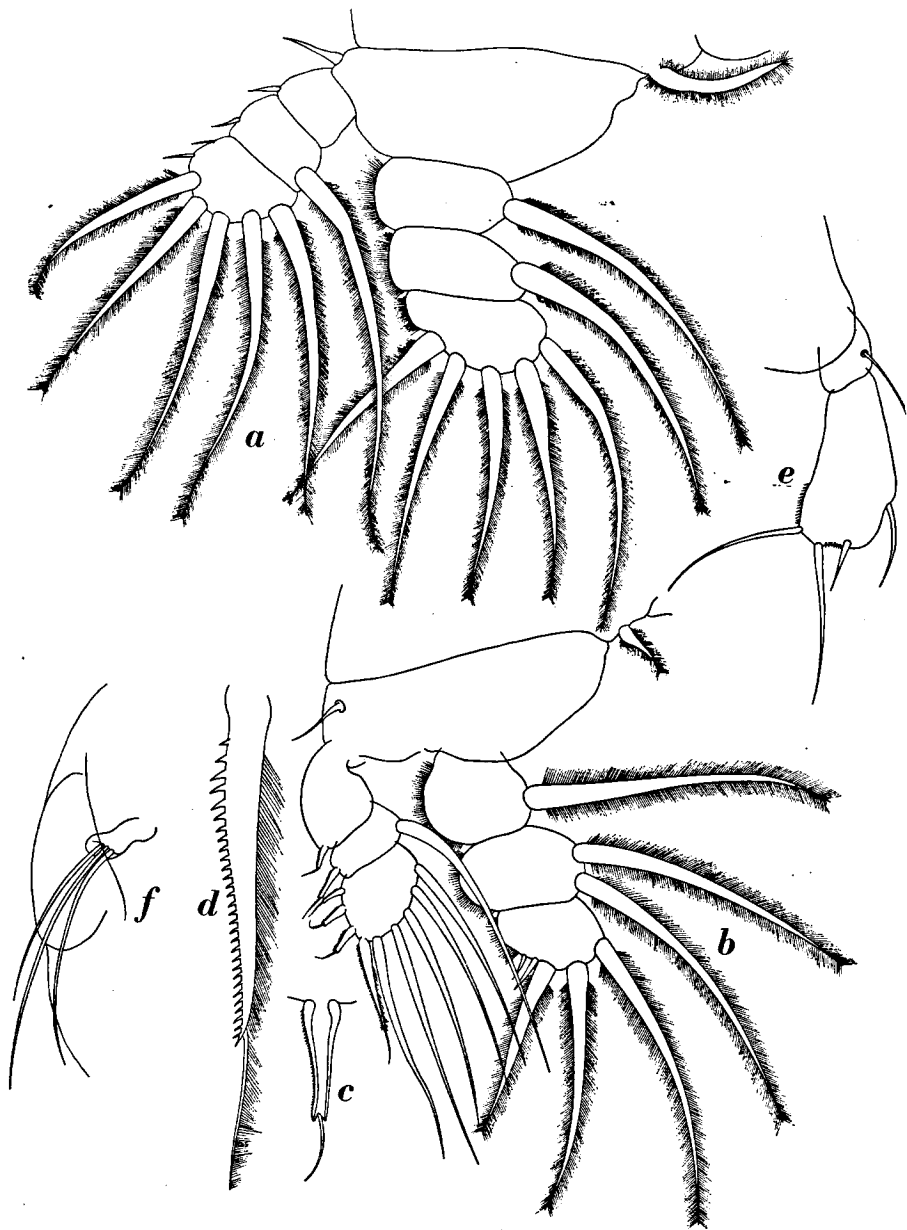


FIGURE 28. *Holobomolochus albidus*, adult ♀, from *Lophius piscatorius*. *a*, leg 1; *b*, leg 2; *c*, second external marginal spine of third exopodal segment of leg 2; *d*, terminal exopodal spine of leg 2; *e*, right fifth leg; *f*, left part of genital complex and sixth leg. — *a*, *b*, × 220; *c*, *d*, × 550; *e*, *f*, × 240.

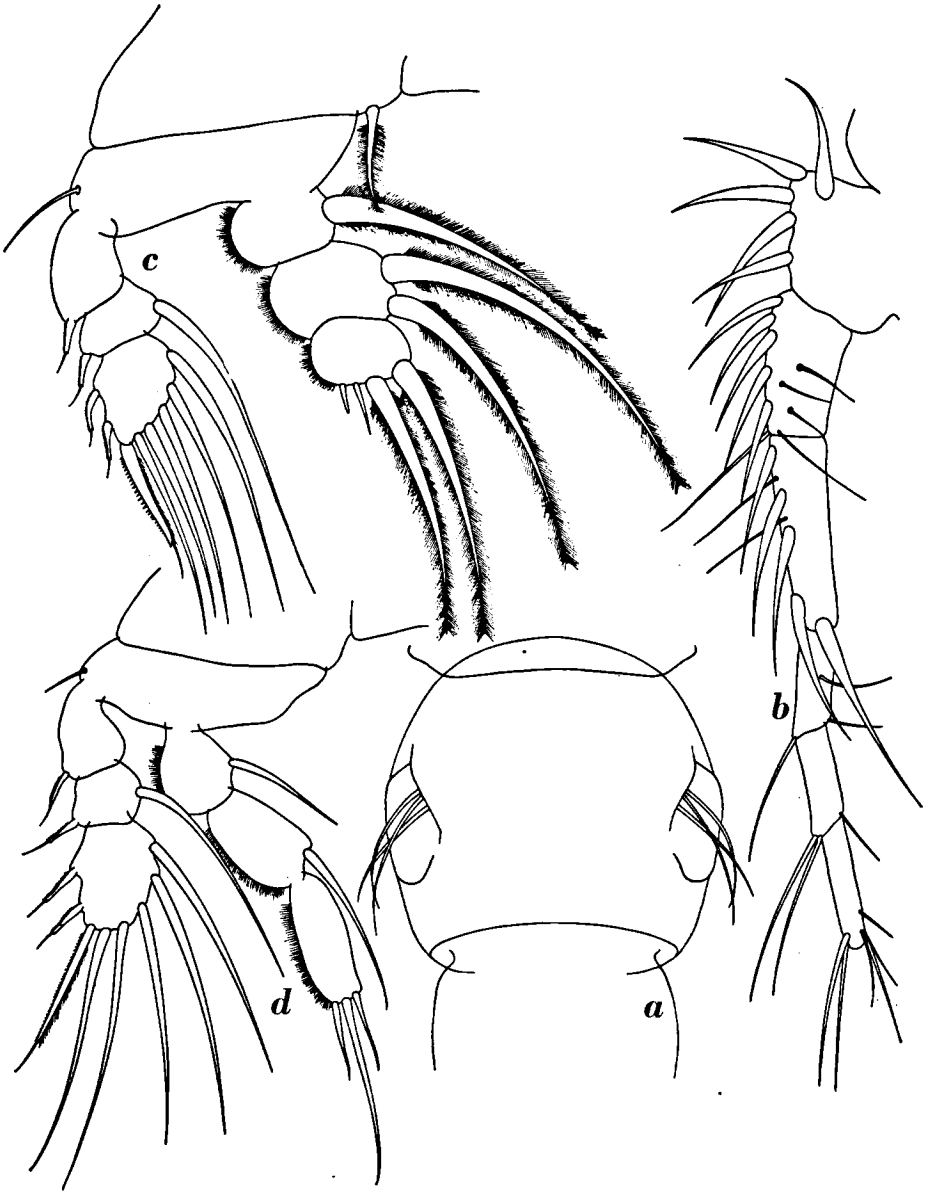


FIGURE 29. *Holobomolochus albidus*, adult ♀, from *Lophius piscatorius*. a, genital complex, dorsal view; b, right antennule, ventral view; c, leg 3; d, leg 4. — a, b, × 240; c, d, × 220.

The terminal part of the external margin and a portion of the apical margin are set with fine spinules.

The *maie* of this species is unknown.

This species exclusively occurs on the gills of *Lophius piscatorius* L. and so far it has only been found in the western part of the Atlantic Ocean (Woods Hole region).

Remarks. — The parasitic Copepod *Bomolochus albidus* was described by C. B. Wilson (1932: 382) from the gill chambers of *Lophius piscatorius* L. examined at Woods Hole. The species was found abundantly and occurred "fastened to the skin in the little pocket above each pelvic fin", but did not occur elsewhere. A single female specimen was selected by WILSON as the holotype and deposited in the U.S. National Museum under no. 60589; the remaining female paratypes were registered under no. 60590. Dr. THOMAS E. BOWMAN, to whom I am indebted for the loan of some of WILSON's material of this species, wrote to tell me that WILSON's holotype, no. 60589, could not be traced; neither could WILSON's batch of paratypes, no. 60590, be found. The specimens discussed below belonged to a batch of specimens, numbered 59770, also identified by C. B. WILSON and collected from the gill chambers of *Lophius piscatorius* at Woods Hole on 5 July 1923. I could also study some specimens from the same area and the same host, collected by A. S. PEARSE (vide supra).

Though *Bomolochus albidus* can easily be recognized from WILSON's description (the structure of the maxillipede and the first pair of legs is highly characteristic), it has never completely been described. Some of the appendages of this species were figured by STOCK (1953, figs. 45–47), who saw part of WILSON's material. I particularly wanted to study the antennular structure and the shape of the first pair of legs.

Discussion. — This species has several remarkable features, that could possibly be considered as primitive characters. First of all it is remarkable by the condition of the antennules, where chitinized plates are absent and all plumose (sensory) setae are normally and uniformly developed. The first pair of legs is not yet

strongly deformed; it has retained the characters of a normally developed Cyclopoid first leg, with coxa, basis, and 3-segmented exo- and endopodite. The hairy flap at the internal corner of the coxa is here present too; it is still distinctly setiform, with a slightly swollen basal part and flattened apical part. The hairy flap, occurring at that position in other Bomolochids, has certainly evolved from a plumose seta.

The condition of the endopodite of the antenna seems to suggest that originally this endopodite is composed of 2 segments separated by a more or less distinct articulation. The lamelliform process is borne by the second endopodal segment; part of the top of the segment may be elongated to form a finger-shaped process.

The maxillipede is remarkable by the comparatively weak development of the triangular "basis". There is a distinct line separating the top part of the triangular base from the rest of the segment, suggesting that the triangular, robust segment in other Bomolochids is in reality composed of two fused segments. The number of setae is two (as in *Nothobomolochus*), one occurring on the claw, the other, a short, squat structure, at the middle of the external margin. The claw is very long and S-shaped, round in cross section, without a trace of an auxiliary spine. In the other Bomolochids it is strongly flattened and usually much shorter.

There can be no reasonable doubt that this is a species of *Holobomolochus*; in this genus it occupies an unique position because of the retention of several "primitive" characters.

***Holobomolochus scutigerulus* (C. B. Wilson, 1935)**

Figs. 7d, 30–36

Bomolochus scutigerulus C. B. WILSON, 1935: 335, pl. 2 figs. 14–22; SEWELL, 1949: 157; STOCK, 1953: 12; YAMAGUTI, 1963: 12, pl. 3 fig. 4.

Bomolochoides scutigerulus, VERVOORT, 1962: 30.

Piscadera Bay, CURAÇAO, 5.XII.1958. From the median wall of the gill chamber of *Upeneus maculatus* (Bloch). Two adult females (one ovigerous) 1.53 and 1.64 mm and one adult male attached to the abdomen of the ovigerous female. Leg. J. H. Stock, no. 114A.

The description is based on the ovigerous female and the male, both of which have been dissected. The appendages are mounted on slides.

Adult *female*. — Total length (from apex of rostrum to end of furca) 1.64 mm; greatest diameter (at the cephalic somite) 1 mm. The cephalic somite is 419 μ long and 999 μ wide; for the remaining thoracic somites these figures are: 338 and 850 μ for the second; 284 and 601 μ for the third; 176 and 338 μ for the fourth, and 135 and 243 μ for the fifth somite. The genital complex is 216 μ long and 473 μ wide; for the remaining abdominal somites these figures are: 95 and 243 μ for the third; 68 and 216 μ for the fourth; 95 and 176 μ for the fifth somite. The furcal rami are 68 μ long and have a basal diameter of 81 μ . The longest furcal seta is 210 μ . The ovisacs are 837 μ long and 270 μ wide; the eggs are large. The general shape of the body is characterized by the fairly broad, oval cephalothorax and the very short abdomen (Fig. 30a). The head and the first thoracic somite are fused to form the cephalic somite, the frontal outline of which is broadly rounded. Both sides of the cephalic somite terminate in a backward produced, rounded lappet. The extreme frontal part of the cephalic somite is set off from the rest of the somite as a flattened, frontal portion, carrying a rounded rostral plate, visible from above as a rounded process between the antennular bases. The rostral plate curves downward and backward and terminates in a bifid point, the apices of which are acutely pointed and not strongly diverging (Fig. 33a). The second thoracic somite is visible dorsally as a fairly broad strip with truncated sides, covering the basal and coxal portions of the second pair of legs. It is slightly narrower than the cephalic somite. The third thoracic somite is more or less trapezoid, narrower than the second; the coxae of the third pair of legs are exposed. The fourth thoracic somite is visible as a small, shield-shaped structure, leaving the bases and coxae of the fourth pair of legs completely exposed. The fifth thoracic somite is trapezoid, with distinct shoulders for the attachment of the fifth pair of legs; it is almost as broad as the fourth thoracic somite.

The first and second abdominal somites are fused to form the genital complex. This too is a trapezoid structure (Fig. 31a), slightly smaller than the preceding somite. The genital slits are visible on the latero-dorsal parts of the complex and are covered by genital flaps, cut off squarely at the sides. The abdominal somites three and four are slightly tapering, cylindrical structures. The shape of the anal somite can best be judged from Fig. 31a; the anal flap is broadly rounded. The furcal rami are slightly broader at the base than they are long; there are five marginal setae and one appendicular (dorsal) seta. The setae 1, 4, and 5 are short and fine; the fifth inserts at about the middle of the external margin. Setae 2 and 3 are lengthened and thickened; the second (the longest) has about the same length as the abdomen.

Three setae protrude from each genital slit (Fig. 32a); the sixth leg, on which they insert, is very indistinctly visible through the tegument.

The antennules (Fig. 30c) are visible from above; they are composed of a basal portion and a 3-segmented flagellum. The basal portion is composed of three distinctly separate segments, the first of which is large and firmly attached to the chitinized structures of the ventral thoracic margin. The basal antennular part carries 15 plumose, sensory appendages, 3 normal marginal setae and 5 smaller setae. All sensory setae are equally developed; none of these is reinforced. The number of setae on the flagellum is 3, 3, and 5, respectively.

The antennae (Fig. 31b) occupy the usual position; they are very slender, particularly the endopodite. The coxa is fairly long; the basis, which is short, has two small setae. The two endopodal segments are fused, the second is elongated. Both are covered with irregularly distributed, fine spinules. In addition there is a closely packed, pectiniform row of spinules, continuing on the lamelliform process. A strongly

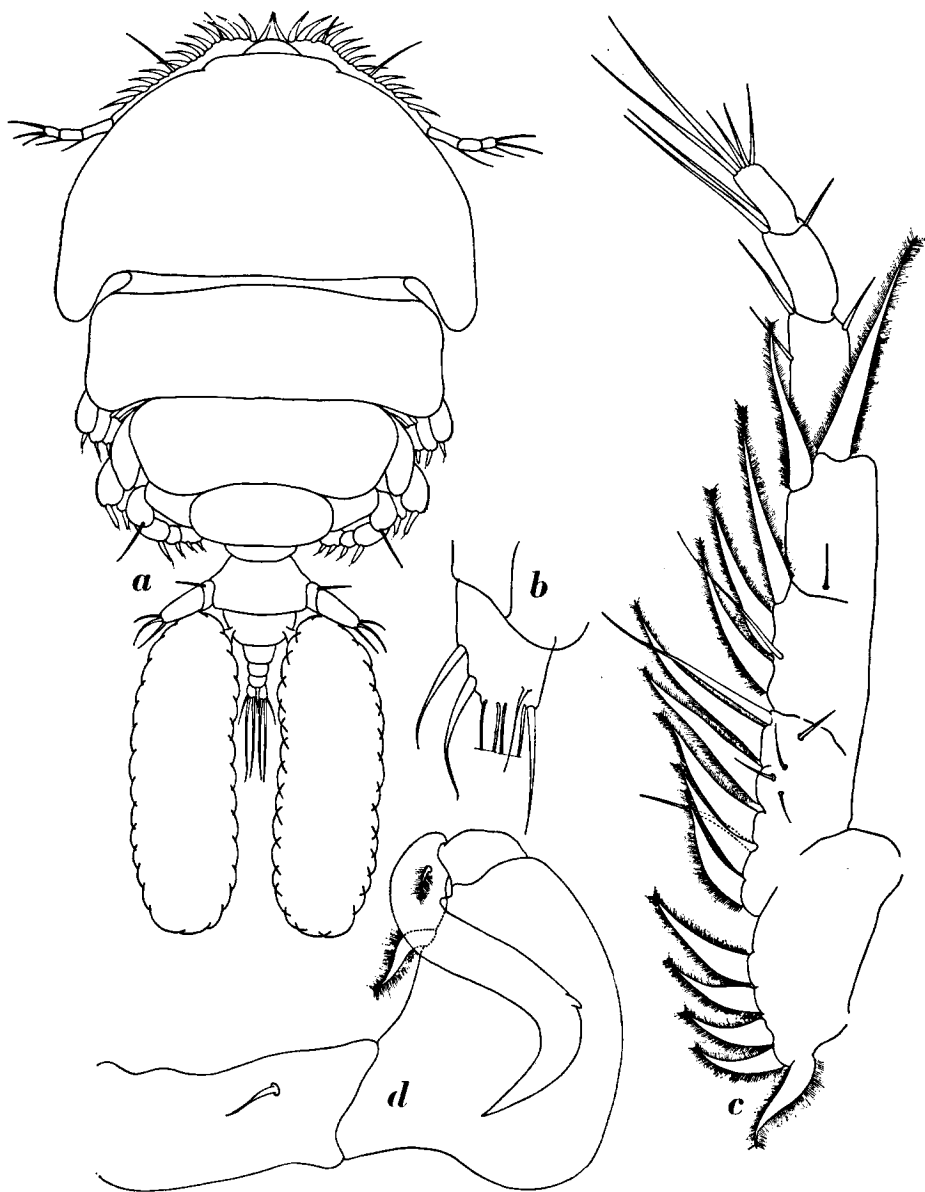


FIGURE 30. *Holobomolochus scutigerulus* (C. B. Wilson), adult ♀, from *Upeneus maculatus* a, whole animal, dorsal view; b, left furcal ramus, dorsal view; c, left antennule, ventral view; d, left maxillipede. - a, $\times 55$; b, $\times 395$; c, $\times 220$; d, $\times 240$.

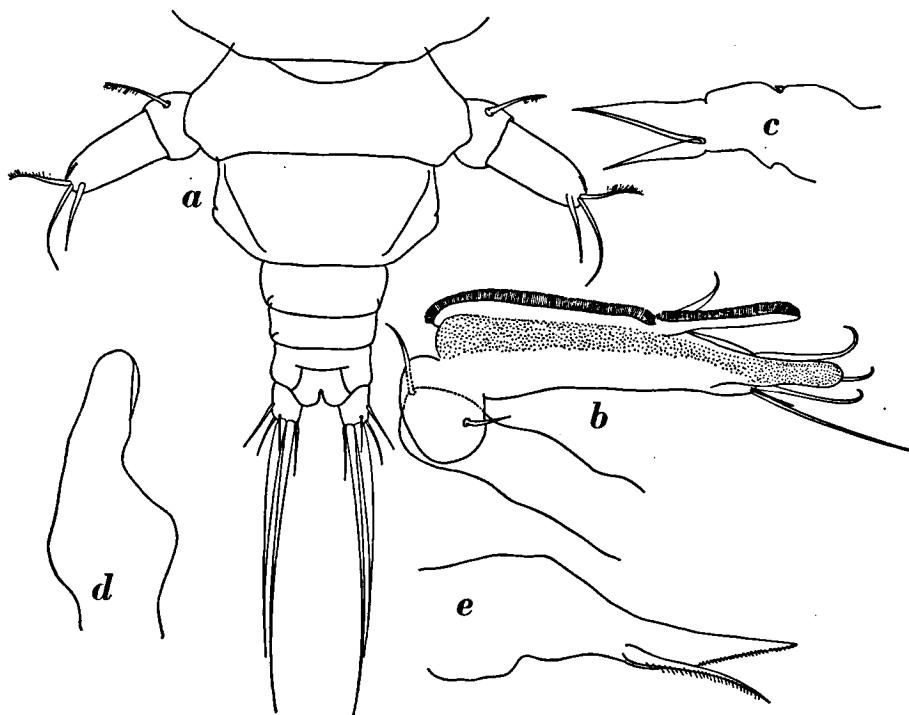


FIGURE 31. *Holobomolochus scutigerulus*, adult ♀, from *Upeneus maculatus*. *a*, fifth thoracic somite and abdomen, dorsal view; *b*, left antenna; *c*, left mandible; *d*, left paragnath; *e*, right maxilla. — *a*, $\times 135$; *b*, $\times 240$; *c*, *d*, *e*, $\times 395$.

curved hook is observed near the insertion of the lamelliform process. Near the place of fusion of the two endopodal segments three hooked spines and two setae can be observed; one of the setae is very small. Labrum and labium are covered with fine hairs. The cutting edge of the mandible (Fig. 31c) is elongated and carries a large triangular tooth with sharp edge. In addition there is a smaller spine or tooth near the insertion of the above-mentioned tooth. The maxillule is a small, rounded structure with three setae. The shape of the paragnath can best be judged in Fig. 31d; the basal portion is swollen, the apical part is finger-shaped with a sharp, caudal edge. The maxilla (Fig. 31e) has a large, triangular, spiniform tooth with haired caudal margin; in addition there is a hairy seta. The caudal wall of the oral field, near the insertion of the maxillae, carries a paired, rounded prominence (the "pad" mentioned by C. B. WILSON). Between the two prominences the raised wall of the oral field has a fairly deep, rounded incision. In contrast to Wilson's observation the surface of the prominences is completely smooth. The maxillipedes occupy a lateral position (Figs. 30d, 33a) and have long, slender coxae, so that the lateral wall of the basis almost touches the lateral body wall. One seta is to be ob-

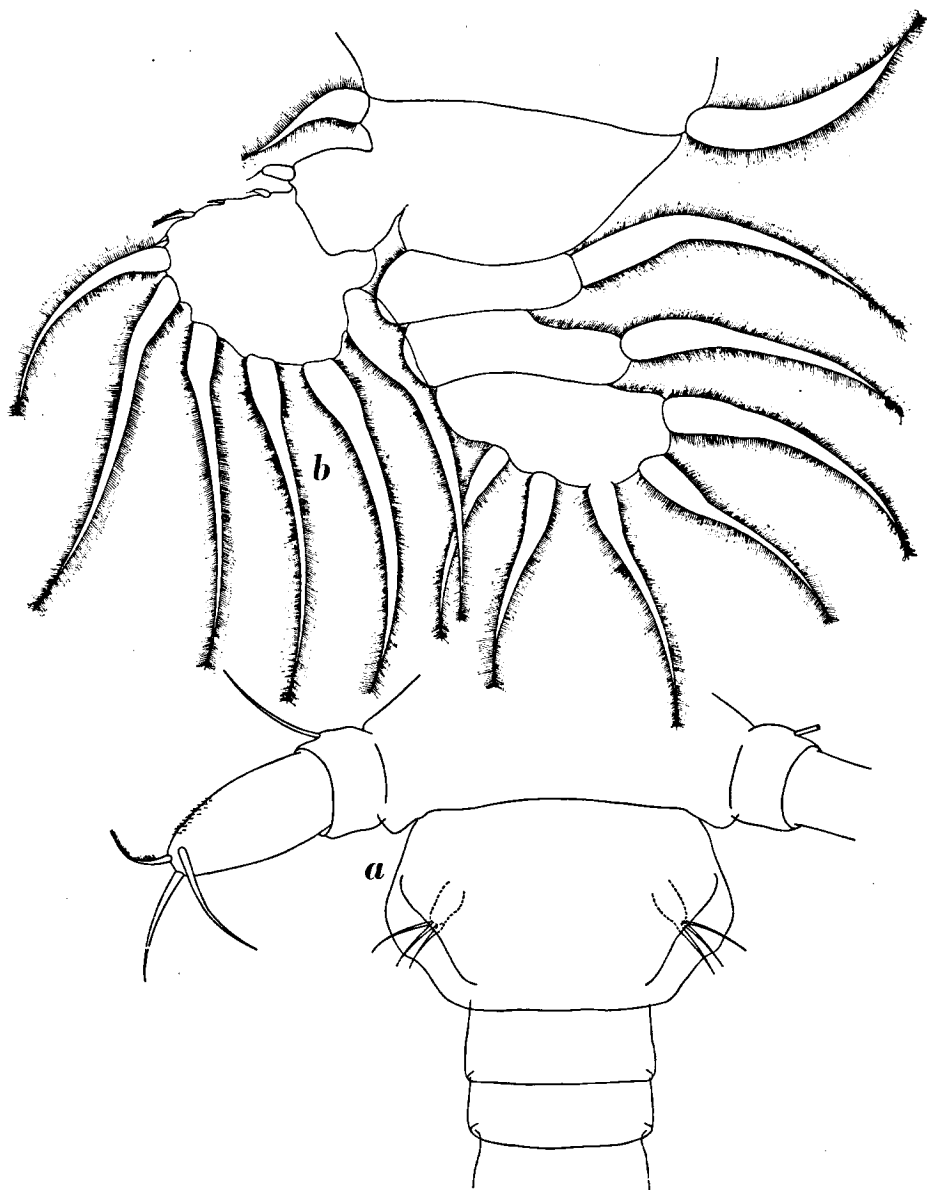


FIGURE 32. *Holobomolochus scutigerulus*, adult ♀, from *Upeneus maculatus*. *a*, fifth thoracic somite and anterior part abdomen, dorsal view; *b*, leg 1. — *a*, *b*, × 220.

served on the coxa. The basis is broad and triangular, bearing a single hairy seta. The claw is fairly slender, strongly curved and with a small additional spinule, which is much less chitinized than the rest of the claw. The basal part of the claw carries a small, hairy seta. The basal part of the claw is distinctly set off from the remaining portion.

The legs 1 to 4 have the following spinal and setal formula (spines in roman numerals, setae in arabic):

	endopodite	exopodite
leg 1	1+0.1+0.5	6+V
leg 2	1+0.2+0.3+II	0+I.1+I.5+III
leg 3	1+0.2+0.2+II	0+I.1+I.5+III
leg 4	1+0.0+0.1+1+I	0+I.1+I.5+III

The internal margin of the coxa of leg 1 (Fig. 32b) has a flattened, setose seta. The external margin of the basis has a thick, plumose seta. Both exo- and endopodites are flattened. The first segment of the exopodite is imperfectly separated from the rest of the appendage; it has a distinct, flagellated spine at the external margin. The fused first and second exopodal segments have six plumose setae and 4 short spines or spiniform setae at the external margin. The external margin of the endopodite is hairy.

The legs 2 and 3 have greatly flattened endopodites. Both have a plumose seta at the internal margin of the coxa and a fine seta at the external margin of the basis. The external surface of the first exopodal segment is covered with sharp teeth.

The external marginal spines of the exopodite of leg 2 (Fig. 33b) are flagellated. The third exopodal segment is deeply incised. The second endopodal segment has 2 setae at the internal margin. The third endopodal segment has three plumose setae and two short, flagellated spines.

The external marginal spines of the exopodite of leg 3 (Fig. 34a) are spurred and flagellated; the margins are nude. The third exopodal segment is not incised. The second endopodal segment has two internal setae; the third endopodal segment has 2 setae and 2 flagellated spines.

The first exopodal segment of leg 4 (Fig. 34c) is covered with small, sharp spinules; the external marginal spines of exopodal segments 2 and 3 are spurred and flagellated. The third exopodal segment is deeply incised (Fig. 34d). The seta at the internal margin of the first endopodal segment is small and spiniform. The second endopodal segment has no internal seta. The third endopodal segment has a terminal spiniform seta flanked by two small spines.

The fifth legs consist of a short intermediate segment and a finger-shaped apical segment. The cylindrical intermediate segment has a single external seta. The apical segment has three setae, the arrangement of which appears from Fig. 32a.

The intercoxal plate of the third pair of legs has a curious, paired structure (Fig. 34b), comparable to a circular pad covered with small tubercles or teeth and apparently serving the attachment of the parasite to the host.

The ovisacs are elongated, sausage-shaped structures, about twice as long as the abdomen. The eggs are large.



FIGURE 33. *Holobomolochus scutigerulus*, adult ♀, from *Upeneus maculatus*. *a*, left part of cephalic somite, ventral view; *b*, leg 2. - *a*, $\times 135$; *b*, $\times 220$.



FIGURE 34. *Holobomolochus scutigerulus*, adult ♀, from *Upeneus maculatus*. a, leg 3; b, intercoxal plate of leg 3; c, leg 4; d, third exopodal segment of leg 4. — a, c. × 220; b, × 135; d, × 395.

The *male* was found attached to the abdomen of the female, the claws of the maxillipedes clasping the genital somites of the female, its ventral surface touching the ventral abdominal surface of the female. It is much smaller than the female, being 611 μ long and with a greatest diameter of 286 μ . The cephalic somite is 226 μ long and 286 μ wide; for the remaining thoracic somites these figures are: 61 and 231 μ for the second, 50 and 198 μ for the third, 44 and 138 μ for the fourth, and 55 and 126 μ for the fifth somite. The genital complex, including the third abdominal somite, is 121 μ long and 132 μ wide. The fourth abdominal somite is 39 μ long and 72 μ wide; for the fifth somite these figures are 22 and 55 μ . The furca is 22 μ long and 19 μ wide at the base. The longest furcal seta is 200 μ .

Compared with the female the cephalothorax is less shield-shaped and more elongated; the abdomen is remarkable by the great development of the genital complex, containing two spermatophores, distinctly visible through the tegument (Fig. 35a).

The first thoracic somite and the head are fused to form the cephalic somite, which has a broadly rounded outline. The frontal portion is more or less set off from the rest of the cephalic somite; no rostral plate has been observed. The antennules, with the exception of the basal portions, are visible from above.

The thoracic somites 2 to 4 diminish in width; the sides of the second and third are cut off squarely, the fourth has rounded sides. The coxae and bases of legs 3 to 4 are partly exposed. The fifth thoracic somite is distinctly trapezoid. The genital complex is a large, barrel-shaped structure, the shape of which can best be seen in Fig. 7d; the third abdominal somite is either completely telescoped into the complex or fused with it. The genital slits are at the latero-dorsal walls of the complex. The fourth abdominal somite is cylindrical, with slightly bulging sides. The anal somite tapers slightly; the anal plate is almost straight. The furcal rami and setae are as in the female.

The antennules (Fig. 35b) are fairly short, 6-segmented structures, not surpassing the cephalic somite. The arrangement of the setae is as follows: segment 1 has 5 plumose setae, segment 2 has 6 plumose and 2 normal setae, segment 3 has 4 plumose setae and 1 normal seta; segment 4 has 3 normal setae, segment 5 has 4 normal setae, and segment 6 has 4 setae.

The antennae, as in the female, are slender. The structure is almost as in the female (Fig. 35c), with the exception of an additional curved spine on the first endopodal segment and great elongation of the lamelliform process.

The mandibles, maxillules, paragnaths and maxillae are as in the female, but correspondingly smaller. The maxillipedes (Fig. 36a) are developed as huge claws, projecting besides the cephalic somite. The short coxa has a single seta. The basis is greatly developed, strongly swollen and more or less triangular. Its internal surface is covered with several rows of blunt, short teeth and has two fine setae at about half its length. The endopodite is distinctly 2-segmented, the first segment is short, the second is elongated and covered internally with a row of scale-shaped teeth. In addition it carries a fine seta near the articulation with the first segment.

The legs 1 to 4 have the following spinal and setal formula:

	endopodite	exopodite
leg 1	1+0.1+0.5+I	0+I.1+I.3+III
leg 2	1+0.1+0.3+II	0+I.1+I.4+III
leg 3	1+0.1+0.2+II	0+I.1+0.4+III
leg 4	1+0.I+1+I	0+I.1+0.4+III

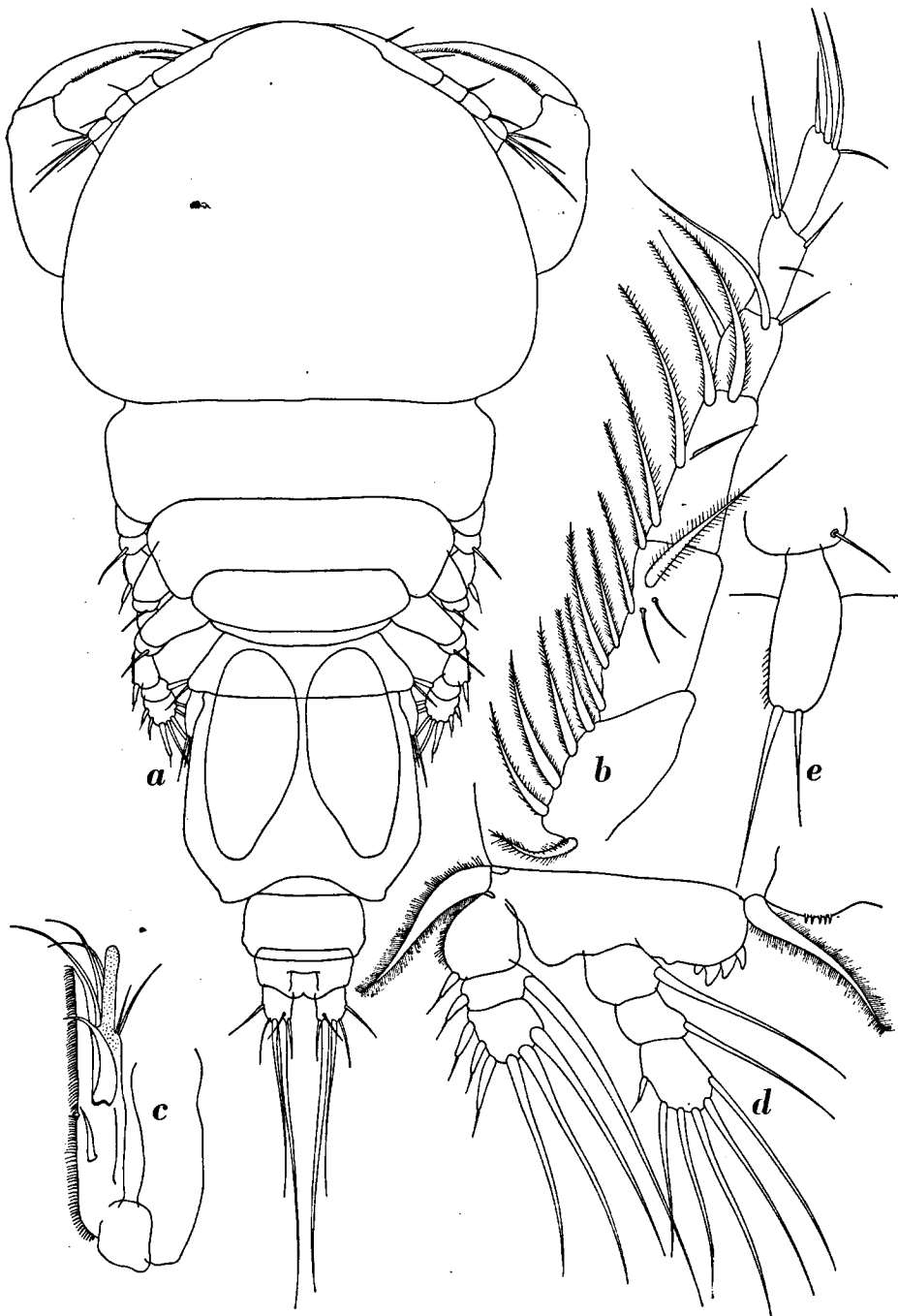


FIGURE 35. *Holobomolochus scutigerulus*, adult ♂, from *Upeneus maculatus*. a, whole animal, dorsal view; b, left antennule, ventral aspect; c, left antenna; d, leg 1; e, leg 5, ventral view. - a, $\times 220$; b-e, $\times 550$.

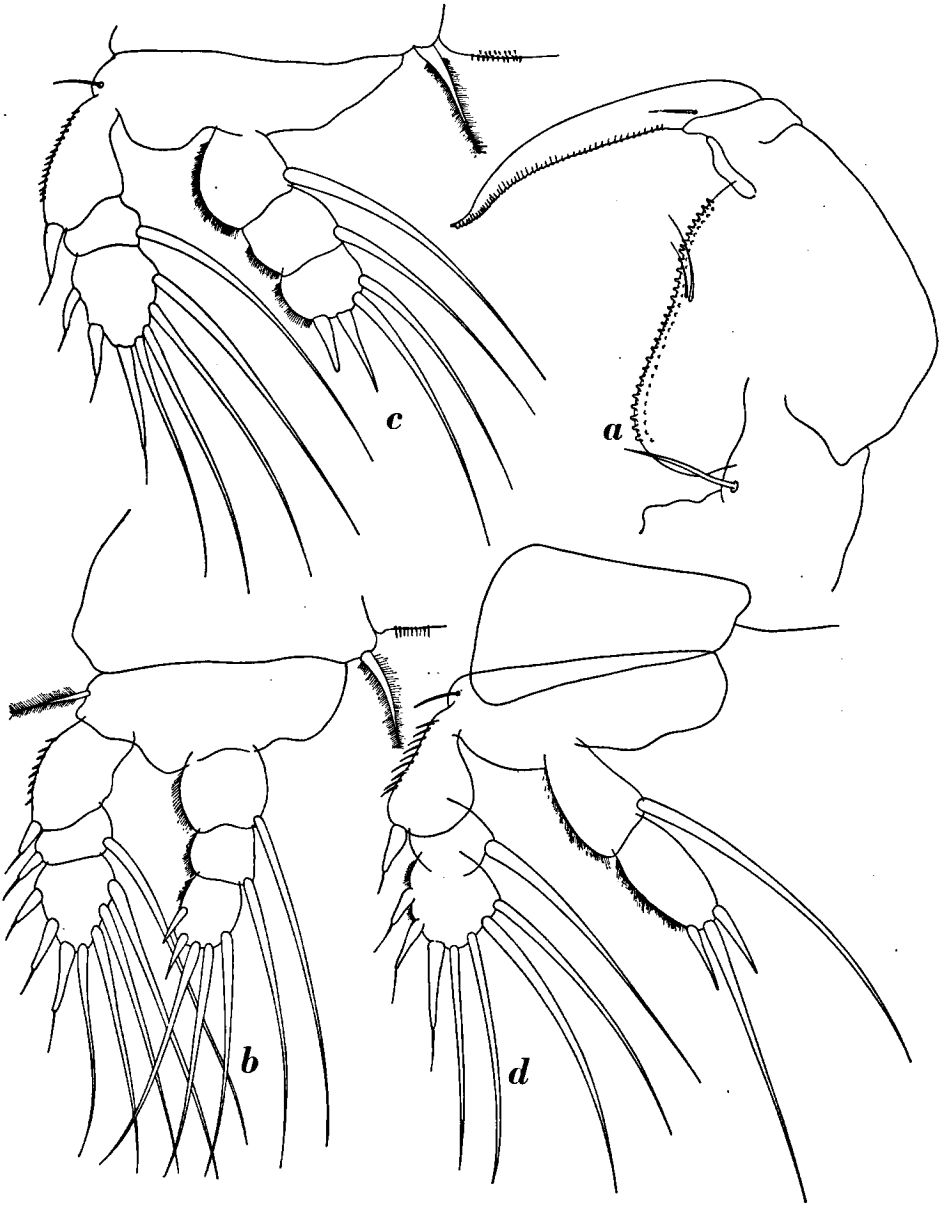


FIGURE 36. *Holobomolochus scutigerulus*, adult ♂, from *Upeneus maculatus*. *a*, left maxillipede; *b*, leg 2; *c*, leg 3; *d*, leg 4. — *a*, × 395; *b*–*d*, × 550.

In addition to the drawings the following details can be given:

Leg 1 (Fig. 35d). Intercoxal plate with some spinules. The setae at the internal margin of the coxa and the external margin of the basis are plumose and large. The internal wall of the basis has some very big spinules. Both exo- and endopodite are 3-segmented. The external marginal spines of the exopodite are flagellated.

Leg 2 (Fig. 36b). Intercoxal plate with some spinules. The setae at the internal margin of the coxa and the external margin of the basis are plumose but notably smaller than in the first pair. External marginal spines of the exopodite flagellated. The endopodite is normally developed and not flattened.

Leg 3 (Fig. 36c). Intercoxal plate as in leg 2. The seta at the internal margin of the coxa plumose, that at the external margin of the exopodite fine and nude. The external marginal spines of the exopodite are flagellated; no such spine occurs at the external margin of segment 2.

Leg 4 (Fig. 36d). No internal marginal spine has been observed at the coxa; that at the basis is as in leg 3. The exopodite is as in leg 3; the endopodite is only 2-segmented.

The intermediate segment of leg 5 (Fig. 35e) is fused with the fifth thoracic somite; it carries a fine seta. The free segment is elongated, with the internal margin finely spinulose and the external margin slightly swollen. There are two terminal setae.

Remarks. — This species was first described by C. B. WILSON from the Dry Tortugas, Fla., U.S.A., where four ovigerous females were found on the gills of *Pseudupeneus maculatus* (Bloch) (= *Upeneus maculatus* (Bloch)). Though there are differences with WILSON'S description and figures (1935: 335, pl. 2 figs. 14–22) there can scarcely be any doubt about the conspecificity of the material. The most important differences are discussed below.

General shape of the body and size. Though the present specimens agree superficially with WILSON'S pl. 2 fig. 14, there are differences in shape of second, third and fourth thoracic somites. The length of the specimens recorded by WILSON is not given in his description but according to the standard given in his figure they must have been about 3 mm. In reality they were probably much smaller.

Rostrum. The general shape of the rostral plate agrees with WILSON'S description, though he failed to observe the bifid point. The whole structure is said to form "a shield-shaped escutcheon extending onto the dorsal surface of the head. The escutcheon is raised in low relief" (WILSON, 1935: 335), which is definitely not the case in the present specimens. Eyes too could not be observed.

Furca. WILSON mentions only 3 marginal setae. Actually 5 marginal setae and one appendicular seta are present.

Antennules. The basal segments are said to be fused and about 21 plumose sensory setae are figured by WILSON. In the present specimens the three basal joints show distinct lines of fusion; only 15 sensory setae are present.

Antennae. Though the structure of these appendages is generally correctly given by WILSON, the presence of fine teeth on the endopodite is not mentioned.

The "three-lobed pad" described by WILSON between the maxillules and the maxillipedes has already been discussed on page 71.

Maxillipedes. The maxillipedes figured by WILSON (pl. 2 fig. 18) have no setae, the claw is obtusely pointed and has no auxiliary tooth.

WILSON's material, composed of two female syntypes, is in the U.S. National Museum under no. 64036.

This species, on account of the large number of sensory setae on the antennules, has been included in the genus *Bomolochoides* VERVOORT (1962: 30). The type of this genus, *Bomolochus nitidus* C. B. Wilson, 1911, is congeneric with *Bomolochus solaea* Claus, 1864, the type of *Bomolochus* Von Nordmann, 1832 (cf. page 27). The genus *Bomolochoides*, consequently, must be dropped. *Bomolochus scutigerulus*, as appears clearly from its antennular structure, must be brought to the genus *Holobomolochus*.

Dicrobomolochus nov. gen.

Diagnosis. *Female*. – The body is elongate, *i.e.*, the thoracic somites narrow gradually. The head and first thoracic somite are fused to form the wide, elongated oval cephalic somite; the remaining somites too are much wider than long, laterally broadly rounded and with scarcely developed epimeral plates; consequently the coxae of the swimming legs are distinctly visible. Between the cephalic somite and thoracic somite 2, as well as between the remaining thoracic somites, the body is deeply constricted. The fourth thoracic somite is more or less trapezoid; the fifth thoracic somite is separate from the genital complex. This complex is broadly rounded, resulting from fusion between the first two abdominal somites. The genital slits are dorsally visible at the end of the genital

complex; only one seta is seen to protrude from the genital opening. The abdominal somites 3 to 5 are well separated, with the fifth (anal) somite considerably narrowing posteriorly and with a distinct anal plate. The furcal rami are slightly longer than wide and taper distinctly; each furcal ramus has 5 marginal setae and one appendicular (dorsal) seta. One of the marginal setae (seta 2) is lengthened and thickened. The egg sacs are elongated oval, flattened structures, composed of a double layer of large eggs.

The antennules are remarkable by the presence of a rounded, chitinized, articulating structure laterally of the rostral prominence. Originally there have been 15 plumose "sensory" setae, two of which (setae 2 and 3) have fused with the chitinized plate, forming a bifurcated, chitinized structure pointing forward between sensory setae 1 and 4. There is a distinct rostral prominence between the basal parts of the antennules; ventrally there are no rostral points.

The antennae have the usual structure; the first and second endopodal segments are fused and have five longitudinal rows of acute, slightly curved spinules. The lamelliform process is short and has a pectinate row of spines, continuing for some distance on the endopodite. There is a strong, curved spine near the articulation of the lamelliform process. The end of the endopodite has three hooked, setiform spines and one seta. The remaining mouth parts are as in *Bomolochus* Von Nordmann, 1832; the maxillule has three setae; the maxillipede has a short, strong claw without auxiliary tooth and three thick setae.

The setal and spinal formula of the legs (exclusively based on the type) is:

	endopodite	exopodite
leg 1	1+0.1+0.5	5+IV
leg 2	1+0.1+0.3+II	0+I.1+I.5+III
leg 3	1+0.1+0.2+II	0+I.1+I.5+III
leg 4	1+0.1+0.I+1+I	0+I.1+I.4+III

The legs 2 to 4 have no internal seta on the coxa and no external seta on the basis. The external marginal spines on the exopodites are much reduced; the third exopodal segment is deeply incised.

The endopodite of leg 2 is not flattened. There is one seta at the internal margin of the second endopodal segment of legs 2 and 3.

The fifth pair of legs has a short, free intermediate segment; the terminal segment is spatulate and has four marginal setae, one of which is lengthened and thickened.

The *males* are unknown.

Parasites of the gills of fishes. The type of the genus is *Bomolochus eminens* C. B. Wilson, 1911. The name of the genus, *Dicrobomolochus* (gender: masculine) has been derived from the greek dikros, forked, and bomolochus, lickspittle, buffoon.

***Dicrobomolochus eminens* (C. B. Wilson, 1911)**

Figs. 37-39

Bomolochus eminens C. B. WILSON, 1911: 368, text-fig. 6, pl. 53 figs. 148-155; COWLES, 1930: 347; C. B. WILSON, 1932: 41; HEEGAARD, 1947: 199, pl. 25 fig. 193; SEWELL, 1949: 157; STOCK, 1953: 12; VERVOORT, 1962: 16; HILDEBRAND, 1963: 405; YAMAGUTI, 1963: 11, pl. 3 fig. 2.

Two syntypes from the U.S. National Museum (no. 38638) and collected 9 July 1906 from the gill cavity of "*Clupanodon pseudohispanicus* (false Spanish sardine)" at the "TORTUGA ISLANDS." (Fla.) One of the females, a 2.44 mm long, ovigerous specimen, is here designated as the lectotype.

Piscadera Bay, CURAÇAO, 3.XII.1958. From the orbit of *Harengula humera is* (Cuv.). About 100 adult, partly ovigerous females, 1.76-2.32 mm (1.98 mm) total length. Leg. J. H. Stock, nos 105 and 105 bis.

Description of lectotype. Adult *female*. - Total length, measured from the tip of the rostral prominence to the end of the caudal rami, 2.44 mm; greatest diameter, at the cephalic somite, 1.16 mm. The cephalic somite, including the rostral prominence, is 715 μ long and 1,161 μ wide. For the remaining thoracic somites these figures are: 365 and 743 μ for the second thoracic somite; 324 and 635 μ for the third thoracic somite; 432 and 540 μ for the fourth thoracic somite and 189 and 338 μ for the fifth thoracic somite. The genital complex is 216 μ long and 338 μ wide. The abdominal somites have the following proportions: third somite, 75 μ long and 160 μ wide; fourth somite, 30 μ long and 155 μ wide; fifth (anal) somite 45 μ long and 150 μ wide near the articulation with the preceding somite. The furcal rami are 40 μ long and have a basal diameter of 34 μ . The lengthened furcal seta is 540 μ long. The egg sacs are 1.458 μ long and 420 μ wide.

The general shape of the body (Fig. 37a) is elongated, with gradually narrowing somites. Those of the thorax are elongated-oval, with deep incisions between the various somites. The abdomen is fairly short; the egg sacs are elongatedly oval

structures, dorso-ventrally strongly compressed and composed of a large number of fairly big eggs.

The head and first thoracic somite are fused to form the cephalic somite, which is distinctly onion-shaped, with broadly rounded anterior margin. The specimen could not be figured laterally, but in lateral aspect the cephalic somite is distinctly swollen, curving laterally and with the free cephalic margin flattened. The cephalic somite is furthermore characterized by the presence of a rounded, more or less conical rostral prominence, distinctly visible dorsally between the basal parts of the antennules (Fig. 37a). The free anterior margin of the rostral prominence is not particularly thickened and on inspection of its ventral side no rostral points could be discovered. The mid-dorsal line of the cephalic somite is slightly deepened frontally; an internal chitinized ridge, serving the attachment of strong bundles of muscles, is just visible through the tegument at the frontal and caudal ends of the mid-dorsal line. Two round structures are visible in that portion of the antennular base, exposed in dorsal view of the whole animal. On closer inspection the two rounded structures, one on each side of the rostral prominence, appear to be strongly chitinized plate-like articulations; strong bundles of muscles are seen to run from the circular structures in the direction of the mid-dorsal line and insert on the internal chitinized ridge.

The thoracic somites two and three are characterized by the absence of epimeral structures and rounded sides; the coxae of the swimming legs are exposed. The fourth thoracic somite is slightly trapezoid; at the insertion of the fourth pair of feet the somite is distinctly inflated. No epimeral structures are visible; the coxae of the fourth pair of legs are exposed. The fifth thoracic somite is fairly narrow, with rounded sides, the intermediate segment of leg 5 is free and visible from above.

The genital complex has resulted from fusion of abdominal somites 1 and 2. Its shape, with rounded sides, can best be judged from Fig. 37b. In the latero-caudal walls of the complex there are two slits, one on each side, opening on the dorsal side of the complex and apparently representing the genital apertures as the envelope of the egg sacs is seen to enter through the slits. After removal of one of the egg sacs one seta was found to protrude from the genital opening. The genital complex, on inspection from the ventral side, shows a pair of rodlike structures, pointing obliquely backward and inserting near the caudal border of the segment (Fig. 37c). These are also figured by WILSON (1911, pl. 53 fig. 149). The exact nature of these rods is unknown. The abdominal somites 3 to 5 are much narrower than the genital complex; the anal somite tapers distinctly. The anal plate is distinctly visible and almost straight. The furcal rami (Fig. 37d) are slightly longer than wide and have an obliquely cut lateral margin. There are, on each furcal ramus, five marginal setae and one appendicular seta. Seta 2 on each side is lengthened and thickened.

The antennules (Fig. 38b) as in many other Bomolochids, are composed of a proximal portion, composed of several (apparently 3 or 4) segments, and a distal portion (flagellum) composed of three free segments. A small part of the proximal portion, including the forked structure, its rounded base and some of the plumose setae are visible in dorsal view. The flagellum is clasped under the cephalic somite. The proximal portion of each antennule articulates with the cephalic somite by means of a rounded, chitinized, plate-like structure, visible as a rounded disc on each side of the rostral projection (Fig. 37a). Each plate is firmly attached to the antennule and articulates with the edge of the cephalic somite; a heavy bundle of muscles

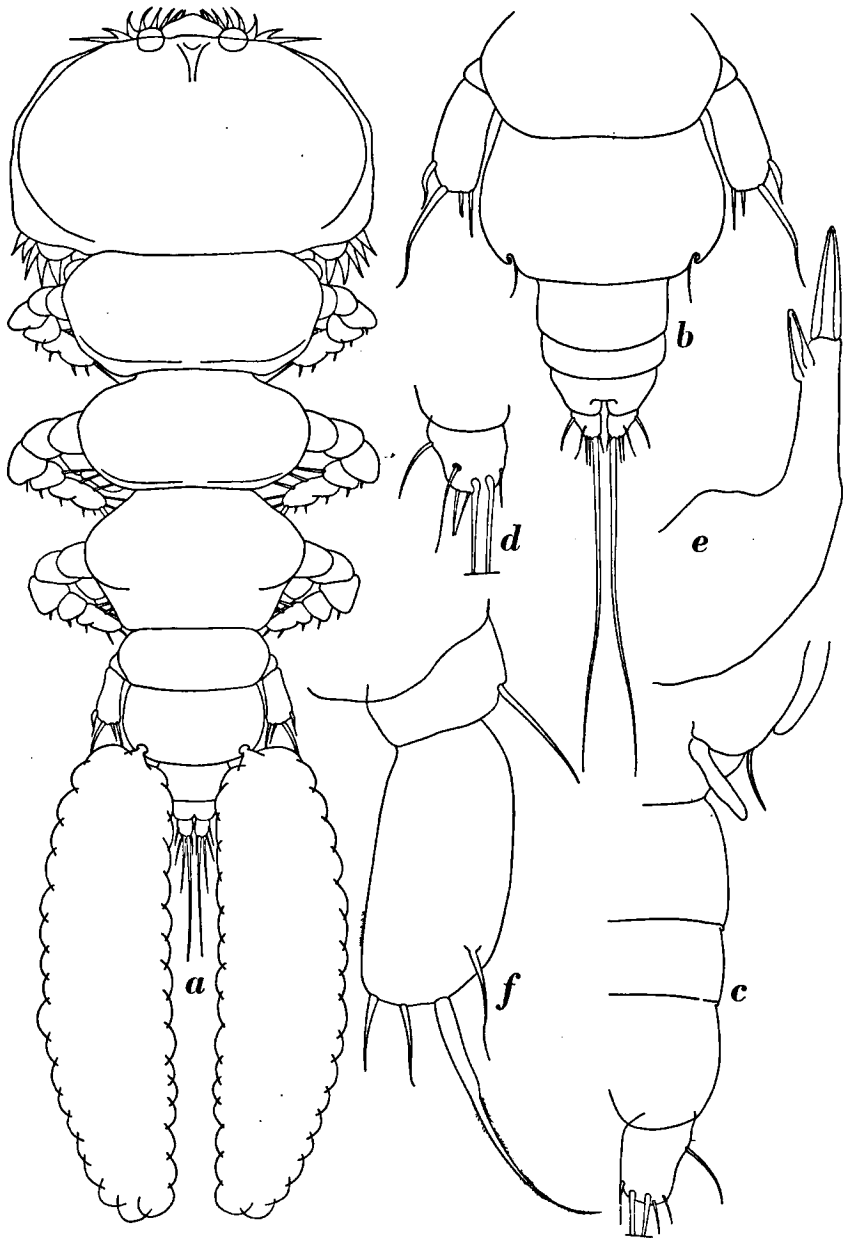


FIGURE 37. *Dicrobomolochus eminens* (C. B. Wilson), adult ♀, lectotype, from "*Clupanodon pseudohispanicus*". *a*, whole animal, dorsal view; *b*, fifth thoracic somite and abdomen, dorsal view; *c*, left part of genital complex and abdomen, ventral view; *d*, left furcal ramus, dorsal view; *e*, left mandible; *f*, right fifth leg. — *a*, × 45; *b*, × 90; *c*, *d*, *f*, × 220; *e*, × 395.



FIGURE 38. *Dicrobomolochus eminens*, adult ♀, lectotype, from "*Clupanodon pseudo-hispanicus*". *a*, left part of cephalic somite, ventral view; *b*, right antennule, ventral view; *c*, proximal part of left antennule, dorsal view; *d*, right antenna; *e*, left paragnath; *f*, right maxillipede. — *a*, *c*, × 135; *b*, *f*, × 220; *d*, *e*, × 395.

runs from the plate in the direction of the mid-dorsal line. There are 13 plumose sensory setae on each antennular base; originally 15 must have been present, but setae 2 and 3 have fused with the chitinized plate and are represented as a bifurcated, chitinized frontal prolongation of the plate (Fig. 38b, c). Seta 9 (numbered with inclusion of the chitinized setae) is placed on the middle of the ventral wall of the antennular base and is directed backward. In addition there are 6 normally developed setae, 3 of which are marginal, 2 ventral and 1 dorsal. The number of setae on the three segments of the flagellum is 3, 3, and 6, respectively.

The antenna (Fig. 38a, d) occupies the usual position. The long coxa has a single terminal seta; the basis is short and without any setae. The endopodite is composed of two completely fused segments; there are, on the first segment, 5 longitudinal rows of fine, slightly curved, acutely pointed teeth, continuing on the second endopodal segment. The lamelliform process is short and set with a pectiniform row of fine spines, continuing for some distance on the first endopodal segment. A big, curved hook inserts on the endopodite close to the articulation of the lamelliform process. In addition there are, on the endopodite, three hooked, setiform spines and one seta.

The mouth parts do not materially differ from those of *Bomolochus psettoobius* (= *Parabomolochus psettoobius*, VERVOORT, 1962: 53), with the exception of the maxillipede. The mandibles (Fig. 37e) have, at the cutting edge, one large, elongated tooth and one small, triangular tooth; they are partly covered by the broadly rounded edge of the labrum. The structure of the labrum is pitted rather than hairy or spinulose; the anterior edge only carries long hairs. The maxillule has two big setae and one small seta. The paragnaths (Fig. 38e) have a swollen, rounded base and a curved, finger-shaped prolongation. The maxilla (Fig. 39e) has two fine, long teeth set with smaller spinules.

The maxillipedes (Fig. 38f) are very big, particularly the coxae; the position of the maxillipedes is far lateral of the other mouth parts (Fig. 38a). The basis is a large, triangular structure with three thick, closely adpressed setae. The claw is short, particularly thick and sigmoid; there is no auxiliary tooth.

The legs 1 to 4 have the following setal and spinal formula:

	endopodite	exopodite
leg 1	1+0.1+0.5	5+IV
leg 2	1+0.1+0.3+II	0+I.1+I.5+III
leg 3	1+0.1+0.2+II	0+I.1+I.5+III
leg 4	1+0.1+0.1+1+I	0+I.1+I.4+III

The legs have the following particulars:

Leg 1 (Fig. 39a). The endo- and exopodite are greatly compressed. The coxa has an internal, hairy flap. No seta occurs at the external margin of the basis. The segmentation between the first and second exopodal segments is indicated; there is a distinct, external marginal setiform spine. There are, on the remaining part of the exopodite (segments 2 and 3) three setiform spines and 5 plumose setae with thickened base. The five setae of the third endopodal segment also have thickened bases.

No setae occur on coxae and bases of legs 2 to 4. All exo- and endopodites are 3-segmented. The third exopodal segment is deeply incised, but there is no additional segmentation. All external marginal spines are reduced in size, being no more than thin, setiform spinules.



FIGURE 39. *Dicrobomolochus eminens*, adult ♀, lectotype, from "*Clupanodon pseudo-hispanicus*". a, leg 1; b, leg 2; c, leg 3; d, leg 4; e, left maxilla. — a–d, × 135; e, × 395.

Leg 2 (Fig. 39b). The endopodite is not compressed. One seta occurs at the internal margin of the endopodite.

Leg 3 (Fig. 39c). Only one seta occurs at the internal margin of the second endopodal segment.

Leg 4 (Fig. 39d). The endopodite is not particularly lengthened. There are two large spiniform setae at the end of the third endopodal segment and one very small spine.

The fifth pair of legs (Fig. 37f) is composed of a short intermediate segment, bearing a single external seta, and a spatulate free segment. The straight internal border of the terminal segment is apically hairy. There are four marginal setae, one of which is greatly lengthened and thickened at the base. One of the marginal setae (that at the external margin) actually inserts on the frontal aspect of the terminal segment.

The male of this species, though mentioned by WILSON (1932: 41) is still undescribed.

Remarks. — WILSON (1911) originally based this species on two specimens collected 9 July 1906 from the gill cavity of a fish from, Tortugas the Fla., named *Clupanodon pseudohispanicus* ("false Spanish sardine") in WILSON's 1911 paper. These two syntypes were registered at the U.S. National Museum under no. 38638; both are in good condition and were not dissected by WILSON, who apparently made the drawings of mouth parts and legs after complete specimens. The lectotype, a 2.44 mm long, adult, ovigerous female, has been described and figured; the oral appendages and legs on the right side have been removed and separately mounted in "Berlese". The specimen itself has been mounted in balsam. The remaining specimen, a female paralectotype, is non-ovigerous and has not been inspected. WILSON (1932: 41) also mentions adult females and males, as well as developmental stages, from the plankton of Chesapeake Bay. Two females from Chesapeake Bay were originally deposited in the U.S. National Museum under no. 58464; Dr. THOMAS E. BOWMAN wrote to tell me that these specimens are no longer present in the vial.

The specimens from Piscadera Bay, Curaçao, agree in all respects with the description of the holotype.

According to WILSON's description (1911: 370) the species has been found in the gill cavities of the false Spanish sardine, *Clupanodon pseudohispanicus*, at Tortuga Islands. The label in the U.S.

National Museum reads "Gills of *Clupeodon pseudoharenga*". *Clupanodon pseudohispanicus* is a synonym of either *Sardinella pseudohispanica* (Poey) or *S. anchovia* Cuvier & Valenciennes. I have followed HILDEBRAND (1963: 405) in the assumption that *Sardinella anchovia* must be considered the type host of this species; this author regards *Sardinella pseudohispanica* as a doubtful synonym of *S. anchovia*. The (fictitious) name on the label in the U.S. National Museum is probably due to a mistake. The specimens from Curaçao occurred on *Harengula humeralis* (Cuv.).

Discussion of species and genus. — Though the species is somewhat wantingly described by WILSON it can easily be recognized from the figures because of the curious shape of its body. The antenna (pl. 53 fig. 150) is incompletely described, only two setae are figured on the maxillule (pl. 53 fig. 151), only one seta is visible on the maxillipede (pl. 53 fig. 151) and nearly all legs are incorrectly figured. All these errors probably result from the fact that WILSON made the drawings from a complete, undissected specimen. WILSON completely failed to recognize the curious structure of the antennule, though he gives a separate figure of the ventral aspect of the antennule (WILSON, 1911, text-fig. 6). This antennular structure puts the genus apart from *Nothobomolochus* VERVOORT (1962: 58); *Bomolochus* VON NORDMANN (1832: 135) and *Ceratocolax* VERVOORT (1965: 24), though it resembles these genera in the structure of the mouth parts. All the above mentioned genera have well developed external marginal spines on the exopodites of legs 2 to 4, a compressed endopodite of leg 2 and two setae at the internal margin of the second endopodal segment of legs 2 and 3.

Orbitacolax Shen, 1957

Orbitacolax SHEN, 1957: 323.

Orbitacolax analogus nov. spec. Figs. 40–46

Piscadera Bay, CURAÇAO, 9.XII.1958. From the orbit of *Sparisoma rubripinne* (C. & V.), captured in canaster. Three adult females, 1.29–1.30 mm (1.30 mm). Leg. J. H. Stock, no. 119.

Piscadera Bay, CURAÇAO, 9.XII.1958. From the orbit of *Acanthurus hepatus* Metzelaar (= *Acanthurus chirurgus* (Bloch)). Five adult females, 1.30–1.43 mm (1.39 mm). Leg. Stock, no. 121 B.

Piscadera Bay, CURAÇAO, 11.XII.1958. From the orbit of *Sparisoma chrysopterygium* (Bl. & Schn.), captured in a canaster. Four adult, ovigerous females, 1.33–1.40 mm (1.35 mm); one adult male, 567 μ . Leg. Stock, no. 126.

Piscadera Bay, CURAÇAO, 11.XII.1958. From the orbit of *Sparisoma distinctum* (Poey), captured in canaster. One adult, ovigerous female, 1.43 mm. Leg. Stock, no. 128.

Piscadera Bay, CURAÇAO, 11.XII.1958. From the orbit of *Acanthurus bahianus* Castelnau, captured in a canaster. One adult female, 1.13 mm. Leg. Stock, no. 129.

The following descriptions are based on an adult female from lot no. 119, 1.30 mm long (holotype) and the male from lot no. 126 (allotype). The appendages from the right side of the holotype have been removed and mounted separately; the rest of the holotype has been preserved as a whole mount. The allotype has been completely dissected and all the appendages have been mounted on slides.

Adult female. – Total length (measured from the apex of the rostrum to the end of the furcal rami) is 1,296 μ ; the greatest diameter, at the third thoracic somite, is 580 μ . The length of the cephalic somite is 434 μ ; the diameter is 554 μ . For the remaining thoracic somites these figures are: 216 and 566 μ for the second; 203 and 580 μ for the third; 189 and 297 μ for the fourth and 66 and 243 μ for the fifth thoracic somite. The genital complex is 74 μ long and 170 μ wide; the remaining abdominal somites have the following lengths and widths: 39 and 99 μ for the third, 33 and 88 μ for the fourth, and 36 and 72 μ for the fifth thoracic somite. The furcal rami are 33 μ long and have basally a width of 28 μ . The longest furcal seta measures 187 μ . The ovisacs are 550 μ long and 250 μ wide.

The general shape of the body (Fig. 40a) is very characteristic. The cephalothorax, with the exception of cephalic somite 5, has the shape of a flat, elongated oval; the abdomen is very short. The various somites of the cephalothorax are separated by very deep incisions; the epimeral portions of the cephalic somites are well developed and laterally produced; only part of the third and fourth pairs of feet is visible from above. The hyaline border of the cephalic somite is very distinctive.

The head and the first thoracic somite are fused to form the cephalic somite. This somite is cut off almost straight at the posterior border, with rounded lateral portions and a slightly produced frontal part, bearing the semicircular rostral plate (Fig. 41a). Both sides are provided with a fairly broad, flat hyaline lamella with rounded outline. The rostral plate is very firmly attached to the cephalic somite: a line of fusion is scarcely visible dorsally, but indicated ventrally, where the rostral plate is provided with a two-pointed rostrum. The two points of this rostrum are very acute and diverge widely (Fig. 43a). The second thoracic somite is fairly narrow; the sides are broadly rounded and well developed, completely covering the second pair of legs. It is latero-dorsally separated from the cephalic and third thoracic somites by fairly broad, deep incisions. The third thoracic somite has rounded sides and is slightly produced latero-caudally, covering a small portion of the fourth thoracic somite. In the third thoracic somite the cephalothorax reaches its greatest diameter. The fourth thoracic somite is much smaller than the third and

rounded: it has several lateral tubercles or lobes and an unpaired, median tubercle, covering part of the fifth thoracic somite; its shape appears best from Fig. 40a. The fifth thoracic somite is trapezoid; the sides are acutely triangular, resulting from the fusion of the intermediate segment of leg 5 with the somite; the seta, usually found on the intermediate segment, now occurs on the extreme lateral part of the somite (Fig. 41b).

The genital complex (Fig. 41b) results from fusion between the genital somite and somite 2; it is about twice as wide as long. The sides are swollen and rounded; latero-dorsally each side has a semi-circular genital plate, covering the genital orifices. Three fine setae protrude from each genital opening. The genital somites 3 and 4 are cylindrical and have about the same length. The anal somite tapers slightly; the anal plate is indistinctly curved and scarcely visible. The furcal rami are longer than wide and taper slightly. Each ramus has five setae and one appendicular seta. The second seta on each side is greatly lengthened and thickened; setae 1 and 3 are short and fine. Setae 4 and 5 and the appendicular seta have about the same length.

The antennules (Fig. 43a) are completely visible from above; they are composed of a proximal part and a 3-segmented terminal part (flagellum). The proximal part has no articulations; proximally it is firmly attached to the ventral side of the cephalic somite. It carries the usual 15 plumose, sensory setae, two groups of each two marginal setae and two fine ventral setae. The fifteenth sensory seta is enlarged. The number of setae on the segments of the flagellum is 2, 2, and 7, respectively.

The antenna has (Fig. 41d) a fairly long coxa, bearing a single terminal seta, a short basis and a slender endopodite, folded over the coxa. The two endopodal segments are fused; at the place of fusion a short lamelliform process and a strong, curved spiniform seta insert. The lamelliform process has a pectiniform row of acicular spinules, continuing for some distance on the endopodite. The endopodite is produced into a slender, finger-shaped process; it has a number (about 6) of longitudinal rows of very fine spinules, continuing on the finger-shaped process. The end of the endopodite has three hooked setae and two normal setae, one of which is very small.

The cutting edge of the mandible (Fig. 41c) is elongated; it carries apically a large tooth, at the base of which a smaller tooth occurs. Both teeth have a crenulated, very sharp hyaline border. The small, rounded maxillule has three strong setae. The paragnath has a swollen basal part; the apex is drawn out in a finger-shaped process, the caudal border of which is sharpened and crenulated. The maxilla has one single, cylindrical lobe, carrying two strong, hairy setiform teeth and a seta. The maxillipedes (Fig. 43b) occupy the usual position lateral of the oral appendages. The coxa is short and strong, bearing a single median seta. The basis is triangular, with particularly heavy lateral and caudal walls. The endopodite is represented by a strongly curved, but fairly short claw with large auxiliary tooth. The basal part of the claw is more or less separated from the rest; a single plumose seta occurs at the base of the claw. In addition one plumose seta occurs on the median wall of the basis.

The first to fourth pairs of legs have the following setal and spinal formula:

	endopodite	exopodite
leg 1	1+0.1+0.5+0	0+I.0+I.6+II
leg 2	1+0.1+0.3+I	0+I.0+I.3+III
leg 3	1+0.1+0.2+I	0+I.0+I.2+III
leg 4	1+0.1+0.2	0+I.0+I.2+III

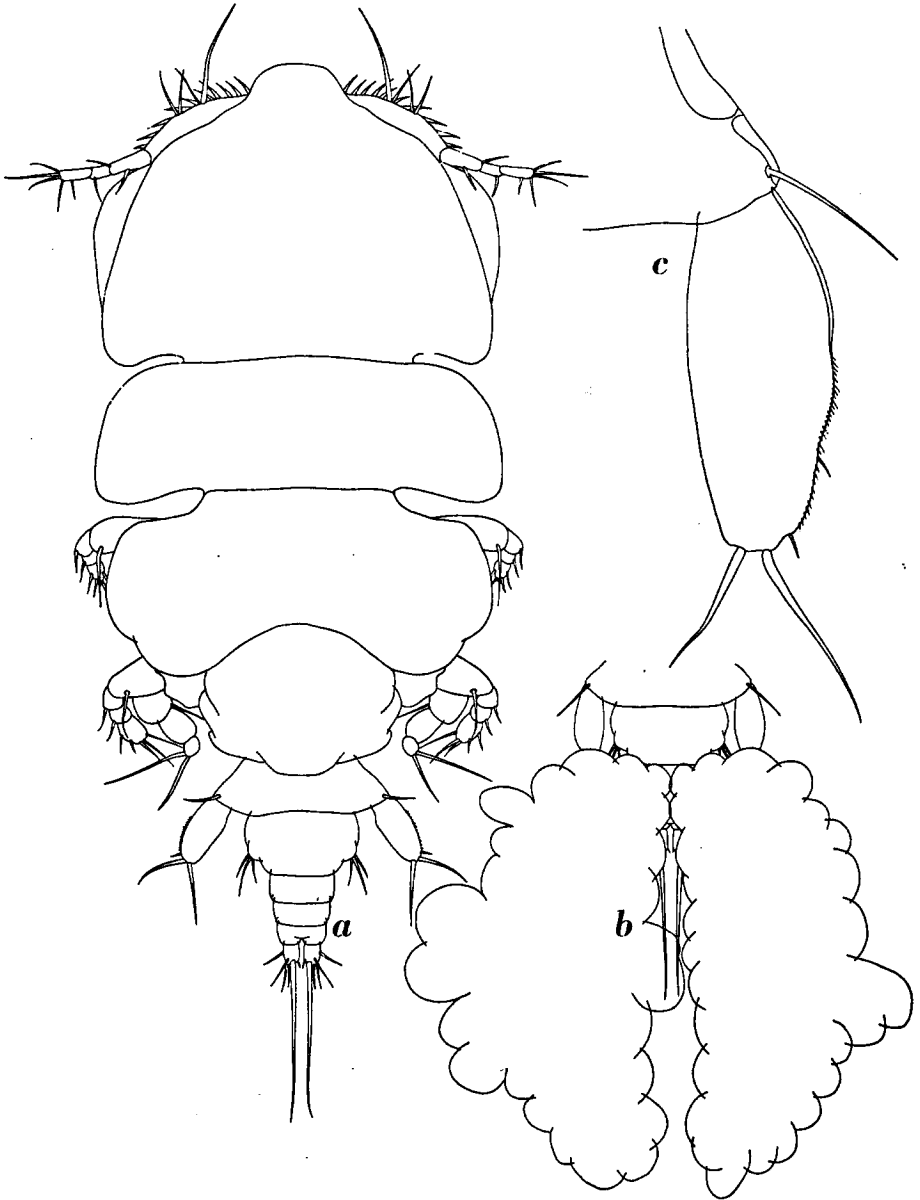


FIGURE 40. *Orbitacolax analogus* nov. spec., adult ♀, holotype, from *Sparisoma rubripinne*. *a*, whole animal, dorsal view, egg sacs removed; *b*, abdomen and egg sacs, dorsal view; *c*, right fifth leg, dorsal view. — *a*, *b*, × 90; *c*, × 395.

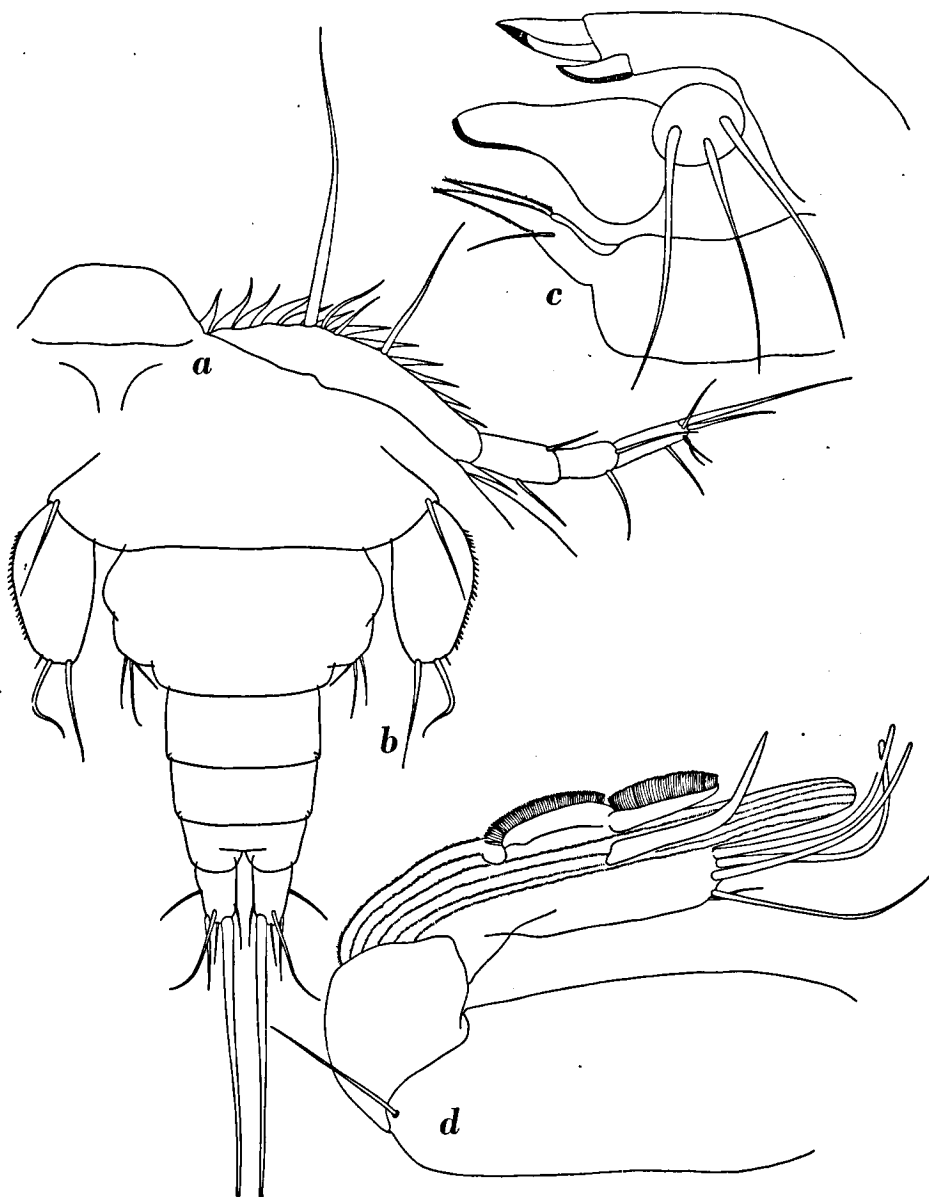


FIGURE 41. *Orbitacolax analogus* nov. spec., adult ♀, holotype, from *Sparisoma rubripinne*. *a*, rostrum and right antennule, dorsal view; *b*, fifth thoracic somite and abdomen, dorsal view; *c*, left oral appendages; *d*, left antenna. - *a*, *b*, $\times 220$; *c*, *d*, $\times 550$.

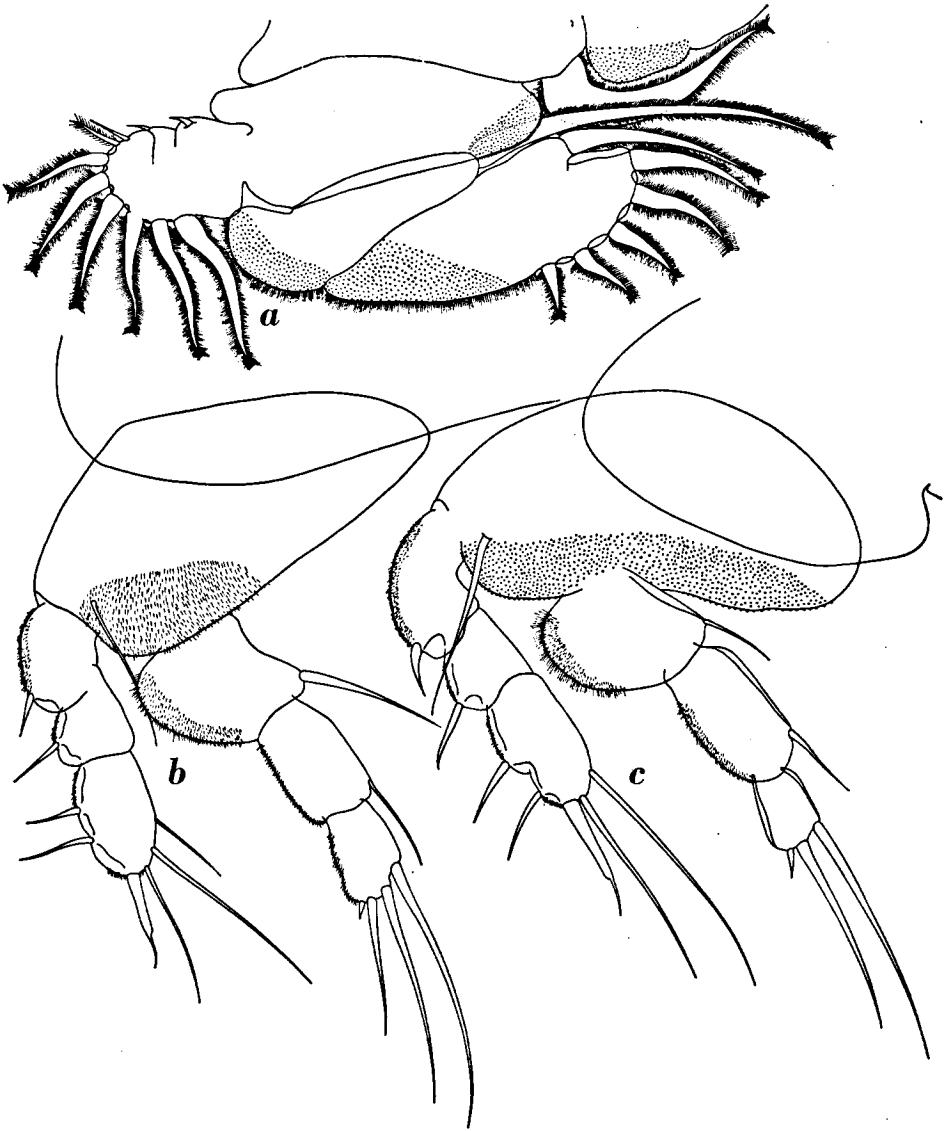


FIGURE 42. *Orbitacolax analogus* nov. spec., adult ♀, holotype, from *Sparisoma rubripinne*. a, leg 1; b, leg 2; c, leg 3. — a, $\times 240$; b, c, $\times 395$.

The legs have the following particulars:

Leg 1 (Fig. 42a) is strongly flattened, with enlarged endopodite. The intercoxal plate is developed as a paired structure, bearing two circular patches of rounded tubercles. The seta at the internal corner of the coxa is large, plumose and flattened. No seta occurs on the basis; the internal corner is swollen and spinulose. The segments of the small exopodite are indistinctly separated. There is one spine at the external margin of exopodal segments 1 and 2; the external margin of segment 3 of the exopodite has two appendages; one of these appendages (the basal) is setose. Segments 2 and 3 of the endopodite are indistinctly separated; the external margin, which is swollen, is also covered with long hairs implanted on a slightly raised tubercle.

Leg 2 (Fig. 42b) has the anterior surface of the basis spinulose; it also carries a long seta. The external margin of the exopodite is hairy; the external marginal spines are fine. The terminal spine on the exopodite is conical and flagellated. The external margin of the endopodite is hairy; the external margin of the first segment is strongly swollen. The terminal endopodal segment has three setae and a short spine.

Leg 3 (Fig. 42c) greatly resembles the second leg; the spinulose portion of the basis is more extended. There are only two internal setae on the third exopodal segment; the terminal endopodal segment has two setae and a short spine.

Leg 4 (Fig. 44a) resembles the second and third legs with the exception of the endopodite. The basis has a large spinulose patch on its anterior surface, also bearing a long seta. The internal margin of the third exopodal segment has two setae, one of which is very fine. The first and second endopodal segments have swollen internal margins; the setae at the internal margin are short and spiniform. The terminal segment has two strong setae; in addition there is a small, hair-like spine at the external margin.

The intermediate segment of leg 5 (Fig. 40c) is fused with the fifth thoracic somite; the seta occurs at the end of the laterally produced part of the somite. The free segment is spatulate; the internal margin is only slightly curved; the external margin is curved and its basal half spinulose. In addition to the small spinules two slightly larger marginal spinules occur on that basal part of the external margin. The apex of the segment has two setae.

The ovisacs are elongated oval in outline but are strongly compressed dorso-ventrally. They are composed of remarkably large eggs, some of which are in the process of development (primary divisions) while still in the ovisacs (Fig. 40b).

Adult male. — Total length 567 μ ; the greatest diameter is 248 μ . The cephalic somite is 198 μ long, the diameter is 243 μ . For the remaining cephalic somites these figures are: 66 and 192 μ for the second, 54 and 153 μ for the third, 54 and 108 μ for the fourth and 39 and 99 μ for the fifth thoracic somite. The genital complex is 78 μ long and has a diameter of 93 μ . For the fourth abdominal somite these figures are 27 and 63 μ , for the fifth 30 and 54 μ . The furcal rami are 21 μ long and have at the base a diameter of 21 μ . The longest furcal seta 225 μ .

The general shape of the body (Fig. 45a) is cyclopid, with the greatest diameter at the cephalic somite and with the thoracic and abdominal somites gradually diminishing in width. The cephalic somite, resulting from fusion of the head and the first thoracic somite, is cut off straight at the caudal border; the sides are rounded and have, as in the female, a hyaline lamella. The rostral plate is only scarcely

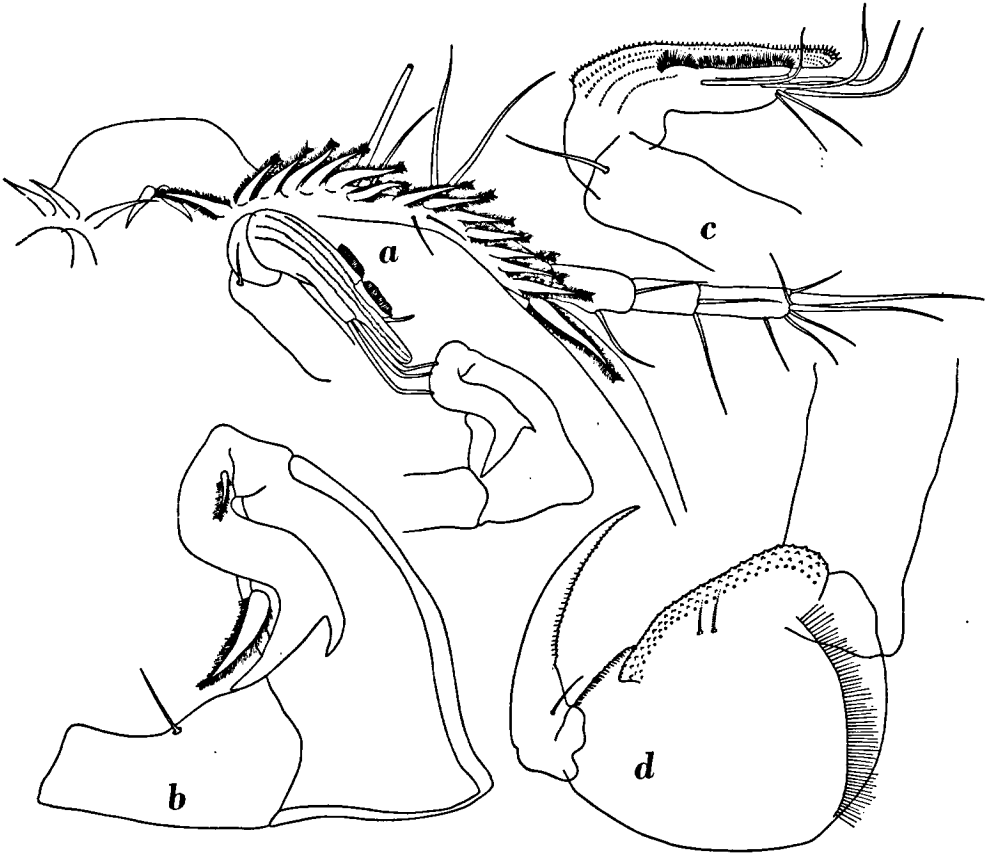


FIGURE 43. *Orbitacolax analogus* nov. spec. *a, b*, adult ♀, holotype, from *Sparisoma rubripinne*. *a*, left part of cephalic somite, ventral view; *b*, left maxillipede. — *c, d*, adult ♂, allotype, from *Sparisoma chrysopterum*. *c*, left antenna; *d*, right maxillipede. — *a*, $\times 135$; *b*, $\times 445$; *c, d*, $\times 550$.

produced and almost completely fused with the cephalic somite. No rostral points on the ventral side have been observed. The thoracic somites 2 to 4 are fairly narrow and gradually diminish in width. The epimeral portions are of reduced size; the coxal and basal portions of the legs of the first to fourth pairs are distinctly visible. Thoracic somite 5, as in the female, is trapezoid; the shape resulting from fusion of the intermediate segment of leg 5 with the somite. The seta occurs at the extreme lateral point of the somite (Fig. 44b).

The genital complex, resulting from fusion of abdominal somites 1 and 2, is barrel-shaped; the third abdominal somite is completely telescoped into the complex. The genital slits occur at the latero-ventral sides of the complex (Fig. 44b); no

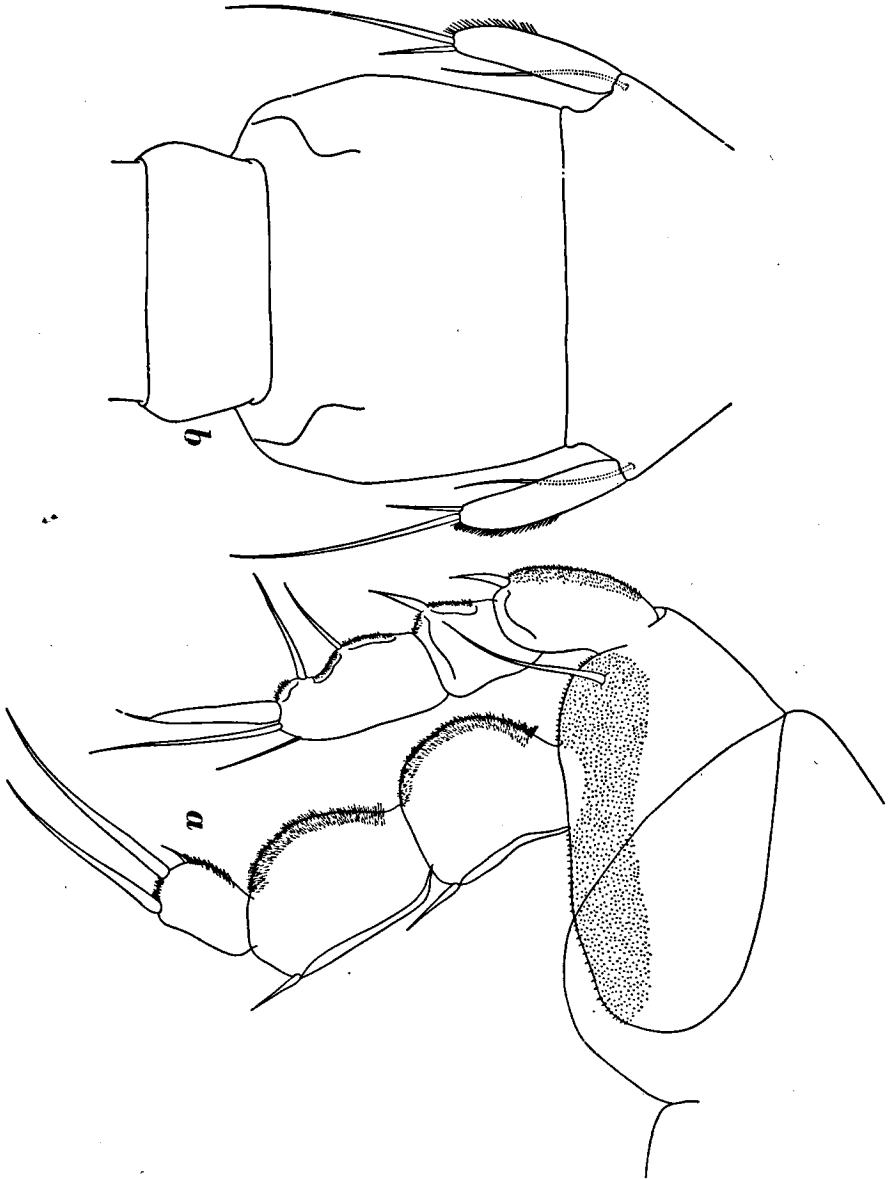


FIGURE 44. *Orbitacolax analogus* nov. spec. *a*, adult ♀, holotype, from *Sparisoma rubripinne*; leg 4. - *b*, adult ♂, allotype, from *Sparisoma chrysopteryum*; fifth thoracic somite and genital complex, ventral view. - *a*, × 395; *b*, × 550.

spermatophores have been observed. The abdominal somites 4 and 5 have about the same length; the fourth is cylindrical, the fifth tapers slightly. The furcal rami are as in the female but comparatively smaller.

The antennules (Fig. 45b) are visible from above and 5-segmented; the second segment, which is fairly long, probably results from the fusion of several smaller segments. The first segment is shield-shaped and firmly attaches the antennule to the ventral portion of the cephalic somite. There are 14 plumose, sensory and some smaller, normal setae, the position of which appears from Fig. 45b. In addition there is one spinulose seta on segment 2, placed at the caudal margin near the articulation with segment 1 and probably representing a modified sensory seta.

The antenna (Fig. 43c) has the same general shape as that of the female, but it is much smaller. The lamelliform process is comparatively longer; it has a pectiniform row of acicular spines, continuing for some distance on the endopodite. The hooked spiniform seta at the insertion of the lamelliform process is slender. The endopodite is covered with longitudinal rows of fine, acute spinules, continuing on the finger-shaped process.

The oral appendages are as in the female, but much smaller. The maxillipede (Fig. 43d) is completely modified and chelate. Its coxa is a cylindrical, strongly chitinized structure without setae. The basis is strongly swollen and almost globular; the internal surface is flattened and set with scale-shaped teeth. In addition the internal wall of the basis has a distinct pad set with rounded tubercles. Two fine setae occur halfway along the internal margin. A row of long, stiff hairs runs across the basis. The claw (endopodite) is slightly curved and pointed; the internal surface is set with scale-shaped teeth. The basal part of the claw, with is more or less separate from the rest of the claw, has a single fine seta.

The first to fourth pairs of legs have the following setal and spinal formula:

	endopodite	exopodite
leg 1	1+0.1+0.3+II	0+I.1+I.4+III
leg 2	1+0.2+0.3+I	0+I.1+I.5+III
leg 3	1+0.2+0.2+II	0+I.1+0.5+III
leg 4	1+0.1+I+1	0+I.1+0.4+III

The intercoxal plates of all legs are set with spiniform tubercles. A fine seta occurs at the external corner of the basis.

Leg 1 (Fig. 46a) has some spinules at the external corner of the coxa; the internal corner has a strongly plumose seta. The internal corner of the basis is set with spinules; in addition there is a big, conical, flagellated spinule at the internal wall of the basis, between the articulation of the endopodite and the patch of spinules. The external marginal spines of the exopodite are conical and flagellated; the whole of the external margin is spinulose. The segments of the endopodite are well separated and not particularly enlarged.

Leg 2 (Fig. 46b) has some spinules at the external corner of the coxa and some at the internal corner of the basis. The whole of the external margin of the exopodite is spinulose; the second exopodal segment has a small external marginal spine. The third endopodal segment has three setae and a short spine; no hyaline spinule could be observed at the end of the external margin.

Leg 3 (Fig. 46c) has a smooth external coxal margin; some spinules are found at the internal corner of the basis. The whole of the external margin of the exopodite is spinulose; no spine occurs at the external margin of segment 2. The third endo-

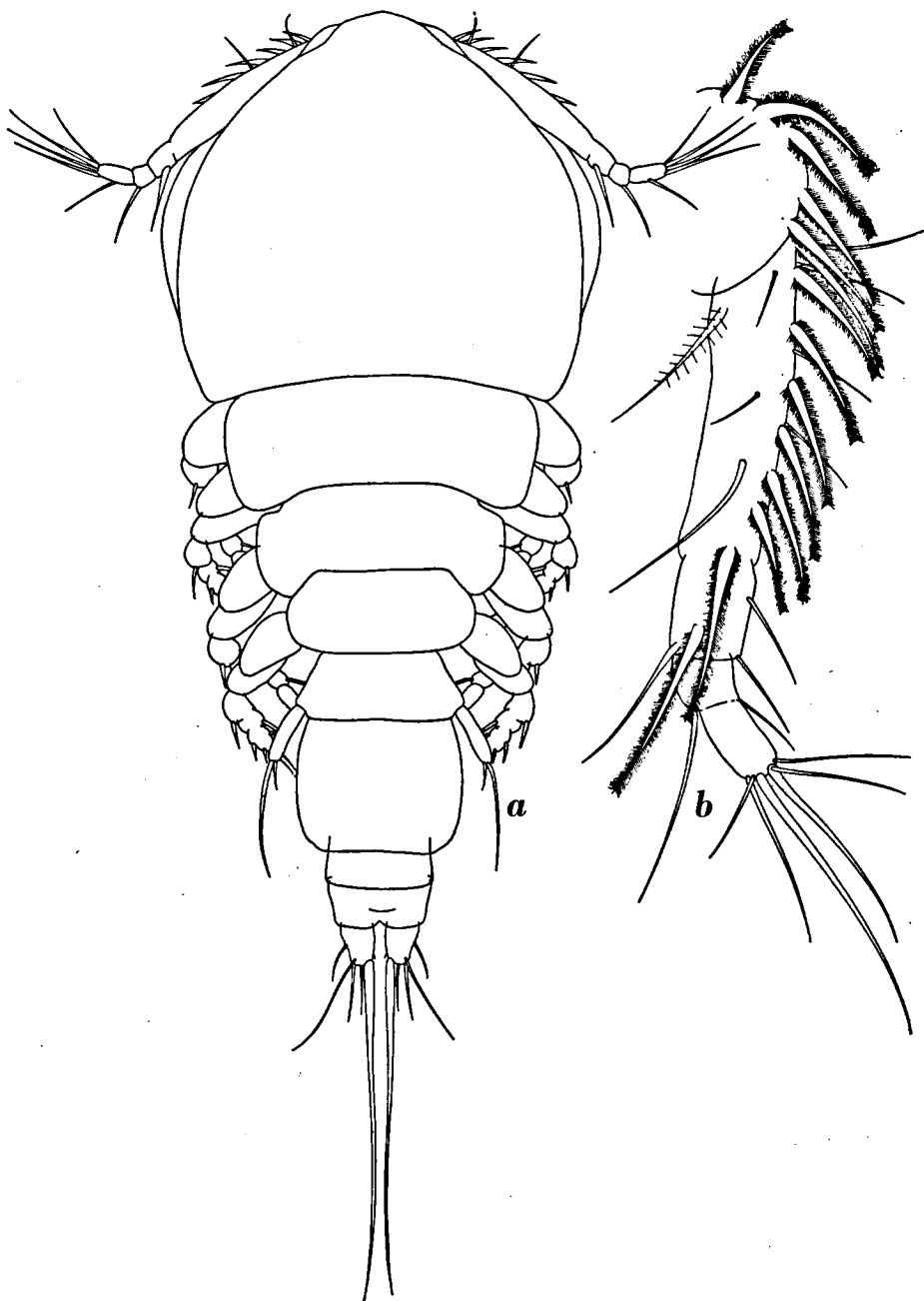


FIGURE 45. *Orbitacolax analogus* nov. spec., adult ♂, allotype, from *Sparisoma chrysopterum*. *a*, whole animal, dorsal view; *b*, left antennule, ventral view. — *a*, × 220; *b*, × 550.

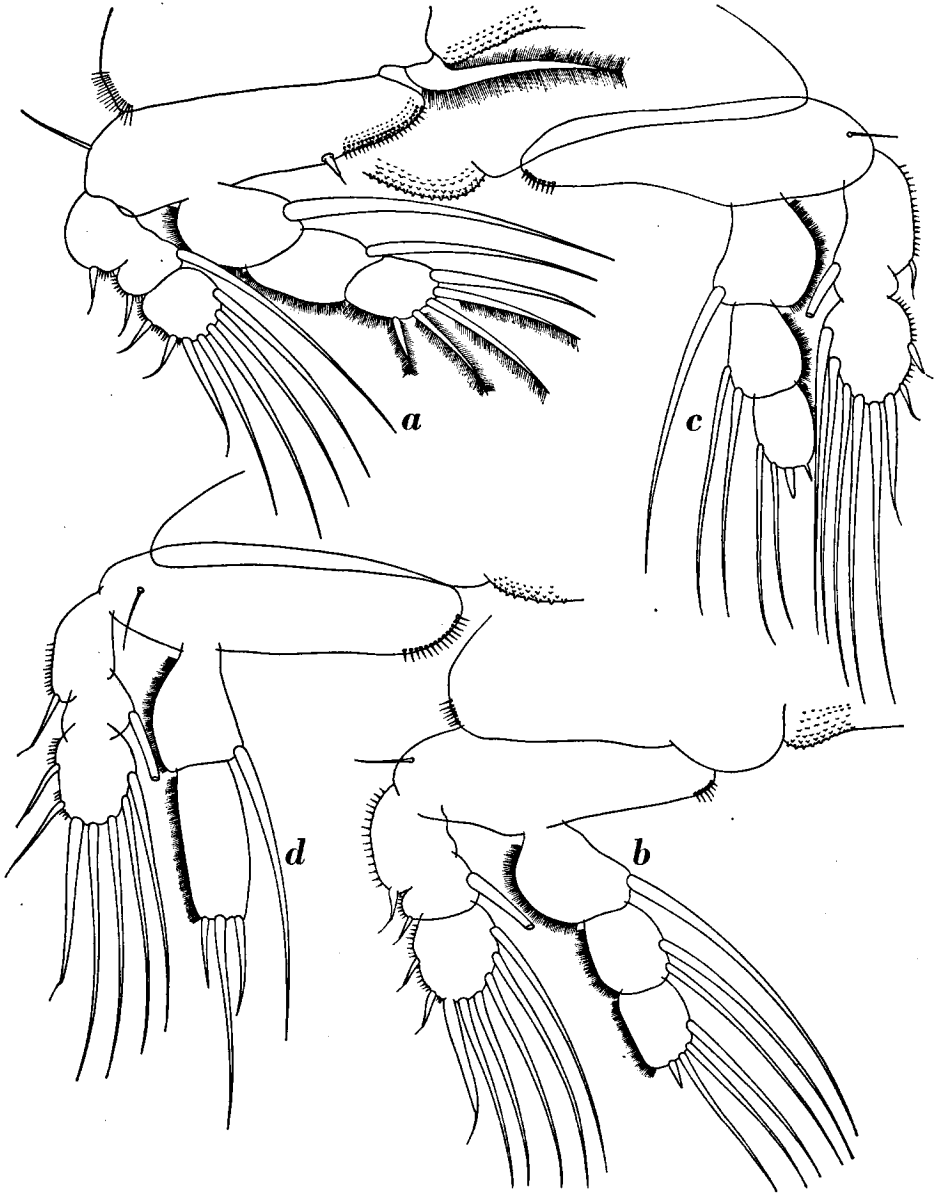


FIGURE 46. *Orbitacolax analogus* nov. spec., adult ♂, allotype, from *Sparisoma chrysopterum*. a, leg 1; b, leg 2; c, leg 3; d, leg 4. - a-d, $\times 550$.

podal segment has two setae and a spine; the external margin terminates into a hyaline spine.

Leg 4 (Fig. 46d) has a smooth external margin of the coxa; the internal margin of the basis is spinulose. The exopodite is as in the third pair, with the exception of the number of setae on the third segment, which is four. The endopodite is 2-segmented, the first with a single internal seta, the second with a terminal seta flanked by two spinules.

Leg 5 (Fig. 44b) consists of a single free segment; the intermediate segment is fused with the fifth thoracic somite. The free segment is elongated and slightly spatulate; the curved external border has a terminal row of fine hairs. The apex carries two setae of unequal length; the internal seta is short and spiniform, the external seta is lengthened.

Remarks. — This species, in external appearance of the female, greatly resembles *Orbitacolax hapalogenyos* (Yamaguti & Yamasu, 1959), a species originally described as *Taeniacanthus hapalogenyos* from gills and mouth cavity of *Hapalogenys mucronatus* Eydoux & Souleyet from the Inland Sea of Japan. There are, however, differences in the shape of the fourth thoracic somite and abdomen, as well as in the setation and spinulation of the legs.

The specific name, *analogus* (from the Greek analogos = resembling), points to the great resemblance of this species with *O. hapalogenyos*. *O. analogus* is quite a common parasite on various species of fish in Piscadera Bay, Curaçao. The male described above was not actually found in copulation with the female, but occurred in the same tube (along with a male of *O. oniscoides*); the presence of a hyaline zone at the cephalic somites makes it extremely likely that it really represents the male of *O. analogus*.

***Orbitacolax oniscoides* nov. spec. Figs. 47–53**

Piscadera Bay, CURAÇAO, 17.XI.1958. From the orbit of *Clepticus parrae* (Bl. & Schn.), captured in canaster at about 10 m depth. Five adult females, 1.17–1.27 mm (1.21 mm), 1 ad. ♂, 638 μ . Leg. J. H. Stock, no. 83.

Piscadera Bay, CURAÇAO, 20.XI.1958. From the orbit of *Monacanthus pullus* (Ranzani). Four adult, partly ovigerous females, 1.15–1.20 mm (1.19 mm). Leg. Stock, no. 89.

Piscadera Bay, CURAÇAO, 1.XII.1958. From the orbit of *Adudejduf saxatilis* (L.), captured in canasters. Two females, one 1.24 mm; the other damaged. Leg. Stock, no. 100.

Piscadera Bay, CURAÇAO, 9.XII.1958. From the orbit of *Sparisoma aurofrenatum* (C. & V.), captured in canasters. Three adult females, 1.35–1.50 mm (1.43 mm). Leg. Stock, no. 118.

Piscadera Bay, CURAÇAO, 11.XII.1958. From the orbit of *Sparisoma distinctum* (Poey), captured in canaster at about 25 m depth. Two adult females, 1.27 mm; 1 adult male, 640 μ , and one immature female. Leg. Stock, no. 125.

Piscadera Bay CURAÇAO, 11.XII.1958. From orbit of *Sparisoma chrysopterum* (Bl. & Schn.) captured in a canaster. One ad. ♂, 495 μ . Leg. Stock, no. 126.

Piscadera Bay, CURAÇAO, 11.XII.1958. From the orbit of *Sparisoma chrysopterum*, captured in a canaster. Two damaged, adult females. Leg. Stock, no. 127.

The following description is based on the complete female specimen from *Adudejuf saxatilis* (holotype, Stock no. 100) and the male from Dr. Stock's lot no. 125 (allotype).

Adult female. – Total length (measured from the apex of the rostrum to the end of the furcal rami) 1,242 μ , the greatest diameter, at the cephalic somite, is 554 μ . The cephalic somite is 392 μ long and 554 μ wide; for the remaining thoracic somites these figures are: 189 and 527 μ for the second, 338 and 540 μ for the third, 54 and 277 μ for the (visible) part of the fourth (total length 176 μ) and 68 and 217 μ for the fifth somite. The genital complex is 81 μ long and 155 μ wide; for the remaining abdominal somites these figures are 41 and 87 μ for the third, 41 and 75 μ for the fourth and 41 and 51 μ for the fifth somite. The furcal rami are 48 μ long and 28 μ wide at the base. The longest furcal seta is 231 μ long.

The general shape of the body (Fig. 47a) is remarkable by the great development of the cephalothorax, which is a broadly rounded structure, and the shortness of the abdomen. The head and the first thoracic somite are fused to form the cephalic somite, a large, semi-circular structure with which the broadly rounded rostral plate is intimately connected; the groove separating both structures is very indistinct. A shallow groove runs in the mid-dorsal line widening near the base of the rostrum. The rostral plate curves sharply ventro-caudally and terminates into a bifid appendage, the points are sharply pointed, curved and diverging (Fig. 49a). The globular surfaces of the cephalic somite, at both sides of the mid-dorsal groove and closely under the rostral plate, each bear a bluntly pointed appendage or tooth (Fig. 49b). The latero-caudal margins of the somite are rounded. The second thoracic somite is only very slightly less wide than the cephalic somite; the epimeral parts are well developed and rounded; they completely conceal the second pair of legs. The third thoracic somite is a large, caudally broadly rounded structure of the same width as the cephalic somite. It is backward produced and covers a considerable portion of the fourth thoracic somite. The epimeral parts of the somite are rounded and though they are well developed, the basis and exopodite of the fourth pair of feet are visible. The fourth thoracic somite is visible as a narrow strip at the end of the preceding somite; in reality the somite is broadly oval, but largely concealed by the backward produced part of the third thoracic somite. It has only the width of the third somite. The fifth thoracic somite is a narrow, trapezoid structure with very distinct shoulders for the attachment of the fifth pair of legs. The shoulders result from fusion of the intermediate segment of leg 5 with the fifth thoracic somite. Each "shoulder" has a distinct, long seta (Fig. 50a). The superior part of the margin is spinulose.

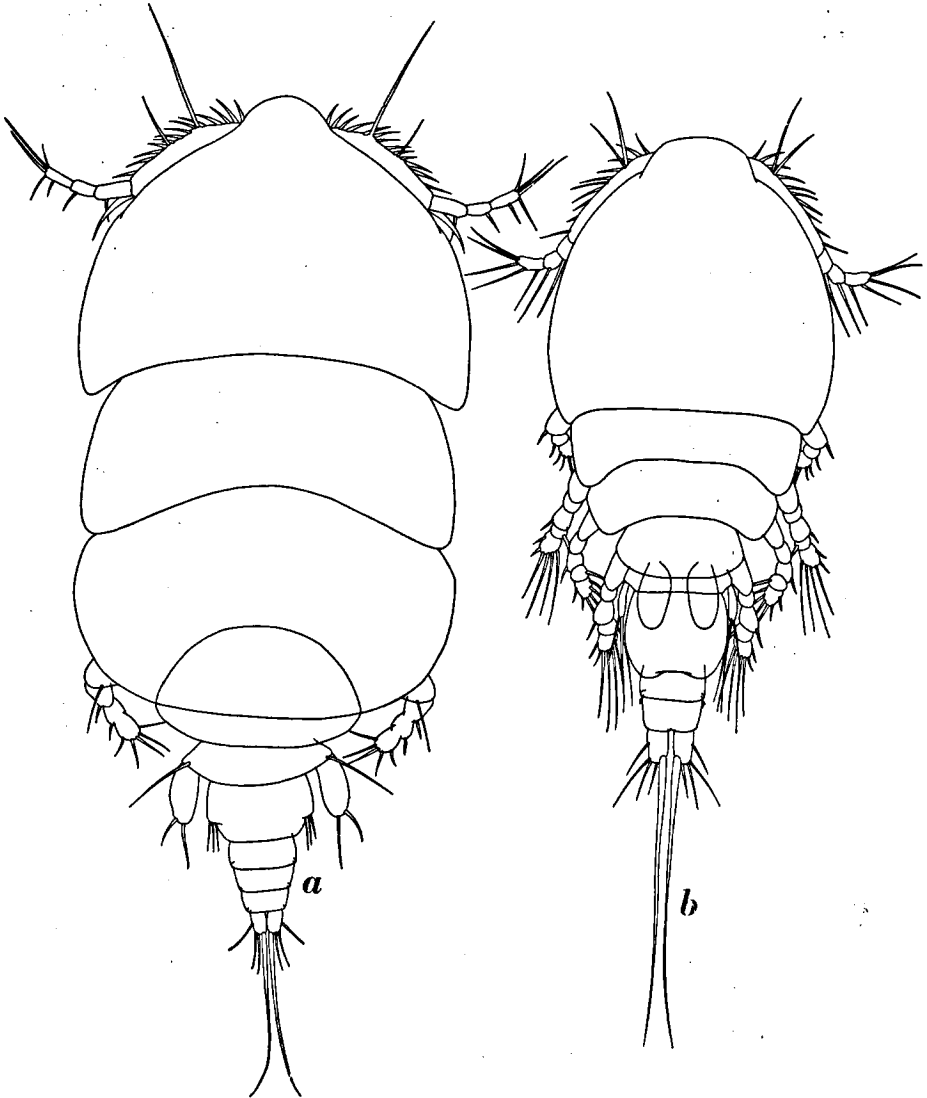


FIGURE 47. *Orbitacolax oniscoides* nov. spec. *a*, adult ♀, holotype, from *Abudedefduf saxatilis*; whole animal, dorsal view. — *b*, adult ♂, allotype, from *Sparisoma distinctum*; whole animal, dorsal view. — *a*, × 90; *b*, × 135.

The genital complex results from fusion between the first (genital) and second abdominal somites. The complex has laterally produced sides, the exact shape of which appears from Fig. 50a. The genital orifices are placed at the dorso-caudal side of the lateral swellings and are covered by rounded plates. Three setae project from the genital slit. The abdominal somites 3 to 5 are cylindrical structures of approximately equal length; the fourth and the fifth taper slightly. The anal plate on the fifth (anal) somite is almost straight and indistinctly visible. The furcal rami are longer than wide and tapering. The internal walls of the two rami are parallel and placed very closely together. There are, on each ramus, five marginal setae and one appendicular (dorsal) seta. Seta 1 is extremely small and only visible if the furcal rami are separated by pressure of the cover glass. Seta 2 is greatly lengthened and thickened; it is as long as the abdomen. The setae 3 to 5 and the appendicular seta are moderately long and of equal length.

The ovisacs are compressed, oval structures, twice as long as the abdomen. They contain a large number of fairly small eggs.

The antennules (Fig. 49a, b) are nearly completely visible from above and fairly long; they are composed of an undivided basal portion and a three-segmented terminal part ("flagellum"). The attachment to the ventral surface of the cephalic somite, close to the rostral plate, is by means of the basal portion and is quite firm. No chitinized plates are visible. The setation can best be observed from Fig. 49a; there are 15 plumose sensory setae dispersed along the free margin of the basal portion; the fifteenth seta is slightly larger. In addition there are two groups of normal marginal setae, numbering 3 and 2 setae, respectively; the ventral surface of the basal portion has 3 short setae. The number of setae on the three segments of the terminal part is 2, 3, and 6, respectively.

The antennae and oral appendages occupy the usual position (Fig. 49a); the maxillipedes have a lateral position. The antenna (Fig. 49c) has a long coxa, with a single terminal seta, a short basis and a fairly long endopodite, folded over the coxa. The two endopodal segments are fused; near the place of fusion the lamelliform appendage and a strong, curved claw insert. The lamelliform appendage, reaching the end of the endopodite, has a pectiniform row of fine acicular spinules, continuing for some distance on the first endopodal segment. The second endopodal segment has a digitiform process; the whole of the endopodite is covered with longitudinal rows of very fine, needle-shaped spinules, continuing on the digitiform process. The apex of the endopodite has three strong, hooked setae and a normal seta. The labrum is more or less triangular and finely hairy; it covers the apex of the mandibles, that (Fig. 48a) are strongly built, with a lengthened masticatory process, bearing one very strong scythe-shaped tooth and a much smaller tooth. The ventral margin of the large tooth is sharp. The maxillule is a rounded structure, more or less concealed between mandible, paragnath and maxilla; it carries two large and a smaller seta. The paragnath has a swollen basal portion; the apex is drawn out into a finger-shaped process, rounded at the tip and caudally with a crenulated, sharp margin. The maxilla is a large, swollen complex, bearing a single lobe, cylindrical in outline and provided with two setiform teeth and one seta. The coxa of the maxillipede (Fig. 49d) is fairly long and cylindrical; it has a single seta. The basis is triangular and large. It carries a single seta along its internal surface. The claw (endopodite) is strongly developed but comparatively short, with strong curvature. It has a sharp auxiliary tooth; the basal portion carries a single seta.

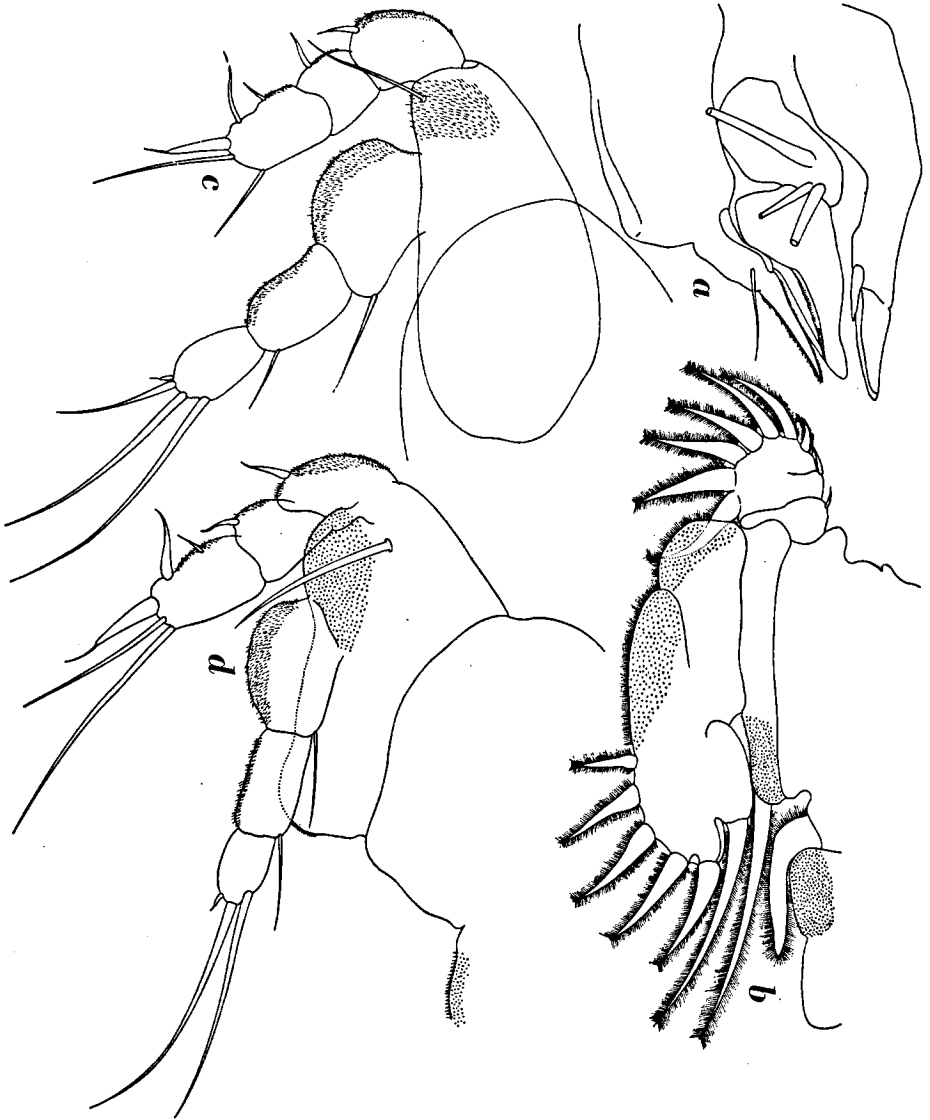


FIGURE 48. *Orbitacolax oniscoides* nov. spec., adult ♀, holotype, from *Abudejduf saxatilis*. *a*, right oral appendages; *b*, leg 1; *c*, leg 2; *d*, leg 3. — *a*, × 550; *b*, × 240; *c*, *d*, × 395.



FIGURE 49. *Orbitacolax oniscoides* nov. spec., adult ♀, holotype, from *Abudofduf saxatilis*. *a*, left part of cephalic somite, ventral view; *b*, rostrum and right antennula, dorsal view; *c*, right antenna; *d*, left maxillipede. — *a*, *b*, × 220; *c*, × 550; *d*, × 335.

The legs of the first to fourth pairs have the following setal and spinal formula:

	endopodite	exopodite
leg 1	1+0.1+0.5+0	0+I.0+I.6+II
leg 2	1+0.1+0.3+I	0+I.0+I.2+III
leg 3	1+0.1+0.2+I	0+I.0+I.2+III
leg 4	1+0.1+0.2	0+I.0+I.2+III

The legs have the following particulars:

Leg 1 (Fig. 48b) has a small exopodite and a very large, strongly flattened, endopodite. The three exopodal segments are partly fused; one of the external marginal spines is hairy and setiform. The intercoxal plate is bilobed and spinulose. The coxa has a large, setose, flattened seta at its internal corner. The internal corner of the basis is spinulose. The second and third endopodal segments are fused. The hairy internal margin of the first and fused segments are strongly swollen and spinulose.

Leg 2 (Fig. 48c) has a laterally directed basis, bearing a single fine seta near the articulation with the exopodite; the apex of the segment is hairy. The structure of the external marginal spines of the three exopodal segments appears from Fig. 48c; all spines are flagellated. The terminal spine on the exopodite is strong and conical. The external margin of the exopodite is hairy. The external margin of endopodal segments 1 and 2 is hairy; that of the first endopodal segment is also strongly swollen. The spine of the third endopodal segment is minute and flagellated.

Leg 3 (Fig. 48d) has a spinulose intercoxal plate. The basis, which as in the second pair is directed laterally, has a spinulose ventral border; the seta at the articulation with the exopodite is large. The structure of the exopodite is as in the second pair. The endopodite is almost as in the second pair, with the exception of the third segment, which has two setae and a minute, flagellated spinule.

Leg 4 (Fig. 51a) differs only slightly from that of the third pair. The coxa is swollen; the second segment of the endopodite is also strongly swollen. The third endopodal segment, which is small, has two setae.

Leg 5 (Fig. 51b) consists of a single spatulate segment; the intermediate segment, present in many species of Bomolochidae as a free segment, is incompletely separated from the fifth thoracic somite and carries a single seta. The free, apical segment has three apical appendages, two strong setae and a small, spiniform seta; both in- and external margins are spinulose.

Adult *male*. — Total length, 638 μ . The greatest diameter, at the cephalic somite, is 264 μ . The cephalic somite, including the rostral plate, is 248 μ , the greatest diameter 264 μ . For the remaining thoracic somites these figures are: 61 and 165 μ for the second, 50 and 165 μ for the third, 55 and 121 μ for the fourth and 33 and 99 μ for the fifth thoracic somite. The length of the genital complex, including the third abdominal somite, is 83 μ , the maximal diameter is 105 μ . For the fourth and fifth abdominal somites these figures are 28 and 66 μ and 33 and 66 μ , respectively. The furcal rami are 28 μ long, each ramus has a diameter of 28 μ at the base. The longest furcal setae are 440 μ long.

The general shape of the body (Fig. 47b) is quite different from that of the female. The body is cyclopoid, with almost oval cephalothorax and short abdomen. The head and first thoracic somite are fused to form the cephalic somite, to which the rostral plate is completely fused. The extreme apex of the rostral plate is very broad-

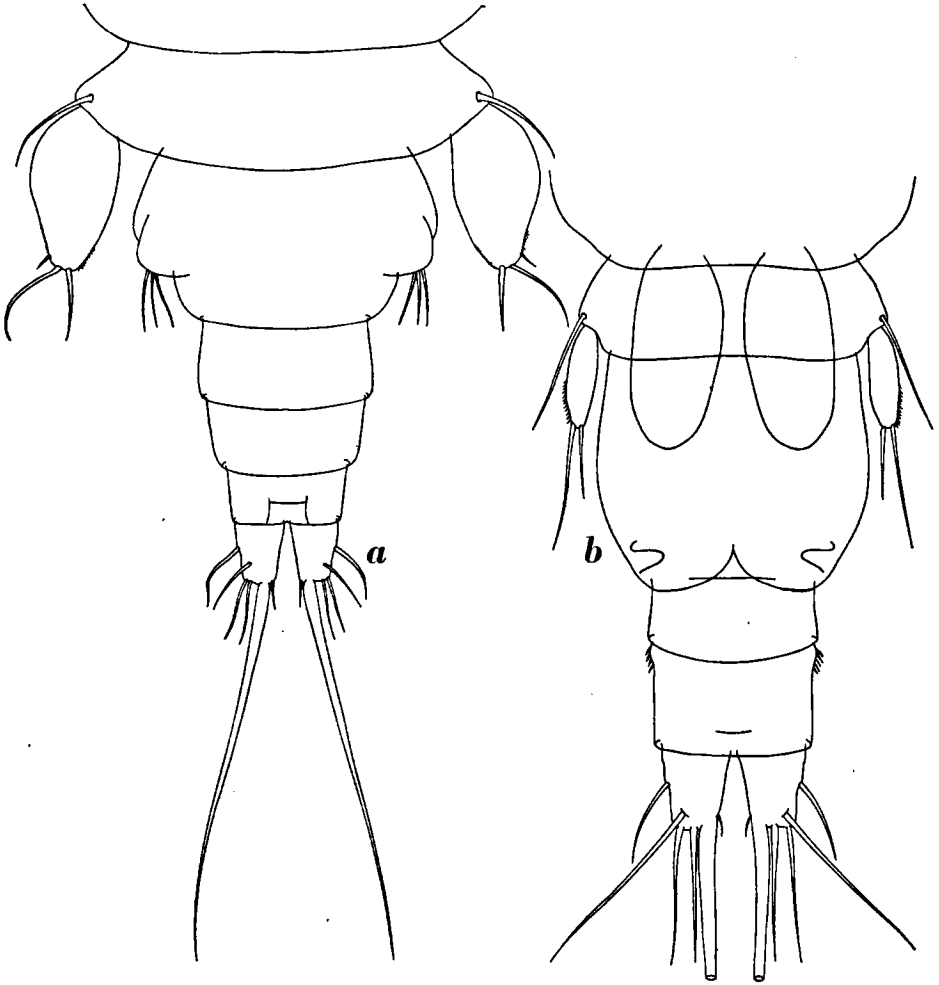


FIGURE 50. *Orbitacolax oniscoides* nov. spec. *a*, adult ♀, holotype, from *Abudejdul saxatifis*; fifth thoracic somite and abdomen, dorsal view; – *b*, adult ♂, allotype, from *Sparisoma distinctum*; fifth thoracic somite and abdomen, dorsal view. – *a*, $\times 135$; *b*, $\times 395$.

ly rounded; no ventral points have been observed. The sides of the cephalic somite are very evenly rounded. The thoracic somites two and three are slightly less wide than the cephalic somite; the fourth thoracic somite has the shape of an elongated oval. The development of the epimeral parts of the somites is such that the legs of the second to fourth pairs are almost completely exposed. The fifth thoracic somite

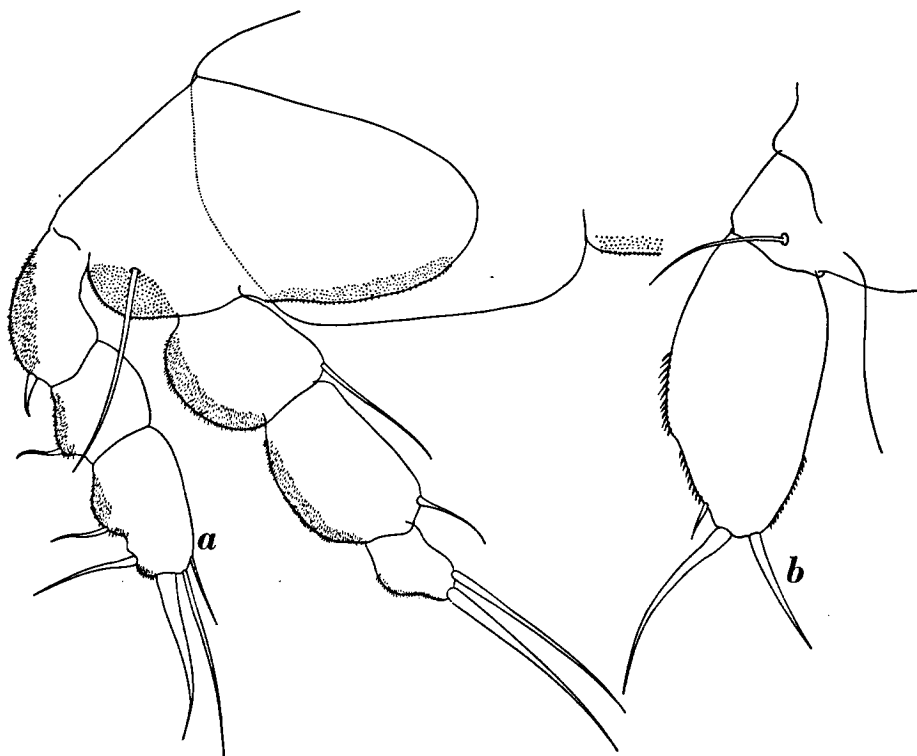


FIGURE 51. *Orbitacolax oniscoides* nov. spec., adult ♀, holotype, from *Abudjeduf saxatilis*. a, leg 4; b, left fifth leg. — a, b, × 395.

appears in the dorsal aspect as a narrow strip of trapezoid shape and with distinct shoulders for the attachment of the fifth legs.

The genital complex results from fusion of abdominal somites 1 and 2; the third abdominal somite is completely telescoped into the complex (Fig. 50b). Ventrally it has a pair of large genital flaps, covering the genital slits and slightly projecting over the fourth abdominal somite. This last somite is a cylindrical structure of short length. The fifth abdominal somite is cylindrical and slightly longer than somite four; the upper portion of the sides is spinulose. The anal plate is indistinctly visible. The structure of the furcal rami is as in the female, the appendicular seta is longer and bigger.

The antennules are fairly long and completely visible from above; the setation is represented in Fig. 53a. There are five free segments; the first, by means of which the antennule is firmly attached to the ventral wall of the cephalic somite, is apically swollen. There are 15 plumose sensory setae, the distribution of which appears in Fig. 53a. One of the sensory setae occurs at the ventral margin of the second segment

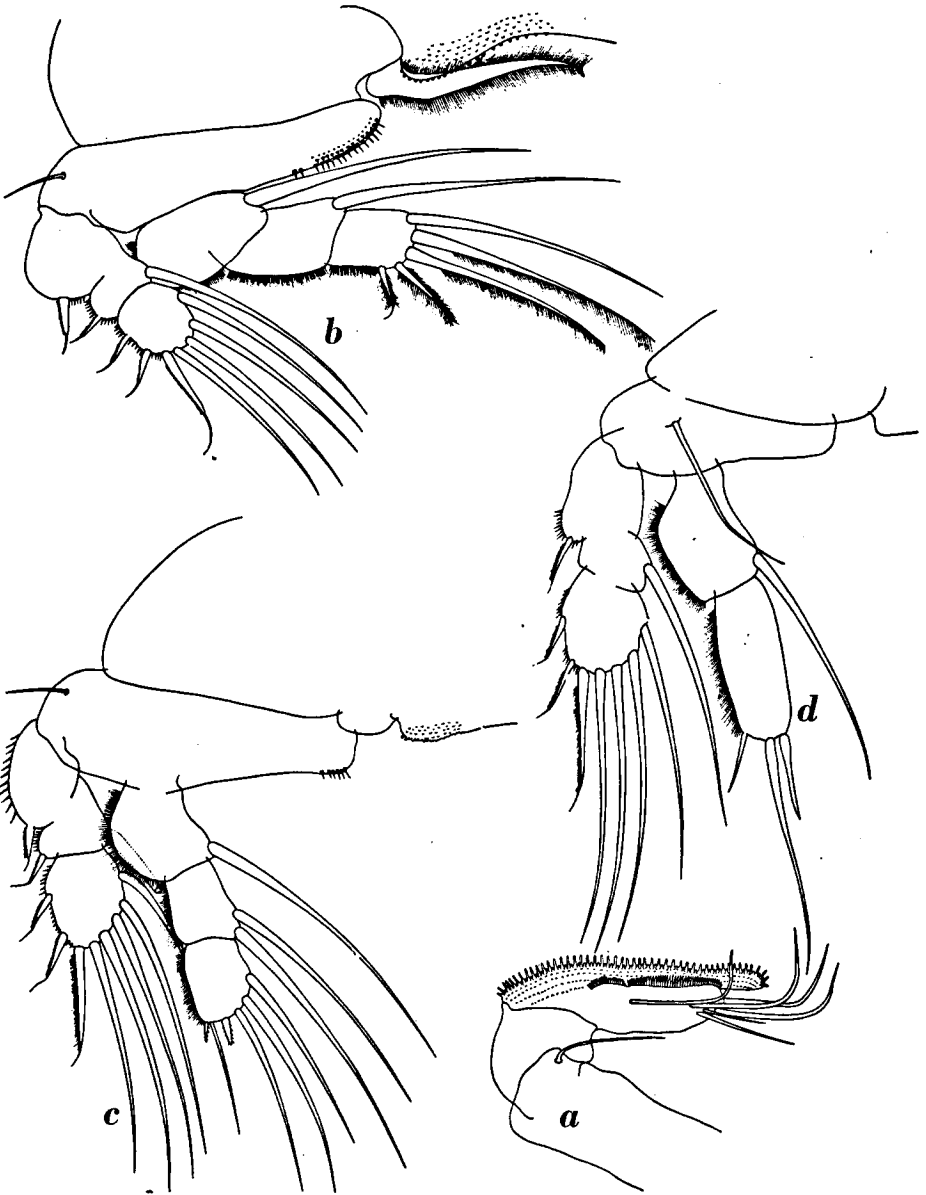


FIGURE 52. *Orbitacolax oniscoides* nov. spec., adult ♂, allotype, from *Sparisoma distinctum*. a, left antenna; b, leg 1; c, leg 2; d, leg 4. - a-d, $\times 550$.

and is spinulose. In addition there are some normal setae; 8 on segment 2, 3 on segment 3, 2 on segment 4, and 7 on segment 5. Some fine setae may have been overlooked.

The structure of the antenna (Fig. 52a) is not much different from that of the female, but the appendage is much smaller. The endopodite is covered with longitudinal rows of large, bluntly pointed spinules. The claw at the insertion of the lamelliform process is replaced by a normal, hooked seta; at the end of the endopodite there are three hooked setae and 2 straight setae. The oral appendages, with the exception of the maxillipedes, are as in the female, but correspondingly smaller. The maxillipedes (Fig. 53b) differ completely from that of the female and are chelate. The coxa is short and apically swollen. The basis is a more or less triangular, strongly swollen structure, with straight internal surface, covered with rows of conical tubercles and with two short setae. The external surface of the basis is strongly swollen, partly bordered by a row of stiff hairs. The claw (endopodite) is slightly curved and has a short setae near its insertion; the internal surface is ribbed.

The legs of the first to fourth pairs have the following setal and spinal formula:

	endopodite	exopodite
leg 1	1+0.1+0.3+II	0+I.1+I.4+III
leg 2	1+0.2+0.3+II	0+I.1+I.5+III
leg 3	1+0.2+0.2+II	0+I.1+0.5+III
leg 4	1+0.1+I+1	0+I.1+0.4+III

Some particulars of the legs are enumerated below.

Leg 1 (Fig. 52b). The intercoxal plate is covered with conical tubercles. The seta at the internal corner of the coxa is flattened and strongly hairy. The external corner of the basis has a fine seta, the internal corner is spinulose. Both exo- and endopodite are 3-segmented. The external margin of the first exopodal segment is strongly swollen. All external marginal spines are flagellated and have the outer edge set with stiff hairs. The endopodite is only slightly flattened; the external margin of the first segment is strongly swollen. The whole of the external margin is hairy. The external margin of the exopodite is spinulose.

Leg 2 (Fig. 52c) has the intercoxal plate and basis as in the first pair; no seta occurs at the internal corner of the coxa. The external marginal spines of the exopodite are flagellated; the whole of the external margin is spinulose. The external wall of the first endopodal segment is swollen; the whole of the external margin of the endopodite is hairy.

Leg 3 (Fig. 53c) differs from the second pair in details of spinulation and setation. The second exopodal segment has no external marginal spine; only two setae (and the two spines) occur at the margin of the third endopodal segment.

Leg 4 (Fig. 52d) has no tubercles on the intercoxal plate; the seta at the external corner of the basis is large. The exopodite is as that of leg 3, but there are only 4 setae (and the 3 spines) on the third exopodal segment. The endopodite is 2-segmented; the first with a single internal seta, the second with an apical seta, flanked by a pair of spines.

Leg 5 (Fig. 50b) is 1-segmented, the intermediate segment, complete with its seta, is fused with the fifth thoracic somite to form a large shoulder, serving the attachment of the free segment. This free segment is elongated-oval, with two apical setae of unequal length and spinulose external margin.

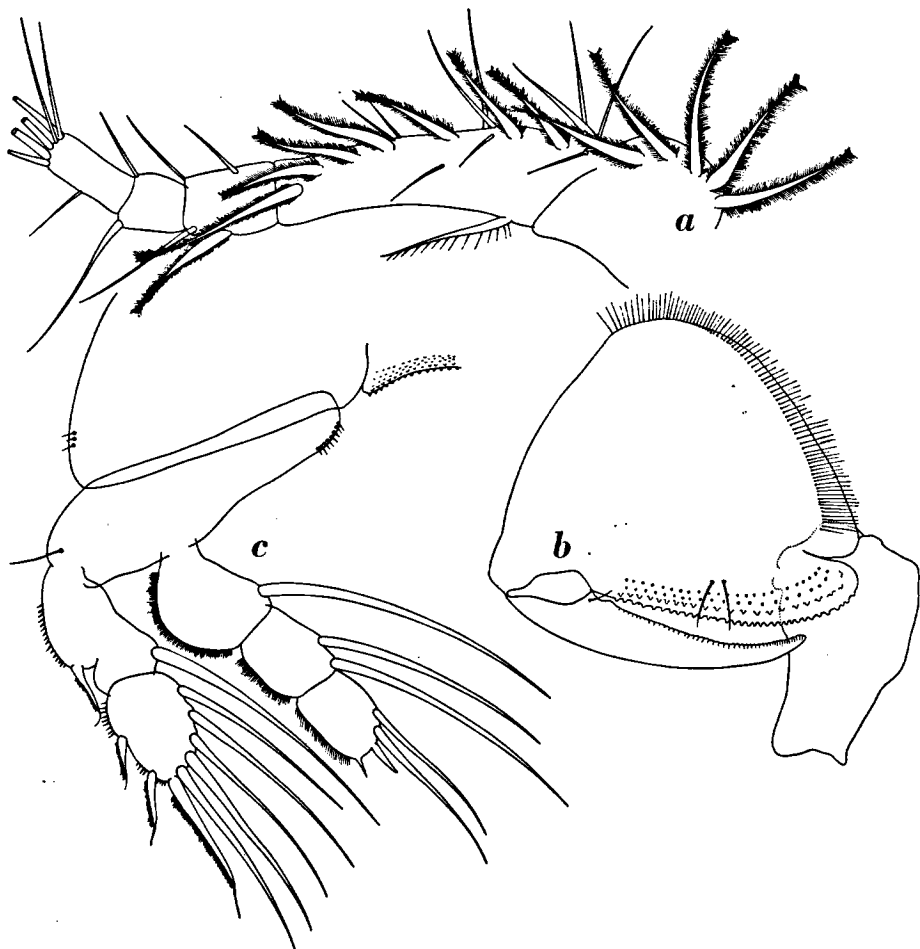


FIGURE 53. *Orbitacolax oniscoides* nov. spec., adult ♂, allotype, from *Sparisoma distinctum*. a, right antenna, ventral view; b, right maxillipede; c, leg 3. - a-c, $\times 550$.

Remarks. - This species approaches *Orbitacolax leptoscari* YAMAGUTI (1953: 222, pl. 1 figs. 9-11, pl. 2 figs. 12-18) closely in the general shape of its body, but differs completely in setation of the legs (cf. SHIINO, 1960: 501, figs. 1-3). *O. leptoscari* is the only species of *Orbitacolax* of which the male has been described (SHIINO,

1960: 505, fig. 3). The male of *O. oniscooides* described here has identical setation and spinulation as that of *O. leptoscari*, with which it also agrees in the structure of the antenna and maxillipede. There are, however, small differences in the finer structure of the legs and antenna and in the general shape of the body. There is complete conformity in setation and spinulation of the legs between the male of *Ceratocolax euthynni* VERVOORT (1965: 36, figs. 20–22) and the males of *Orbitacolax*; in the male of *C. euthynni* the maxillipede, though chelate, is differently shaped.

O. oniscooides is quite a common parasite in the orbit of fishes from Piscadera Bay, Curaçao, being recorded from different species. The type host is *Abudefduf saxatilis* (L.). The specific name, *oniscooides*, is from the Greek oniskos, sowbug, and points to its superficial resemblance with the Isopod genus *Oniscus*.

The male has been found in the sample together with females; it has not actually been observed to be attached to the abdomen of the female.

Acanthocolax nov. gen.

· **Diagnosis. Females.** – Bomolochid Copepoda with cyclopid body. The cephalothorax is swollen and globular, rounded in outline; the abdomen is short. The head and the first thoracic somite are fused; the third thoracic somite is backward produced and covers a large part of the fourth somite, which is just visible in dorsal view. The thoracic somites 2 and 3 are broadly rounded laterally; the epimeral portions are well developed and the coxal parts of the legs are covered. The fifth somite is short; the genital complex results from fusion between abdominal somites 1 and 2; the sides are swollen and carry the genital slits on their latero-dorsal surface. The abdominal somites 3 to 5 are well separated. The furcal rami are slightly longer than wide and have 5 marginal setae, two of which are elongated and thickened. In addition each ramus has an appendicular seta. The cephalic somite, in the type species, has a frontal, rounded protuberance on each side of a shallow mid-dorsal groove; a rounded rostral plate is attached to the cephalic somite between these tubercles; the ventral edge of the rostral plate termi-

nates in two diverging, sharp points. The antennules are remarkable by the presence of a pair of rounded, plate-like structures, inserted between the basal part of the antennules and the ventral wall of the cephalic somite; the free margin of each plate points anteriorly. Each antennule has 15 plumose sensory setae, none of which is reinforced with chitinized strips. The "flagellum" is 3-segmented. The antenna has the usual structure; the endopodite is covered with many acicular teeth, indistinctly arranged in longitudinal rows. The lamelliform process has a pectiniform row of slender teeth, continuing for some distance on the endopodite. Mandible, paragnath and maxilla have the usual structure. The maxillule has two strong setae and a short, nude seta. The claw of the maxillipede is fairly short and strongly sigmoid; it has an auxiliary tooth. One plumose seta occurs on the basal part of the claw; two plumose setae insert on the internal margin of the basis.

The pattern of setation and spinulation of the legs, as observed in the type species, is (setae in arabic, spines in roman numerals):

	endopodite	exopodite
leg 1	1+0.1+0.5+0	6+IV
leg 2	1+0.2+0.3+II	0+I.1+I.4+IV
leg 3	1+0.1+0.2+II	0+I.1+I.4+III
leg 4	1+0.1+0.I+1+I	0+1.1+I.3+III

The setation of the exopodite is reduced. The endopodite of leg 1 is slightly flattened; the endopodites of legs 2 and 3 are not enlarged or flattened. The segmentation of the exopodite in leg 1 is still partly visible. The external marginal spines of the exopodites of legs 2 to 4 are all flagellated; the outer edge of each spine is set with fine teeth increasing in size from the base onwards and merging gradually into a distinct spur. The inner edge is hairy. The external margin of the exopodites of legs 2 to 4 is strongly spinulose; the anterior surface of the endopodites of these legs also has big spines. The fifth legs are composed of a short intermediate segment, hairy externally and carrying a fine seta, and an elongated, spinulose apical segment with a total of 4 setae.

The ovisacs are fairly short and have large eggs.

The *males* are unknown.

Parasites of the nasal fossae of fishes. The type species has been found on *Acanthurus* spec.

Type species: *Acanthocolax similis* nov. spec.

Remarks. – This genus approaches *Ceratocolax* VERVOORT (1965: 24) from the nasal fossae of *Euthynnus alleteratus* (Rafinesque), in the extreme spinulation of the legs, the antennular structure and the horned condition of the cephalic somite. In *Ceratocolax* the protuberances of the cephalic somite are placed close together (separated by a wide gap in *Acanthocolax*), the antennular plates are pointed (rounded in *Acanthocolax*), the endopodite of leg 2 is flattened (normally developed in *Acanthocolax*) and the setation of the exopodites is not reduced.

The generic name *Acanthocolax* (gender: masculine) has been taken from the Greek akantha, -thes, thorn, and kolax, -akos, flatterer or fawner.

***Acanthocolax similis* nov. spec. Figs. 54–57**

Piscadera Bay, CURAÇAO, XI.1958. From the nasal fossae of *Acanthurus hepatus* Metzelaar (= *A. chirurgus* (Bloch)), captured in canasters. Five ovigerous females, 1.07–1.27 mm (1.19 mm) and two juveniles. Leg. J. H. Stock, no. 85.

Piscadera Bay, CURAÇAO, 14.XI.1958. From the nasal fossa of *Acanthurus hepatus*, captured in canaster at about 8 m depth. One adult, ovigerous female, 1.17 mm. Leg. Stock, no. 81.

Piscadera Bay, CURAÇAO, 1.XII.1958. From the nasal fossae of *Acanthurus bahianus* Castelnau, captured in canasters. Twenty-eight adult, partly ovigerous females, 1.08–1.18 mm (1.15 mm). Leg. Stock, no. 99.

One of the specimens from the first mentioned lot (no. 85, Piscadera Bay, XI. 1958), a 1.22 mm long female, has been selected as the holotype. This specimen has first been figured externally; it has subsequently been dissected and the appendages mounted. The description is almost entirely based on this holotype.

Adult *female*. – Total length (measured from the apex of the rostrum to the end of the furcal rami) 1,215 μ , the greatest diameter (at the cephalic somite) is 689 μ . The cephalic somite is 365 μ long (from the tip of the paired rostral projections to the articulation of the somite) and 689 μ wide; for the remaining thoracic somites

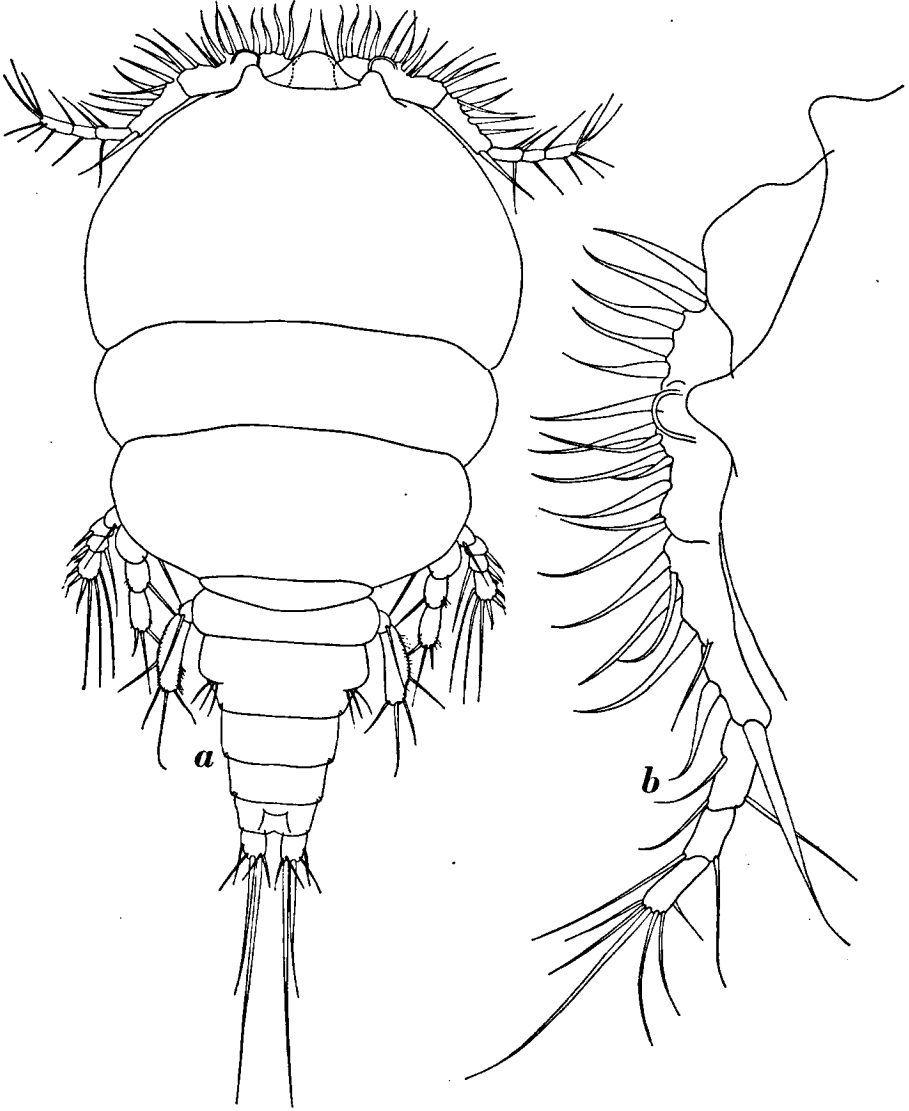


FIGURE 54. *Acanthocolax similis* nov. spec., adult ♀, holotype, from *Acanthurus hepatus*. *a*, whole animal, dorsal view; *b*, rostrum and left antennule, dorsal view. — *a*, × 90; *b*, × 220.

these figures are: 162 and 608 μ for the second, 216 and 500 μ for the third, 61 and 230 μ for the fourth, and 54 and 270 μ for the fifth thoracic somite. The genital complex is 122 μ long and 237 μ wide; for the remaining abdominal somites these figures are: 68 and 149 μ for the third, 54 and 122 μ for the fourth, and 41 and 115 μ for the fifth thoracic somite. The furcal rami are 48 μ long and 41 μ wide at the base. The longest furcal seta is 365 μ , the ovisac is 810 μ long and 284 μ wide.

The general shape of the body (Fig. 54) is very characteristic; the cephalothorax is strongly swollen and dorsally almost globular, the abdomen is short. A depression in the frontal portion of the cephalic somite is flanked by a pair of rounded, anteriorly projecting knobs; the antennules, at that level, each have a semicircular plate bordered by a thickened ridge, so that at superficial examination two pairs of horns appear to be present (Fig. 54b). This, and the general shape of the body, strikingly resemble the condition described for *Bomolochus exilipes* C. B. Wilson by PILLAI (1957: 255, figs. 7, 8). *B. exilipes*, however, has quite different appendages.

The head and the first thoracic somite are fused to form the cephalic somite, which has a broadly rounded frontal outline. In the mid-dorsal line there is a slight deepening, widening anteriorly into the depression serving the attachment of the rostral plate. This plate, in dorsal view, has a fairly broad base and smoothly rounded apex; it curves ventrally and caudally and terminates in two, slightly diverging, sharp points (Fig. 55b). The place of attachment of the rostral plate is flanked on each side by a rounded, knob-shaped projection, pointing frontally and very slightly upwards. The second thoracic somite is broadly rounded laterally and only slightly less wide than the cephalic somite; the epimeral portions of the somite are well developed and the legs of the second pair are invisible from above. The second thoracic somite is fairly narrow, in contradistinction to the third thoracic somite, which is much produced caudally and strongly swollen, almost completely covering the fourth thoracic somite. Though its sides are broadly rounded the development of the epimeral parts is such that the coxae of the third pair of legs may be exposed. The fourth thoracic somite, in dorsal view, is a very narrow strip; its length, however, is dependent upon the development of the third thoracic somite. The coxae, exo- and endopodites of the fourth pair of legs are visible from above. The fifth thoracic somite is only slightly longer than the preceding somite but has almost the same width; the insertion of the fifth legs is distinctly visible from above. The cephalic somite and the thoracic somites two to four form a strongly swollen, semi-globular structure; the mode of swelling varies in the various specimens inspected and is dependent upon the condition of the ovaries.

The first two abdominal somites are fused to form the genital complex, the shape of which appears best from Fig. 56a. The sides are distinctly swollen; the genital slits are visible on the latero-dorsal parts of each swelling and are covered by rounded plates. Three fine setae project from each slit. The abdominal somites three to five have almost the same cylindrical shape; they gradually narrow caudally. Somites three and four have about the same length and are nude. The fifth (anal) somite is slightly shorter than the preceding somites and hairy on the sides. The anal plate is small and slightly curved.

The furcal rami (Fig. 56b) are only slightly longer than wide and distinctly tapering. There are five marginal setae and one appendicular (dorsal) seta; the arrangement appears best from Fig. 56b. The setae 1, 4, 5 and the appendicular seta are short and fine; the setae 2 and 3 are lengthened and thickened; the second is the longest. There are a few spiniform hairs at the external surface of each furcal ramus.



FIGURE 55. *Acanthocolax similis* nov. spec., adult ♀, holotype, from *Acanthurus hepatus*. a, egg sac; b, left part of cephalic somite, ventral view; c, left antenna; d, left mandible; e, right paragnath; f, left maxilla; g, left maxillipede. - a, $\times 90$; b, $\times 220$; c-g, $\times 335$.

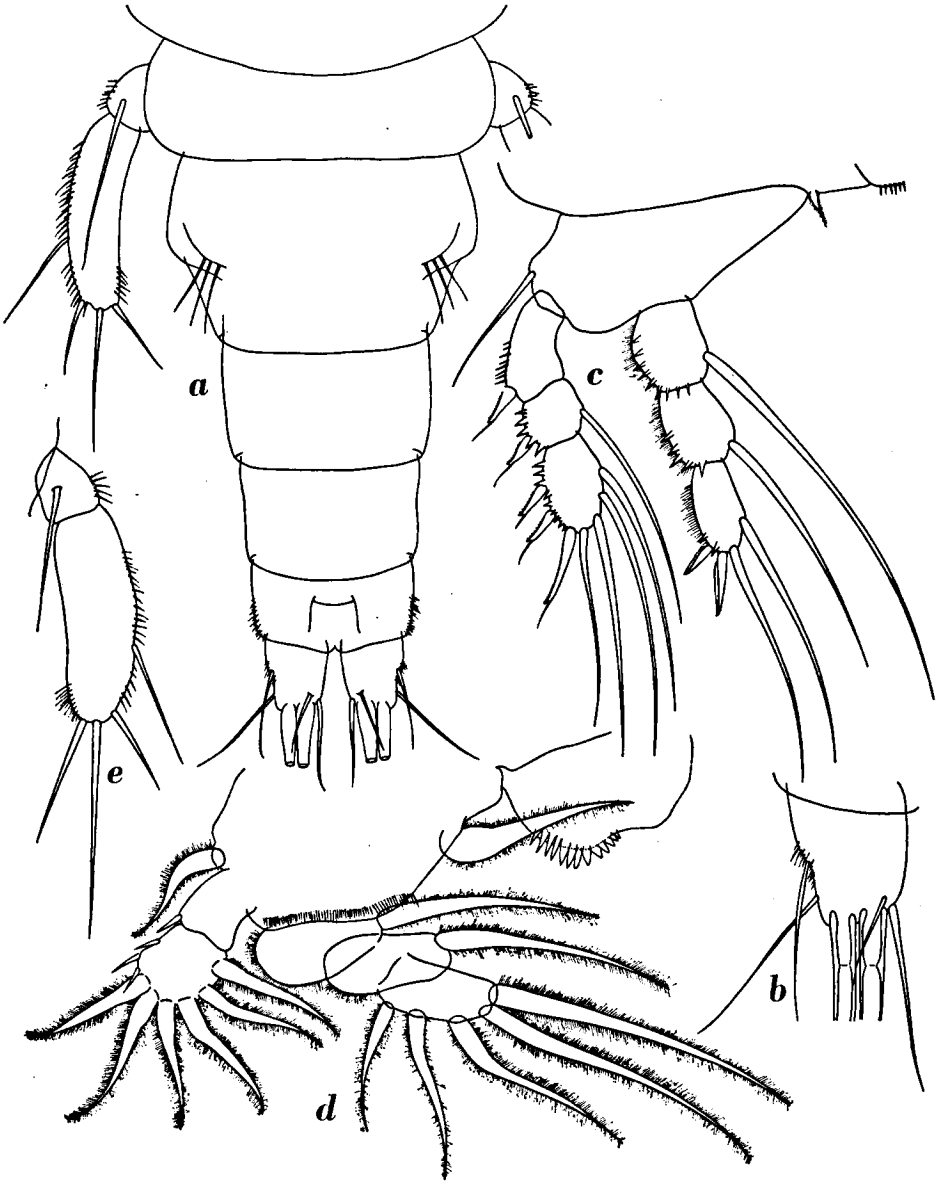


FIGURE 56. *Acanthocolax similis* nov. spec., adult ♀, holotype, from *Acanthurus hepatus*. a, fifth thoracic somite and abdomen, dorsal view; b, left furcal ramus, dorsal view; c, leg 3; d, leg 1; e, right fifth leg. — a, $\times 220$; b, $\times 395$; c–e, $\times 240$.

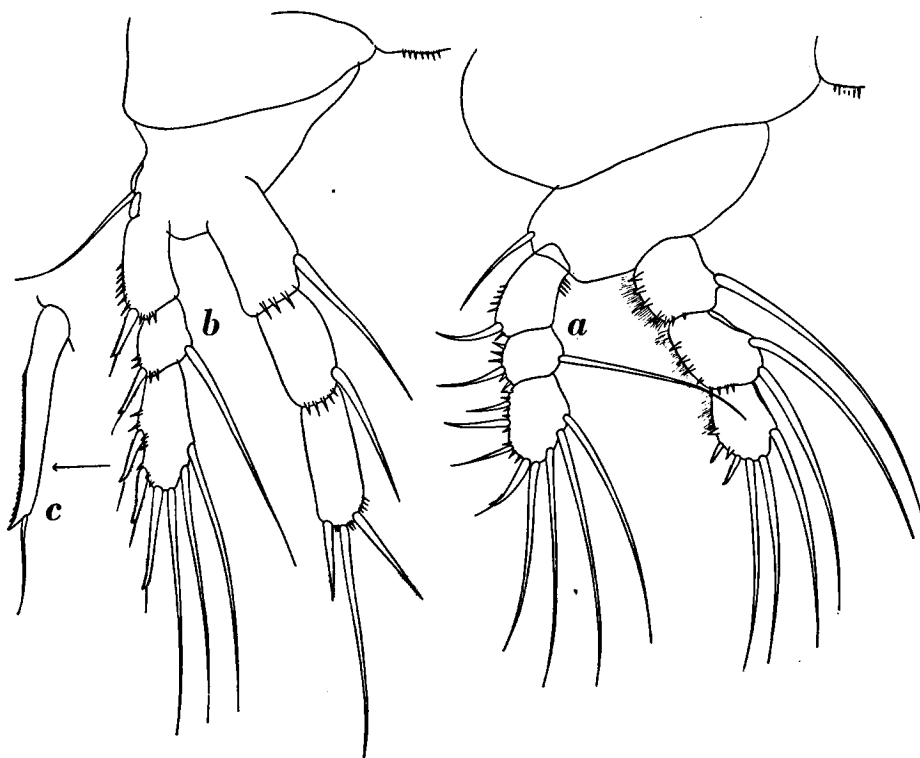


FIGURE 57. *Acanthocolax similis* nov. spec., adult ♀, holotype, from *Acanthurus hepatus*. a, leg 2; b, leg 4; c, first external marginal spine of third exopodal segment of leg 4. — a, b, $\times 240$; c, $\times 550$.

The antennules (Fig. 54b) are fairly long, project besides the cephalic somite and are distinctly visible from above. Each antennule is composed of an apparently 3-segmented basal part and a 3-segmented apical part ("flagellum"). The proximal portion of each basal part is slightly widened and carries a rounded plate-like structure with thickened frontal edge, fused with the dorsal surface of the antennule and serving the attachment of the antennule to the ventral margin of the cephalic somite. The plates project forward in front of and slightly lateral to the knob-shaped projections of the cephalic somite. Strong bundles of muscles are seen to run from the mid-dorsal line of the cephalic somite in the direction of the antennular plate. Fifteen plumose, sensory setae occur on the basal portion of the antennule; none of these setae has chitinous strips or plates. In addition there are five normally developed marginal setae and two ventral setae. The number of setae on the three segments of the "flagellum" is 3, 2, and 6, respectively. The arrangement of the setae appears best from Figs. 54b and 55b.

The antennae and mouth-parts occupy the usual position (Fig. 55b). The coxa of the antenna (Fig. 55c) is strongly developed and fairly long; it has a single seta near the insertion of the basis. The basis, in comparison to other species of Bomo-lochidae, is fairly long, the endopodite is comparatively short and folded over the coxa. The two endopodal segments are fused; the second segment is produced into a rounded, finger-shaped appendage. The ventral surface of the endopodite is covered with fine, acute, slightly curved spinules, continuing on the finger-shaped process; these spinules are indistinctly arranged in longitudinal rows. The lamelli-form process has a pectiniform row of needle-like spinules, continuing for some distance on the endopodite. Near the place of insertion of the lamelliiform process there is a strong, curved claw or tooth. The end of the endopodite, under the place of origin of the finger-shaped prolongation, has four hooked setae and one normal, long seta. The customary short seta has not been observed, though it may have been overlooked.

The free margin of the labrum is semicircular and covers the cutting edge of the mandibles; it is covered with fine, hairlike spinules. The cutting edge of the mandible (Fig. 55d) is elongated and provided with two unequally large teeth, each shaped like a scalpel. The cutting edge of each tooth is hyaline and finely serrated. The maxillules are rounded structures, each carrying two strong, hairy setae and a short, nude seta. The paragnaths (Fig. 55e) are swollen basally; they are medially elongated into a fairly broad prolongation with sharp caudal edge. The maxillae (Fig. 55f) taper gradually into their only lobe, which is set with two large, pointed teeth, one of which is spinulose, the other hairy.

The maxillipedes (Fig. 55g) occupy the usual position lateral of the other oral appendages. The coxa is long and cylindrical; it carries a single nude seta. The basis is more or less triangular; the internal margin has two hairy setae. The claw (endopodite) is strongly sigmoid and fairly short. The basal portion of the claw is set off, more or less, from the rest of the claw, with which it seems to articulate. The remaining portion of the claw proper has a distinct though blunt auxiliary tooth and a hairy seta near its base.

The legs of the first to fourth pairs have the following setal and spinal formula:

	endopodite	exopodite
leg 1	1+0.1+0.5+0	6+IV
leg 2	1+0.2+0.3+II	0+I.1+I.4+IV
leg 3	1+0.1+0.2+II	0+I.1+I.4+III
leg 4	1+0.1+0.1+1+I	0+I.1+I.3+III

Leg 1 (Fig. 56d). There is a thick, plumose seta near the articulation of coxa and basis at the internal margin. The intercoxal plate is set with strong teeth. The external margin of the basis has a plumose seta; a longitudinal row of fine, needle-like spinules runs on the frontal aspect of this segment. The endopodite is not particularly enlarged or flattened. The exopodite is indistinctly 3-segmented; the lines of fusion, particularly between segments 1 and 2, are visible. There are 4 spines of moderate size at the external exopodal margin.

Leg 2 (Fig. 57a). The intercoxal plate is spinulose. No seta could be observed at the internal corner of the coxa, though it may have been overlooked. The seta at the external margin of the basis is nude. The external margin of the exopodite has strong spinules in addition to the external marginal spines; the position appears from Fig. 57a. The fourth external marginal spine of the third exopodal segment is

flagellated. Part of the internal margin of the first exopodal segment is spinulose. The frontal aspect of the endopodite carries a number of large spines, particularly along the external margin (Fig. 57a); the internal margin itself is hairy.

Leg 3 (Fig. 56c). There is a small, hairy seta at the internal margin of the coxa; the intercoxal plate is spinulose. The seta at the external margin of the basis is nude. As in leg 2 strong spinules occur along the external margin of the exopodite; the external marginal spines are all flagellated, with the outer edge set with fine teeth, increasing in size apically and merging gradually into the spur. The external margin of the endopodite is hairy; the anterior surface of the endopodite carries large spines, particularly along the external margin (Fig. 56c). The two spines of the third endopodal segment have one of the edges finely serrated. The endopodites of legs 2 and 3 are normally developed and not enlarged or flattened.

Leg 4 (Fig. 57b, c). The intercoxal plate is spinulose; no seta occurs at the internal margin of the coxa. The seta at the external corner of the basis is long and fine. The external margin of the exopodite is spinulose; the external marginal spines are flagellated; the toothed outer edge terminates in a spur. The anterior surface of the endopodite has some large spines near the articulation between segments 1 and 2, and 2 and 3. Some spinules occur at the apex of the third exopodal segment.

Leg 5 (Fig. 56e). The short intermediate segment is spinulose at the external margin; in addition there is a fine, long seta. The elongated terminal segment has an almost straight internal margin, hairy near the apex, and a curved, spinulose external margin. There are four marginal setae, the distribution of which appears from Fig. 56e.

The ovisacs are oblong-oval structures, composed of a reduced number of comparatively large eggs, arranged in four or five longitudinal rows (Fig. 55a).

Remarks. — In external appearance this species closely resembles *Bomolochus exilipes* C. B. Wilson as this species has been redescribed by PILLAI (1967, as *Parabomolochus exilipes* (C. B. Wilson)). The resemblance is so close that the two species can only be distinguished after inspection of the legs. In *Bomolochus exilipes* the spinulation and setation is of the *Bomolochus*-type, in *Acanthocolax similis* the setation is reduced. There are also minor differences in the structure of the remaining appendages, as appears from the following list:

Antennules. Though the antennules of *B. exilipes* are not described in detail by PILLAI (1967) his figure (fig. 7 no. 3) shows a different shape of the projection of the basal part of the antennule; the sensory setae, as in all species of *Bomolochus*, are reinforced by prolongations of chitinous plates, without a curved fourth seta being present in *B. exilipes*. In *A. similis* all sensory setae are normally developed, *i.e.*, they have no chitinous strips.

Antenna. In *B. exilipes* the basis is short and the endopodite long.

In *A. similis* the basis is (comparatively) long, and the endopodite is short.

Maxillule. There are four setae in *B. exilipes*; three are present in *A. similis*.

The trivial name *,similis*, has been taken from the Latin word "similis" meaning similar and referring to the similarity of this species to *Bomolochus exilipes*.

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