BEAUFORTIA

SERIES OF MISCELLANEOUS PUBLICATIONS
INSTITUTE OF TAXONOMIC ZOOLOGY (ZOOLOGICAL MUSEUM)
UNIVERSITY OF AMSTERDAM

No. 275 Volume 21 September 3, 1973

Cyclopoid copepods associated with the ophiuroid *Astroboa nuda* in Madagascar

ARTHUR G. HUMES

ABSTRACT

Two cyclopoid copepods are associated in large numbers with the basket star *Astroboa nuda* in Madagascar. For one, the siphonostome *Collocherides astroboae* Stock, 1971, a few details are supplied. For the other, the poecilostome *Metaxymolgus micropus* n. sp., a full description is given.

INTRODUCTION

The large tropical basket star *Astroboa nuda* (Lyman) is already known to serve as host for a siphonostome copepod. Stock (1971) described *Collocherides astroboae* (family Asterocheridae) from specimens found in the stomach of two species of *Astroboa*, *A. nuda* from Eilat (Gulf of Aqaba) and the Dahlak Archipelago (Red Sea) and *A. albatrossi* Döderlein from Indonesia.

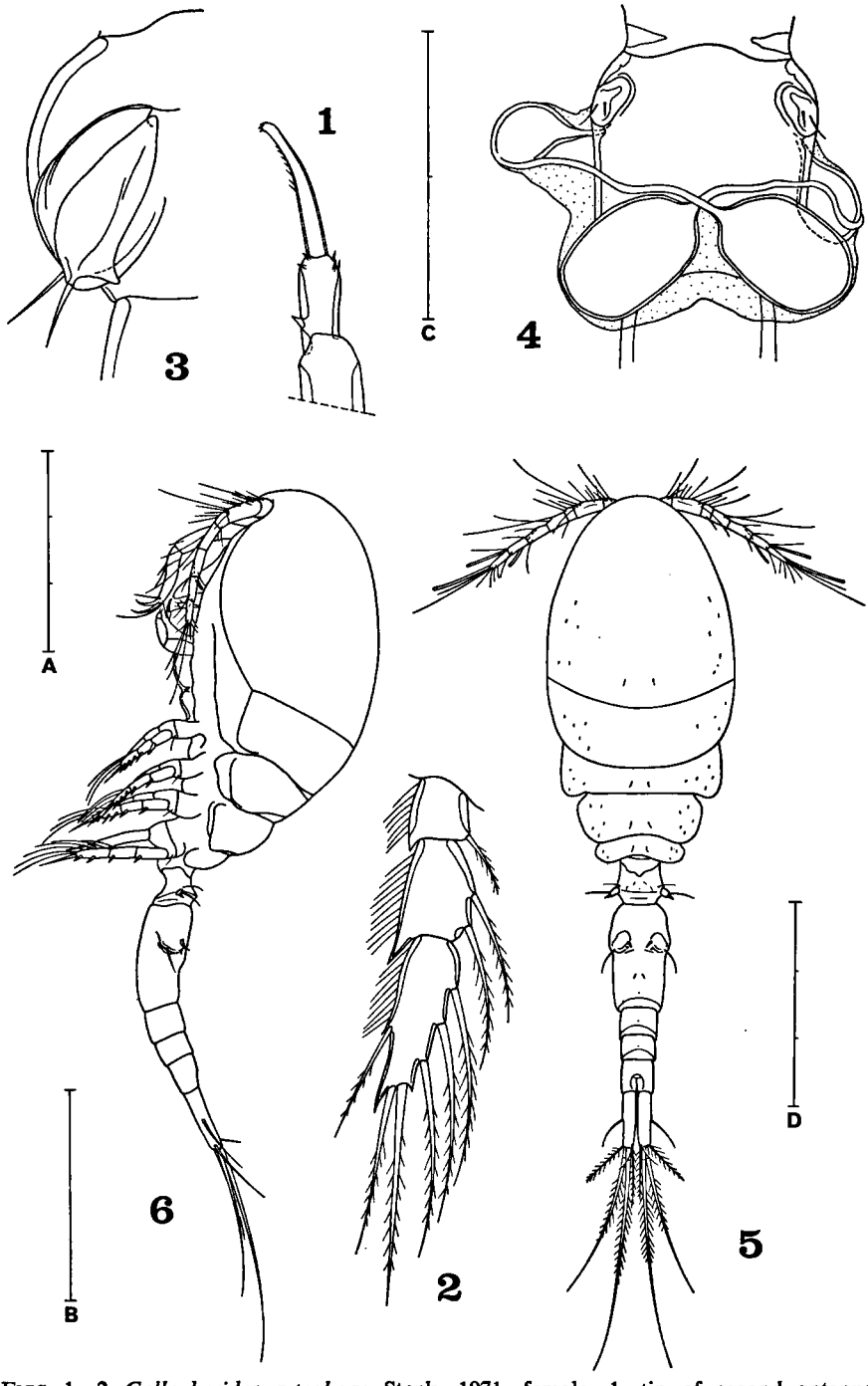
In Madagascar *Astroboa nuda* harbors two copepods, the siphonostome *Collocherides astroboae* Stock, 1971, and also the poecilostome *Metaxymolgus micropus* n. sp.

The basket stars were collected during SCUBA dives. Each ophiuroid was lifted from the sandy bottom and placed immediately in a plastic bag which was then securely tied. Later the basket stars were washed in weakly alcoholized sea water and the copepods recovered from the sediment obtained.

The copepods were collected in 1967 during field work supported by a grant (GB-5838) from the National Science Foundation of the United States and the study of the copepods has been aided by another grant (GB-8381X) from the same Foundation.

I am indebted to Mr. James F. Clark, Museum of Comparative Zoology,

Received: April 24, 1973.



FIGS. 1—2. *Collocherides astroboae* Stock, 1971, female. 1, tip of second antenna, anterior (A); 2, endopod of leg 2, anterior (B).

FIGS. 3—4. *Collocherides astroboae* Stock, 1971, male. 3, leg 6, ventral (B); 4, spermatophores attached to genital segment of female, dorsal (C).

FIGS. 5—6. *Metaxymolgus micropus* n. sp., female. 5, dorsal (D); 6, lateral (D).

Harvard University, for the identification of the host echinoderm.

All figures were drawn with the aid of a camera lucida. The letter after the explanation of each figure refers to the scale at which it was drawn. The abbreviations used are: A_1 = first antenna, A_2 = second antenna, MXPD = maxilliped, and P_1 = leg 1.

Siphonostoma

Asterocheridae

Collocherides astroboae Stock, 1971
Figs. 1—4

Specimens collected. — 4,441 ♀♀, 2,411 ♂♂ from one basket star, *Astroboa nuda* (Lyman), on a sandy bottom in 18 m, in the pass between Pte. Lokobe, Nosy Bé, and Nosy Komba, northwestern Madagascar, 3 July 1967; 7,952 ♀♀, 9,342 ♂♂ from two hosts, same locality and date. Specimens have been deposited in the Zoölogisch Museum, Amsterdam, and in the National Museum of Natural History (USNM), Washington. (A few late copepodids, difficult to distinguish from adults without detailed individual examination, are included with the specimens.)

The material from Madagascar agrees almost completely with Stock's original description based on specimens from *Astroboa nuda* at Eilat in the Gulf of Aqaba and at Umm Aabak, Dahlak Archipelago, Ethiopia, and from *Astroboa albatrossi* Döderlein in Indonesia. It suffices to give a few details by way of supplement to the original description.

Female. — The last segment of the second antenna (Fig. 1) bears a proximal hyaline element not shown in Stock's Figure 2b. In the endopods of legs 1—4 the outer distal corner of the first segment has a small hyaline spiniform process (Fig. 2). This process is smaller in leg 1 than in legs 2—4. The genital area bears two setae, one longer and more slender than the other (Fig. 4).

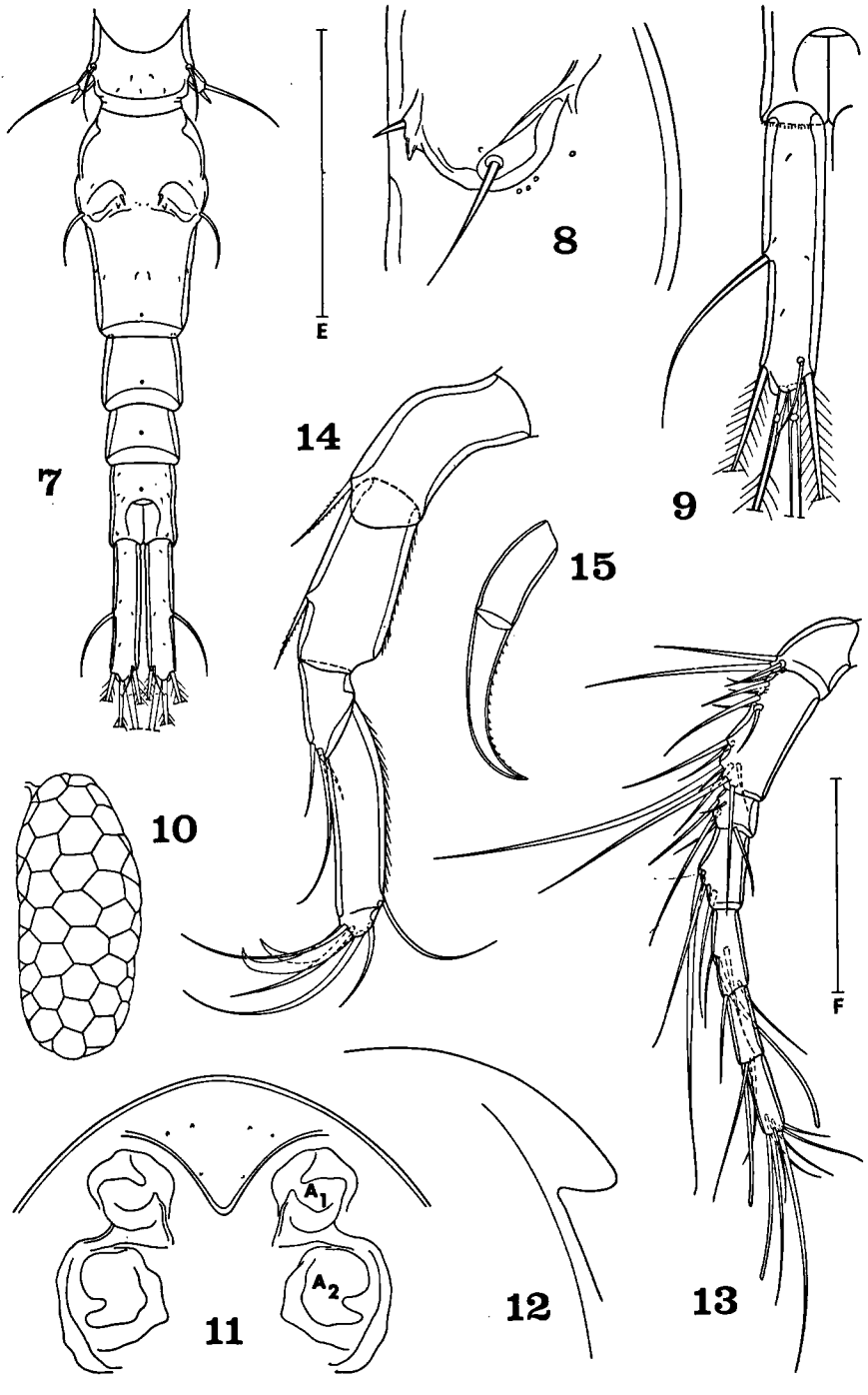
Male. — The formula for the first antenna is 1, 2, 2, 2, 2, 2, 2, 2, 6, 2 (1 seta and 1 spine), 2, 2, 2, 2, 2, 2, 3 + 1 aesthete, 9. Leg 6 (Fig. 3) has two slender naked setae about 17 μ long. The spermatophore (Fig. 4) is composed of two parts connected by a long slender neck and is fastened to the genital segment of the female by a hyaline cement.

Poecilostoma

Lichomolgidae

Metaxymolgus micropus n. sp.
Figs. 5—34

Type material. — 396 ♀♀, 282 ♂♂, and 181 copepodids from one *Astroboa nuda* (Lyman), on a sandy bottom in 18 m, in the pass between Pte. Lokobe, Nosy Bé, and Nosy Komba, 3 July 1967. Holotype ♀, allotype, and 225 paratypes (130 ♀♀, 95 ♂♂) deposited in the Zoölogisch Museum, Am-


7
E
8
9
14
15
10
F
A1
A2
11
12
13

sterdam; the same number of paratypes in the National Museum of Natural History (USNM), Washington; and the remaining paratypes and the copepodids in the collection of the author.

Other specimens (all from *Astroboa nuda*). — 1,125 ♀♀, 756 ♂♂, and 323 copepodids from two hosts in the type locality, 3 July 1967.

Female. — The body (Figs. 5 and 6) is slender, with the prosome somewhat thickened dorsoventrally. The length (not including the setae on the caudal rami) is 0.93 mm (0.81—1.00 mm) and the greatest width is 0.26 mm (0.24—0.29 mm), based on 10 specimens in lactic acid. The first pedigerous segment is separated from the cephalosome by a weak dorsal transverse suture. The ratio of the length to the width of the prosome is 1.93:1. The ratio of the length of the prosome to that of the urosome is 1.25:1.

The segment of leg 5 (Fig. 7) is 60 x 72 μ. Between this segment and the genital segment there is no ventral intersegmental sclerite. The genital segment is elongated, 153 x 88 μ, with only slightly swollen sides in dorsal view. The genital areas are located dorsolaterally just anterior to the middle of the segment. Each area (Fig. 8) bears a long naked seta 39 μ, a short naked spine 8 μ, and between these elements a small spiniform process. The three postgenital segments are 52 x 52 μ, 39 x 47 μ, and 55 x 42 μ from anterior to posterior. The anal segment bears on each side a posteroventral row of very small spinules.

The caudal ramus (Fig. 9) is elongated, 92 x 19 μ in greatest dimensions, the ratio being 4.84:1. The outer lateral seta is 66 μ and naked. The dorsal seta is 30 μ and naked. The outermost terminal seta is 83 μ, the innermost terminal seta 104 μ, and the two median terminal setae 198 μ (outer) and 330 μ (inner), both inserted between small dorsal (smooth) and ventral (with a few minute marginal spinules) flaps. All four terminal setae are plumose.

The body surface has a few hairs (sensilla) and refractile points as indicated in Figs. 5 and 7.

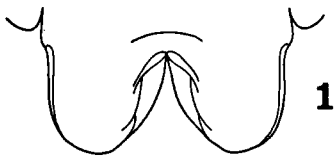
The egg sac (Fig. 10) is moderately elongated, 440 x 154 μ in the only ovigerous female seen, reaches well beyond the caudal rami, and contains numerous eggs about 52 μ in diameter.

The rostrum (Fig. 11) is subtriangular in ventral view. In lateral view (Fig. 12) it projects noticeably.

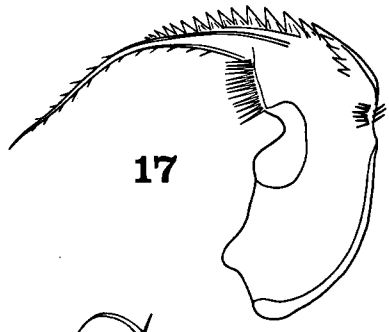
The first antenna (Fig. 13) is 249 μ long. The lengths of the seven segments (measured along their posterior nonsetiferous margins) are 22 (39 μ along the anterior margin), 56, 17, 33, 35, 32, and 36 μ respectively. The formula for the armature is 4, 13, 6, 3, 4 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete. All setae are naked.

The second antenna (Fig. 14) is 4-segmented, with armature 1, 1, 3, and

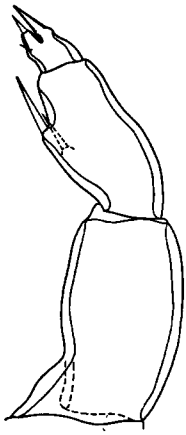
FIGS. 7—15. *Metaxymolgus micropus* n. sp., female. 7, urosome, dorsal (E); 8, leg 6, lateral (B); caudal ramus, dorsal (C); 10, egg sac, dorsal (D); 11, rostrum, ventral (C); 12, outline of rostrum, lateral (C); 13, first antenna, anterodorsal (F); 14, second antenna, postero-inner (C); 15, claw of second antenna, posterior (A).



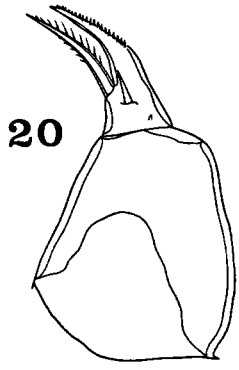
16



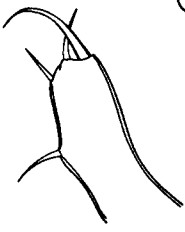
17



21

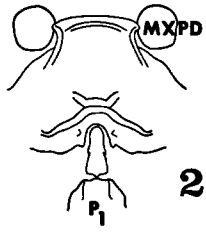


20



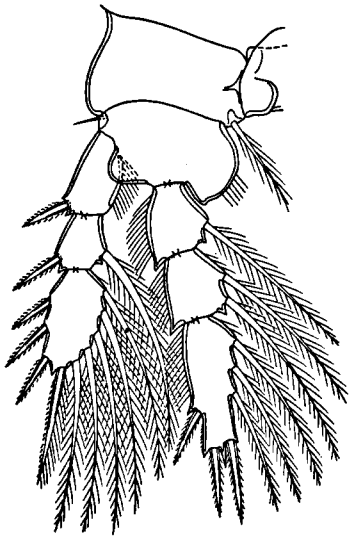
19

18

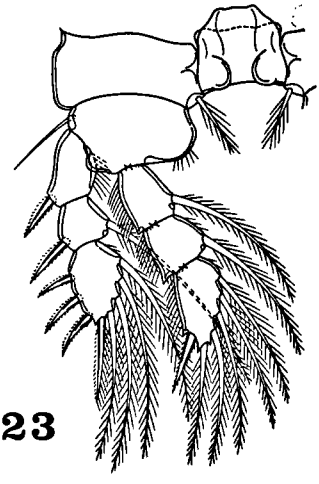


22

25



24



23

II + 5. The fourth segment is 77 μ along the outer side, 52 μ along the inner side, and 18 μ wide. The two jointed claws are 36 μ and 31 μ, both with a few small teeth along the distal concave margin (Fig. 15). The second and fourth segments have outer marginal spinules.

The labrum (Fig. 16) has two broadly rounded posteroventral lobes. The mandible (Fig. 17) has on the convex margin of the base two groups of small slender spinules opposing each other followed by a row of graduated teeth. The concave margin of the base beyond the indentation bears a row of equal spinules. The lash is long and barbed. The paragnath (Fig. 18) is a small partially haired lobe medial to the base of the first maxilla. The first maxilla (Fig. 19) has four naked elements. The second maxilla (Fig. 20) has a large unarmed proximal segment. The distal segment is extended to form a short lash with unilateral spinules. This segment carries a small posterior surficial hyaline seta and an inner distal barbed spine which is slightly longer than the lash. The maxilliped (Fig. 21) is 3-segmented, the first segment unarmed, the second segment with two naked setae, and the third segment bearing a short naked seta borne on a pedicel and an adjacent minute setule, and terminating in a naked spiniform process.

The area between the maxillipeds and the first pair of legs (Fig. 22) is protuberant (as in Fig. 6), with a sclerotized line connecting the bases of the maxillipeds.

Legs 1—4 (Figs. 23, 24, 25, and 26) are segmented and armed as in other species of the genus, although the endopod of leg 4 is, like that of *Metaxymolgus claudus* Humes & Stock, 1973, functionally 1-segmented, the line of articulation between the two segments being incomplete and observable in most cases only on the posterior surface of the ramus. In leg 4 the inner coxal seta is 11 μ and naked. The inner margin of the basis is smooth. The exopod of leg 4 is 138 μ long. The endopod is 88 (including the terminal spiniform process of 6 μ) x 19 μ (greatest width), the ratio being 4.63:1. The inner seta (of the first segment) is 37 μ and plumose. The two terminal barbed spines are 46 μ (outer) and 66 μ (inner).

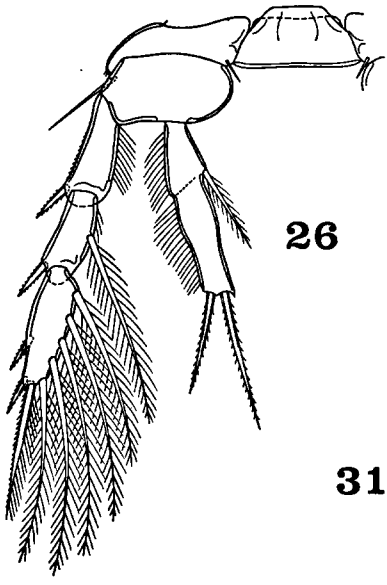
Leg 5 (Fig. 27) has a very small free segment 11 x 11 μ bearing two unequal naked terminal elements, one 10 μ and spiniform, the other 51 μ and setiform. The segment is ornamented with a few minute outer spinules. The seta adjacent to the segment is 33 μ and naked.

Leg 6 is represented by the two setae on the genital area (Fig. 8).

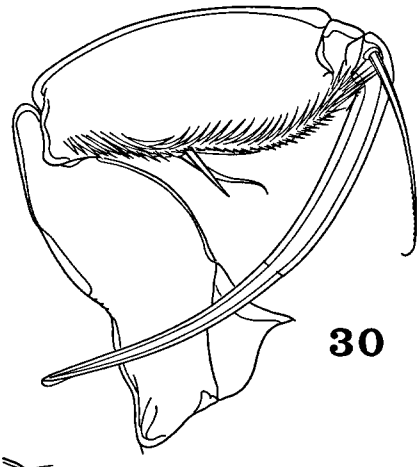
Living specimens in transmitted light are very light tan, the eye red, the egg sacs gray.

Male. — The body (Fig. 28) resembles in general form that of the female. The length (excluding the ramal setae) is 0.76 mm (0.72—0.77 mm) and the

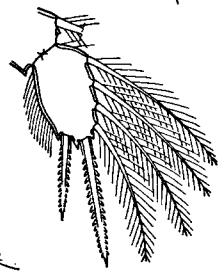
FIGS. 16—25. *Metaxymolgus micropus* n. sp., female. 16, labrum, ventral (B); 17, mandible, posterior (A); 18, paragnath, ventral (A); 19, first maxilla, anterior (A); 20, second maxilla, posterior (B); 21, maxilliped, anterior (B); 22, area between maxillipeds and leg 1, ventral (F); 23, leg 1 and intercoxal plate, anterior (F); 24, leg 2, anterior (F); 25, third segment of endopod of leg 3, anterior (F).



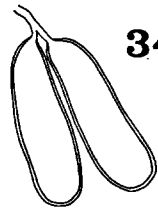
26



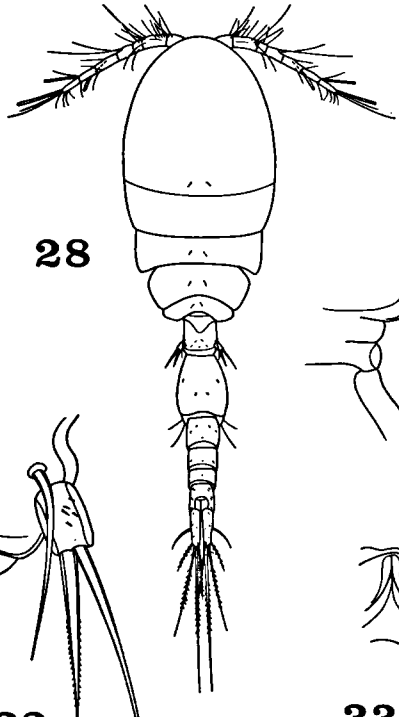
30



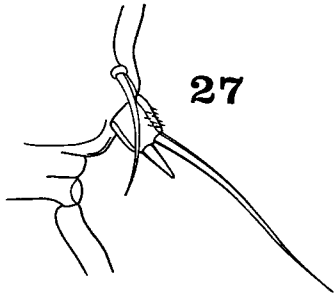
31



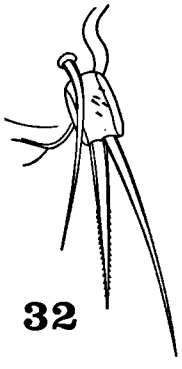
34



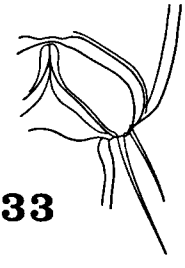
28



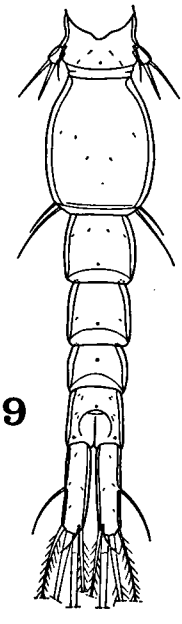
27



32



33



29

greatest width is 0.22 mm (0.21—0.22 mm), based on 10 specimens in lactic acid. The ratio of the length to the width of the prosome is 1.85:1. The ratio of the length of the prosome to that of the urosome is 1.22:1.

The segment of leg 5 (Fig. 29) is 39 x 51 μ. There is no ventral intersegmental sclerite. The genital segment is elongated, 91 x 73 μ. The four postgenital segments are 47 x 47 μ, 39 x 42 μ, 31 x 36 μ, and 39 x 36 μ from anterior to posterior.

The caudal ramus resembles that of the female but is shorter, 59 x 19 μ, with the ratio being 3.1:1.

The body surface bears hairs (sensilla) and refractile points much like those of the female.

The rostrum, first antenna, second antenna, labrum, mandible, paragnath, first maxilla, and second maxilla are like those of the female. The maxilliped (Fig. 30) is 4-segmented (assuming that the proximal part of the claw represents a fourth segment). The first and third segments are unarmed. The second segment has two naked setae and two rows of spines. The claw is 110 μ along its axis including the small terminal lamella, is incompletely divided about midway, and bears proximally two extremely unequal setae, the longer one finely barbed along one side distally.

The area between the maxillipeds and the first pair of legs is like that of the female.

Legs 1—4 are segmented as in the female, with the same spine and setal formula as in that sex. In leg 1 sexual dimorphism appears in the third endopod segment (Fig. 31), where the formula is I, I, 4 (instead of I, 5 as in the female), with both spines having conspicuous blunt barbs. The rest of leg 1, legs 2 and 3, and the exopod of leg 4 resemble the female. The endopod of leg 4 is about 60 x 16 μ, the ratio being 3.75:1, thus relatively shorter than in the female.

Leg 5 (Fig. 32) has a free segment 10 x 6.5 μ, more slender than in the female. The inner terminal element is finely barbed and 24 μ, much longer than in the female. The outer terminal element is 33 μ and naked. The seta adjacent to the free segment is 28 μ and naked. The segment is ornamented with fewer minute spinules than in the female.

Leg 6 (Fig. 33) is a posteroventral flap on the genital segment bearing two naked setae 51 μ and 28 μ.

The spermatophore, attached to the female in pairs (Fig. 34), is 88 x 26 μ without the neck.

The color of living specimens is like that of the female.

Etymology. — The specific name *micropus*, from Greek μικρὸς = small

FIGS. 26—27. *Metaxymolgus micropus* n. sp., female. 26, leg 4 and intercoxal plate, anterior (F); 27, leg 5, dorsal (B).

FIGS. 28—34. *Metaxymolgus micropus* n. sp., male. 28, dorsal (D); 29, urosome, dorsal (E); 30, maxilliped, inner (B); 31, third segment of endopod of leg 1, anterior (C); 32, leg 5, dorsal (A); 33, leg 6, ventral (C); 34, spermatophores attached to genital segment of female, dorsal (F).

and $\pi o \upsilon \varsigma$ = foot, refers to the small size of the free segment of leg 5 in this species.

Comparison with related species. — *Metaxymolgus micropus* is close to *M. claudus* Humes & Stock, 1973, a species found in the stomach of the basket star *Euryale aspera* Lamarck at Palembang, Indonesia. The new species may be separated from all species in the genus other than *M. claudus* by the same criteria used by Humes & Stock (1973) to distinguish *M. claudus*.

M. micropus differs from *M. claudus* in several characters, primarily those of the size of the caudal ramus and the aspect of leg 5. In *M. claudus* the female caudal ramus is 82 x 23 μ, with a ratio of 3.56:1, relatively shorter and wider than in the new species (92 x 19 μ, ratio 4.84:1). In *M. claudus* the female leg 5 has a free segment 37 x 16 μ, with the two terminal elements 32 μ and 46 μ, while in the new species the dimensions are 11 x 11 μ, with the elements 10 μ and 51 μ.

Other points of difference are to be found in the number of teeth on the convex side of the mandible (12 in *M. claudus*), the size and number of teeth on the lash of the second maxilla (12 teeth in *M. claudus*), the shape of the third endopod segment of leg 1 (broad in *M. claudus*, ratio 1.47:1, but more elongate in the new species, 1.93:1), the dimensions of the male genital segment (104 x 100 μ in *M. claudus*), and the size of the free segment in the male leg 5 (16 x 11 μ in *M. claudus*).

Number of copepods on *Astroboa nuda*

In Madagascar *Astroboa nuda* harbors large numbers of copepods. The collections from the three *A. nuda* examined may be summarized as follows:

	from 1 *Astroboa nuda*	from 2 *Astroboa nuda*	totals
Collocherides astroboae			
Females	4,441	7,952	
Males	2,411	9,342	24,146
Metaxymolgus micropus			
Females	396	1,125	
Males	282	756	
Copepodids	181	323	3,063
Totals	7,711	19,498	
Grand total	27,209		

From the three basket stars examined 27,209 copepods were recovered, with an average of just over 9,000 on each host (comprising about 8,000 *Collocherides astroboae* and 1,000 *Metaxymolgus micropus*). It is thus apparent that *Astroboa nuda* is capable of supporting very large populations of these two species of copepods.

References

HUMES, A. G. & J. H. STOCK
1973 A revision of the family Lichomolgidae Kossmann, 1877, cyclopoid copepods mainly associated with marine invertebrates. — Smithson. Contr. Zool., 127: (in the press).

STOCK, J. H.
1971 *Collocherides astroboae* n. gen., n. sp., a siphonostome cyclopoid copepod living in the stomach of basket stars. — Bijdr. Dierk., **41** (1): 19—22.

Dr. ARTHUR G. HUMES
Boston University Marine Program
Marine Biological Laboratory
Woods Hole (Massachusetts) 02543 — U.S.A.