JOURNAL OF NATURAL HISTORY, 1987, 21, 1025–1034

Pœcilostomatoid copepods parasitic on fishes off the west coast of Africa

JU-SHEY HO† and JERZY ROKICKI‡

† *Department of Biology, California State University, Long Beach, California, 90840, U.S.A.*

‡ *Department of Zoology, Institute of Biology, University of Gdansk, 81–378 Gdynia, Poland*

(*Accepted 3 June 1986*)

Three species of fish-parasitizing poecilostomatoid copepods are redescribed based on material collected off the coasts of Mauritania and Senegambia. They are: *Bomolochus unicirrus* Richiardi from *Lichia glauca* Linnaeus, *Taeniacanthus balistae* (Claus) from *Balistes capriscus* Gmelin, and *Chondracanthus brotulae* Capart from *Molva molva* (Linnaeus).

KEYWORDS: Poecilostomatoida, parasitic copepoda, fishes of West Africa.

Introduction

Knowledge of the copepod parasites of fishes off the coasts of Mauritania and Senegambia is particularly meager. Six species of poecilostomatoid copepods were reported by Brian (1924) from the fishes of Mauritania, they are: *Bomolochus soleae* Claus, *B. unicirrus* Richiardi, *B. monodi* (Brian) (= *Artacolax monodi*), *Nothobomolochus cornutus* (Claus) (= *Artacolax cornutus*), *Acanthochondria soleae* (Krøyer) (= *Chondracanthus soleae*), and *Chondracanthus angustatus* Heller. Aside from the addition of *Pumiliopes capitulatus* by Cressey and Cressey (1980) in the recent past, no other fish-parasitizing poecilostomatoid has been recorded from this region. Therefore, the opportunity of examining the catch made by the Polish trawlers operating on the continental shelves off Mauritania and Senegambia was greeted with our utmost enthusiasm. Fifteen species of parasitic copepods were recovered from the examination of 4049 fishes belonging to 16 species in 12 families. We report in this paper the three species of Poecilostomatoida. Since these three poecilostomatoids have never been adequately characterized, a full redescription for each species based on the new material is attempted.

Description

Bomolochus unicirrus Richiardi, 1880

(Figs 1, 2)

Material examined. Sixty-two females recovered from gill cavities of 38 *Lichia glauca* Linnaeus, caught at 12°25′N 17°15′W, on 3.ix.1977 and at 12°05′W on 14.ix.1977. Ninety-six hosts were examined.

Female. Body (Fig. 1 (*a*)) of typical bomolochid form, bearing a pair of sharp-tipped tines in rostral area (Fig. 1 (*b*)). All metasomal and urosomal somites wider than long. Postero-ventral surface of abdominal somites armed with a band of spinules (see Fig. 1 (*c*)), except for anal somite which bears two patches of such spinules on the ventral surface. Caudal ramus (Fig. 1 (*c*)) about twice as long as wide, bearing usual

armature of four short setae and two long inflated setae. Egg sac (Fig. 1(*d*)) about as long as body.

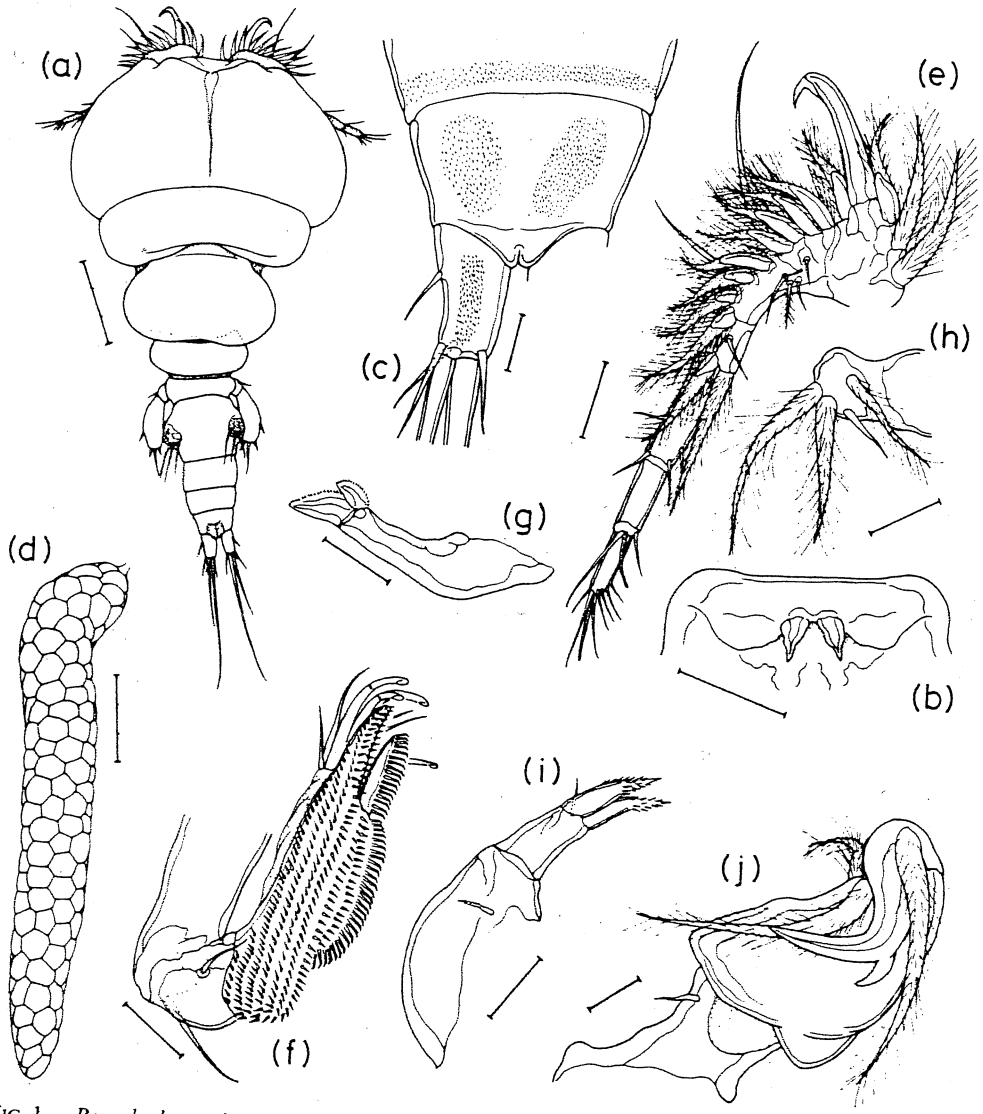

FIG. 1. *Bomolochus unicirrus* Brian, female. (*a*) Habitus, dorsal; (*b*) rostral area, ventral; (*c*) anal segment and caudal ramus, ventral; (*d*) egg sac; (*e*) first antenna, ventral; (*f*) second antenna; (*g*) mandible; (*h*) first maxilla; (*i*) second maxilla; (*j*) maxilliped. Scale bars: (*a*), (*d*) = 0·3 mm; (*b*), (*e*) = 0·1 mm; (*c*), (*f*), (*g*)–(*j*) = 0·05 mm.

Basal part of first antenna (Fig. 1 (*e*)) fringed with 14 robust hairy setae and one recurved hook, in addition to six setae of various length on dorsal surface and six short setae on ventral surface. Formula of armature on three-segmented distal part being 4, 2+1 aesthete, and 7+1 aesthete. Second antenna (Fig. 1 (*f*)) with each of two basal segments bearing a seta; third segment carrying about seven or eight rows of small

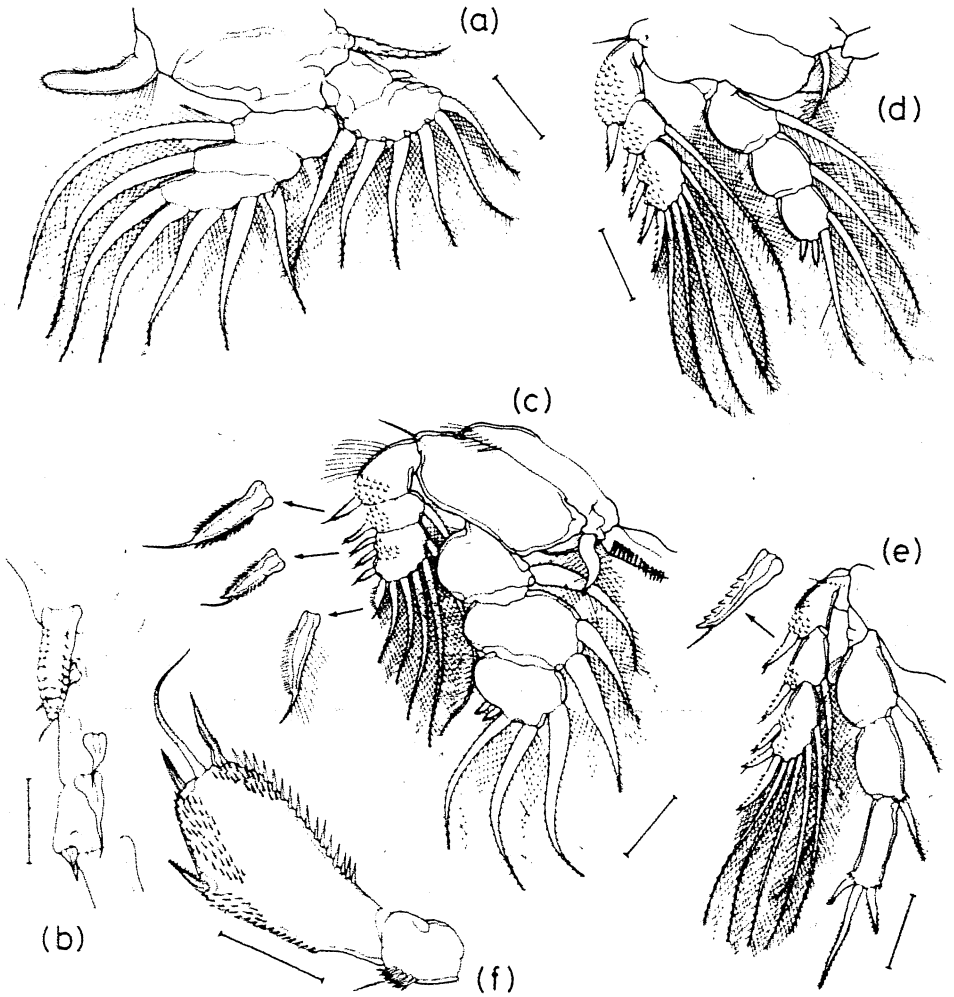

FIG. 2. *Bomolochus unicirrus* Brian, female. (*a*) Leg 1, ventral; (*b*) outer spines of leg 1 exopod; (*c*) leg 2, anterior; (*d*) leg 3, anterior; (*e*) leg 4, anterior; (*f*) leg 5, ventral. Scale bars: (*a*), (*c*)–(*f*) = 0·1 mm; (*b*) = 0·3 mm.

curved hooks on ventral (inner) surface and one row of longer and slender curved hooks on anterior margin. Terminally, third segment protruded into a blunt process, with rows of hooks extended from segment proper and bearing one pectinate lamella, four curved claws, and four simple setae. Mandible (Fig. 1 (*g*)) tipped with two unequal fringed blades. First maxilla (Fig. 1 (*h*)) with three hairy setae and one small simple seta. Second maxilla (Fig. 1 (*i*)) two-segmented; proximal segment armed with a small seta and distal segment tipped with two spinulose processes and a small simple seta at its midpoint. Maxilliped (Fig. 1 (*j*)) three-segmented; proximal segment carrying a small simple seta; middle segment greatly inflated, with two unequal, stout setae at disto-inner corner; and terminal segment, a sigmoid claw with a hooklet on mid-outer surface and a large hairy seta at base.

Legs 1–4 biramous, with three-segmented rami, except for exopod of leg 1 which is

two-segmented. Formula of spines (Roman numerals) and setae (Arabic numerals) as follows:

	Exopod	Endopod
Leg 1	I–0; IV, 6	0–1; 0–1; I,5
Leg 2	I–0; I–1; III,I,5	0–1; 0–2; II,3
Leg 3	I–0; I–1; II,I,5	0–1; 0–1; II,2
Leg 4	I–0; I–1; II,I,5	0–I; 0–I; III

Coxa of leg 1 (Fig. 2 (*a*)) with a large plumose blunt process on inner surface; five outer spines on exopodal segments varied in size and appearance (Fig. 2 (*b*)). Intercoxal plate of leg 2 (Fig. 2 (*c*)) with a row of spinules (not on those of legs 3 and 4). Outer spines on exopodal segments of leg 3 (Fig. 2 (*d*)) and leg 4 (Fig. 2 (*e*)) with toothed outer surface and smooth inner surface (see enlarged spine in Fig. 2 (*e*)). Leg 4 without inner seta on coxa. Leg 5 (Fig. 2 (*f*)) two-segmented, both segments bearing spinules; small proximal segment with one seta but large distal segment bearing one seta and three spines. Leg 6 represented by three long setae in egg sac attachment area (see Fig. 1 (*a*)).

Remarks. The name *Bomolochus unicirrus* was given by Richiardi (1880) without description or figures to a bomolochid found in the gill cavity of *Lichia glauca* Linnaeus and *Lichia amia* Linnaeus in the Mediterranean. It remained in name only until 1902 when Brian attempted a full description based on the specimen collected from *L. glauca* at Portoferraio, Elba Island, Italy. Although more anatomical information was added by Brian (1924) in his treatment of Mauritanian material, the fine structures of the appendages of this species have never been described.

In his report on the occurrence of *Bomolochus decapteri* Yamaguti on the surfperches in the Far East, Ho (1983) discussed the affinity between it and *B. megaceros* Heller and *B. unicirrus* Richiardi. The present redescription substantiates Ho's assumption that these three species of *Bomolochus* form a cohesive species-complex that separates them from the remaining 12 species of congeners by three combined apomorphic states on leg 4 (see Ho, 1983: 42 for these character states).

Taeniacanthus balistae (Claus, 1864)
(Figs 3, 4)

Material examined. One female recovered from gill filament of *Balistes capriscus* Gmelin, caught at 12°52′N 17°00′W, on 12.ix.1977. Six hosts were examined.

Female. Cephalothorax including first pedigerous somite. Free prosomal somites decreasing in width posteriorly (see Fig. 3 (*a*)). All somites in urosome distinctly wider than long. Abdomen four-segmented, only anal somite bearing patches of spinules (Fig. 3 (*b*)). Caudal ramus 1·78 times longer than wide, with regular armature of four small and two large setae (see Fig. 3 (*b*)).

First antenna (Fig. 3 (*c*)) bearing 23 hairy setae on proximal three segments (5, 11, 7); second segment with three additional naked setae and third segment with one. Formulae of armature on distal three segments being 4, 2+1 aesthete and 7+1 aesthete. Post-antennal process (Fig. 3 (*d*)) with sharp curved tine. Second antenna (Fig. 3 (*e*)) with both two basal segments bearing a distal seta; third segment with five setae, three curved spines, and two pectinate processes in distal region (Fig. 3 (*f*)). Proximally, third segment also protruded into a pectinate process like those occurring distally. Mandible tipped with two unequal fringed blades (Fig. 3 (*g*)). First maxilla (Fig. 3 (*h*)) with three barbed, short and two naked, large setae. Second maxilla two-segmented; proximal segments robust and unarmed; distal segment (Fig. 3 (*i*)) tipped

with one simple seta and two unequal processes bearing a row of spinules. Corpus of maxilliped bearing two small setae and sickle-shaped terminal claw, with a small basal seta (see Fig. 3 (*j*)).

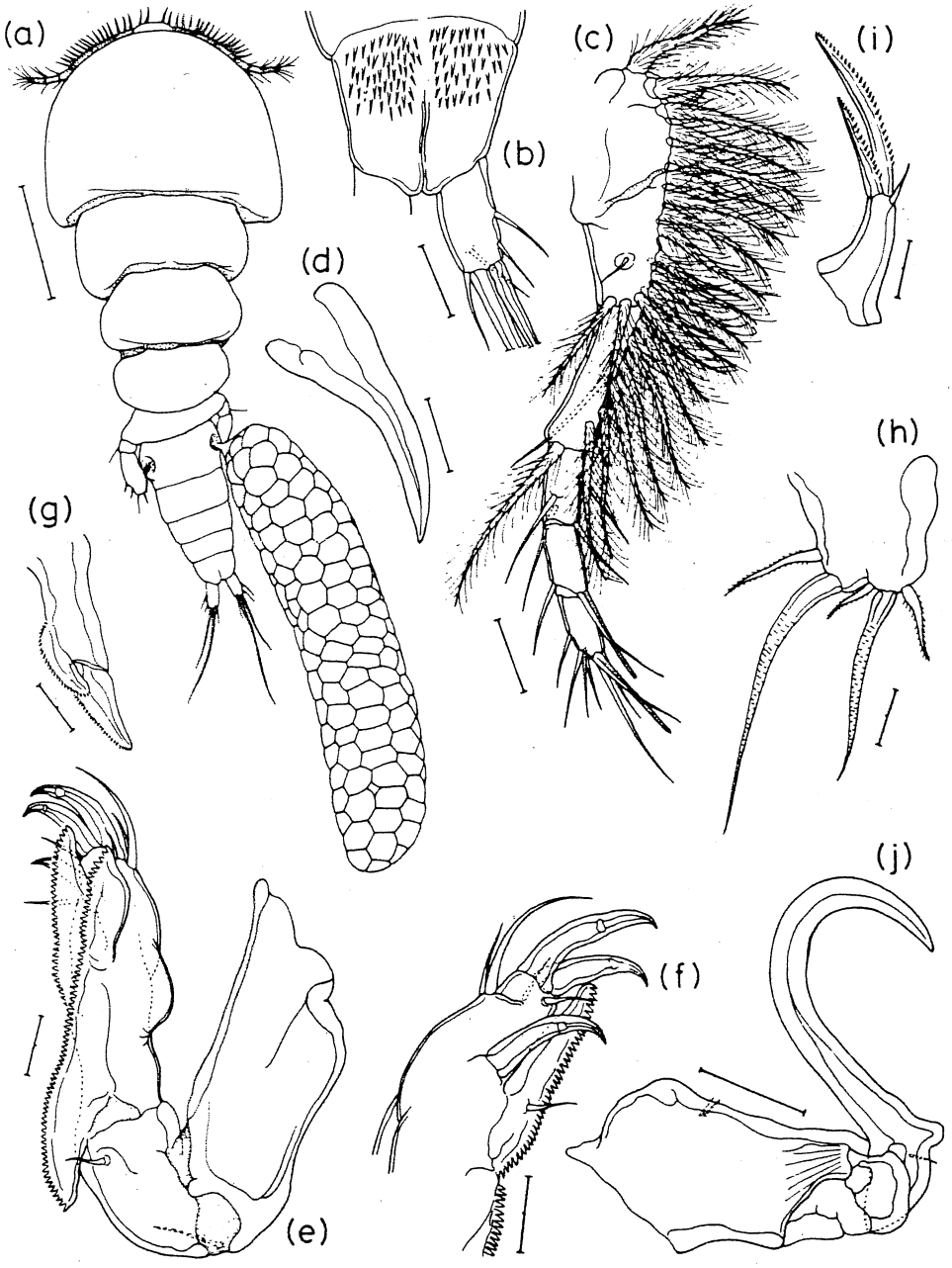

FIG. 3. *Taeniacanthus balistae* (Claus), female. (*a*) Habitus, dorsal; (*b*) anal somite and caudal ramus, ventral; (*c*) first antenna, ventral; (*d*) post-antennal process, lateral; (*e*) second antenna; (*f*) tip of second antenna; (*g*) tip of mandible; (*h*) first maxilla; (*i*) tip of second maxilla; (*j*) maxilliped. Scale bars: (*a*) = 0·3 mm; (*b*)–(*d*), (*j*) = 0·05 mm; (*e*)–(*h*) = 0·02 mm.

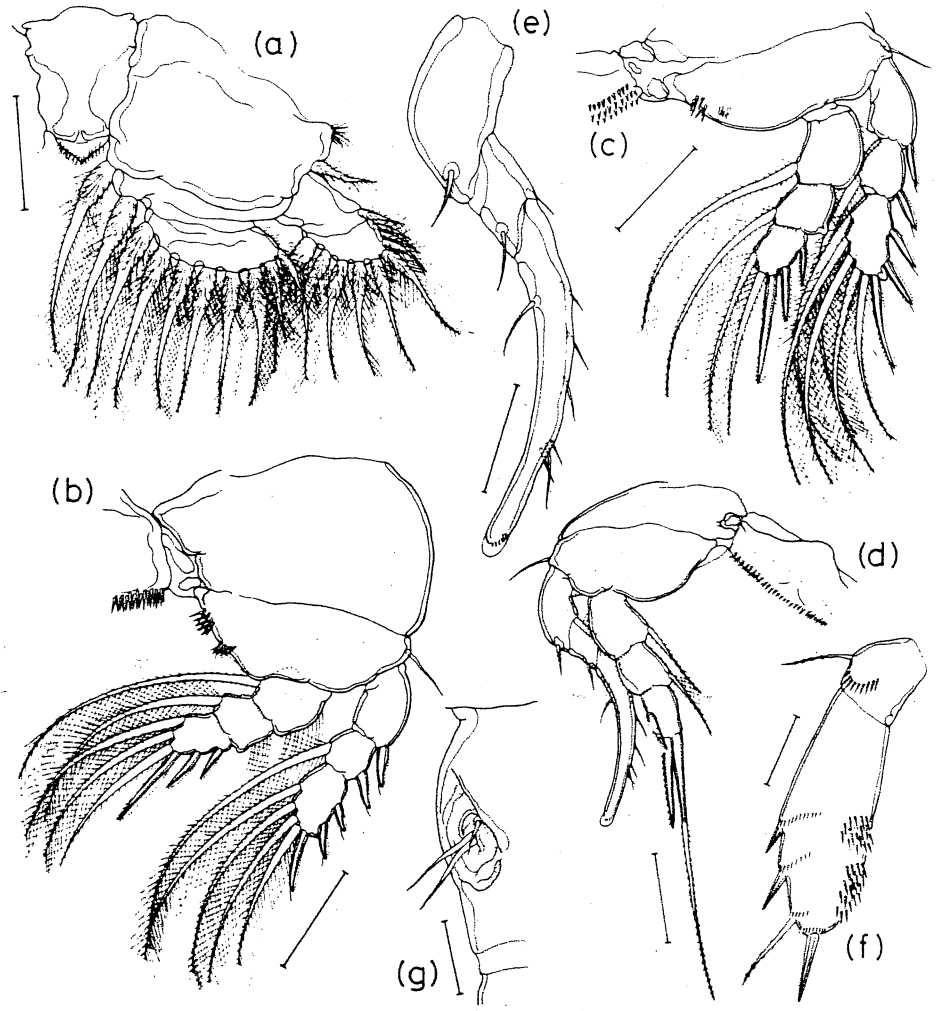

FIG. 4. *Taeniacanthus balistae* (Claus), female. (*a*) Leg 1, ventral; (*b*) leg 2, anterior; (*c*) leg 3, anterior; (*d*) leg 4, anterior; (*e*) leg 4 exopod, anterior; (*f*) leg 5, ventral; (*g*) egg sac attachment area and leg 6. Scale bars: (*a*)–(*d*) = 0·1 mm; (*e*)–(*g*) = 0·05 mm.

Formula of spines (Roman numerals) and setae (Arabic numerals) on legs 1–4 as follows:

	Exopod	Endopod
Leg 1	1–0; 9	0–1; 7
Leg 2	I–0; I–1; II,I,4	0–1; 0–1; II,I,3
Leg 3	I–0; I–1; II,I,5	0–1; 0–1; II,I,2
Leg 4	1–0; 1–1; 1–6	0–1; 0–1; I.I.1

Sympod of leg 1 (Fig. 4 (*a*)) carrying one outer and two inner modified setae. Coxa of leg 2 (Fig. 4 (*b*)), leg 3 (Fig. 4 (*c*)) and leg 4 (Fig. 4 (*d*)) without inner seta. Exopod of leg 4 (Fig. 4 (*c*)) with weak armature. Leg 5 (Fig. 4 (*f*)) two segmented, both segments bearing spinules; armature on these two segments being 1–0; II,1,I. Leg 6 represented by two long and one short setae in egg sac attachment area (see Fig. 4 (*g*)).

Remarks. The taeniacanthid described above is considered to be conspecific with *Eucanthus balistae*, which was described more than 120 years ago by Claus (1864) from an unidentified species of triggerfish (*Balistes* sp.). The two unusual apomorphic states (the large sickle-shaped claw of the maxilliped and the strongly modified exopod of leg 4) shared between Claus' and our specimens prompted our such identification. *Anchistrotos occidentalis* Wilson is also known to possess a sickle-shaped maxilliped claw and a modified exopod in leg 4, but based on Humes and Rosenfield's (1960) redescription, the fine details of these two structures are quite different. For instance, in *A. occidentalis*, the base of the maxilliped claw lacks a knob-like protrusion and the modified exopod of leg 4 still carries spines and plumose setae. *Anchistrotos occidentalis* is parasitic on the orange filefish. *Alutera schoepfi* (Walbaum), from Woods Hole, Massachusetts.

Wilson (1911) transferred *Eucanthus balistae* Claus to the genus *Anchistrotos* Brian because the name *Eucanthus* had been preoccupied by a group of beetles. Although Yamaguti (1963) placed this species under *Taeniacanthus* without justification, his opinion is, nevertheless, adopted here in following the advice received from Dr Masahiro Dojiri (National Museum of Natural History, Smithsonian Institution) who is currently reviewing the family Taeniacanthidae.

Chondracanthus brotulae Capart, 1959

(Figs 5, 6)

Material examined. Two females each carrying a male recovered from gill chambers of two *Molva molva* (Linnaeus), caught at 20°51′N 18°00′W, on 25.v.1978. Twenty-two hosts were examined.

Female. Body (Fig. 5 (*a*), (*b*)) greatly transformed and exhibiting typical chondracanthid form. Cephalothorax long, with a prominent constriction slightly posterior to middle (see Fig. 5 (*b*)). Carapace distinctly longer than wide. First pedigerous somite wider than carapace but narrower than second pedigerous somite. Third and fourth pedigerous somites greatly inflated to form a trunk that carries two pairs of lateral processes and a pair of posterior processes. Genito-abdomen (Fig. 5 (*c*)) of usual form. Caudal ramus (Fig. 5 (*d*)) à pointed process bearing proximally three setae and a small knob. Egg sac nearly as long as body, with several rows of eggs.

First antenna (Fig. 5 (*e*)) small, filiform; carrying usual armature of 1, 1, 2, 2, 8. Second antenna broken (see Fig. 5 (*a*)). Labrum (Fig. 5 (*f*)) with a small lateral knob and a row of fine marginal teeth. Mandible (Fig. 5 (*g*)) two-segmented; falcate distal segment armed with 26 teeth on convex side and 33 teeth on concave side. Paragnath a small spinulose lobe. First maxilla (Fig. 5 (*h*)) tipped with two stout spinous elements and carrying a spinulose basal process. Second maxilla two-segmented; proximal segment large, with a spinous terminal element (see Fig. 5 (*i*)); distal segment a bluntly pointed process bearing a row of 11 teeth and a small seta (Fig. 5 (*i*)). Maxilliped (Fig. 5 (*j*)) three-segmented; proximal segment largest, but unarmed; middle segment with two patches of spinules; distal segment a pointed curved claw bearing a hooklet. Leg 1 (Fig. 5 (*k*)) with exopod much longer than endoped. Leg 2 (Fig. 5 (*l*)) larger than leg 1 and with approximately equal rami. Both legs covered with fine spinules.

Male. Body (Fig. 6 (*a*)) with inflated cephalothorax; metasome and urosome fused into a cylindrical ventrally bent trunk. Region of genital complex indicated by a pair of ventral ridges and that of abdomen by a pair of small dorsal setules (see Fig. 6 (*b*)). Caudal ramus more slender than in female, with three basal setae (see Fig. 6 (*b*)). First antenna (Fig. 6 (*c*)) filiform, armature as in female. Second antenna (Fig. 6 (*c*)) two-

segmented, distal segment a strongly recurved hook. Labrum as in female except for a small central protrusion. Mandible, paragnath, and maxilliped as in female. First maxilla (Fig. 6 (*d*)) almost as in female but second maxilla (Fig. 6 (*e*)) lacking a row of teeth on terminal segment. Leg 1 (Fig. 6 (*f*)) a fleshy lobe bearing two distal setae and a small protrusion. Leg 2 (Fig. 6 (*g*)) smaller than leg 1, tipped with two setae and bearing a basal protrusion.

Remarks. Based on Capart's (1959) original work, *Chondracanthus brotulae* can be characterized with the following gross anatomy: (1) the cephalothorax is much longer than wide, (2) the trunk carries two pairs of lateral processes (in addition to a pair of large posterior processes), (3) the first antenna is small and filiform, (4) the first leg has

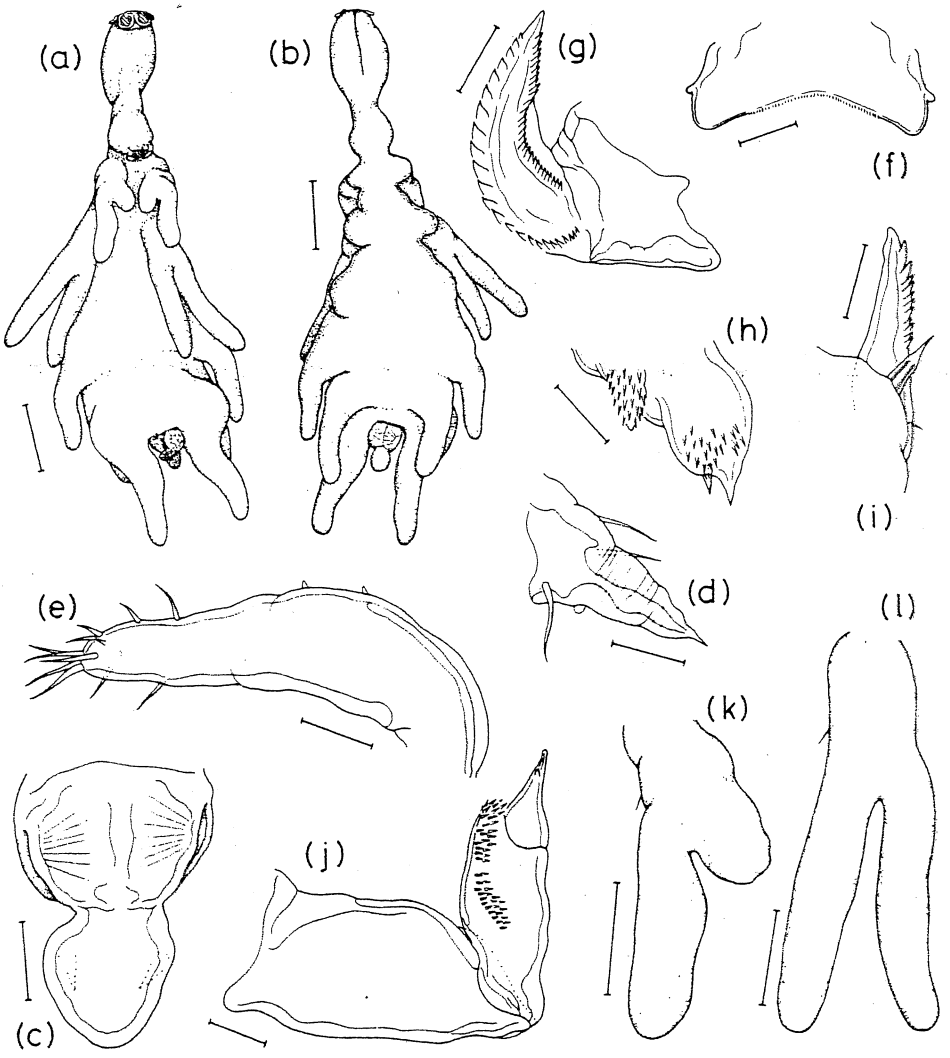

FIG. 5. *Chondracanthus brotulae* Capart, female. (*a*) Habitus, ventral; (*b*) habitus, dorsal; (*c*) genito-abdomen, dorsal; (*d*) caudal ramus, lateral; (*e*) first antenna; (*f*) labrum, ventral; (*g*) mandible; (*h*) tip of first maxilla; (*i*) tip of second maxilla; (*j*) maxilliped; (*k*) leg 1; (*l*) leg 2. Scale bars: (*a*), (*b*) = 1 mm; (*c*) = 0.2 mm; (*d*), (*e*), (*g*)–(*j*) = 0·05 mm; (*f*) = 0·1 mm; (*k*), (*l*) = 0·5 mm.

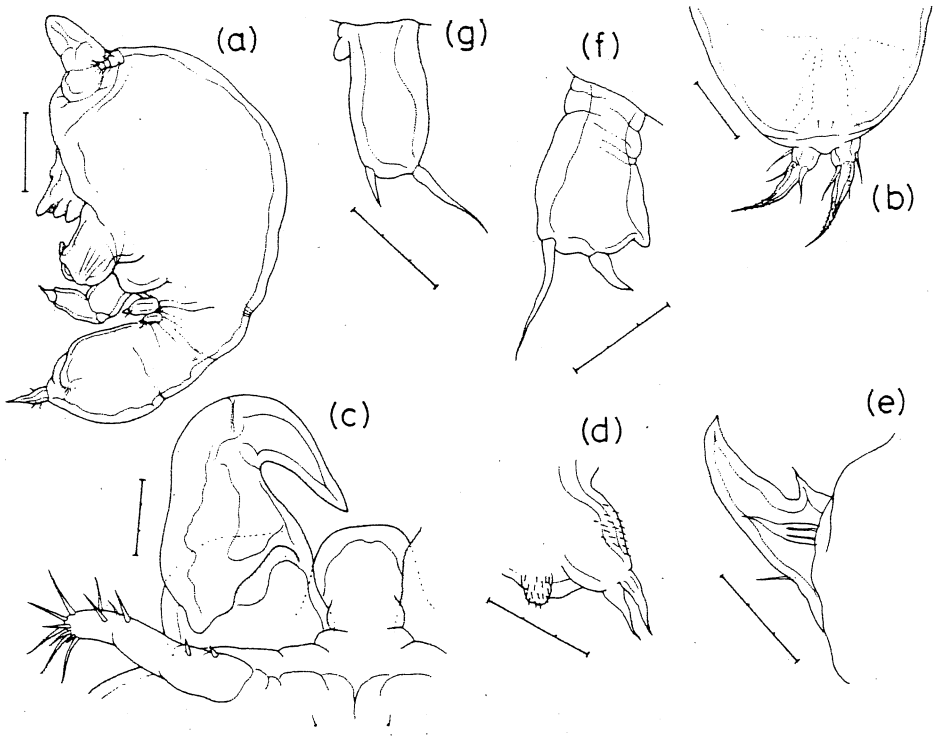

FIG. 6. *Chondracanthus brotulae* Capart, male. (*a*) Habitus, lateral; (*b*) posterior end of trunk; (*c*) first and second antennae; (*d*) tip of first maxilla; (*e*) tip of second maxilla; (*f*) leg 1, anterior; (*g*) leg 2, anterior. Scale bars: (*a*) = 0·1 mm; (*b*) = 0·05 mm; (*c*)–(*g*) = 0·03 mm.

the endopod much shorter than the exopod, and (5) the second leg bears very long rami. Since our Mauritanian specimen also exhibits these five apomorphic states of characters, it is identified as *Ch. brotulae*. Capart's (1959) specimens were taken from *Brotula barbata* (Schneider) caught off Angola at 11°10′S 13°30′E.

Acknowledgement

We thank Dr Masahiro Dojiri for advising us on the status of *Eucanthus balistae* Claus, 1864.

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