

Revision of the Cypridinacea  
of the Gulf of Naples  
(Ostracoda)

LOUIS S. KORNICKER

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY • NUMBER 178

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## ABSTRACT

Kornicker, Louis S. Revision of Cypridinacea of the Gulf of Naples (Ostracoda). *Smithsonian Contributions to Zoology*, number 178, 64 pages, 26 figures, 1974.— The Cypridinacea described by G. W. Müller in 1894 are restudied. Supplementary descriptions and new illustrations are given for 11 of the 12 species described by Müller. In addition three new species from Müller's material and two new genera and two new species from specimens collected from 1962 to 1966 in the Gulf of Naples, are described. *Cypridina squamosa lernerii* Kornicker, 1958, is raised to the specific level and referred to the genus *Skogsbergia* as *Skogsbergia lernerii* (Kornicker, 1958).

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# Revision of the Cypridinacea of the Gulf of Naples (Ostracoda)

*Louis S. Kornicker*

## Introduction

The present work is principally a revision of the Cypridinacea described by G. W. Müller in his monumental 1894 publication on the Ostracoda of the Gulf of Naples. With the exception of 13 specimens, the ostracodes studied herein are from the Gulf of Naples collection of Prof. Müller made available to me by Dr. Harbans S. Puri, who had obtained it from several museums. This study is part of a project organized by Dr. Puri for the re-study of the Ostracoda of the Gulf of Naples.

Müller (1894) described 12 species of Cypridini-  
dae (=Cypridinacea herein) from the Gulf of Na-  
ples. The present revision discusses 11 of these  
(*Pseudophilomedes angulata* was not available for  
study) and, in addition, describes three new species  
from Müller's material and two new species and  
two genera from the new collections.

In *Das Tierreich*, Müller (1912), in effect, re-  
vised his 1894 work, placing *Cylindroleberis ob-*  
*longa* in synonymy with *Asterope mariae* and re-  
ferring *Cylindroleberis teres* and *Cylindroleberis*  
*lobiancoi* to *Asterope teres* and *Cyclasterope lobi-*  
*ancoi*, respectively. In the present revision the  
names of only 3 of the 11 species described by  
Müller in 1894 and studied herein remain the same  
(Table 1), but 5 of the 11 had been already  
changed by previous authors. The descriptions of

species herein differ from those of Müller in being  
more detailed and in having more appendages illus-  
trated.

Collections made by Dr. Puri and Dr. Gioacchino  
Bonaduce during 1962-1963 contained 10 speci-  
mens of Cypridinacea belonging to 7 species, 1  
new and 6 previously collected by G. W. Müller in  
the Gulf of Naples. During a week of collecting in  
1966 from some of Müller's localities, I obtained  
only two specimens of a new species and one speci-  
men of a species described previously by Müller  
(1894).

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Napoli. The source of the specimens studied are  
indicated in the text. I am grateful to Dr. E. M.  
Poulsen for reviewing the manuscript and suggest-  
ing many changes. The ostracode carapaces in Fig-  
ure 13 were drawn by Mrs. Carolyn Bartlett Gast,  
who also prepared Figures 3-7, 16-18, 20, 21, 23,  
and 26 from my camera lucida drawings. Final  
preparation, from my camera lucida drawings, of  
Figures 1 and 2, was done by Mrs. Elaine Taylor  
Hodges and of Figures 8-12, 14, and 15 was done  
by Mrs. Ann Hoskins.

ABBREVIATIONS IN THE TEXT AND FIGURES.—The  
following abbreviations are used throughout: ant=  
antenna; arrow=the anterior of the structure;

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TABLE 1.—Comparison of species names and classification used by Müller (1894, 1912) and herein (names with same number are equivalent species)

Herein	Müller, 1894	Müller, 1912
Suborder: Myodocopina	Tribe: Myodocopa	Suborder: Myodocopa
Superfamily: Cypridinacea		
Family: Cypridinidae	Family: Cypridinidae	Family: Cypridinidae
Subfamily: Cypridininae	Subfamily: Cypridinidae	Subfamily: Cypridininae
1. <i>Skogsbergia costai</i> , new species	1. <i>Cypridina mediterranea</i>	1. <i>Cypridina mediterranea</i>
2. <i>S. squamosa</i>	2. <i>C. squamosa</i>	2. <i>C. squamosa</i>
Family: Philomedidae		
Subfamily: Philomedinae		Subfamily: Philomedinae
3. <i>Euphilomedes sinister</i> , new species	3. <i>Philomedes interpuncta</i>	3. <i>Philomedes interpuncta</i>
4. <i>E. asper</i>	4. <i>P. aspera</i>	4. <i>P. aspera</i>
5. <i>Philomedes levis</i>	5. <i>P. levis</i>	5. <i>P. levis</i>
Subfamily: Pseudophilomedinae		
6. <i>Pseudophilomedes foveolatus</i>	6. <i>Pseudophilomedes foveolata</i>	6. <i>Pseudophilomedes foveolata</i>
7. [No specimens]	7. <i>P. angulata</i>	7. <i>P. angulata</i>
Family: Sarsiellidae		
Subfamily: Sarsiellinae		Subfamily: Sarsiellinae
8. <i>Sarsiella neapolis</i> , new species	8. <i>Sarsiella capsula</i>	8. <i>Sarsiella capsula</i>
9. <i>S. capsula</i>	9. <i>S. levis</i>	9. <i>S. levis</i>
Family: Cylindroleberididae		
Subfamily: Cylindroleberidinae		Subfamily: Asteropinae
10. <i>Cylindroleberis</i> species indeterminate	10. <i>Cylindroleberis oblonga</i>	10. <i>Asterope mariae</i>
11. <i>Parasterope muelleri</i>	11. <i>C. teres</i>	11. <i>A. teres</i>
<i>Prionotoleberis gyion</i> , new genus, new species		
<i>Polyleberis mackenziei</i> , new genus, new species		
Subfamily: Cyclasteropinae		
12. <i>Cycloleberis lobiancoi</i>	12. <i>C. lobianci</i>	12. <i>Cyclasterope lobiancoi</i>

bas.=basale; cox.=coxale; end.=endopodite; ep.=epipodite; ex.=exopodite; GMZ=Zoological Institute of Greifswald, Germany i.m.=inner margin of infold; l.eye=lateral eye; l.p.=lamellar prolongation; mand.=mandible; m.eye=medial eye; m.s.=muscle scar; mx.=maxilla; precox.=precoxale; u.lip=upper lip; USNM=United States National Museum collection in the National Museum of Natural History, Smithsonian Institution; ZMB=Zoological Museum of Berlin.

### Classification

Müller (1894) subdivided the Ostracoda into two tribes (=suborders), Myodocopa and Podocopa. The tribe Myodocopa consisted of three families: Cypridinidae, Halocypridae, and Polycopidae.

The present paper is concerned with ostracods recognized by Müller as forming the family Cypridinidae. In 1894 Müller recognized only five genera in the Cypridinidae but, later (Müller, 1912), he recognized four subfamilies: Cypridininae, Philomedinae, Sarsiellinae, Asteropinae. Skogsberg (1920) raised the family Cypridinidae to a suborder (Cypridiniformes) and placed within it four families: Cypridinidae, Rutidermatidae, Sarsiellidae, Asteropidae. Sylvester-Bradley (1961:Q397) lowered the rank of Cypridiniformes to a superfamily (Cypridinacea) composed of the families Cypridinidae, Cylindroleberididae (=Asteropidae), Sarsiellidae, and three families with only fossil representatives. Poulsen (1962, 1965) and Hartmann (1965) were in general agreement with

Skogsberg (1920). Kornicker (1967a) recognized six families in the Cypridinacea: Cypridinidae, Rutidermatidae, Sarsiellidae, Cylindroleberididae, Philomedidae, and Pseudophilomedidae, but later

relegated the last family to subfamily status (Kornicker, 1968). Members of Rutidermatidae are not present in material from the Gulf of Naples.

### Key to the Families of Cypridinacea

1. Well-developed gills along posterior of body, maxilla with baleen-comb . . . . . **CYLINDROLEBERIDAE**  
Without well-developed gills and baleen-comb on maxilla . . . . . 2
2. Mandible of female with large pincers distally . . . . . **RUTIDERMATIDAE**  
Mandible without large pincers . . . . . 3
3. Fifth limb of female with large teeth . . . . . 4  
Fifth limb of female without large teeth . . . . . **SARSIELLIDAE**
4. Lamellar prolongation of selvage with fringe of hair, fifth limb of female with quadrate tooth . . . . . **PHILOMEDIDAE**  
Lamellar prolongation of selvage without fringe of hair, fifth limb of female without quadrate tooth . . . . . **CYPRIDINIDAE**

### CYPRIDINIDAE Baird, 1850

This family is represented in the collection by only one genus, *Skogsbergia* Poulsen, 1962, with two species.

#### *Skogsbergia* Poulsen, 1962

**TYPE-SPECIES.**—*Skogsbergia minuta* Poulsen, 1962, by present designation.

Poulsen (1962:162) established the genus *Skogsbergia* for cypridinids having the two following diagnostic characters: "An upper lip divided in glandular, lobe-formed field, but without larger processes; and a short, reduced, unjointed endopodite of the 2nd antenna."

Two species considered herein were included by Poulsen (1962:146) in a list of species not investigated by him that he believed probably should be included in the genus *Skogsbergia*: *Skogsbergia mediterranea* (O. Costa) and *Skogsbergia squamosa* (Müller). My examination of the endopodite on the 2nd antenna of the latter species and specimens identified by Müller (1894) as *Cypridina mediterranea* (Costa) (= *S. costai*, new species) leads me to interpret them as being 2-jointed, although the separation between the joints is not always distinct and the 2nd joint could be interpreted as the base of the bristle. The endopodite of the 2nd antenna of another species in Poulsen's list, *Skogsbergia megalops* (Sars) must, according to the description and illustration by Sars (1922), also be considered to be 2-jointed. Therefore, I have emended the

diagnosis of the genus to include species having an endopodite of the 2nd antenna with 1 or 2 joints.

Poulsen (1962:162) in his diagnosis of the genus, which was based on the four species in his collection, stated that the bristle of the 2nd joint on the exopodite of the 2nd antenna is characterized by having only 5–9 spines, and the basale of the mandible is characterized by having only 1 d-bristle. It has been necessary to disregard these criteria in order to include *S. costai* and *S. squamosa* in the genus.

Characteristics of both *S. costai* and *S. squamosa* seem to be intermediate between those diagnostic of the genera *Skogsbergia* and *Paradoloria* Poulsen, 1962. Possibly these genera should be combined. The criterion I have used herein to distinguish between the genera is that the length of the stem of the endopodite of the 2nd antenna of *Paradoloria* is more than twice its width, whereas, the length of the stem on the same appendage of *Skogsbergia* is less than twice its width. The endopodite of the 2nd antenna of *Paradoloria* is elongate and 3-jointed compared to short and 1- or 2-jointed for *Skogsbergia*, but the number of joints is not always useful because of the difficulty in distinguishing partitions between joints.

**DIAGNOSIS.**—Poulsen (1962:162) emended to include *S. costai*, new species, and *S. squamosa*.

Second antenna: Endopodite short with 1 or 2 joints, length of stem less than twice its width; ventral margin of bristle on 2nd joint of exopodite with 4–25 spines.

Mandible: Ventral margin of basale with 1 or 2

d-bristles, one of these being long, stout, with wreaths of long hairs.

Furca: Each lamella with 7–11 claws; claw 2, claws 2 and 3, or no claws may be separated from lamella.

Seventh limb: Each limb with 12–28 bristles.

### *Skogsbergia squamosa* (Müller, 1894)

FIGURES 1, 2

*Cypridina squamosa* Müller, 1894:207, pl. 2, figs. 3, 6, 7, 21, 28–32; 1912:10 [key], 12 [diagnosis].—Rome, 1942:8 [listed]; 1965:4, table 1 [listed].—Puri, 1963:2 [listed].

*Cypridina (Vargula) squamosa*.—Skogsberg, 1920:75, 247 [discussion].

*Skogsbergia squamosa*.—Poulsen, 1962:162 [discussion], 163 [distribution], 164 [key].

Not *Cypridina squamosa*.—Tressler, 1949:335, fig. 21 [probably *Skogsbergia lernerii* (Kornicker, 1958); see p. 4].

Not *Cypridina squamosa lernerii*.—Kornicker, 1959:229, figs. 47a–b, 48a–d, 49a–e [= *Skogsbergia lernerii* (Kornicker, 1958); see p. 4].

Not *Cypridina (?) squamosa*.—Brady, 1897:90, pl. 16, figs. 10–12 [species dubium].

LECTOTYPE (designated herein).—One female with eggs in ovaries (ZMB 9151). Carapace, upper lip, 1st antenna preserved in alcohol, remaining appendages on 1 slide; collected by G. W. Müller.

TYPE-LOCALITY.—Gulf of Naples.

MATERIAL.—Pre-adult ♀ with eggs in ovaries (ZMB 9151). Carapace, upper lip, and one 1st antenna preserved in alcohol; remaining appendages on slides (lectotype). Adult ♀ without carapace from the Zoological Institute of Greifswald (GMZ 24999); dissected specimen now on slides. The description given below is based on this specimen and the lectotype. The specimen was in a vial, which also contained a juvenile without carapace and four separated valves. All specimens collected by G. W. Müller.

DISTRIBUTION.—Mediterranean: Gulf of Naples; also reported off Monaco (Rome, 1942, 1965).

Brady and Norman (1896:650) referred specimens collected in the Gulf of Naples to *Cypridina mediterranea* Costa, 1845. They recognized two forms "typica" and "Var. b," and stated that after their description was written, Müller (1894) described variety b under the name *Cypridina squamosa*. Later, Müller (1912:12) included Brady and Norman's variety b in his synonymy of *C. squamosa*, but questioned it. As Brady and Norman

did not describe the appendages, and illustrated (1896, pl. 54: figs. 3, 4) only a lateral and dorsal view of the carapace, it is not possible to refer, with certainty, their variety b, to any particular species.

A specimen designated "*Cypridina (?) squamosa*" by Brady (1897:90, pl. 16: figs. 10–12) does not have the 2nd and 3rd claws of the furca united with the lamella. Brady (1897:90) recognized that he knew too little about the soft parts of the species to be certain about its generic position. He apparently named the species prior to being aware of Müller's 1894 name for the Gulf of Naples' species, and did not wish to change the name in manuscript. Müller (1912:52) correctly listed this species under "*Cypridinidarum genera dubia et species dubiae*."

Skogsberg (1920:247) included *Cypridina squamosa* Müller in a list of species to be included in his subgenus *Vargula*.

Tressler (1949:335, fig. 21) identified specimens from Florida as *Cypridina squamosa* Müller. I have examined the caudal furca on one of Tressler's specimens (USNM 88862) and find only claw 2 continuous with the lamella, and, therefore, conclude that Tressler's specimens are not conspecific with *S. squamosa*.

Kornicker (1958:229, figs. 47a–b; 48a–d; 49a–e) identified specimens from the Bahamas as *Cypridina squamosa lernerii*. These have only claw 2 of the furca continuous with the lamella. I believe that this difference warrants raising the subspecies to specific rank. After having examined a paratype, I conclude that the species *C. lernerii* should be referred to the genus *Skogsbergia*.

Poulsen (1962:162) referred *C. squamosa* to *Skogsbergia*.

DESCRIPTION OF FEMALE.—Carapace oval in lateral view with greatest height posterior to middle;

FIGURE 1.—*Skogsbergia squamosa*: a, anterior part of right valve, medial view; b, central muscle scars of left valve, lateral view; c, scalelike pattern on shell (from near posterior part of shell); d, anterior part of right valve, lateral view; e, section of posteroventral margin of left valve, medial view; f, section of ventral margin of left valve, medial view; g, posterior right valve, medial view; h, posterior left valve, medial view; i, left 1st antenna, lateral view; j, right 2nd antenna, medial view; k, proximal part of endopodite of right 2nd antenna; l, right mandible, medial view; m, anterior margin of 2nd joint of endopodite of right mandible, medial view; n, left maxilla, lateral view; o, tip of right maxilla, medial view; p, ventral part of right 5th limb, posterior view. (a–h, n–p, ZMB 9151, lectotype; i–m, GMZ 24999.)



inferior tip of rostrum pointed; inner margin of incisur rounded (Figure 1a,d); caudal process narrow extending to middle of posterior margin (Figure 1g,h).

Ornamentation: Surface with scalelike reticulations (Figure 1c) posterior margin of scales convex; shell surface appearing smooth under low magnification; valves translucent with lateral eyes and muscle scars visible in external view.

Infold (Figure 1e,f): Infold broad and vestibule deep along anterior shell margin and in front of caudal process; infold narrow and vestibule shallow along ventral margin; infold above incisur with about 16 bristles, below incisur and along ventral margin with about 25 bristles in row.

Hinge: Sclerotized inner ridge of caudal process of left valve with knob at dorsal end which may interlock with socket on right valve.

Marginal pore canals: Numerous along free margins. Similarly oriented canals also present along sclerotized inner bar of caudal process.

Central muscle scars (Figure 1b): Consisting of about 15 individual scars; of these, 3 elongate anterior scars slope downward posteriorly, whereas, posterior scars trend downward anteriorly producing a roughly chevron-type muscle scar.

Size: ♀ (N-1 instar), length 2.61 mm, height 1.69 mm. Müller (1894:207) gave the lengths of 2 females as 3.3 mm, and of 2 males as 2.6 mm.

Sexual dimorphism: According to Müller (1894:207), the shell of the male is similar to that of the female but smaller.

First antenna (Figure 1i): 3rd joint with dorsal margin longer than ventral, dorsal bristle proximal to middle, and ventral bristle distal to middle; 4th joint with 2 bare terminal bristles, 1 ventral, 1 dorsal; 5th joint separated from 6th by distinct suture; sensory bristle of 5th joint with 8 long proximal and 3 or 4 short distal filaments; 6th joint with bare lateral bristle. 7th joint: a-bristle bare, b-bristle with about 3 filaments, c-bristle with short proximal filaments and 1 long and 1 short distal filament. 8th joint with 4 bristles: d- and e-bristles bare, f- and g-bristles with filaments.

Second antenna (Figure 1j,k): Protopodite with medial bristle with short marginal spines. Endopodite 2-jointed: 1st joint with 5 bristles consisting of a proximal group with 3 short bare bristles and 1 long bristle with marginal spines and a distal long ventral bristle with few marginal spines; 2nd

joint with long, faintly annulate, terminal bristle (2nd joint could be interpreted as being bulbous base of bristle). Exopodite: length of 2nd joint equal to combined lengths of joints 3-5; bristle of 2nd joint without curly hairs proximally and with about 14 ventral spines; joints 3-9 with basal spines, spines longer on distal joints; 9th joint with 4 bristles, 3 long and 1 short; bristles on joints 3-9 with natatory hairs.

Mandible (Figure 1l,m): Coxale endite spinous. Basale with 3 dorsal and 6 ventral bristles: 1 long spinous and 2 short bare a-bristles, 1 long c-bristle, and 1 long spinous and 1 short bare d-bristle. Exopodite with acute tip and 2 ventral bristles, proximal bristle longer of two. Endopodite: 1st joint with 2 long and 2 short distoventral bristles; 2nd joint with 3-4 ventral spinelike bristles, 1-2 distal to middle and 2 proximal to terminal tooth, and about 19 dorsal bristles; end-joint with 3 claws and 4 bristles. Ventral margin of basale on N-1 ♀ with 8 bristles: 1 long and 2 short a-bristles, 1 short b-bristle close to a-bristles, 1 short and 1 long c-bristle, and 1 short bare and 1 long spinous d-bristle; ventral margin of 2nd joint of endopodite with 2 spinelike bristles distal to middle and 2 proximal to the reduced terminal tooth.

Maxilla (Figure 1n,o): Precoxale with fringed marginal epipodial appendage; coxale with plumose bristle on anterior margin; 1st-3rd endites hirsute, 1st with about 11 bristles, 2nd with about 7, 3rd with 7 distal and 1 proximal bristle; basale with bare ventral bristle (missing on some appendages); 1st joint of endopodite with 2 bare  $\alpha$ -bristles and 3  $\beta$ -bristles; cutting edge on distal posterior corner of 1st joint consisting of ridge with 3 arcs; end joint of endopodite short, with about 11 bristles; medial surface with clusters of fine hairs; exopodite hirsute along posterior margin, with 1 plumose posterior bristle and 2 terminal bristles, 1 bare, 1 plumose.

Fifth limb (Figure 1p): Epipodial appendage with 53-55 plumose bristles; endites I-III each with about 5 bristles. Exopodite: 1st joint with 6 curved teeth in row followed by conical tooth; 2nd joint with 4 curved clawlike teeth, 8 stout curved bare bristles, and 3 plumose bristles; 3rd joint hirsute, inner lobe with 2 distal and 1 proximal bristle, outer lobe with 2 distal bristles; 4th and 5th joints fused, hirsute with total of 4 bristles distally.

Sixth limb (Figure 2a): Epipodial appendage



FIGURE 2.—*Skogsbergia squamosa*: a, left 6th limb, lateral view; b, 7th limb; c, furca with brush-shaped organ and genitalia; d, detail of proximal part of furca; e, brush-shaped organ; f, anterior part of animal with upper lip and rod-shaped organ; g, lateral eye; h, egg cluster and detail of an egg showing nucleolus, germinal vesicle and cytoplasm containing yoke granules. (a, d, e, f, h, ZMB 9151, lectotype; b, c, g, GMZ 24999.)

with 4 bare bristles. End joint with 15 bristles, the 2 posterior bristles longer than others. First endite with 1 long and 2 short bristles; 2nd endite with 2 long and 2 short bristles; 3rd endite with 3 long and 1 short bristle; 4th endite with 3 long and 2 short bristles. End joint with clusters of spines on lateral surface and longer spines along ventral margin; medial surface with clusters of long spines.

Seventh limb (Figure 2*b*): Adult ♀ with 13 proximal and 15 distal bristles; comb with about 20 square-tipped teeth opposite short blunt cylindrical tooth. N-1 ♀ with 14 proximal and 14 distal bristles and only about 14 teeth in comb. All bristles with 2-6 distal bells and without marginal spines.

Furca (Figure 2*c,d*): Each lamella with 7 claws in adult ♀, 6 in N-1 ♀; 2nd and 3rd claws united with lamella; 4th claw more slender than 5th; ventral margin and lateral surface of each lamella proximal to claws bearing clusters of short spines; proximal claws on right lamella slightly longer than on left; claws 1-5 with lateral and medial spines in row along concave margin, claws 6-7 with single row; claws 1-2 with minute spines distally along convex margin; claw 1 with large medial spines distally; several small spines present along anterior margin of each lamella.

Brush-shaped organ (Figure 2*e*): Short lobe bearing 8 bare annulate bristles situated above genital organs and behind each 7th limb (observed on both adult ♀ and N-1 ♀).

Genitalia (Figure 2*c*): Bilobed (attached to one of the lobes of the N-1 ♀ is what appears to be a rhizopod similar to the genus *Centropyxis*.)

Eyes (Figure 2*g*): Lateral eyes with 29-34 ommatidia, all but few divided; medial eye about half diameter of lateral eye.

Rod-shaped organ (Figure 2*f*): Short, pear-shaped with concentric ridges distally and terminal node. Conical projection present between organ and upper lip.

Upper lip (Figure 2*f*): Anterior lobe undivided and with glandular openings; posterior lobe divided, hirsute; lateral lobes small, hirsute. Lower lip helmet-shaped, hirsute.

Eggs (Figure 2*h*): Cluster of 13 round eggs present in each ovary of N-1 ♀ instar.

### *Skogsbergia costai*, new species

FIGURE 3

*Cypridina mediterranea*.—Müller, 1894:206, pl. 1: fig. 16, pl. 2: figs. 1-2, 4-5, 8-20, 22-26, 33, pl. 34: figs. 21-24, 48, pl. 40: fig. 19 [not Costa, 1845].

*Cypridina mediterranea* [forma typica].—Brady and Norman, 1896:650, pl. 54: figs. 1, 2, pl. 55: figs. 1-11.

HOLOTYPE.—One female with eggs in ovaries in Zoological Museum, Berlin (ZMB 9150:1); valves, upper lip and some appendages preserved in alcohol, remaining appendages on slides; collected by G. W. Müller.

TYPE-LOCALITY.—Gulf of Naples. Müller collected one specimen from the bottom and numerous specimens from the stomach of a fish "*Mustelus laevis*." The vial containing the holotype did not contain information concerning its exact source; it is most likely from the fish stomach.

MATERIAL.—One complete female with eggs in the ovaries and 3 separated valves (ZMB 9150). I dissected the female and have designated it on labels as 9150 sp. 1 (holotype); the valves, some appendages and the upper lip are preserved in alcohol, the remaining appendages are on slides. In addition to the above, I briefly examined, while at the Zoological Station of Naples, about 21 specimens, including separated valves (GMZ 24997); most of these specimens were instars. The description below is based principally on the complete female with eggs, but the furca of a specimen from the Zoological Institute of Greifswald is also illustrated. All specimens collected by G. W. Müller.

DISTRIBUTION.—Gulf of Naples.

DISCUSSION.—Müller (1894:206) considered it probable that ostracods known at that time as *Cypridina mediterranea* belonged to two or more closely related species. He assigned the specimens collected by him in the Bay of Naples to *C. mediterranea* because the outline of the shell conforms rather well with the sketch by Costa (1845, pl. 1: fig. 2), and because it was collected in the same area. I do not believe that Müller's specimens are conspecific with *C. mediterranea* Costa because the latter species has 59 bristles on the 7th appendage (Costa, 1845, fig. 12), whereas, the 7th appendages on Müller's specimens have only 25-28 (Müller, 1894, pl. 2: figs. 10-11; see Figure 3*k*). Also, *C. mediterranea* Costa has 8 furcal claws (Costa, 1845, fig. 14) compared to 10 or 11 for the specimens col-

lected by Müller (1894, pl. 2: fig. 25; see Figure 3i). Dr. G. Bonaduce kindly inquired at the University in Naples, which has in its collections ostracodes collected by Costa, but specimens of *C. mediterranea* could not be located. Because of this it is necessary to rely on the description of the species by Costa. I consider the above differences in the 7th appendage and the furca to be too great to be the result of poor observation or variability within a species. It is possible that the furca illustrated by Costa is from a juvenile specimen; however, if it is assumed that the well-developed 7th limb is from the same specimen, the possibility of the specimen being a juvenile diminishes.

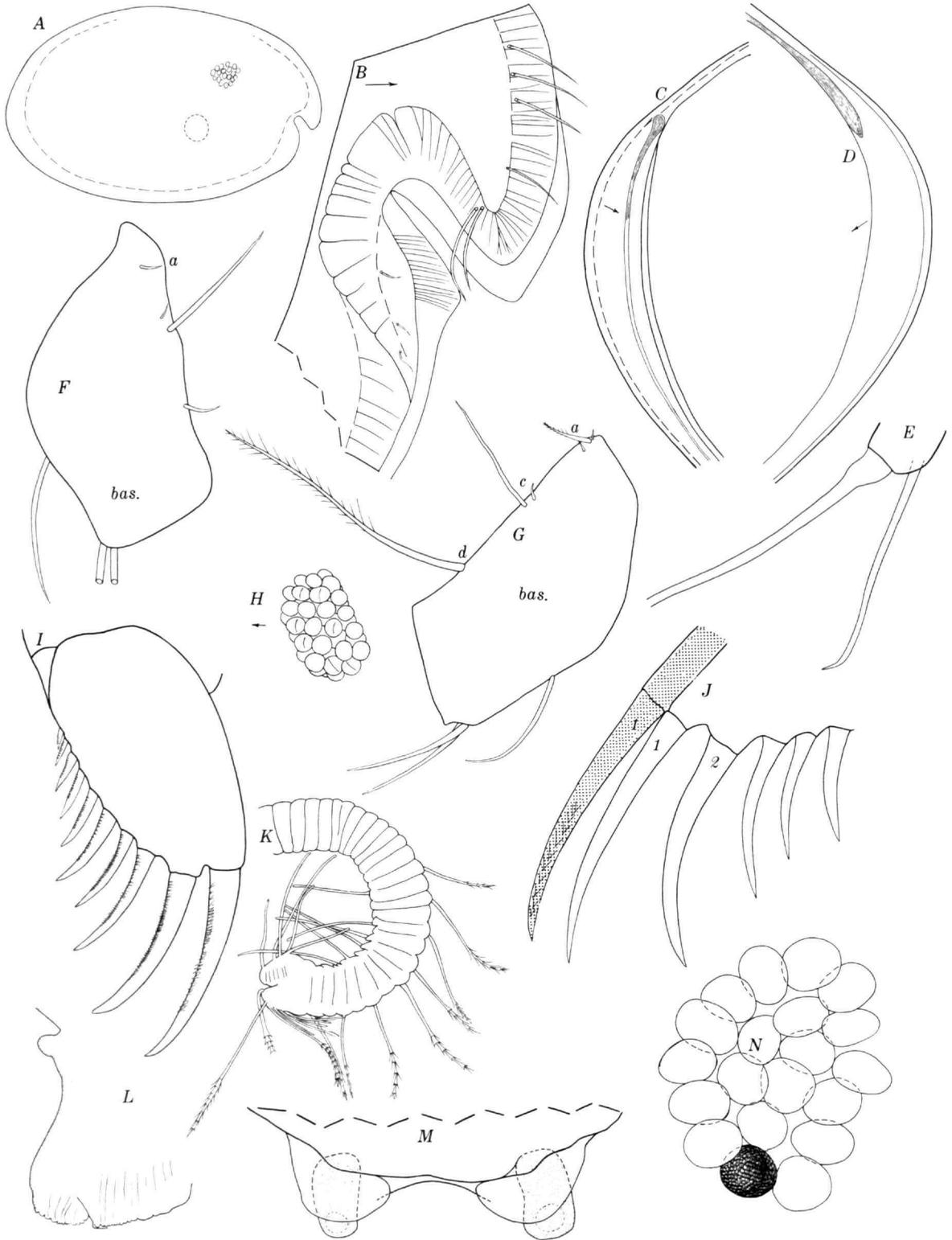
Claus (1865:153, pl. 10: figs. 1,2-7) described the new species *Cypridina messinensis* from the Mediterranean. In 1873 (p. 221, pl. 11: figs. 16-20) he referred *C. messinensis* to *Cypridina mediterranea* Costa. Brady and Norman (1896:650) and Müller (1894:00 [with a "?"]; 1912:11) agreed that *C. messinensis* was a synonym of *C. mediterranea*. The 6th limb of *C. messinensis* and *S. costai* differ in that *C. messinensis* has 10 bristles on the end joint and 3 bristles in place of the epipodial appendage (Claus, 1865, pl. 10: fig. 5) compared to 18 and 4, respectively, on *S. costai* (Müller, 1894, pl. 2: fig. 13). In addition, the posterior process of the right valve of *C. messinensis* illustrated by Claus (1865, pl. 10: fig. 1) is considerably more prolonged than that of either *S. costai* or *C. mediterranea*. The same might be said of the shell of the specimen from Trieste illustrated by Claus (1876, pl. 18: fig. 5) and identified by him as *C. mediterranea* Costa.

Sars (1888:208) referred specimens collected at Spezia in the Mediterranean to *Cypridina mediterranea* Costa. The appendages of Sars' specimens are quite similar to those of the specimens collected by Müller in the Gulf of Naples, but as previously stressed by Müller (1894:207), Sars' specimens are smaller. Sars (1888:208) gave the length of a female with eggs in the brood chamber as 2.62 mm and of a male as 2.80 mm. Müller (1894:206) gave the length of a female as 3.9 mm and of 2 males as 2.7 mm; Müller (1894:206) stated that the size of the female varies but that, unfortunately, he could not determine whether the animals of different sizes bore eggs or were mature. The female that I describe herein has eggs in the ovaries and is 3.14 mm long. It is known that differences in environment can cause a difference in size of specimens of the

same species, but it seems unlikely that the size could differ as much as found in the females collected in the Gulf of Naples and at Spezia. Therefore, I have not included Sars' species in the synonymy of *S. costai*.

Brady and Norman (1896:650) referred specimens from the Bay of Naples to *Cypridina mediterranea*. They recognized two forms of this species: "typica" and "Var. b." Form "typica" was considered by them to be close to *C. mediterranea* Costa; "Var b" was considered close to *C. messinensis* Claus, which they designated (1896:652) as "*C. mediterranea* var. *messinensis* (Claus)." Form "typica" was referred to *C. mediterranea* Costa by Müller (1912:11). I believe that the specimens designated "typica" by Brady and Norman are conspecific with those collected by Müller and refer them herein to *S. costai*. This belief is based primarily on the number of bristles (29) on the 7th limb (Brady and Norman, 1896, pl. 55: fig. 10), the number of furcal claws (11) (Brady and Norman, 1896, pl. 55: fig. 11), and on the shape of the carapace (Brady and Norman, 1896, pl. 54: figs. 1,2). Brady and Norman (1896:650) and Müller (1912:11) included in the synonymy of *C. mediterranea* Costa specimens referred to *Bradycinetus brenda* (Baird, 1850) by Brady (1871:292, pl. 26: fig. 6), who described the secondary branch of the male 2nd antenna as "largely developed and triarticulate." Although the specimens are largely unknown, the morphology of the endopodite of the 2nd antenna of the male excludes it from the genus *Skogsbergia*.

Skogsberg (1920:247) included "*Cypridina mediterranea*, O. Costa, 1845, (G. W. Müller, 1894, p. 206, pl. 2, figs. 1, 2, 4, 5, 8-20, 22-27, 33)" in a list of species in his subgenus *Vargula*. Rome (1942:7, pl. 1: figs. 1, 2) referred juveniles collected in the vicinity of Monaco to *Cypridina mediterranea* Costa. The 4th furcal claw illustrated by Rome (1942, pl. 1: fig. 2) is much shorter relative to the 3rd and 5th claws than the 4th claw on either *S. costai* or *C. mediterranea* Costa. Therefore, I think it necessary to consider the identification to be uncertain. Granata and Caporiacco (1949:6) refer ostracodes from the Mediterranean to *Cypridina (Vargula) mediterranea* (Costa). The ostracods are not described in sufficient detail to verify the identification, but as the furca bears 10 claws, the specimens probably are related more closely to the



specimens of Müller than those of Costa. However, it would be necessary to examine the specimens before attempting to reassign them. Poulsen (1962: 162) lists "*Skogsbergia mediterranea* (O. Costa)" along with other species not investigated by him in the genus *Skogsbergia*. *Cypridina mediterranea* Costa has been reported from other areas in the Mediterranean, but either without accompanying descriptions or with insufficient description (e.g., Ramsch, 190a, 1906b; Brian, 1909; Hartmann, 1959; Reys, 1965a, 1965b; Rome, 1965).

**DESCRIPTION OF FEMALE** (details of most appendages are obscured by debris and therefore description below is incomplete).—Carapace oval in lateral view with greatest height near middle and greatest length below middle, posterior evenly rounded (Figure 3*a-d*); inferior tip of rostrum narrowly rounded, inner margin of rostrum broadly rounded.

**Ornamentation:** Surface smooth without ornamentation; valves translucent, lateral eyes and muscle scars visible in lateral view.

**Infold** (Figure 3*b-d*): Broad along anterior and posterior parts of shell, narrow ventrally; infold above incisur obscure, but with 6 or more long bristles; below incisur and along ventral margin with about 21 bristles in row.

**Hinge:** Sclerotized ridge with knob at dorsal end present near inner margin of inner lamella in posterior part of left valve; sclerotized ridge present on inner lamella in posterodorsal part of right valve fits in front of knob on left shell.

**Marginal pore canals:** Numerous canals present along free margins.

**Central muscle scars:** Obscured in specimen examined. Müller (1894, pl. 2: figs. 1, 3) illustrates valves with 11 elongate scars ventral to 1 oval scar.

**Salvage:** Narrow striated ridge with lamellar prolongation present along anterior and ventral valve margins; lamellar prolongation with smooth margin, unstriate except along lower margin of incisur.

**FIGURE 3.**—*Skogsbergia costai*, new species, female: *a*, carapace showing position of central muscle scars and lateral eye; *b*, rostral area left valve, medial view; *c*, posterior left valve, medial view; *d*, posterior margin right valve, medial view; *e*, part of endopodite of 2nd antenna; *f*, basale of right mandible, medial view; *g*, basale of left mandible, medial view; *h*, lateral eye; *i*, furca; *j*, claws 1-5 of left lamella of furca (teeth on posterior margins of claws not shown); *k*, 7th limb; *l*, upper lip; *m*, genitalia (spermatophores) *n*, cluster of eggs (oil globules shown in 1 egg), (*i*, GMZ 24997; *a*, *h*, *j-n*, ZMB 9150:1, holotype).

**Size:** Female holotype with eggs in ovaries, length 3.14 mm, height 1.95 mm. Müller (1894:206) gave the length of a female as 3.9 mm, and of 2 males as 2.7 mm.

**First antenna:** 3rd joint short with 1 dorsal and 1 ventral bristle; 4th joint with 1 dorsal and 1 ventral bristle distally; sensory bristle of 5th joint with about 12 marginal filaments, of these, distal 3 shorter than others; lateral bristle of 6th joint about 3 times length of 7th joint; end joints with bristles typical for genus.

**Second antenna:** Medial bristle of protopodite not observed. Short endopodite with weak suture separating 2 joints (Figure 3*e*): 1st joint with 1 long and several shorter bristles; 2nd joint with 1 long terminal bristle (2nd joint could be interpreted as bulbous base of bristle). Exopodite: bristle of 2nd joint with about 25 ventral spines, and about the same number of weaker spines dorsally (proximal hairs not observed); bristles of joints 3-9 with natatory hairs; 9th joint with 3 long and 1 medium bristle; joints 5-8 with large basal spines; joint 9 with large lateral spine; dorsodistal corner of joints 2-8 with minute spine, or comb of minute spines. Dorsal margin of protopodite with numerous protozoans attached.

Debris obscured appendages, especially the endopodite. The 2nd antennae I examined is essentially similar to that illustrated by Müller (1894, pl. 2: fig. 22). A few differences are noted below. The endopodite in Müller's illustration has only 1 joint, whereas the specimen I examined has 2; however, additional specimens should be examined before definitely establishing which interpretation is correct. Another difference is that the bristle on the 2nd joint of the exopodite on the specimen I examined has both ventral and dorsal spines, whereas, this bristle in Müller's illustration has only ventral spines. The ventral and dorsal spines could be seen quite clearly on the specimen I examined. I think it quite likely that the 4th joint of the exopodite has a basal spine as shown by Müller; I could not observe it on the appendages I examined, but this could be because of the debris.

**Left mandible:** Basale (Figure 3*g*): Ventral margin with 3 a-bristles, 2 c-bristles, and 1 long d-bristle; dorsal margin with 1 bristle near middle and 2 subterminally. Ventral margin of 2nd endopodite joint with 2 single spines distally and a group of 2 spines terminally.

Right mandible: Ventral margin of basale differs from left in having 1 short a-bristle, 2 c-bristles, and 1 short d-bristle (Figure 3f). The ventral margin of the basale of the right mandible illustrated by Müller (1894, pl. 2: fig. 17) has 2 or 3 a-bristles, 1 c-bristle, and a long and short d-bristle. It is necessary to examine more specimens to determine the variability of bristle distribution on the basale.

Seventh limb (Figure 3k): Each limb with about 14 lateral and 13 distal bristles; terminal comb with about 12 or 14 blunt teeth.

Lateral eyes (Figure 3h): Large with 34–36 divided ommatidia.

Upper lip (Figure 3l): Consisting of unpaired anterior part and paired posterior part without tusks. An unpaired protuberance present above upper lip and below anterior margins of 1st antennae.

Furca (Figure 3i,j): Each lamella with 10 or 11 claws, all separated from lamella; 4th claw slightly more slender than 5th; all claws with spines in row laterally along concave margin; claw 1 with broad medial spines distally and few short spines along distal convex margin.

Genitalia (Figure 3m): Consisting of 2 parts, each having 1 lobe (A spermatophore is connected to each lobe in Figure 3m).

### PHILOMEDIDAE Müller, 1906

The Philomedidae contains two subfamilies, Philomedinae Müller, 1906, and Pseudophilomedinae Kornicker, 1967a; both subfamilies are represented in the Gulf of Naples.

#### Key to the Subfamilies of Philomedidae

Maxilla with 3 large endites; tooth on 2nd joint of 5th limb not prolonged ..... PHILOMEDINAE  
 Maxilla with 2 large and 1 reduced endite; tooth on 2nd joint of 5th limb prolonged, fanglike  
 ..... PSEUDOPHILOMEDINAE

#### PHILOMEDINAE Müller, 1906

The Philomedinae is represented in the collection by two genera *Philomedes* Liljeborg, 1853, and *Euphilomedes* Poulsen, 1962.

##### *Philomedes* Liljeborg, 1853

TYPE-SPECIES.—*Philomedes longicornis* Liljeborg, 1853. Gender: Masculine.

##### *Philomedes levis* Müller, 1894

#### FIGURE 4

*Philomedes levis* Müller, 1894:211, pl. 3: figs. 4, 15, 18, 29–31, 36; 1912:26, 30 [diagnosis].—Poulsen, 1962:345 [listed].

LECTOTYPE.—Female without eggs in the Zoological Museum of Berlin (ZMB 9153). I have designated this specimen: 9153:1. The valves of the lectotype and some appendages are preserved in alcohol; the remaining appendages are on slides. An instar that was in the same vial is herein designated 9153:2. The instar which is a paralectotype, is preserved whole in alcohol.

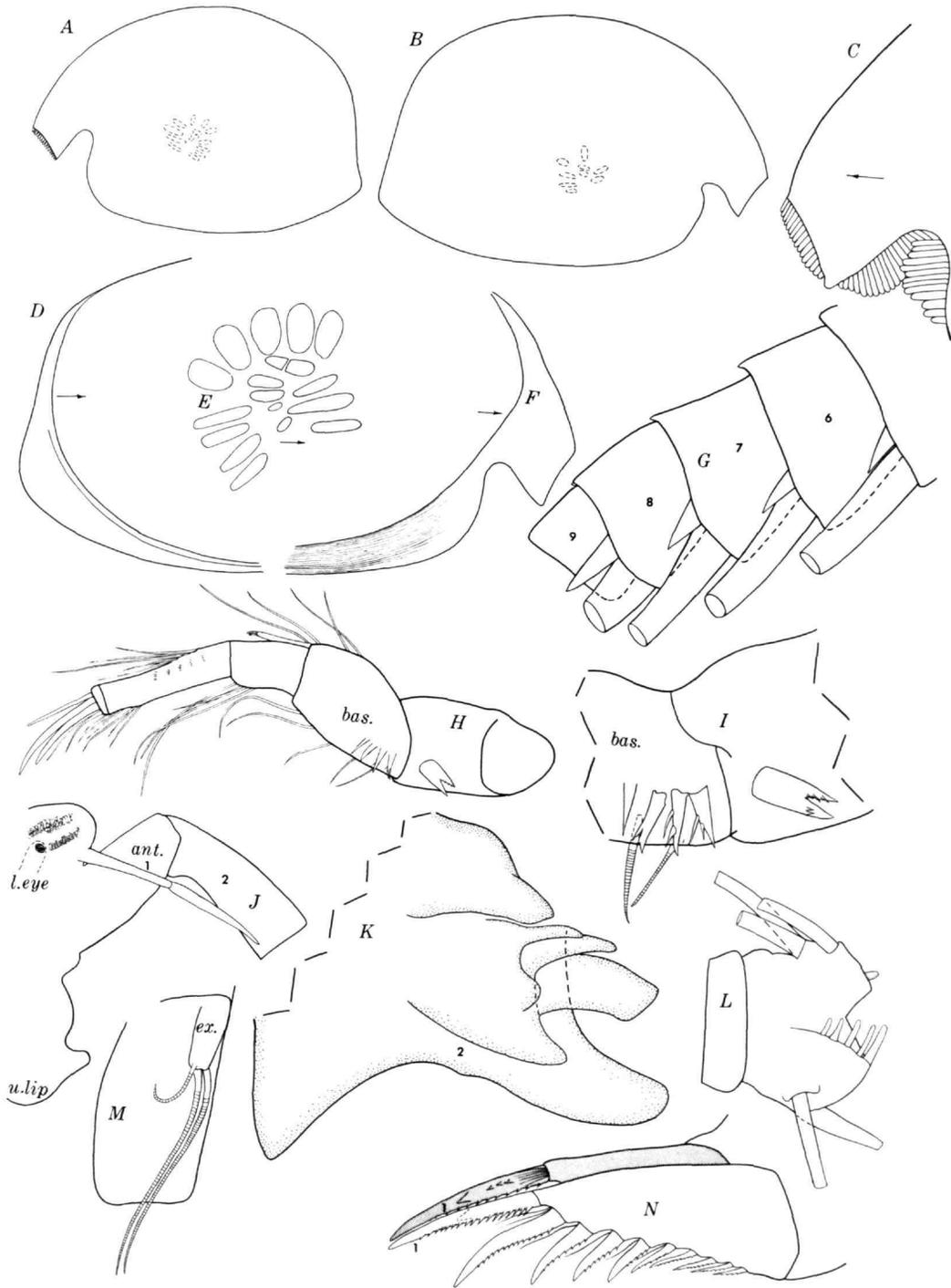
TYPE-LOCALITY.—Gulf of Naples, Italy.

MATERIAL.—Two specimens (ZMB 9153) in vial containing label "9153 *Philomedes levis* n. sp. Müller." The female in this vial has been selected as the lectotype and designated ZMB 9153:1. It is presently preserved in alcohol except for some appendages on slides. The 2nd specimen, an instar preserved in alcohol, is designated ZMB 9153:2. In addition to the above I had the opportunity to examine briefly about 14 specimens preserved in alcohol GMZ 25010) at the Zoological Museum at Naples. The specimens are in poor condition.

DISTRIBUTION.—Gulf of Naples.

DESCRIPTION OF FEMALE (details of appendages and carapace are obscured by debris and radial crystals; therefore, the description is incomplete).—Carapace oval in lateral view with greatest height

FIGURE 4.—*Philomedes levis*: a, carapace, length 1.21 mm; b, carapace, length 1.37 mm; c, part of anterior of left valve, lateral view; d, posterior left valve, medial view; e, muscle scars right valve, lateral view; f, anterior left valve, medial view (lamellar prolongation not shown); g, part of exopodite of 2nd antenna, medial view; h, left mandible, medial view (all bristles not shown); i, coxale endite and part of basale of left mandible, medial view; j, anterior of animal; k, terminal teeth of 5th limb; l, tip of 7th limb; m, exopodite of maxilla; n, furca. (a, c, e, ZMB 9153:2; b, d, f–n, ZMB 9153:1.)



and length near middle (Figure 4 *a-c*); linear anterior margin of rostrum forming acute angle with ventral margin; inferior tip of rostrum with small protuberance; posterior margin of valve with caudal process at border with ventral margin.

Ornamentation: surface smooth without ornamentation; valves translucent with muscle scars visible in lateral view.

Infold (Figure 4 *d,f*): Broad along anterior and posterior parts of valve, narrow ventrally; anteroventral part striate. (Bristles on infold are obscured by debris, but Müller (1894, pl. 3: fig. 36) illustrates 19 on rostrum and 10 below rostrum on anteroventral part of infold.)

Central muscle scars (Figure 4 *e*): 5 large ovoid scars forming slight arc over 6 smaller scars and 2 rows of elongate scars: anterior row with 3 scars, posterior row with 4. (The U-shaped scar shown by Müller (1894, pl. 3: fig. 4) is incorrect; it consists of 2 ovoid scars with 2 smaller scars near their ventral margins.)

Salvage: Wide lamellar prolongation present along rostrum and below incisor; prolongation being subdivided into broad platelets with blunt tips. (The broad platelets are useful for recognizing this species.)

Size: ♀ lectotype, length 1.37 mm, height 0.91 mm; instar paralectotype, length 1.21 mm, height 0.81 mm.

First antenna: 2nd joint with 1 dorsal, 1 lateral, and 1 or 2 ventral bristles, about 5 clusters of spines along ventral margin, and numerous clusters on ventral surface; 2nd joint with 1 ventral and 2 dorsal bristles.

Second antenna: Endopodite 2-jointed: 1st joint with 6 bristles, 5 proximal, 1 distal; 2nd joint with 2 bristles, 1 proximal and 1 terminal, latter bristle recurved. Exopodite (Figure 4 *g*): joints 2–8 with basal spines increasing in length on distal joints; bristle of 2nd joint reaching well past joint 9; bristles of joints 2–4 without natatory hairs; 9th joint with 4 long and 2 or 3 short bristles.

Mandible (Figure 4 *h,i*): Coxale endite bifurcate with several teeth near tips; basale with 3 or 4 stout medial spines with secondary teeth; exopodite reaching three-fourths length of 1st joint of endopodite; end-joint of endopodite with 3 claws, 2 curved, 1 almost straight; straight dorsal claw not quite as long as curved ventral claw.

Maxilla: With 3 endites, 1st with about 10 bris-

cles, 2nd about 6; exopodite with 3 bristles, proximal bristle about one-half length of 2 distal bristles (Figure 4 *m*).

Fifth limb (Figure 4 *k*): 1st exopodite joint with 4 or 5 stout teeth; 2nd exopodite joint with usual large triangular tooth.

Seventh limb (Figure 4 *l*): About 5 bristles present in distal group and 12 in proximal group, each with 3–6 bells; 1 main peg present opposite comb (a few smaller pegs also may be present, but are difficult to see because of condition of appendage).

Furca (Figure 4 *n*): Each lamella with 10 claws separated from lamella by suture; claws decreasing in length proximally on lamella except for last 4 claws, which are of about same length; claws 1 to 6 or 7 with teeth along concave margin; claw 1 with large tooth and several smaller proximal teeth on medial side; 1 or more rather long thick hairs present laterally near base of most claws; tuft of hair present laterally at base of claw 1; tips of claws 1–5 with blunt rounded tips.

Eyes (Figure 4 *j*): Medial eye large; lateral eye minute.

Rod-shaped organ (Figure 4 *j*): 2-jointed, elongate, tapering distally.

Upper lip (Figure 4 *j*): Rounded with anterior process.

### *Euphilomedes* Poulsen, 1962

TYPE-SPECIES.—*Euphilomedes nodosus* Poulsen, 1962, by subsequent designation (Kornicker, 1967a: 1). Gender: Masculine.

### *Euphilomedes asper* (Müller, 1894)

#### FIGURE 5

*Philomedes aspera* Müller, 1894:210–211, pl. 3: figs. 3, 17, 21, pl. 8: fig. 1; 1912:26, 27 [key, diagnosis].  
*Philomedes foveolata*.—Brady and Norman, 1896:659–661, pl. 56: figs. 4, 5 [not *Pseudophilomedes foveolata* Müller, 1894].  
*Ph. (Ph.) aspera*.—Skogsberg, 1920:351 [discussion].  
*Euphilomedes aspera*.—Poulsen, 1962:363 [key].  
*Euphilomedes asper*.—Kornicker, 1967a:18, figs. 9, 10, 11a–d, 12 [supplementary description].

LECTOTYPE.—One adult male in the Zoological Museum of Berlin (ZMB 9152). I have designated this specimen as 9152:1 because two separated valves also have the number 9152. The valves of the lectotype and its appendages are preserved in

alcohol, except for a 2nd antenna and one of the 7th limbs, which are on slides.

TYPE-LOCALITY.—Gulf of Naples, Italy.

MATERIAL.—(1) A small vial containing 1 whole ostracod and 1 left and 1 right valve and a label "9152 *Philomedes aspera* n. sp. Müller." This is the same material from the Zoological Museum of Berlin described by Kornicker (1967a:19) but then a jar containing the specimens had the label "Type, *Philomedes aspera* G. W. Müller, Kat. Nr. 9152, Fundort Napoli." The whole specimen, an adult male designated the lectotype herein, was partly dissected and is presently in alcohol except for one 2nd antenna and one 7th limb, which are on slides. I have designated the lectotype as 9152:1, the right valve as ZMB 9152:2, and the left valve as ZMB 9152:3. The right valve is probably from an adult male, the left from an instar. Both valves have been replaced in the same vial from which they were obtained. Most appendages of the lectotype and internal features of its valves are partly obscured by debris. (2) Two instars from station B30, Gulf of Naples; collected by Harbans S. Puri and Gioacchino Bonaduce in 1962 or 1963. (3) One instar, USNM 112803, from vicinity of Benta Palumma, Gulf of Naples; collected for L. S. Kornicker by technician at Naples Zoological Station, 21 April 1966. Sample reported to be from depth of 55 meters. (4) I also had the opportunity to examine briefly while at the Zoological Station at Naples in 1966, four of Müller's Gulf of Naples specimens in the collection of the Zoological Institute of Greifswald (GMZ 25003). One of these specimens, an adult male, was dissected and some of its appendages are illustrated herein (Figure 5*g,i,j,k*).

DISTRIBUTION.—Gulf of Naples, Monaco (Rome, 1942, 1965). Marseille (Reys, 1964, 1965a, 1965b).

DISCUSSION.—A supplementary description of this species based mostly on specimens collected in the Gulf of Naples by A. M. Norman in 1887 and reported upon by Brady and Norman (1896:659), but also in part on specimens collected by G. W. Müller, was published by Kornicker (1967a:18). The brief description below is based solely on Müller's specimens. The adult male designated in the 1967 paper as ZMB 9152:1 is herein selected as the lectotype. The specimen is assigned the same number in the present paper. Kornicker (1967a:18) was incorrect in listing *Euphilomedes asper* as a "new combination" because it had previously been

assigned to *Euphilomedes* in a key to the genus by Poulsen (1962:363).

DESCRIPTION OF ADULT MALE.—Lateral outline oval, elongate with greatest height near middle, prominent rostrum, broad rostral incisure, and angular caudal process (Figure 5*a-c*).

Ornamentation: Shell with numerous large oval pits (Figure 5*b*). Hairs with taper distributed on lateral surface of rostrum, some forming row near ventral margins of valves; additional hairs sparsely distributed on valve surface.

Infold: Broad at caudal process and behind rostrum; 12–13 bristles forming row on infold behind rostrum; infold below rostrum with small bristle followed by space and additional small bristles in row; infold anterior to caudal process with short bristles; infold along posteroventral and posterior margins with small bristles forming row on list.

Hinge: Linear along posterodorsal margin.

Marginal pore canals: Numerous along free margins but faint.

Central muscle scars: Obscure, consisting of about 17 individual scars.

Salvage: With wide striate lamellar prolongation with slender spines along outer edge.

Size: Shell dimensions (in mm) are as follows:

Great- est length	Great- est height	Collector	Remarks
1.30	0.80	Müller	adult male (lectotype)
1.28	0.78	Müller	adult male
0.94	0.60	Müller	instar
0.90	0.60	Puri and Bonaduce	instar
0.76	0.49	Puri and Bonaduce	instar
0.70	0.46	Kornicker	instar

First antenna: 2nd joint with a dorsal, ventral, and lateral bristle; 3rd joint with 1 ventral and 2 dorsal bristles; 4th joint with 2 dorsal and 4 ventral bristles distally; 5th joint inserted ventrally between 4th and 6th joints and bearing sensory bristle with broad base and numerous filaments; 6th joint with medial bristle distally; end joints with 2 long stout c- and f-bristles, 1 short spinous dorsal a-bristle, 2 long b- and g-bristles with filaments, and 2 bare d- and e-bristles.

Second antenna (Figure 5*d-f*): Endopodite 3-jointed: 1st joint with 5 proximal and 1 distal bristle; 2nd joint elongate with 2 bristles near middle; 3rd joint prehensile with 1 proximal and 2

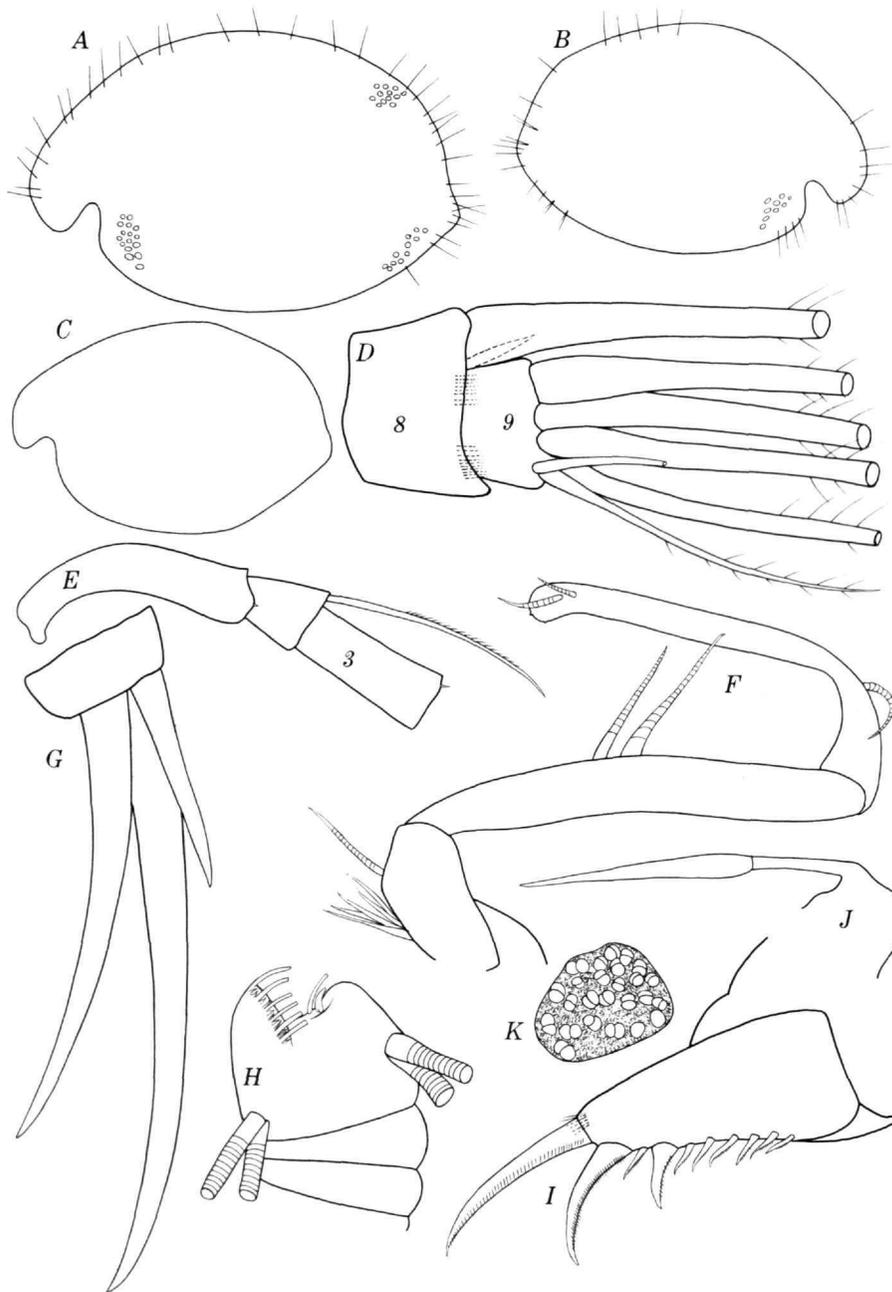


FIGURE 5.—*Euphilomedes asper*: a, carapace showing some punctae, length 0.90 mm; b, carapace showing some punctae, length 0.76 mm; c, carapace, length 0.70 mm; d, tip of 2nd antenna, medial view; e, part of exopodite of 2nd antenna, medial view; f, endopodite of left 2nd antenna; g, end claws on mandible (bristles not shown); h, tip of 7th limb; i, furca; j, outline of rod-shaped organ and medial eye; k, lateral eye. (l, ZMB 9152:1, from station B30; b, ZMB 9152:2, from station B30; c, juvenile, USNM 112803; g, i, j, k, adult ♂, GMZ 25003, a, d-f, h, ZMB 9152:1, lectotype).

distal bristles and ridges terminally. Exopodite: 1st joint with small medial spine; joints 3–8 with slender basal spines; bristle of 3rd joint with marginal spines ventrally; joints 2–8 with short hairs in row distally on lateral margin; 9th joint with 4 long and 2 short bristles.

Mandible (Figure 5g): Basale: Ventral margin with 7 bristles; dorsal margin with 1 bristle near middle and 2 terminally; medial surface with about 5 short bristles proximally near ventral margin. Exopodite reaching about middle of 1st endopodite joint, with 2 terminal bristles. Endopodite: 1st joint with 2 short and 3 long distoventral bristles; 2nd joint with 2 dorsal bristles proximally, 5 or 6 dorsal bristles near middle, 2 ventral bristles subdistally and about 4 ventral bristles terminally; end joint with 2 long subequal claws, 1 short dorsal claw and about 4 bristles.

Seventh limb (Figure 5h): Four long bristles in distal group, each with about 5 bells; 4 shorter bristles in proximal group, each with 3 or 4 bells; terminal comb opposed by 2 blunt pegs.

Furca (Figure 5i): Each lamella with 10 or 11 claws, all separated from lamellae; claws 1, 2, 4 primary, remaining claws secondary; 3rd claw about same length as 5th; primary claws with lateral and medial rows of spines; spines on each claw about same length; secondary claws with marginal spines; clusters of long hairs present medially at base of some claws.

Eyes: Lateral eye (Figure 5k) large with about 26 divided ommatidia. Medial eye (Figure 5j) about same size as lateral eye.

Rod-shaped organ (Figure 5f): Elongate with 2 joints; 2nd joint broad proximally and tapering distally.

### *Euphilomedes sinister*, new species

#### FIGURES 6–7

*Philomedes interpuncta*.—Brady, 1868b:463, pl. 33: figs. 10–13, pl. 41: fig. 3; 1871:293, pl. 26: figs. 1–5; 1872:60, pl. 1: figs. 5.—Müller, 1894:210, pl. 3: figs. 1–2, 5–16, 19–20, 24–28.—Brady and Norman, 1896:656, pl. 56: figs. 6–10, pl. 57.—Fage, 1934:249, figs. 1–2.—Caraion, 1959:266, fig. 1 [not Baird, 1850].

ETYMOLOGY.—The specific name from the Latin *sinister* (left) refers to the posterior spines of the carapace being restricted to the left valve.

HOLOTYPE.—One female without eggs in the

Zoological Station of Naples. The valves and some appendages in alcohol; remaining appendages on slides; length 1.24 mm.

TYPE-LOCALITY.—Benta Palumma, station B27, 90 M, Gulf of Naples, Italy.

MATERIAL.—One female from station B27, Gulf of Naples, collected by Harbans S. Puri and Gioacchino Bonaduce. I also had the opportunity to examine briefly while at the Zoological Station at Naples in 1966, three of Müller's specimens in the collection of the Zoological Institute of Greifswald (GMZ 25008).

DISTRIBUTION.—Gulf of Naples; Loch Long, Fosse de Cap Breton (Bay of Biscay), Cumbrae (Brady and Norman, 1896:657); Bosphorus, 41°25'S, 28°59'E (Caraion, 1959:266).

DISCUSSION.—Müller (1894:205) assigned specimens of *E. sinister* collected in the Gulf of Naples to *Philomedes interpuncta* (Baird, 1850). The incomplete description of the latter species (Baird, 1850: 257, pl. 17: figs. 8–10) makes it necessary to place it in the category "species dubia." However, the absence of secondary claws between the primary claws of the furca (Baird, 1850, pl. 17: fig. 8) indicates that Baird's species does not belong in the genus *Euphilomedes*. Unfortunately, the type-specimen of *P. interpuncta* has been lost (Loft-house, 1966).

According to Müller (1894:205), the left valves of females have an upper and lower spine posteriorly, whereas, the male has only the lower spine. Previously, Brady (1868b:464) had stated concerning specimens of *E. sinister* from the English coast, which he identified as *Philomedes interpuncta* (Baird), "There is much variety in the spinous armature of the posterior margin; in most cases one short spine exists near its lower extremity, and rarely one likewise at the upper angle; not infrequently they are altogether wanting." Unfortunately, I do not have a sufficient number of specimens to determine the degree of constancy of spines. However, I am inclined to believe that their absence would have been mentioned by Müller. In view of the diverse localities from which the species was reported by Brady (1868a, 1868b). I think it possible that specimens lacking spines may not be conspecific with *E. sinister*.

Specimens from Plymouth sound identified by Norman (1861:280, pl. 14: fig. 11) as *Philomedes lilljicornis* (Lilljeborg, 1853) differ from *E. sinis-*



ter in being without spines or in having a single spine on the upper posterior margin. Another difference is that the surfaces of Norman's specimens are described as having large circular or subcircular pits, whereas, *E. sinister* has polygonal reticulations. Brady (1868b:464) stated that Norman's figure and description were based on worn specimens; however, Norman (1861:280) stated that he found specimens "in some numbers among dredged stuff sent to me by W. Webster, Esq., from Plymouth Sound . . ." It would seem that if a number of specimens were collected, a lower spine, if originally present, would have remained on some specimens even if worn, because the lower spine is present on both males and females, whereas the upper spine is only on females. For the above reasons, I have not included Norman's specimens in *E. sinister*.

Lilljeborg (1875:3) placed specimens identified by Brady (1968b:463) as *Philomedes interpuncta* (Baird) in synonymy with *Philomedes globosus* (Lilljeborg). The absence of secondary claws alternating with primary claws on the furca of the latter species makes the referral untenable.

Skogsberg (1920:398) considered the specimens identified by Norman (1861:280) as *P. longicornis* to belong to *P. interpuncta* (Baird). I consider the following statement in Norman's description of the species as an indication that Skogsberg's conclusion is incorrect, "I am indebted to Dr. Baird for pointing out to me the identity of the Plymouth Entomostracan with Lilljeborg's species." This shows that Baird did not consider Norman's specimens to be conspecific with his species.

**DESCRIPTION OF FEMALE.**—Carapace oval in lateral view with greatest height near middle and truncate posterior (Figure 6a); inferior tip of broad rostrum with stout protuberance.

**Ornamentation (Figure 6e):** Posterior margin of

FIGURE 6.—*Euphilomedes sinister*, new species, female, holotype, length 1.24 mm: a, carapace showing positions of muscle scars and lateral eye; b, adductor muscle scars right valve, lateral view; c, tip of rostrum, right valve, medial view; d, anterior left valve, medial view; e, posterior left valve showing some surface reticulations, medial view; f, right 1st antenna, medial view (only a-bristle shown on end joints); g, part of exopodite of right 2nd antenna, medial view; h, tip of right 2nd antenna, medial view; i, endopodite of right 2nd antenna; j, proximal part of 2nd antenna (not under cover glass); k, furca without claws, and genital area; l, anterior of animal; m, posteroventral margin of right valve, medial view.

left valve with dorsal and ventral spine and toothed margin between spines; posterior margin of right valve without spines or teeth; surface of valves with reticulate pattern. Bristles present along margins and scattered over carapace.

**Infold (Figure 6c-e,m):** Broad along anterior and posteroventral parts of valve, narrow ventrally; anteroventral part striate. Infold behind rostrum with 16–18 bristles, most with marginal spines; infold along anteroventral margin with 13 or 14 spinous bristles; infold along posteroventral margin with 3 short bristles near middle and 3 at outer margin; list along posterior and posteroventral infold with about 33 bristles, some arranged singly and some in pairs.

**Central muscle scars (Figure 6b):** Six ovoid muscle scars forming arc behind and over 2 to 5 indistinct scars.

**Selvage:** Wide lamellar prolongation along anterior, ventral, and posterior margins; prolongation divided on rostrum in area of protuberance at inferior corner; prolongation striate, with marginal fringe of long and short spines.

**Size:** ♀ holotype, length 1.24 mm, height 0.82 mm. (Müller, 1894:210, gave length of both sexes as 1.27 mm.)

**First antenna (Figure 6f):** Joints 1–5 with clusters of hairs medially; 2nd joint with about 5 spines along dorsal margin and 3 bristles, 1 dorsal, 1 ventral, and 1 lateral, all with spines; 3rd joint with 3 bristles, 2 dorsal, 1 ventral, all with spines; 4th joint with 6 bristles, 2 dorsal, 4 ventral; 5th joint with filamentous sensory bristle ventrally; 6th joint with slender bristle with few long spines; a-bristle of 7th joint longer than bristle of 6th joint; bristles of joints 7 and 8 typical for family.

**Second antenna (Figure 6g–j):** Prodopodite with clusters of short spines on lateral surface. Endopodite 2-jointed: 1st joint with 5 proximal and 1 distal bristle; 2nd joint with long spinous lateral bristle and 1 slender spine subterminally. Exopodite: 1st joint with small medial terminal spine; terminal margin of joints 2–8 with comb of short spines; bristles of joints 2–5 with short ventral spines near middle and without natatory hairs; bristles of joints 6–8 with natatory hairs and without ventral spines; joint 9 with 7 bristles, 4 terminally with natatory hairs, 3 distoventrally with short marginal spines (spinous bristles shorter than those with natatory hairs.)



FIGURE 7.—*Euphilomedes sinister*, new species, female, length 1.24 mm: *a*, coxale endite and part of basale of right mandible, medial view; *b*, exopodite right mandible, lateral view; *c*, endites of 5th limb; *d*, furca; *e*, right maxilla, lateral view; *f*, outline of 2nd joint of right 5th limb, anterior view; *g*, distal end left 5th limb, anterior view; *h*, 6th limb; *i*, tip of 7th limb.

Mandible (Figure 7a,b): Coxale endite with bifurcate tip, secondary teeth and clusters of spines. Basale: lateral and medial surface hirsute; medial surface with 3 broad spines with secondary teeth and 1 plumose bristle; dorsal margin with 1 bristle near middle and 2 distally; ventral margin with 7 plumose bristles; lateral surface hirsute. Exopodite about three-fourths length of 1st endopodite joint, with terminal spine and 2 plumose bristles: terminal bristle reaching middle of 2nd endopodite joint, subterminal bristle reaching about two-thirds length of 2nd endopodite joint. Endopodite: 1st joint with 3 subterminal plumose ventral bristles; 2nd joint ventral margin with 2 clusters of distal bristles, 3 in proximal group, 4 in terminal group; dorsal margin with 2 groups of bristles, 4 in proximal group, 6 in distal group near middle of margin; end-joint with 2 subequal long claws and 1 short dorsal claw, all pectinate, and 4 bristles; 1st and 2nd endopodite joints with clusters of spines on lateral and medial surfaces.

Maxilla (Figure 7e): Precoxale and coxale with fringe of hairs along anterior margins; coxale with spinous anterior bristle. Basale with 3 long distal bristles. Endites: 1st with about 9 bristles, 2nd about 6; 3rd about 9 plus 1 proximal bristle. Exopodite with 2 long and 1 short bristle. 1st endopodite joint with A-bristle with wreaths of long hairs and short marginal spines, and 5 B-bristles mostly without spines.

Left fifth limb (Figure 7g): 1st joint of exopodite with 2 anterior bristles near middle of distal margin; tooth in front of main tooth complex bearing 3 projections and having proximal anterior bristle; large triangular tooth of the 2nd exopodite joint follows pattern for genus.

Right fifth limb (Figure 7c,f): Limb abnormal in not having main tooth.

Sixth limb (Figure 7h): Epipodial appendage with 3 short spinous bristles; end-joint with about 15 bristles; 2nd endite with 3 terminal and 1 proximal bristle; 3rd and 4th endites each with 1 proximal bristle and numerous terminal bristles.

Seventh limb (Figure 7i): Terminal comb with about 15 teeth having basal spines; 2 pegs present opposing comb, inner peg with lateral spines and larger of 2; 5 bristles present in distal group, 4 in proximal group; each bristle with short spines laterally and 4-5 bells distally.

Furca (Figures 6k, 7d): Each lamella with 12

claws; claws, 1, 2, 4, 6 primary, remaining claws secondary; claw 1 with rows of lateral and medial teeth; medial teeth increasing in size near middle of claw; medial teeth of claw 1 of right lamella larger than same claw on left lamella; claws 2, 4, 6 with teeth in row along concave margin; claws 4 and 6 with few spines along convex margin; secondary claws with spines along anterior and posterior margins; bases of some claws with clusters of hairs medially; edge of each lamella near bases of claws with hairs medially; numerous hairs present along margin of lamella posterior to claw 12.

Genitalia: Consisting of large ovoid lobe.

Eyes (Figure 6l): Medial eye large, pigmented. Lateral eyes very small.

Rod-shaped organ (Figure 6l): Elongate, 2 jointed, with 2 small terminal spines.

Upper lip (Figure 6l): Rounded, hirsute, with anterior projection.

#### **PSEUDOPHILOMEDINAE Kornicker, 1967**

This subfamily is represented by two species in the Gulf of Naples, *Pseudophilomedes angulata* and *Pseudophilomedes foveolatus*. Specimens of the former species were not available during the present study.

#### ***Pseudophilomedes* Müller, 1894**

TYPE-SPECIES.—*Pseudophilomedes foveolata* Müller, 1894, by subsequent designation (Sylvester-Bradley, 1961:Q399). Gender: Masculine.

#### ***Pseudophilomedes foveolatus* Müller, 1894**

##### FIGURES 8-10

*Pseudophilomedes foveolata* Müller, 1894:211-212, pl. 3: figs. 34-35, 45-49, 51, 53-54, pl. 4: figs. 1-2, 7.

*Pseudophilomedes foveolatus*.—Sylvester-Bradley, 1961:Q399, fig. 322.2.—Kornicker, 1967a:13, figs. 7-8.

LECTOTYPE (designated herein).—Female (late instar), ZMB 9154:1. This specimen is on 13 slides which bear the ZMB numbers 3755 to 3767 in addition to the above. The valves are on slide ZMB 3755. This specimen was described and illustrated by Kornicker (1967a:13, figs. 7, 8; the captions under figs. 7, 8 should have given Gulf of Naples for the locality, not "BST 30.")

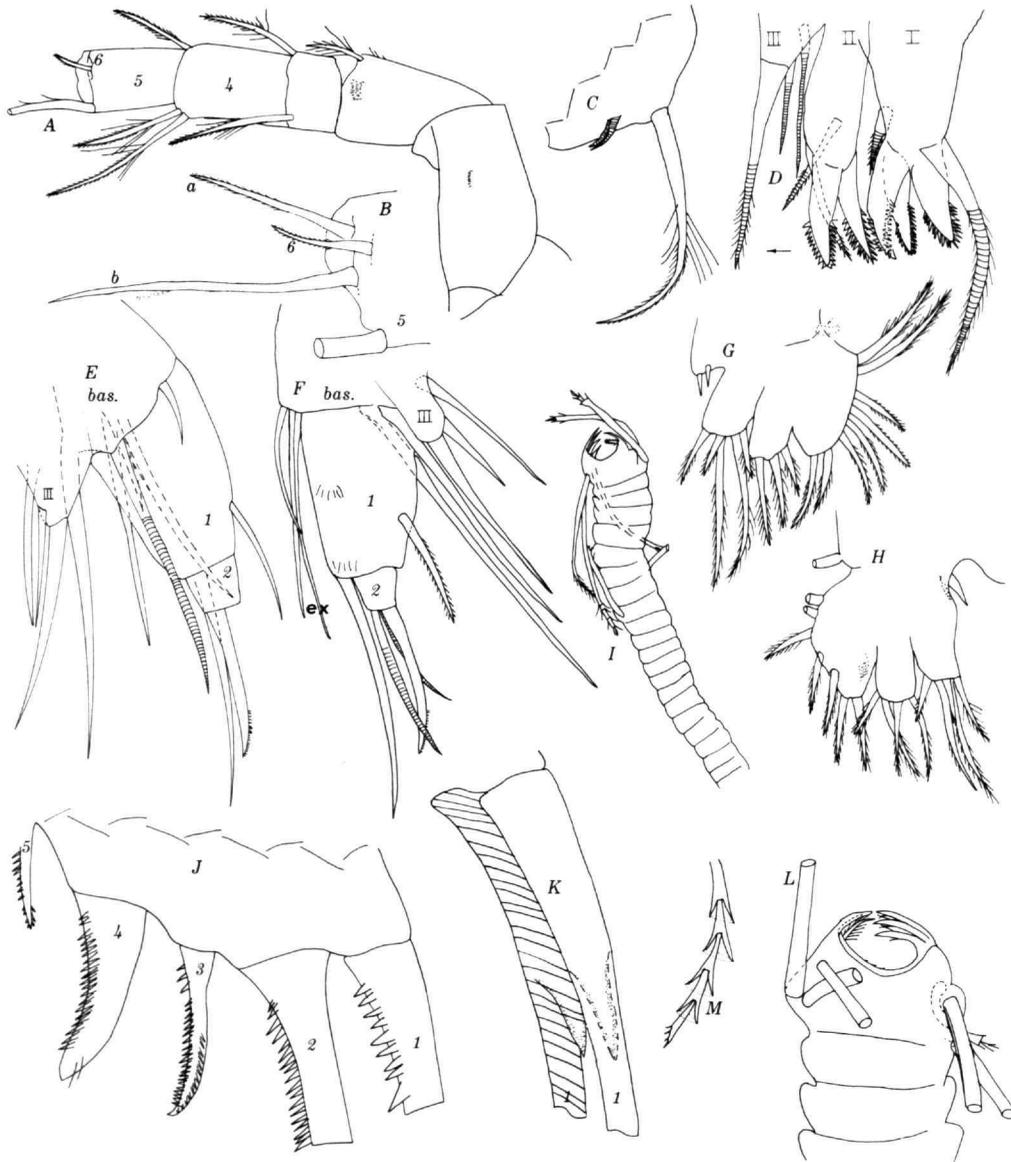


FIGURE 8.—*Pseudophilomedes foveolatus*, female, GMZ 25012: *a*, 1st antenna (bristles of joints 7–8 not shown); *b*, end of right 1st antenna (all bristles not shown; *b*-bristles obscure and may contain more filaments than shown); *c*, endopodite of 2nd antenna; *d*, endites of right maxilla; *e*, part of left maxilla, medial view (not all bristles shown); *f*, part of right maxilla (not all bristles shown); *g*, *h*, 6th limbs; *i*, 7th limb; *j*, part of furca; *k*, part of 1st claws of furca; *l*, tip of 7th limb; *m*, detail of tip of bristle of 7th limb.

TYPE-LOCALITY.—Gulf of Naples.

MATERIAL.—In addition to the lectotype, I had the opportunity to examine briefly while at the Zoological Station in Naples about 12 specimens (GMZ 25012). I dissected one of the females in Naples and then examined the appendages in my laboratory at the Smithsonian Institution. This paralectotype has been used to supplement previous description of the species. Two immature males were collected at station B23 by Drs. Puri and Bonaducci. These are the first males of this family reported. (Kornicker (1967a:8) erroneously reported the holotype of *P. ferulanus* as a male.) Specimen No. 1 from station B23 is in the collection of the Zoological Station at Naples; specimen No. 2 (USNM 121428) is in the collections of the Smithsonian Institution.

DISTRIBUTION.—Gulf of Naples.

DISCUSSION.—Müller (1894) described two species of *Pseudophilomedes* from the Bay of Naples, *P. foveolata* and *P. angulata*. The main difference in appendage morphology between the two species is the presence of an additional lobe bearing two bristles on the 6th limb of *P. angulata*. Müller (1894:212) stated that *P. angulata* also differs from *P. foveolata* in that the spines on the 1st masticatory process of the maxilla of *P. angulata* are weakly dentate, whereas these spines are bare on *P. foveolata*. The present study supports a previous one (Kornicker, 1967a:15) in showing that the spines on the 1st masticatory process of the maxilla of *P. foveolata* are also dentate. The length of the carapace of *P. angulata* is 1.23 mm and the surface has distinct longitudinal ribs, whereas the length of the carapace of the female of *P. foveolatus* is 0.93 mm and the surface is without ribs (Müller, 1894:212). The carapace of the immature male described herein has a faint rib along its ventral part.

In a previous study of the maxilla of *P. foveolatus* (Kornicker, 1967a:15), I described a short lobe with three bristles located distally of the coxale endite. I now believe that this lobe should be considered a 3rd endite. Thus, the number of endites (3) is the same as on the maxillae of species in the subfamily Philomedinae, but endite III is reduced.

The immature male described here differs mainly from the female in having well-developed lateral eyes, a 3-jointed elongate endopodite on the 2nd antenna, no proximal bristles on the 7th limb, and

4 bristles on the 9th exopodite joint of the 2nd antenna.

SUPPLEMENTARY DESCRIPTION OF APPENDAGES OF FEMALE (this specimen is assumed mature, but it could be an N-1 instar).—First antenna (Figure 8a,b): 1st joint with spines in cluster on medial surface; 2nd joint with spines in rows distally on lateral surface; 4th joint with 2 spinous bristles ventrally. Limb, in general, similar to that of male described below (I could not discern number of filaments on bristles of end joints). (Apparently, the N-1 female and male have only 1 ventral bristle on the 4th joint, whereas, the adult has 2.)

Second antenna (Figure 8c): Endopodite single-jointed with 2 short proximal bristles and 1 long spinous distal bristle. Exopodite: 9th joint with 1 long and 1 short bristle; bristles of joints 2-9 with marginal spines, but without natatory hairs.

Maxilla (Figure 8d-f): 1st endite with 3 stout pectinate spines and 2 spinous bristles, 1 long, 1 short; 2nd endite with 2 stout pectinate spines and 2 short spinous bristles; 3rd endite consisting of short lobe with 3 bristles, 1 long and 2 short; distal margin of basale with 3 bristles, 2 on inner corner and 1 medially; exopodite consisting of 3 bristles, 2 long, 1 short; 1st joint of endopodite with 2 bristles, 1 subterminal on distal anterior margin and 1 terminal; end joint with slender bristle-like process and 3 bristles.

Mandible and fifth limb: Similar to that of immature male described below.

Sixth limb (Figure 8g,h): 1st endite with 2 bristles; 2nd endite with 5 bristles; 3rd endite with 3 or 4 bristles; end joint with 7 or 8 bristles; single bristle in place of epipodial appendage.

Seventh limb (Figure 8i,l,m): One limb with 5 bristles in distal group, other with additional dwarf bristle; both limbs with 2 bristles in proximal group, 1 on each side; each bristle with 2-5 bells distally; terminus cannot be observed clearly on specimen, but apparently consisting of comb with about 6 teeth opposing 1 curved tooth having at each side a tooth with long marginal spines. (Müller (1894, pl. 3: fig. 47) illustrated a 7th limb with 4 bristles in distal group and 2 in proximal group, both bristles in proximal group being on same side.)

Furca (Figure 8j,k): Morphology as previously reported by Kornicker (1967a:18) with following exception: 3rd claw about same length as 4th and located equidistant between 2nd and 4th claws.

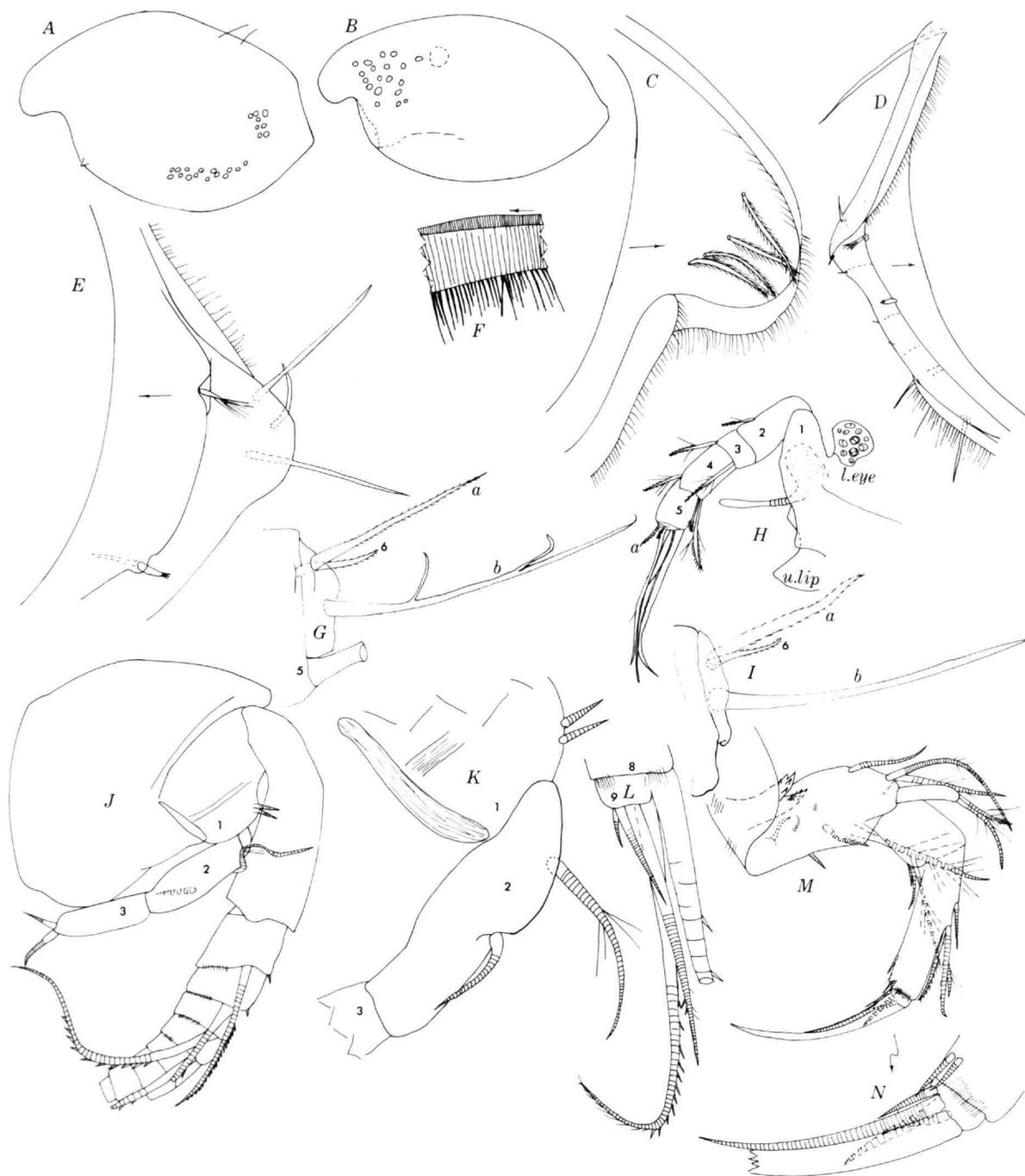


FIGURE 9.—*Pseudophilomedes foveolatus*, juvenile male: *a*, carapace showing some punctae and position of lateral eye, length 0.84 mm; *b*, carapace showing some punctae and position of lateral eye, length 0.83 mm; *c*, anterior of left valve, medial view; *d*, posterior of left valve, medial view; *e*, caudal process right valve, medial view; *f*, section of ventral part of ventral margin, right valve, showing selvage with lamellar prolongation; *g*, tip of right 1st antenna, lateral view (not all bristles shown); *h*, anterior of animal; *i*, tip of 1st antenna, lateral view (not all bristles shown; *b*-bristles obscure and may have filaments); *j*, left 2nd antenna, medial view (not all bristles of exopodite shown); *k*, joints 1 and 2 of endopodite of right 2nd antenna, lateral view; *l*, tip of right 2nd antenna, lateral view; *m*, right mandible, lateral view; *n*, enlargement of tip of right mandible (all from station B23: *a*, *g*, USNM 121428; *b-f*, *h-n*, GMZ 25012:1).

DESCRIPTION OF IMMATURE MALE (probably N-1 instar).—Carapace oval in lateral view with greatest height and length near middle (Figure 9*a,b*); incisur broadly rounded; lower margin of rostrum forming right angle with anteroventral shell margin; posterior margin of valve with caudal process just below valve middle.

Ornamentation: Surface with large punctae; short process present on anteroventral margin; faint longitudinal ridge along lower part of shell.

Infold (Figure 9*c-f*): Broad along anterior and posterior parts of valves, narrow ventrally; 4 spinous bristles at rostrum; 2 spinous bristles at caudal process.

Selvae: Broad lamellar prolongation with marginal fringe present along anterior, ventral, and posterior margins of each valve.

Size: One immature ♂ (specimen no. 1) from station B23, length 0.83 mm, height 0.49 mm; immature ♂ (USNM 121428) from station B23, length 0.84 mm, height 0.53 mm.

First antenna (Figure 9 *g-i*): 2nd joint with 1 spinous dorsal bristle and short spines in row along dorsal margin of lateral surface; 3rd joint with 2 spinous bristles, 1 ventral, 1 dorsal; 4th joint with 3 spinous bristles, 2 ventral, 1 dorsal; 5th joint with long ventral bristle with sensory filaments; 6th joint minute with short spinous medial bristle; 7th joint reduced and fused to 8th; a-bristle about three-fourths length of b-bristle, b-bristle with 1 proximal and 1 distal filament, c-bristle long and with filaments; 8th joint reduced, with long bare d- and e-bristles and long f- and g-bristles, each with 5 filaments.

Second antenna (Figure 9*j-l*): Endopodite 3-jointed: 1st joint with 2 short bare bristles; 2nd joint with 1 long proximal bristle with wreath of spines, and 1 shorter bare bristle near middle; 3rd joint with 2 short bare terminal bristles. Exopodite: bristles on joints 2-8 with stout ventral spines; joint 9 with 4 bristles, 1 long and 1 medium with spines, 2 short without spines, all without natatory hairs; distal margins of joints 2-8 with comb of slender spines.

Mandible (Figure 9*m,n*): Coxale endite large, bifurcate, spinous distally; surface of coxale and basale with clusters of spines; basale with 7 bristles, 3 dorsally, 2 ventrally, and 2 on medial surface; exopodite with 2 spinous terminal bristles. Endopodite: 1st joint with 3 ventral bristles; 2nd joint

with 1 short dorsal bristle proximal to middle, 3 dorsal bristles near middle, 1 short subterminal ventral bristle and 2 short terminal bristles near ventral margin; distal margin of 2nd joint with spines in row; end joint with 3 bristles and 2 claws, 1 of latter very long, other less than one-third length of long claw.

Maxilla (Figure 10*a*): 1st endite with 3 short pectinate spines and 2 spinous bristles, 1 long, 1 short; 2nd endite with 2 stout pectinate spines and 2 bristles; 3rd endite consisting of short lobe with 3 bristles, 1 long and 1 short terminally, 1 medium proximally; coxale with short spinous anterior bristle; basale with 3 spinous bristles on distal margin, 1 medially, and 2 near inner corner; 1st joint of endopodite with 2 spinous bristles, 1 anteriorly and 1 terminally; end joint with stout bristle-like process and 3 bristles, stout process with few spines along convex margin distally; exopodite consisting of 3 spinous bristles.

Fifth limb (Figure 10*b,c*): Distal tooth of 1st joint of exopodite consisting of large recurved pectinate tooth having 1 or 2 smaller teeth proximally; proximal tooth of 1st joint trident: proximal tooth with 1 small spine, middle tooth smooth, distal tooth pectinate; 2nd joint with long fanglike tooth followed along inner margin by 1 small tooth and 2 trident teeth; inner margin of protopodite with small bristle at distal corner. (Distribution of bristles on joints 1-4 shown in Figure 10*b*).

Sixth limb (Figure 10*d,e*): 1st endite with 2 bristles; 2nd endite with 4 or 5 bristles; 3rd endite with 4 bristles; end joint with 7 bristles; 1 or 2 bristles in place of epipodial appendage; endites and end joint hirsute.

Seventh limb (Figure 10*f,g*): 4 bristles present in distal group, none proximally; 2-4 bells present distally on bristles; terminus with single erect tooth opposing reclining tooth, both teeth with marginal spines.

Furca (Figure 10*i-k*): Claws 1, 2, 4 stout, remaining claws slender; claw 3 about same length as claw 4; claw 1 with large medial tooth. USNM 121428 with 3 slender claws following claw 4 on left lamella, but only 2 on right lamella; specimen 1 (B23) with 2 slender claws following claw 4 on both lamellae.

Rod-shaped organ (Figures 9*h*, 10*h*): Elongate, jointed proximally.

Eyes (Figure 9*h*): Lateral eye with about 15



FIGURE 10.—*Pseudophilomedes foveolatus*, juvenile male: *a*, maxilla, lateral view; *b*, part of left 5th limb, posterior view; *c*, part of left 5th limb, anterior view, (all bristles and inner teeth on 2nd joint not shown); *d*, *e*, sixth limbs; *f*, *g*, distal ends of 7th limbs; *h*, proximal part of rod-shaped organ; *i*, part of right furca, medial view; *j*, left lamella of furca, lateral view; *k*, left lamella of furca, lateral view (all from station B23: *h*, *i*, *k*, USNM 121428; *a*–*g*, *j*, GMZ 25012:1).

divided ommatidia; medial eye pigmented, about same size as lateral eye.

### SARSIELLIDAE Brady and Norman, 1896

The Sarsiellidae are represented in the Gulf of Naples by only one genus, *Sarsiella* Norman, 1869, with two species.

#### *Sarsiella* Norman, 1869

TYPE-SPECIES.—*Sarsiella capsula* Norman, 1869, by monotypy.

#### *Sarsiella capsula* Norman, 1869

FIGURES 11–13a, b

*Sarsiella capsula* Norman, 1869:293.—Brady and Norman, 1896:677, pl. 60: figs. 1–4, 18.—Kornicker, 1967b:32, fig. 16 [redescription].

*Sarsiella levis* Müller, 1894:216, pl. 4: figs. 11–12, 19–20, 23–24, 26, 32, 36, 45–47, pl. 8: figs. 2–3.

*Nematohamma obliqua* Brady and Norman, 1896:680–682, pl. 52: figs. 1–2, pl. 53: figs. 12–15.

*Sarsiella* (?) *capsula*.—Scott, 1902:475, pl. 25: figs. 27–32.

Not *Sarsiella capsula*.—Sars, 1888:229, pl. 3: figs. 5–7, pl. 10.—Müller, 1894:214, pl. 4: figs. 4–6, 8–10, 22, 25, 27–29, 31, 33–35, 37, 48, pl. 8: figs. 6–7.—Brady, 1911:595.—Rome, 1942:8.

MATERIAL.—Two immature females from station B59, Gulf of Naples, collected by H. S. Puri and G. Bonaduce; 1 left valve of an immature female and 1 juvenile (ZMB 9156) and 1 adult male and 5 females and juveniles (GMZ 25020) collected by G. W. Müller. I had the opportunity to examine briefly the specimens of the Zoological Institute of Greifswald but did not dissect any. The present study is based primarily on specimen No. 1 from station B59 (Figure 11), which I estimate to be an N-1 stage instar. This specimen is part of the collections of the Zoological Station of Naples; some appendages are on slides, the remaining appendages and the valves are preserved in alcohol.

DISTRIBUTION.—Mediterranean: Gulf of Naples. Atlantic Ocean: In vicinity of Shetland Islands, Valentia, Ireland; Birterbuy Bay, Ireland.

DISCUSSION.—This species was described by Müller (1894:216) as a new species, *Sarsiella levis*. It was placed in synonymy with *Sarsiella capsula* Norman by Kornicker (1967b:32). The present description is in essential agreement with Müller's.

An exception is the presence of six faint setae in a position posterodorsal to each of the genital openings. These were probably overlooked by Müller. Setae in a similar location were described by Kornicker (1967b:16,42) on *Sarsiella zostericola* Cushman, 1906, and *Sarsiella disparalis* Darby, 1965. I now consider these to be brush-shaped organs and have so named them herein.

DESCRIPTION OF FEMALE (N-1 instar).—Oval in lateral and dorsal view except for caudal process and truncate posterior formed by large corner-like posterodorsal process (Figures 11b, 13a,b); anterior margin rounded without rostrum or incisur; caudal process extending posteroventrally and with rounded tip; left valve overlapping right along anterodorsal margin.

Ornamentation: Valves with flat or slightly depressed central area and 8 low radial ridges, 3 anteriorly, 3 ventrally, 1 dorsally, and 1 extending onto caudal process; dorsally the upper anterior radial ridge continues posteriorly onto large posterodorsal corner-like process; ventrally the radial ridge of caudal process continues anteriorly connecting with inner ends of the 3 ventral ridges and lowest of anterior ridges; surface of valves between ridges with large rounded pits; surface of ridges with minute spines and 1–3 long hairs; anterior and ventral margins of valves with scalloped edges and subequal hairs in 2 or 3 rows; caudal process with scattered hairs and 4 terminal and numerous marginal spines; valves translucent, muscle scars and small lateral eyes visible through shell in lateral view.

Infold (Figure 11c-e): Broad with 1 small bristle on anterior part above midline, 7 on caudal process; 2 groups of 2 or 3 bristles near inner margin anterior to caudal process; 2 brushlike bristles dorsal to caudal process, and 1 short bristle near inner margin of posterior part.

Selvage: Striated, narrow with broad unstriated lamellar prolongation anteriorly, ventrally, and posteriorly.

Hinge: Linear, extending from middle of dorsal margin to posterior edge of dorsal crest.

Marginal pore canals: Anterior and ventral margins with numerous false radial pore canals leading to marginal hairs; caudal process with 4 distinct canals leading to terminal spines; posterior margin with scattered canals leading to minute pits, some terminating in hairs.



FIGURE 11.—*Sarsiella capsula*, immature ♀ (specimen 1, sta. B59): *a*, muscle scars, right valve, lateral view; *b*, anterior part right valve, lateral view; *c*, caudal process left valve, medial view; *d*, anterior margin left valve, medial view; *e*, posterior part right valve, medial view; *f*, 1st antenna, rod-shaped organ, and medial eye, medial view; *g*, 2nd antenna, medial view; *h*, mandible, medial view; *i*, 1st joint endopodite right mandible, medial view; *j*, maxilla, lateral view; *k*, endites of maxilla, medial view.

Central muscle scars (Figure 11a): Consisting of about 15 individual scars located slightly antero-ventrally of middle of valve and within circumscribing ridge.

Size: Immature ♀, specimen 1 from station B59, length 1.08 mm, length excluding caudal process 0.98 mm, height 0.86 mm; left valve from sample 9156, length 1.08 mm, length excluding caudal process 0.97 mm, height 0.89 mm; juvenile from sample 9156, length 0.94 mm, length excluding caudal process 0.83 mm, height 0.72 mm.

First antenna (Figure 11f): Dorsal margin of 2nd joint with spinous bristle near middle; joints 3 and 4 not separated by suture; joint 3 with spinous dorsal and bare ventral bristle; 4th joint with 1 dorsal and 3 ventral bristles, all with marginal spines; 5th joint with long, bare, distoventral bristle; short 6th joint with small spinous medial bristle; joints 7 and 8 with total of 7 bristles: a-bristle bare, about one-third length of other bristles; b-bristle slender; c-, d-, f-, g-bristles similar in length to sensory bristle of 5th joint, e-bristle slightly shorter.

Second antenna (Figure 11g): Protopodite without medial bristle or marginal hairs. Endopodite 1-jointed, with 2 small annulate proximal bristles and minute terminal button. Exopodite: 1st joint with small bent medial spine terminally; joints 2-7 with comb of short subterminal spines; bristles on joints 2-8 with ventral spines proximally and natatory hairs distally, bristles on joints 6-8 with relatively few spines; joint 9 with 2 bristles, 1 long ventral bristle with marginal spines near middle and natatory hairs distally, and 1 short dorsal bristle, latter bare except for 2 or 3 short spines near middle.

Mandible (Figure 11h,i): Coxale with short spines along ventral margin and spinelike medial bristle proximally; basale with 6 subequal bristles ventrally and 1 minute subterminal spine dorsally. Endopodite: 1st joint with minute spines on medial surface, 3 or 4 small ventral spines proximal to large terminal claw, and 1 small terminal spine dorsally; 2nd joint with large terminal claw ventrally and short subterminal spine dorsally; 3rd joint with large terminal claw, and 1 dorsal and 1 or 2 ventral short spines.

Maxilla (Figure 11h): Coxale with bare annulate bristle on anterior margin; endites with total of 16 bristles (Figure 11k); basale? with slender bare

bristle laterally near basis of endite III; exopodite with 1 long spinous bristle and 1 short bare bristle. Endopodite: 1st joint with spinous  $\alpha$ - and  $\beta$ -bristles and spines along anterior margin; 2nd joint with 5 stout terminal bristles, 2 slender lateral bristles, and 1 short bare medial bristle.

Fifth limb (Figures 12a): Endite with 1 short bare bristle, epipodial appendage with 29 plumose bristles. Exopodite: 1st joint with 2 spinous bristles, 1 medium and 1 long; joints 2-5 hirsute, with total of 9 unequal bristles, most with short marginal spines.

Sixth limb (Figure 12b): End joint with 10 annulate spinous bristles followed by 2 plumose bristles; posterior margin near plumose bristle hirsute; medial and lateral surfaces with clusters of minute spines; endite with 1 long and 2 short annulate bristles.

Seventh limb (Figure 12f): Terminal end smooth with 6 bristles, 3 on each side; rings 8 and 9 counting from terminal segment with total of 2 bristles, 1 on each side; all bristles with 3-6 distal bells; complete limb with total of about 64 rings.

Furca (Figure 12e): Each lamella with 5 pointed claws; claw 1 continuous with lamella, claws 2-5 separated from lamella by sutures; claws 1-4 with lateral spines in row along posterior margins; claws 1 and 3 with short spines or hairs along anterior margins; anterior margin of each lamella with several short spines above claw 1; posterior margin of each lamella with several spines between claws 4 and 5 and following 5, more on left lamella than on right; medial side of each lamella with hairs above bases of claws; claws 4 and 5 less curved than claws 1 to 3.

Brush-shaped organ (Figure 12h): Consisting of about 5 annulate setae situated posteroventrally to each genital opening.

Genitalia (Figure 12e): Consisting of vaguely defined lobes with a large vaginal opening on each side, openings situated some distance from furca.

Eyes (Figure 12d,g): Medial eye large, pigmented; lateral eyes pigmented, smaller than medial eye and with 4 or 5 divided ommatidia.

Rod-shaped organ (Figure 12d): Weakly separated into 2 joints; inflated end joint with unevenly rounded tip.

Upper lip and anterior (Figure 12d): Upper lip helmet-shaped with small protuberance at tip; a

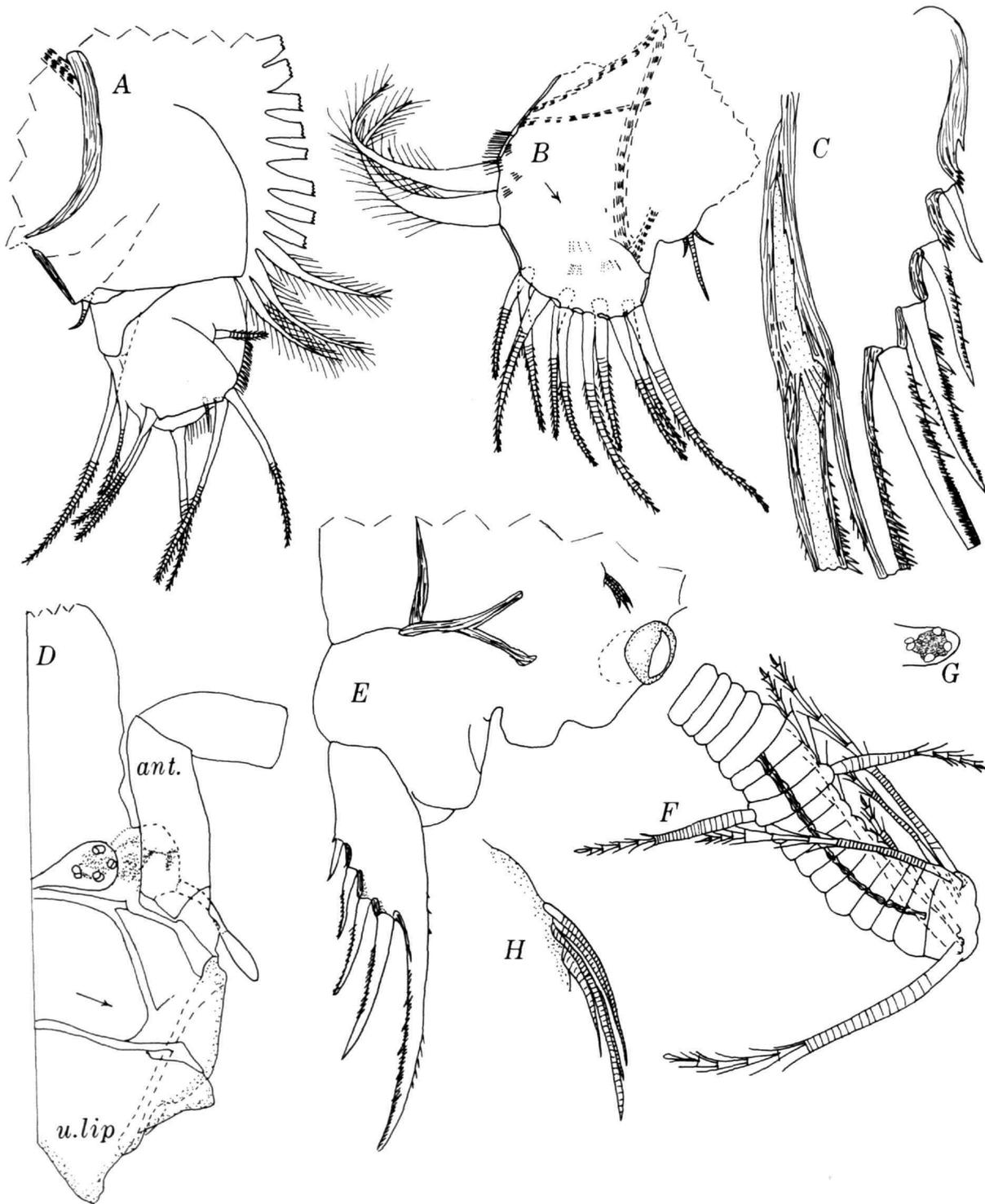


FIGURE 12.—*Sarsiella capsula*, immature ♀ (specimen 1, sta B59): *a*, right 5th limb, medial view; *b*, right 6th limb, lateral view; *c*, furca; *d*, anterior part of animal; *e*, furca, genitalia, brush-shaped organ; *f*, distal part of 7th limb; *g*, lateral eye; *h*, brush-shaped organ.

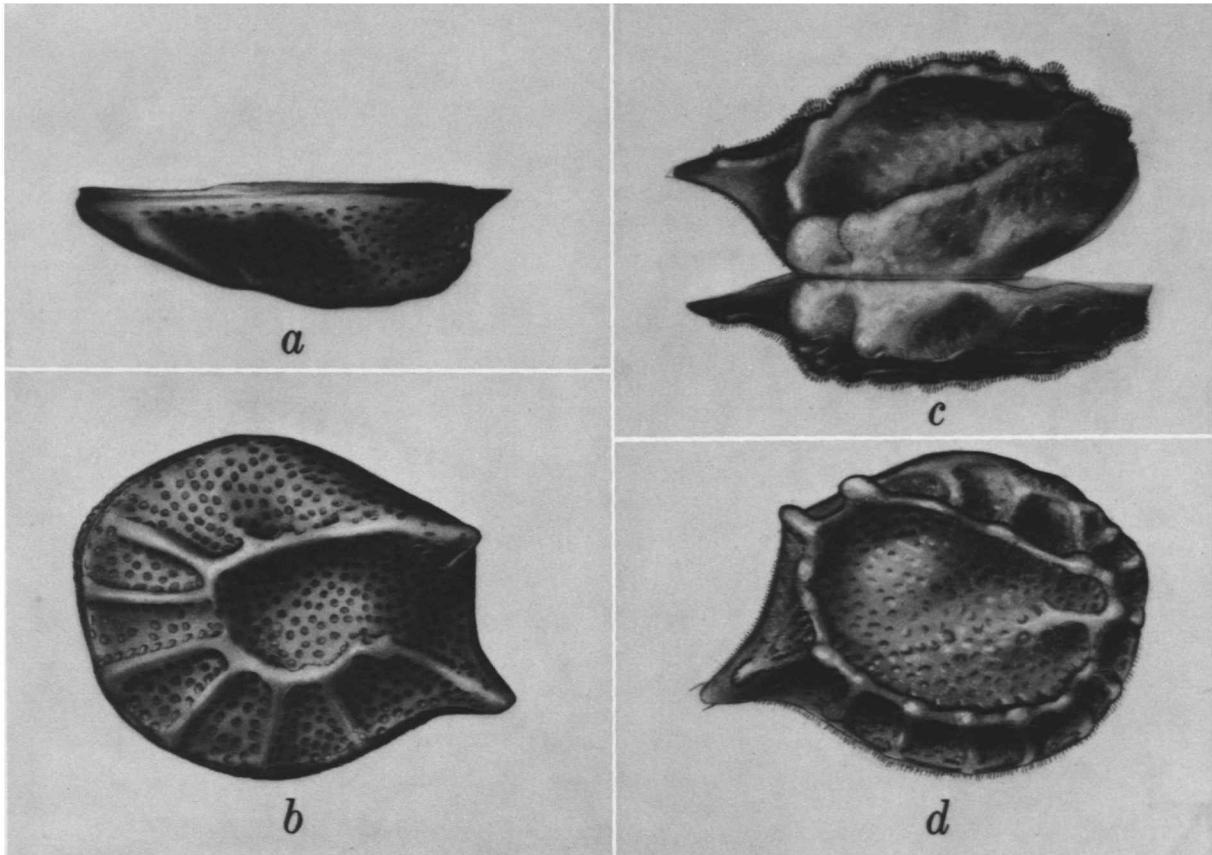
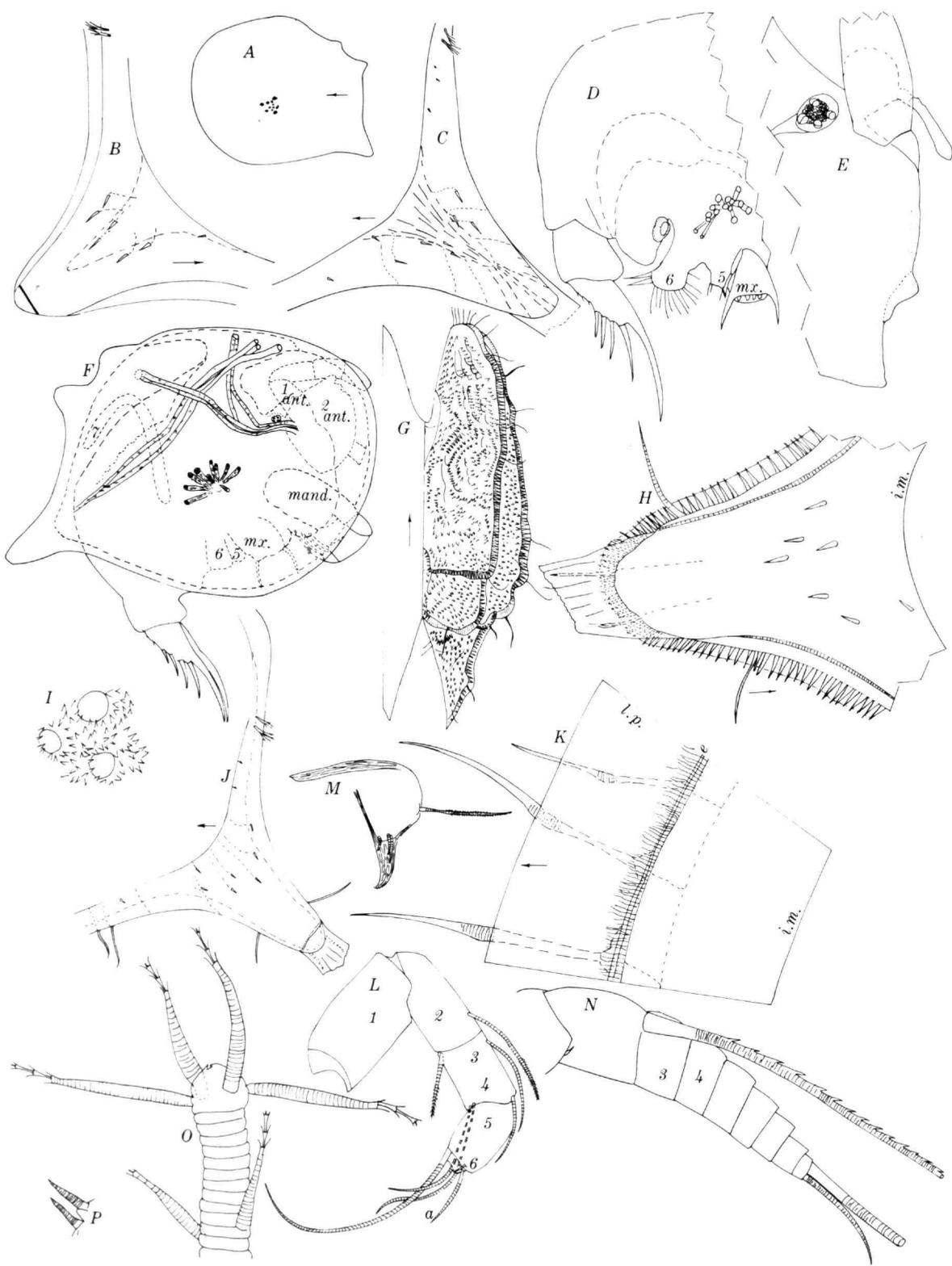


FIGURE 13.—*Sarsiella capsula*, immature ♀ (specimen 1, sta. B59), left valve, length 1.08 mm: *a*, dorsal view; *b*, lateral view. *Sarsiella neapolis*, immature ♀, (specimen 1, sta. B17) length 1.12 mm: *c*, dorsal view; *d*, lateral view.



triangular process present on each side about midway between lip and basis of 1st antenna.

*Sarsiella neapolis*, new species

FIGURES 13c,d, 14, 15

*Sarsiella capsula*.—Sars, 1888:229, pl. 3: figs. 5-7, pl. 10.—Müller, 1894:214, pl. 4: figs. 4-6, 8-10, 22, 25, 27-29, 31, 33-35, 37, 48, pl. 8: figs. 6-7.—Rome, 1942:8.—Poulsen, 1965:44 [discussion].—Kornicker, 1967b:33 [discussion]. [Not *Sarsiella capsula* Norman, 1869.]

**HOLOTYPE**.—A female in the collection of the Zoological Museum of Berlin (ZMB 9155). Appendages and valves are preserved separately in alcohol. I have labeled the vial as follows: "9155, sp. No. 1, Holotype, *Sarsiella neapolis* L. S. Kornicker, 1967 (ident. as *S. capsula* by Müller in 1894)." The size of the carapace suggests that the holotype is an N-1 instar; however, the appendages and genital organs seem fully developed.

**PARATYPES**.—I have selected 3 specimens as paratypes: (1) A left valve preserved in alcohol in the collection of the Zoological Museum of Berlin (ZMB 9155). I have labeled this specimen, "9155, Sp. No. 2." (2) A ♀ (appendages only) in the collection of the Zoological Institute of Greifswald (GMZ 25019). I dissected this specimen and have mounted the appendages on a single slide; in addition to the museum number I have put on the label, "Sp. No. 1." (3) An immature ♀ from station B17, Gulf of Naples, collected by H. S. Puri and G. Bonaduce; the shell is preserved in alcohol, the appendages are mounted on 3 slides. This specimen is in the collections of the Zoological Station of Naples. The first two specimens may be N-1 instars, the third an N-2 instar.

FIGURE 14.—*Sarsiella neapolis*, new species: *a*, carapace, length 1.37 mm; *b*, caudal process left valve, medial view; *c*, caudal process right valve, medial view; *d*, posterior part of body; *e*, anterior part of body; *f*, body and some shell muscles as seen through right valve; *g*, right valve, dorsal view; *h*, caudal process left valve, medial view; *i*, punctae and spines, left valve near middle, lateral view; *j*, posterior right valve, medial view; *k*, part of anterior margin of right valve, medial view; *l*, right 1st antenna, medial view (all bristles of joints 7-8 not shown); *m*, endopodite of right 2nd antenna, medial view; *n*, part of exopodite of left 2nd antenna, medial view (bristles on joints 3-8 not shown). *o*, distal part of 7th limb; *p*, brush-shaped organ (*a-e*, ZMB 9155:1, holotype; *f-k*, *m*, *o*, *p*, immature ♀, specimen 1, sta. B17; *l*, *n*, GMZ 25019:1).

**TYPE-LOCALITY**.—Gulf of Naples.

**ADDITIONAL MATERIAL**.—1 adult ♂ and about 14 ♀ and juveniles collected by G. W. Müller (in the collection of the Zoological Institute of Greifswald, GMZ 25019). One of the paratypes listed above was selected from this sample.

**DISTRIBUTION**.—Mediterranean: Gulf of Naples; off Monaco (Rome, 1942); Messina?, Syracuse? (Sars, 1888).

**DISCUSSION**.—Kornicker (1967:33) reviewed species that had been assigned to *Sarsiella capsula* Norman and concluded that the species referred to *S. capsula* by Müller (1894) probably is a new species, and it is so described herein.

**DESCRIPTION OF FEMALE**.—Oval in lateral view except for caudal process and 2 posterodorsal projections; anterior margin rounded without rostrum or incisur (Figures 13c,d; 14a,g); caudal process extending posteroventrally; left valve overlapping right along anteroventral margin.

**Ornamentation** (Figure 14g,i): Valves with flat central area surrounded by narrow ridge linear dorsally and convex anteriorly, ventrally and posteriorly; posterodorsal part of ridge with 2 prominent projections; about 11 radial ridges present, 1 or 2 dorsally, 5 anteriorly, 3 or 4 ventrally, and 1 extending onto caudal process; surface between ridges with large oval-to-elongate pits, and with scattered long hairs; anterodorsal, anterior, and ventral margins with spines and 2 or 3 rows of unequal hairs; caudal process with 1 ventral, 1 dorsal, and 2 terminal hairs.

**Hinge**: Linear extending from about one-fourth distance from anterior margin to point near last posterodorsal projection.

**Infold** (Figure 14b,c,h,j,k): Broad with 7 or 8 bristles on caudal process, 1 short spine anterior to caudal process, 2 brushlike bristles above caudal process, 2 short spines near inner margin between brushlike bristles and caudal process; selvage, narrow, striated, with broad lamellar prolongation with smooth edge.

**Marginal pore canals**: Fairly numerous anteriorly, ventrally, and on caudal process.

**Central muscle scars**: Consisting of about 11 individual scars located slightly anteroventrally of middle of valve.

**Dorsal muscle scars** (Figure 14f): 6 or 7 muscle scars present near dorsal margin: 3 furcal muscle scars, 2 anterior head-region muscle scars, 1 or 2



FIGURE 15.—*Sarsiella neapolis*, new species, GMZ 25019:1: *a*, part of left 2nd antenna, medial view; *b*, right mandible, lateral view; *c*, part of 1st joint of endopodite of left mandible, medial view; *d*, part of maxilla, lateral view; *e*, part of maxilla showing endites; *f*, part of 5th limb; *g*, left 6th limb, lateral view; *h*, distal part 7th limb; *i*, furca.

posterior head-region muscle scars (scars in these general positions are present on other mydocopid ostracods but are not usually included in description).

Size: Immature ♀, specimen 1 from station B17, length 1.12 mm, length excluding caudal process 0.99 mm, height 0.86 mm. Complete ♀ (ZMB 9155:1, holotype), length 1.37 mm, length excluding caudal process 1.25 mm, height 1.10 mm. Left valve of female (ZMB 9155:2), length 1.38 mm, length excluding caudal process 1.28 mm, height (possibly distorted) 1.16 mm; Müller (1894:215, 216) gave the length of an adult ♀ as 1.58 mm, an adult ♂ as 1.33 mm, and a larval ♀ as 1.33 mm. Sars (1888:229) gave the length of an adult ♀ as 1.53 mm.

First antenna (Figure 14l): 2nd joint with dorsal bristle about one-fourth distance from distal end; 3rd and 4th joints not separated by suture; 3rd joint with 1 ventral and 1 dorsal bristle; 4th joint with 3 terminal bristles, 1 dorsal and 2 ventral; 5th joint with long ventral bristle; 6th joint with short lateral bristle; joints 7 and 8 with 7 bristles similar to those on *S. capsula*.

Second antenna (Figures 14m,n; 15a): Proto-podite without medial bristle or marginal hairs. Endopodite 1-jointed with 2 or 3 small bare bristles proximally, and 1 long spinous and either no or 1 of short bare bristle terminally. Exopodite: 1st joint with short bent medial spine; bristle on joints 2–8 with strong ventral spines proximally and natatory hairs distally; joint 9 with 1 long ventral bristle with natatory hairs distally and 1 short bare dorsal bristle. Distribution of bristles on endopodite of 3 specimens examined is as follows:

Station & cat. no.	Endopodite	Terminal bristles	Proximal bristles
ZMB 9155:1	left	1 long	2 short
	right	1 long	2 short
GMZ 25019:1	left	1 long, 1 short	2 short
	right	1 long	3 short
Sta. B17	left	1 long	2 short
	right	1 long	3 short

Mandible (Figure 15b,c): Coxale endite with short spines along ventral margin and spinelike medial bristle proximally; basale with 1 dorsal spine and 3 short bristles near ventral margin. Endopodite: 1st joint with spines on medial surface, 1 small terminal spine dorsally, and about 10 small spines in row along convex margin of large

ventral claw; 2nd joint with small terminal spine dorsally, and faint minute spines proximally along both margins of main claw (faint spines do not extend past claw margins); 3rd joint with small terminal spine dorsally, and 2 small spines and large claw ventrally.

Maxilla (Figure 15d,e): Coxale with bare bristle on anterior margin; endites with total of about 15 bristles; exopodite with 2 bristles, 1 short, bare, other long spinous. Endopodite: 1st joint with spinous  $\alpha$ - and  $\beta$ -bristles,  $\beta$ -bristles with more denticles proximally than  $\alpha$ -bristle; 2nd joint with 2 lateral, 1 medial, and 5 stout terminal bristles; anterior terminal bristle annulate, spinous distally.

Fifth limb (Figure 15f): Endite with 1 short bare bristle. Exopodite: 1st joint with 2 spinous bristles, 1 medium, 1 long; joints 2–5 hirsute with total of 7 unequal bristles, some with marginal spines. Epipodial appendage with about 33 plumose bristles.

Sixth limb (Figure 15g): End joint with 11 spinous bristles followed by 2 plumose bristles; posterior margin and medial side hirsute; endite with 1 long and 2 short bristles.

Seventh limb (Figure 10o; 15h): Terminal end with 6 bristles, 3 on each side; rings 9 to 12 counting from terminal segment with total of 2 bristles; all bristles with 2–5 distal bells; complete limb with total of about 70 rings; terminus appearing as 2 opposing pincers, but additional transparent teeth present (very faint even under oil immersion). Juvenile from station B17 with 6 tapered bristles, 4 terminally and 2 laterally, each with 1–3 distal bells.

Furca (Figure 15i): Distribution of claws similar to furca of *S. capsula*; all claws with lateral spines along concave margins and minute spines along convex margins; anterior margin of each lamella with several short spines above claw 1; posterior margin of each lamella with 4 groups of 1–3 spines behind claw 5, spines on left lamella longer than on right; medial sides of each lamella with long hairs above bases of claws, and minute spines in clusters near anterior margin.

Brush-shaped organ: Juvenile specimen from station B17 with 2 small annulate bristles anterior to Y-shaped sclerite of furca. (Condition of additional 2 specimens examined did not permit ascertaining presence of absence of this organ).

Genitalia (Figure 14d): Consisting of large genital opening on each side.

Eyes (Figure 14e): Lateral eyes pigmented, each with 4 divided ommatidia; medial eye larger than lateral eye.

Rod-shaped organ (Figure 14e): Elongate, inflated distally.

Upper lip and anterior (Figure 14e): Similar to *S. capsula*.

COMPARISONS.—The mandible of the female *S. neapolis* may be distinguished from other species of *Sarsiella* in having about 10 small spines in a row along the convex margin of the large ventral claw of the 1st endopodite joint. The margin of this claw is smooth in other species. The distinctive 1-jointed endopodite of the 2nd antenna of the male was discussed by Poulsen (1965:44). The endopodite is similar to *Sarsiella rugosa* Poulsen, 1965, but *S. neapolis* may be distinguished from that spe-

cies by differences in ornamentation on the shell. Specimens from the Mediterranean identified by Sars (1888:229) as *S. capsula* Norman closely resemble *S. neapolis* in shell ornamentation and appendage morphology, except for the furca which was illustrated as having 6 claws (Sars, 1888, pl. 10: fig. 12). Because of the overall similarity, Sars' species has been placed in synonymy with *S. neapolis*, but with a question mark.

### CYLINDROLEBERIDIDAE Müller, 1906

The Cyndroleberididae includes two subfamilies, Cyclasteropinae Poulsen, 1965, and Cyndroleberidinae Müller, 1906. Both subfamilies are represented in the Gulf of Naples.

#### Key to the Subfamilies of Cyndroleberididae

Second joint of 1st antenna with 1 dorsal bristle .....	CYLINDROLEBERIDINAE
Second joint of 1st antenna with at least 2 dorsal bristles .....	CYCLASTEROPINAE

### CYLINDROLEBERIDINAE Müller, 1906

This subfamily is represented by four genera in the study area: *Parasterope* Poulsen, 1965; *Cyndroleberis* Brady, 1868; *Prionotoleberis*, new genus; *Polyleberis*, new genus.

#### *Parasterope* Poulsen, 1965

TYPE-SPECIES.—*Asterope muelleri* Skogsberg, 1920, by subsequent designation (Kornicker, in press).

#### *Parasterope muelleri* (Skogsberg, 1920)

FIGURE 16

- Asterope Mülleri* Skogsberg, 1920:483, fig. 89.—Vos, 1957:8, pl. 3: figs. 2a-f[?].  
*Cyndroleberis teres* (Norman).—Müller, 1894:220, pl. 4: figs. 13, 30, 43, pl. 5: figs. 15, 24, 25, pl. 8: fig. 5.  
*Asterope teres* (Norman).—Müller, 1912:46 [part].  
*Asterope muelleri* (Skogsberg).—Klie 1940:409, figs. 7-10 [?].  
*Asteropina mulleri* (Skogsberg).—Kornicker, 1958:239, figs. 60a-f, 61a-f, 86a-d, g.  
*Asterope mulleri* (Skogsberg).—Reys, 1965b:258 [listed] [?].  
*Parasterope muelleri* (Skogsberg).—Poulsen, 1965:370, figs. 122-124[?].

HOLOTYPE.—One adult ♀ on slides in Swedish State Museum, Stockholm (Skogsberg, 1920:491).

TYPE-LOCALITY.—English Channel, off Salcombe, coast of England.

MATERIAL.—Four juveniles collected by G. W. Müller (ZMB 9158). I dissected two of these, both males; the appendages are on slides, the valves in alcohol. I have designated one dissected specimen as specimen no. 1 (estimated as an N-2 instar) and the other as specimen no. 2 (estimated as an N-1 instar). I dissected these specimens while in Naples and had the opportunity to examine the valves only briefly and did not measure them; therefore, the descriptions in this paper are of the appendages, which I had the opportunity to further examine at the Smithsonian Institution.

DISTRIBUTION.—English Channel: Salcombe (Skogsberg, 1920:49); Roscoff? (Vos, 1957:8). Mediterranean: Gulf of Naples (Müller, 1894:220; Skogsberg, 1920:491); Marseille? (Reys, 1965b:258). Klie (1940:409) reported the species from the vicinity of the Southwest Africa, but it may not be the same species. Kornicker (1958:239) reported the species from the Bahamas, and Poulsen (1965:370) reported it from the West Indies.

DISCUSSION.—Skogsberg (1920:483) established a new species *Asterope Mülleri* based on two mature

females, one from the English Channel, the other from the Gulf of Naples. He apparently also had one larva from the English Channel, but did not describe it. Skogsberg (1920:490) selected the mature female from the English Channel as the holotype.

Under "Remarks," after having described the new species, Skogsberg (1920:489) stated the following:

As is seen above, I have identified the species described by me above with G. W. Müller's species *Cylindroleberis teres*, 1894. This identification is not based on G. W. Müller's description and figures. It is based instead on an investigation I made of a specimen from the Bay of Naples, which Prof. G. W. Müller had determined as *Cylindroleberis teres* and which was kindly placed at my disposal by this investigator. On the contrary G. W. Müller's description and figures show not a few differences from the type-specimen described by me above. According to this the Bay of Naples form is distinguished by a shell only 1.24 mm. long; the shape of its shell, to judge from pl. 8, fig. 5 [Müller, 1894], differs from the form described above, though only in details; the spine-bearing list has only 25 hyaline spines. First antenna: The boundary between the fourth and fifth joints is not slightly concave, but forms a sharp, almost a right angle. Maxilla: This has a strongly reduced epipodite; without any dorso-proximal bristle and without the short ventero-distal bristle on the basale; the proximal endite has no short bristle; the baleen bristles are blunt distally. In all these characters the specimen from the Bay of Naples investigated by me closely agreed to the species described above. Its shell was 1.41 mm. long and with regard to the shape of the shell it showed complete agreement with the figures given in this treatise; the bristle-bearing list had 29-31 spines. First antenna: The boundary between the fourth and fifth joints was like that shown in the figure given by me. Similarly the maxilla agreed entirely with that of the species described above. The difference I observed between the specimen from the Bay of Naples that I investigated and the type-specimen of this species with regard to the hyaline spines on the spine-bearing list, the postero-distal bristles on the fourth joint of the first antenna, the basal spines on the exopodite of the second antenna and the medial cleaning bristles of the mandible (see above) [Skogsberg, 1920:486] cannot be considered to stand in the way of this identification, as these are characters which, as I showed in the description of the genus, I did not find quite constant in the species of the genus. With regard to the postero-distal bristles on the fourth joint of the first antenna G. W. Müller's [1894] fig. 30, pl. 4 agrees well with mine, a fact which may, of course, be considered to support this identification still further.

Skogsberg's claim that the illustration of the maxilla by Müller (1894, pl. 5: fig. 15) does not have a dorsoproximal bristle, or a short bristle on the proximal endite is unfounded; they are faint

but easily visible with the aid of a magnifying glass.

The juvenile males I examined differ in some characters from the adult females described by Müller (1894) and Skogsberg (1920). This is primarily because of their being younger and of a different sex. However, some differences that cannot be attributed to these factors are the presence on the juvenile males of a short bristle at the basis of the coxale endite on the mandible, and spines along the dorsal margin of the basale of the maxilla. Both may have been overlooked by Müller and Skogsberg.

Klie (1940:409, figs. 7-10) referred specimens from Lüderitz Bay, Union of South Africa, to *Asterope muelleri* Skogsberg. I concur with Poulsen (1965:378) in being doubtful that the specimens are conspecific with *P. muelleri*.

Vos (1957:8, pl. 3: fig. 2a-f) referred two females collected in the English Channel near Roscoff, France, to *Asterope muelleri* Skogsberg. The proximity of the collecting area to the type-locality of the species gives support to the possibility that the Roscoff specimens have been correctly identified. The identification, however, cannot be verified by study of the description and illustrations of Vos. Therefore, I have designated this identification as questionable in the synonymy.

Kornicker (1958:239, figs. 60, 61, 87a,d,g) referred specimens from the Great Bahama Bank to *Asteropina muelleri* (Skogsberg), and Poulsen (1965:370-379, figs. 122-124) assigned specimens from numerous localities in the West Indies to *Parasterope muelleri* (Skogsberg). Poulsen (1965:379) enumerated some difference between specimens described by Kornicker (1958) from the Bahamas and those described by Skogsberg (1920) from the English Channel and by Poulsen (1965) from the West Indies. These differences concern the number of bristles with filaments on the end joints of the 1st antenna, number and kind of bristles on the basale endite of the mandible, number of bristles on the endites of the maxilla, and presence or absence of "2 bunches of hairs" on the 6th limb. I have reexamined a gravid female from the Bahamas and find it similar to those from the West Indies and English Channel in the above points.

Poulsen (1965:378) listed some of the differences between specimens from the West Indies and English Channel. This list, expanded to include a

specimen from the Bahamas, is given in Table 2, from which it is possible to infer that the European form is more closely related to the Bahamian form than it is to the West Indian form.

According to the illustrations of the 1st antenna of the Bahamian form by Kornicker (1958, fig. 61a) and the West Indian form by Poulsen (1965, fig. 123a), the distal margin of the 4th joint is linear. This is quite different than the 1st antennae on specimens from the English Channel and Gulf of Naples, which have concave distal margins on the 4th joint. I have reexamined this margin on the Bahamian specimen, however, and find it to be concave, similar to the European form. If the West Indian form does not have a concave margin, it is probably not conspecific with either the Bahamian or European forms.

Another criterion suggesting that the Bahamian and West Indian forms are not conspecific is the absence of a bristle at base of the coxale endite on the West Indian form (Poulsen, 1965:372) and its presence on the Bahamian form (observed on specimen studied herein). The juvenile males from the Gulf of Naples contain a bristle in this position, but it was not reported by either Skogsberg or Müller on the specimens they examined.

Although I have doubts about the conspecificity of the European and Bahamian-West Indian forms, especially with the latter, I have retained both in the synonymy, but with a question mark. It should be noted that the basal spines on the exopodite of the 2nd antenna of the Naples' specimen are longer

than those on the Bahamian and West Indian specimens.

DESCRIPTION OF JUVENILE MALE APPENDAGES.—  
First antenna (ZMB 9158:1, Figure 16a): 1st joint with spines in clusters on medial surface; 2nd joint with 1 distolateral bristle, 1 spinous dorsal bristle, and few spines in clusters along dorsal margin; 3rd and 4th joints separated by very faint suture; 3rd joint with 1 short ventral bristle and 4 long dorsal bristles, of the latter, the proximal bristle has many long spines; 4th joint with 1 dorsal bristle, 2 ventral bristles and cluster of spines on ventral margin; suture between 4th and 5th joints concave; sensory bristle of 5th joint with 6 terminal filaments; 6th joint with 1 spinous distomedial bristle. 7th joint with a-, b-, c-bristles: a-bristle clawlike, with small spines proximally along concave margin; b-bristle with 4 filaments; c-bristle with 6 marginal filaments. 8th joint with e-, f-, g-bristles: e-bristle similar in length to b-bristle; f-bristle with 6 marginal filaments; g-bristle with 5 marginal filaments.

Second antenna (ZMB 9158:1, Figure 16b): Prodopodite with short distomedial bristle and several spines along dorsal margin. Endopodite 3-jointed: 2nd joint with short bristle near middle; 3rd joint with long annulate filament near base. Exopodite: 1st joint with short spines distally near inner margin; 2nd–6th joints with combs of short spines along distal margins; joints 3–9 with minute spine distally on inner margin; bristle of 2nd joint not over-reaching 9th joint, with ventral spines; bristles of joints 3–9 with ventral spines proximally

TABLE 2.—*Variations of characters of female Parasterope muelleri from three localities*

<i>Females</i>	<i>West Indies</i>	<i>English Channel</i>	<i>Bahamas</i>
Length of shell (mm) .....	1.11–1.23	1.37–1.41	1.26
1st antenna, lateral bristle on 2nd joint ...	bare	short hairs	short hairs
1st antenna, a-claw of 7th joint, dorsal margin .....	bare	short hairs	short hairs
Mandible, dorsal bristle of basale .....	bare	short hairs	short hairs
Mandible, endopodite, 2nd joint, number of cleaning bristles in proximal row ....	1	2	2
Mandible, endopodite, 2nd joint, number of cleaning bristles in distal row .....	5	5–6	3–4
Maxilla, dorsal margin of basale .....	hairs	bare *	hairs
Maxilla, epipodite .....	hairs	bare	bare?
Furca, number of pairs of claws .....	8	9	9

\* Immature males described herein from the Gulf of Naples have hairs on the dorsal margins of basale on maxillae.



FIGURE 16.—*Parasterope muelleri*: a, right 1st antenna, medial view; b, left 2nd antenna medial view (only 2 short bristles of 9th joints shown; bristles on joints 3–8 not shown); c, exopodite of right mandible, medial view; d, coxale endite of right mandible, medial view; e, part of maxilla; f, 6th limb; g, furca; h, gill-like structures (h, ZMB 9158:2; a–g, ZMB 9158:1).

and natatory hairs; 9th joint with 4 bristles, 2 short with short spines, 1 medium and 1 long with natatory hairs.

Mandible (ZMB 9158:1, Figure 16c,d): Basale endite with 3 triaenid bristles with 2 or 3 pairs of distal spines, 4 terminal bristles, and 1 rather long dwarf bristle; dorsal margin of basale with 2 long spinous bristles; faint spines forming clusters present along dorsal margin and medial surface of basale. Exopodite almost reaching distal margin of 1st endopodite joint (Figure 16c). Endopodite: 1st joint with 3 long spinous bristles on ventral margin; dorsal margin of 2nd joint with spinous a-, b-, c-, and d-bristles; long slender bristle between b- and c-bristles; medial side of 2nd joint with short spinous bristle near base of b-bristle, 3 unequal spinous bristles forming transverse row near basis of c-bristle, and 1 long slender spinous bristle near basis of d-bristle; ventral margin of 2nd joint with 3 spinous bristles terminally; 3rd joint with stout dorsal claw and 5 bristles. Coxale endite with short bristle at basis (Figure 16d); ventral branch of endite with sharp spines in 3 transverse rows proximally, and 2 spines terminally; distance from main spine on posterior margin of dorsal branch to tip of branch equal to 38 percent of distance from tip of ventral branch to tip of dorsal branch.

Mandible (ZMB 9158:2): Basale endite with 4 triaenid bristles, each with 2 or 3 pairs of distal spines, 4 terminal bristles, 1 dwarf bristle, and prominent glandular peg. Transverse row of medial spinous bristles present near basis of c-bristle on 2nd endopodial joint.

Maxilla (ZMB 9158:1, Figure 16e): Epipodial appendage triangular, fairly short; proximal endite with 1 short and 3 long bristles; distal endite with 3 long bristles; dorsal margin of basale spinous, with short proximal and distal bristles; ventral margin of basale with moderately long midbristle with spines, 1 short bare distal bristle, and 1 long spinous terminal bristle; endopodite with 2 bristles on 1st joint and 1 on 2nd.

Maxilla (ZMB 9158:2): Similar to ZMB 9158:1 except for midbristle on ventral margin of basale being bare.

Fifth limb (ZMB 9158:1): Exopodial bristle overreaching end of comb; anterodorsal margin of comb with several long hairs; 2 or 3 short bare bristles present near base of long exopodial bristle; dorsal margin of comb smooth.

Sixth limb (ZMB 9158:1, Figure 16f): Anterior margin hirsute and with 2 endite bristles; anteroventral corner with 2 unequal bristles; anteroventral margin hirsute, without bristles; posteroventral margin with 11–14 spinous bristles, of these, posterior 5 or 6 longer than others; posterior margin hirsute.

Furca (ZMB 9158:1, Figure 16g): Each lamella with 6 curved claws and 1 backward pointing bristle; concave margins of claws 1 and 2 with 7 or 8 short spines in groups separated by a longer spine; concave margins of claws 3–6 with short hairs. Furca of ZMB 9158:2 same as above.

Eyes (ZMB 9158:1): Lateral eyes large, each with 17 ommatidia. Medial eye hirsute.

Gills (ZMB 9158:2, Figure 16h): 7 elongate gills on each side; distal end of each gill prolonged ventrally.

### *Cylindroleberis* Brady, 1868

TYPE-SPECIES.—*Cypridina mariae* Baird, 1850 (p. 257, pl. 17: figs. 5–7), designated by Sylvester-Bradley (1961:Q402).

### *Cylindroleberis* species indeterminate

#### FIGURE 17

MATERIAL.—1 ♀, probably N-1 instar, collected by G. W. Müller (ZMB 9157). I dissected this specimen while at the Zoological Station of Naples. The appendages are presently mounted on slides. A right valve and left valve, each without associated appendages, were also in the vial (no. 9157). I examined these briefly, but did not attempt to identify them. During the dissection, many bristles and claws separated from the remainder of the appendages, probably due to brittleness; also, many minute crystals are attached to the appendages. The shell of the dissected specimen was left with other material at the Zoological Station of Naples, so that I did not have the opportunity to examine it in detail. I have designated the dissected specimen as specimen number 1 to distinguish it from other specimens that were in vial 9157.

DISTRIBUTION.—Gulf of Naples.

DISCUSSION.—Müller (1894:219) identified a number of specimens collected in the Gulf of Naples as *Cylindroleberis oblonga* (Grube, 1859). He

referred *C. oblonga* to *Asterope mariae* (Baird, 1850) in his synoptic work of 1912 (p. 45).

Skogsberg (1920:518) referred *Cylindroleberis oblonga*, Müller, 1894 [not Grube, 1859], to "*Asterope Grimaldi* n. sp. var. *vicina* n. var." Under "Remarks," he made the following statement:

In order to make a verificatory examination I applied to Professor G. W. Müller for a mature female of the species from the Bay of Naples, which he has dealt with on p. 219 of his large monograph, 1894, under the name of *Cylindroleberis oblonga*. Professor Müller kindly sent me a Naples specimen of this form. Although unfortunately this specimen was not mature—it was a male in the last larval stage—yet my synonymization given above, the result of a careful examination of this specimen, may be considered, if not as absolutely certain, at least as being fairly certain . . .

A principle difference between *C. grimaldi* and *C. grimaldi vicina* is the presence of 1 or 2 midbristles on the dorsal margin of the basale of the mandible of *C. grimaldi* and no bristles on *C. grimaldi vicina*. The juvenile female described herein bears 1 midbristle on the dorsal margin of the mandibular basale, and thus, is closer in that feature to *C. grimaldi* than to *C. grimaldi vicina*. The dorsal margin of the 2nd joint of the 1st antenna of the present specimen forms a bulge in the vicinity of the dorsal bristle and, in that respect, is similar to the 1st antenna illustrated by Müller (1894, pl. 4: fig. 14). The dorsal margin of the 2nd joint of *C. grimaldi* is almost linear (see Skogsberg, 1920, fig. 99:14). The shape of the 2nd joint of *C. grimaldi vicina* was not described or illustrated by Skogsberg. The mandible illustrated by Müller (1894, pl. 4: fig. 39) does not have a midbristle on the dorsal margin of the mandibular basale. Apparently the specimens included by Müller in *Asterope oblonga* (Grube) have mandibles with or without a bristle on the dorsal margin of the mandibular basale. Additional specimens must be studied in order to determine whether this is due to interspecific variability or to the presence of more than 1 species. It should be noted that the dorsal margin of the 6th joint on the male 1st antenna illustrated by Müller (1894, pl. 4: fig. 15) bears a proximal protuberance, which is absent on the male 1st antenna of *C. grimaldi* illustrated by Skogsberg (1920, fig. 99:15). It should also be noted that the female 1st antenna illustrated by Müller (1894, pl. 4: fig. 14) does not bear a proximal filament on the sensory bristle. Its absence is assumed

to have been due to observational error. Because of the need for additional study before specimens from the Gulf of Naples referred by Müller to *A. oblonga* can be correctly identified, I have referred the individual studied herein to *Cylindroleberis* species indeterminate.

**DESCRIPTION OF APPENDAGES OF FEMALE** (probably N-1 instar).—First antenna: 2nd joint with short lateral bristle distally; dorsal margin forming bulge near bristle (bristle missing on specimen); sensory bristle of 5th joint with 6 terminal filaments and 1 short subterminal filament (Figure 17a); 8th joint with reduced e-bristle and without d-bristle.

Second antenna (Figure 17b): Protopodite without distomedial bristle; endopodite weakly 3-jointed, with annulate terminal bristle.

Mandible (Figure 17c-e): Coxale with small spine near basis of endite. Dorsal margin of basale with 1 short bristle near middle and 2 long bristles terminally. Exopodite very small, about one-fourth length of 1st endopodite joint, hirsute distally. 1st joint of endopodite with short bare proximal bristle, a fairly short spinous bristle between b- and c-bristles, and 4-5 medial bristles near c-bristle.

Maxilla (Figure 17h): Proximal endite with 4 bristles, 3 long and 1 short; distal endite with 3 long bristles, all with marginal spines distally; long bristle of 1st endopodial joint not quite reaching tip of terminal bristle on end joint.

Fifth limb (Figure 17i): Exopodial bristle slightly overreaching end of comb; lateral side of comb with 5 short bristles distal to base of exopodial bristle; anterodorsal margin of comb with about 10 long hairs. (Ventral bristles of comb, except anteriorly, not shown in Figure 17i).

Sixth limb (Figure 17g): Anterior margin with 2 bristles; anteroventral end with 6 spinous bristles; posteroventral margin with about 24 bristles. (Bristles are broken off on specimen; therefore, number of bristles are estimated from empty sockets).

Seventh limb (Figure 17k): Each end comb with about 16 spinous teeth; limb with 6 terminal bristles and 3 lateral bristles, each with 3 to 5 bells.

Eyes: Lateral eyes (Figure 17f) large with 19-20 ommatidia. Medial eye (Figure 17j) about same size or slightly smaller than lateral eye.

Rod-shaped organ (Figure 17j): Elongate, tapering distally.

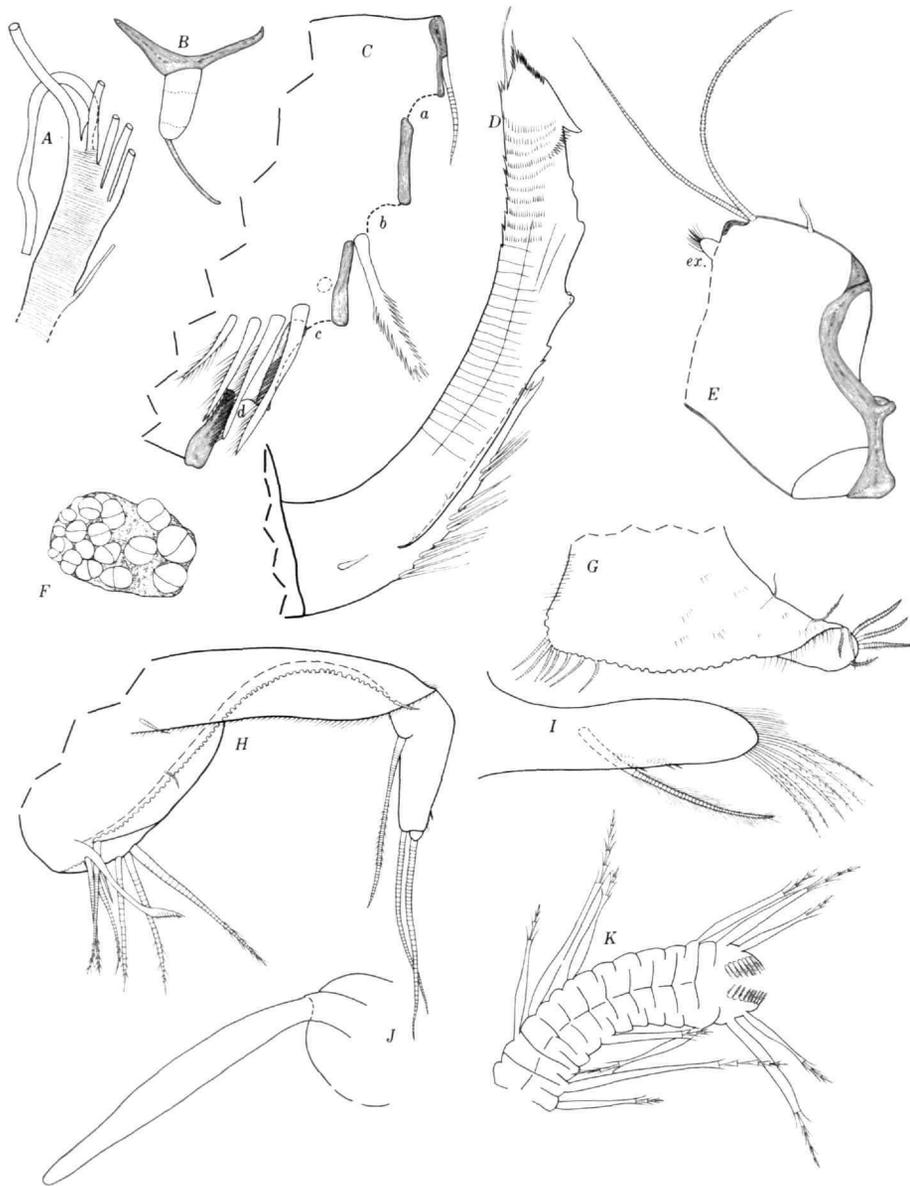


FIGURE 17.—*Cyldroleberis* species indeterminate, ZMB 9157:1, female: *a*, end of sensory bristle of 5th limb of 1st antenna (bristles incompletely shown); *b*, endopodite of 2nd antenna; *c*, margin of 2nd endopodite joint of mandible, medial view (only shows sockets of main bristles); *d*, coxale endite of mandible; *e*, basale of mandible showing exopodite; *f*, lateral eye; *g*, 6th limb (many posteroventral bristles missing); *h*, maxilla (epipodite not shown); *i*, distal end of 5th limb, medial view; *j*, rod-shaped organ and medial eye; *k*, distal end of 7th limb.

*Prionotoleberis*, new genus

ETYMOLOGY.—The generic name *Prionotoleberis* from the Greek *prionotos* (jagged, serrated) + *leberis* (sloughed skin). Gender: feminine.

TYPE-SPECIES.—*Prionotoleberis gyion*, new species.

The collection on hand includes only two specimens of *P. gyion*, both juveniles. Additional specimens of a second species are present in a collection from Mauritania (Kornicker and Caraion, 1974). The diagnosis of the genus is based on the specimens from the Gulf of Naples and Mauritania.

DIAGNOSIS OF GENUS.—First antenna: Sensory bristle of adult female with 6 long terminal filaments and 1 short proximal filament; d-bristle of 8th joint absent or minute. Mandible: Exopodite longer than one-half length of dorsal margin on 1st endopodite joint; no long slender lateral bristle between b- and c-bristles of 2nd endopodite joint; ventral branch of coxale endite with 3 broad spines at tip. Maxilla: End joint with 1 long terminal bristle.

Comparisons of two characters of the appendages of *Parasterope*, *Synasterope*, *Diasterope*, and *Prionotoleberis* show the following: (1) Proximal filament on sensory bristle of the 1st antenna of adult female is absent in *Parasterope* and *Synasterope*, and present in *Diasterope* and *Prionotoleberis*. (2) Long slender lateral bristle between b- and c-bristles of the 2nd joint of endopodite of the mandible is absent in *Synasterope* and *Prionotoleberis*, and present in *Parasterope* and *Diasterope*.

*Prionotoleberis gyion*, new species

FIGURES 18–20

ETYMOLOGY.—The specific name *gyion* from the Greek noun meaning "limb."

HOLOTYPE.—Juvenile male, USNM 120344; valves in alcohol, some appendages on slides, others in alcohol.

PARATYPE.—Female instar in the collections of the Zoological Station of Naples, Italy; valves in alcohol, some appendages on slides, others in alcohol.

TYPE-LOCALITY.—Gulf of Naples, Italy, near Benta Palumma.

MATERIAL.—1 juvenile ♂ (estimated at N-1 instar) collected in muddy sand from near Benta

Palumma, Gulf of Naples, at depth of 55 m, on 27 April 1966 by L. S. Kornicker; 1 juvenile ♀ (estimated as N-2 instar) collected in same sample as ♂ instar above.

DISTRIBUTION.—Gulf of Naples.

DESCRIPTION OF MALE INSTAR (Figure 18).—Carapace elongate, oval in lateral view with height 49 percent of length; anterior and posterior ends evenly rounded (Figure 18a); inferior tip of rostrum with short broad spines (not readily visible except under oil immersion); inner angle of incisor acute with lateral overlap of dorsal edge.

Ornamentation: Shell smooth without hairs or pits; valves almost opaque, but with lateral eyes and muscle scars visible in lateral view.

Infold (Figures 18d–f, 19c–f): Broad anteriorly and posteriorly, narrow ventrally; infold above incisor with about 12 bristles in row parallel to upper edge of incisor, 16 long (some spinous) and 14 short bristles in row parallel to anterodorsal margin of valve, about 7 bristles on low transverse ridge, and 6 bristles between the bristles on transverse ridge and anterior margin of valve; infold below rostrum with about 25 long, and numerous very short, bristles followed by about 12 long bristles evenly spaced along the ventral margin; posterior ridge with broad transparent spines and short spines; infold between posterior ridge and posterior margin of valve with numerous bristles in row parallel to posteroventral margin, and 5 or 6 faint minute processes.

Hinge: Linear along dorsal margin.

Marginal pore canals: Fairly numerous along free margins.

Central muscle scars (Figure 18b,c): Consisting of 14–16 individual oval scars.

Selvage: Lamellar prolongation narrow, bare, except for fringe of short hairs along anterodorsal margin of each valve, and long hairs along lower edge of incisor (Figure 19c–d).

Size: Length 1.54 mm, height 0.75 mm; height 49 percent of length.

Micromorphology based on scanning-electron photomicrographs: Outer surface with scattered long bristles emerging from open pores ringed by concentric ridges (Figure 19a); minute simple pore often near ringed pore (Figure 19a); open pores with raised rim widely spaced on surface of valve (Figure 19b). Fringed lamellar prolongation present on selvage along lower margin of incisor (Fig-



FIGURE 18.—*Priontoleberis gyion*, new species, USNM 120344, juvenile male: *a*, carapace, length 1.54 mm; *b*, muscle scars left valve, lateral view; *c*, muscle scars right valve, lateral view; *d*, anterior left valve, medial view; *e*, central part ventral margin left valve, medial view; *f*, tip of rostrum left valve, medial view; *g*, 1st antenna, medial view; *h*, 2nd antenna, lateral view (not all bristles of exopodite shown); *i*, mandible, medial view (bristles of end joint not shown); *j*, 6th limb; *k*, anterior part maxilla, medial view; *l*, distal part 7th limb; *m*, furca; *n*, lateral eye; *o*, upper lip; *p*, rod-shaped organ and medial eye.

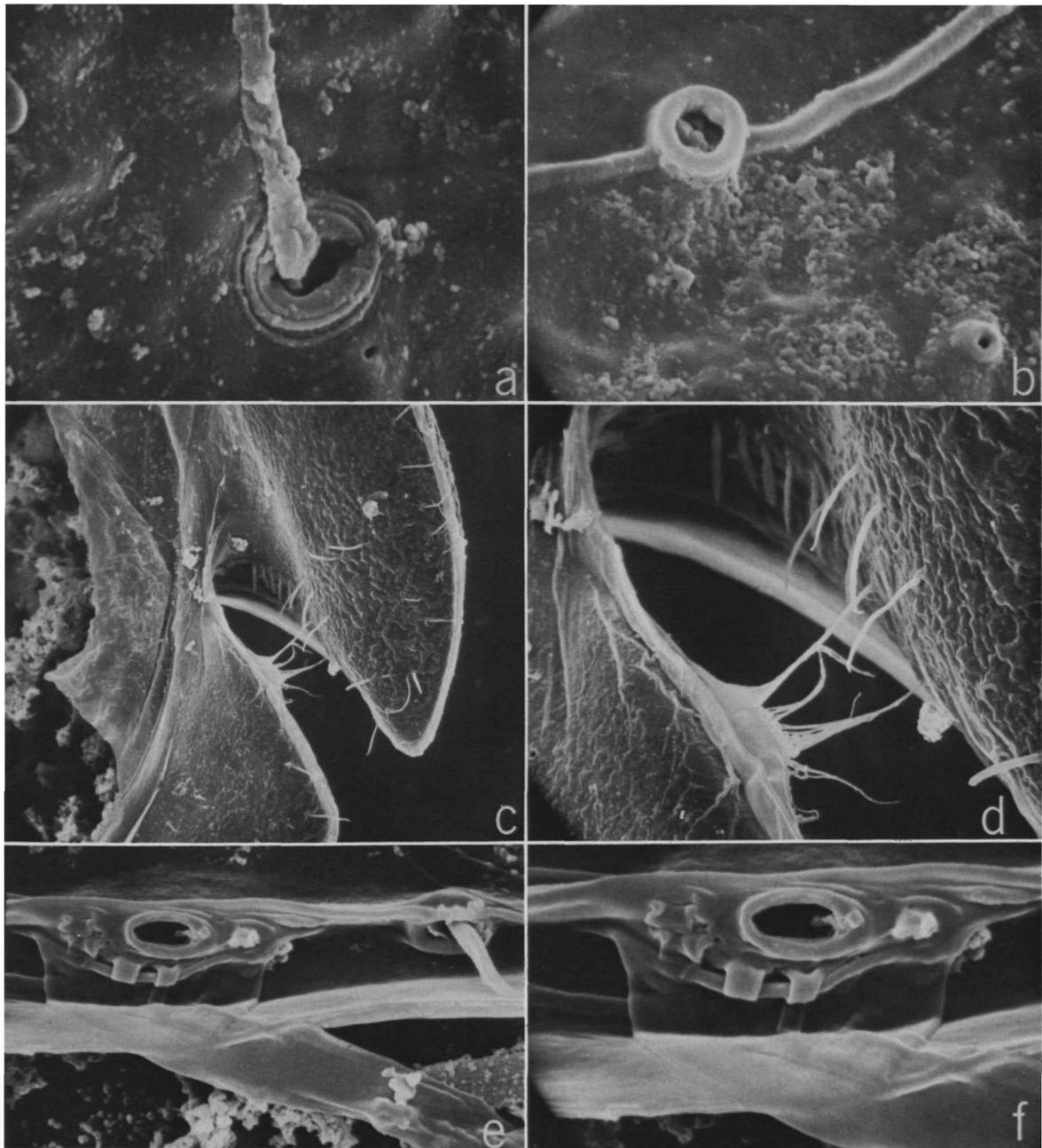


FIGURE 19.—*Prionotoleberis gyion*, new species, USNM 120344, juvenile male, left valve: *a*, bristle and pore with concentric ridges on outer side of valve,  $\times 8000$ ; *b*, 2 pores with raised rim on outer side of valve,  $\times 8000$ ; *c*, incisur and rostrum, medial view,  $\times 3000$ ; *d*, detail of "c" showing fringed lamella prolongation on selvage along lower margin of incisur,  $\times 850$ ; *e*, flaplike bristle and simple bristle on posterior list,  $\times 4450$ ; *f*, detail of base of flaplike bristle shown in "e" showing tubelike pores,  $\times 7000$ . (Photos reduced to 82 percent.)

ure 19c-d). Posterior list with flaplike bristles with pores and tubes at their bases alternating with simple bristles emerging from open pores (Figure 19e-f).

First antenna (Figure 18g): 1st and 2nd joints with clusters of spines medially and laterally; 2nd joint with spinous distolateral bristle, and long spinous subterminal bristle on dorsal margin; 3rd joint with short ventral bristle and 6 spinous dorsal bristles; 4th joint with 3 spinous terminal bristles, 1 dorsally, 2 ventrally; 3rd and 4th joints separated by weak suture; sensory bristle of 5th joint with thick trunk, 1 short proximal filament and 6 terminal filaments; 6th joint with spinous medial bristle overreaching claw of 7th joint. 7th joint with a-, b-, and c-bristles: a-bristle clawlike, curved; b-bristle with 4 marginal filaments; c-bristle with 8 marginal filaments. 8th joint with e-, f-, and g-bristles: e-bristle about one half length of g-bristle; f-bristle at right angles to stem, with about 6 short spines proximally, and 5 marginal filaments distally, 2 of the filaments with marginal spines; g-bristle with 6 marginal filaments.

Second antenna (Figure 18h): Protopodite with medial distal bristle, 1 or 2 spines along anterior margin, and clusters of spines on medial surface. Endopodite 3-jointed, with long bristle near middle of 3rd joint. Exopodite: 1st joint with medial spines in cluster subterminally near inner margin; joints 3-9 with large basal spines; joints 2-8 with short distal spines in row along lateral and medial margins; joints 3-9 with short peg and spines present on corner of joint opposite basal spine; bristle of 2nd joint terminating close to proximal margin of 9th joint, and with ventral margin having stout spines proximally and slender spines distally; bristles of joints 3 and 4 with many ventral spines; bristles of joints 5-7 with few; bristles of joints 3-8 with natatory hairs; 9th joint with 2 unequal long bristles with natatory hairs, and 2 unequal short bristles with marginal spines.

Right mandible (Figure 18i): Basale: lateral surface with clusters of spines; dorsal margin with 3 long spinous bristles, 1 medial near middle, and 2 subterminal; endite with 4 triaenid bristles having 3 pairs of spines distally, 4 spinous bristles, 2 bare dwarf bristles and glandular peg. Exopodite about three-fourths length of 1st endopodite joint, with 2 short bristles and hairs terminally. Endopodite; 1st and 2nd joints each with 3 spinous ventral bristles;

dorsal margin of 2nd endopodite joint with stout a-, b-, c-, and d-bristles, 1 short spinous bristle proximal to a-bristle, 1 short spinous bristle medially between a- and b-bristles, 2 short spinous bristles medially between b- and c-bristles, 5 spinous bristles in transverse row medially near d-bristle, 1 long slender spinous bristle between c- and d-bristles, and 1 medium spinous bristle distal and medial to d-bristle; d-bristle with marginal spines; c-bristle stouter and shorter than b- and c-bristles; 3rd endopodite joint with stout dorsal claw and 5 bristles, 3 stout, 2 slender. Coxale endite: ventral branch with sharp spines in 4 rows, and tip with 3 stout spines; dorsal branch with ventral margin with 1 pointed double-tooth followed by 3 rounded double-teeth and 4 small projections; main tooth of dorsal branch with spines along inner margin; dorsal margin of dorsal branch serrate; distal bristle of endite overreaching tip; small medial bristle present near basis of ventral branch.

Left mandible: Left mandible differing from right in having no proximal bristle on dorsal margin of 2nd joint of endopodite, and in having only 1 triaenid bristle, 3 spinous bristles, 2 dwarf bristles, and glandular peg on basale endite (the sparsity of bristles on the endite suggests that it is abnormal).

Maxilla (Figure 18k): Endites covered with debris and could not be observed; in other features, similar to that of female described below.

Fifth limb: Similar to that of female described below.

Sixth limb (appendage with some bristles missing, and coated with much debris; Figure 18j): Anterior margin with 2 endite bristles and short hairs; anteroventral corner with 3 or 4 spinous bristles; anterior margin of lateral sole with 1 spinous bristle and numerous long hairs; ventral margin posterior to lateral sole with hairs followed by 14 (estimated) bristles with long proximal and short distal spines, 2 bristles with long spines, a space without spines, and then 5 bristles with long spines; posterior margin and medial surface hirsute: 2 small medial bristles present proximally near anterior margin.

Seventh limb (Figure 18l): Terminus with opposing combs, each comb with about 16 spinous teeth. Bristles in distal group: 6, proximal group: 6, each with 2-4 bells; tip of each bristle elongate, spinous.

Upper lip (Figure 18o): With low unpaired an-



FIGURE 20.—*Prionotoleberis gyion*, new species, paratype, juvenile female: *a*, carapace, length 1.39 mm; *b*, tip of rostrum left valve, medial view; *c*, muscle scars left valve, lateral view; *d*, muscle scars right valve, lateral view; *e*, anterior left valve, medial view; *f*, part of posteroventral margin left valve, medial view; *g*, tip of 1st antenna, medial view; *h*, proximal part 2nd antenna, medial view; *i*, part of margin 2nd endopodite joint of left mandible, medial view; *j*, part of margin of 2nd endopodite joint of right mandible, lateral view; *k*, maxilla, medial view (surface spines not shown); *l*, anterior part 5th limb, medial view (only few ventral bristles shown); *m*, 6th limb, lateral view; *n*, rod-shaped organ and medial eye.

terior part, and a pair of hirsute lobes posteriorly; each posterior lobe with elongate, hirsute, lateral lobe.

Furca (considerable debris in vicinity of secondary claws making observation difficult; Figure 18*m*): Each lamella with about 5 stout curved claws and 3 weak secondary claws, some bristle-like; stout claws with teeth along concave margins; claws 1-3 with fine spines along distal part of convex margins.

Eyes: Lateral eye (Figure 18*n*) pigmented, with about 19 ommatidia; medial eye (Figure 18*p*) pigmented, about same size as lateral eye.

Rod-shaped organ (Figure 18*p*): Elongate, expanding near middle and tapering distally.

Gills: 7 elongate gills present on each side of posterior.

DESCRIPTION OF FEMALE INSTAR (Figure 20).—Carapace quite similar to that of male instar described above except for size and minor variations in bristle distribution on inner lamella (Figure 20*a-f*). Minute indistinct processes (5 or 6) present between posterior list and valve margin.

Size: Length 1.39 mm, height 0.71 mm, height 51 percent of length.

First antenna (Figure 20*g*): Proximal filament on sensory bristle slightly longer than on male; f-bristle of 8th joint without short proximal spines; d-bristle present as short stump; other features similar to limb of male instar described above.

Second antenna (Figure 20*h*): Endopodite 3-jointed with long terminal bristle on 3rd joint. Exopodite without cluster of subterminal spines on medial surface of 1st joint, and with 1 short and 2 long bristles on 9th joint. In other features similar to appendage of male instar described above.

Mandible (Figure 20*i,j*): Basale endite with 3 triaenid bristles, 4 spinous bristles, 2 dwarf bristles and glandular peg. 2nd endopodite joint: short proximal bristle present on dorsal margin; a-, b-, c-, d-bristles with marginal spines. Other features similar to that of male instar described above.

Maxilla (Figure 20*k*): Epipodial appendage hirsute, pointed distally, less than one-half length of protopodite; proximal endite with 4 bristles, 3 long and 1 short; distal endite with 5 or 6 bristles, 3 long and 1 or 2 short. Basale: ventral margin with 1 short proximal and 1 long distal bristle; dorsal margin with 3 short bristles; medial surface hirsute with 1 short bristle near center anterior to endites.

Endopodite: 1st joint spinous, with 1 short subterminal bristle anteriorly and 1 long bristle posteriorly; 2nd joint with long terminal bristle.

Fifth limb (Figure 20*l*): Comb: Dorsal margin bare, straight (folded over in illustration); long lateral bristle spinous, considerably overreaching tip of comb; lateral side with 5 short bristles between basis of long bristle and ventral margin of comb; anterior edge with long hairs; ventral margin hirsute, and with numerous spinous bristles.

Sixth limb (Figure 20*m*): Anterior margin with 2 endite bristles and short hairs; anteroventral corner with 2 or 3 spinous bristles; anterior margin of lateral sole with 1 spinous bristle and numerous long hairs; ventral margin posterior to lateral sole with hairs followed by 14 bristles with long proximal and short distal spines, 2 bristles with long spines, a space without spines but with marginal hairs, and then 5 bristles with long spines; posterior margin and medial surface hirsute.

Seventh limb, rod-shaped organ, eyes (Figure 20*n*): Similar to those of male instar described above.

Furca: Similar to male instar except for having fewer secondary claws.

### *Polyleberis*, new genus

ETYMOLOGY.—The generic name *Polyleberis* is from the Greek *poly* (many) + *leberis* (sloughed skin). Gender: feminine.

TYPE-SPECIES.—*Polyleberis mackenziei*, new species.

Additional specimens of the type-species, including adult females, were collected off Mauritania (Kornicker and Caraion, 1974). The diagnosis of the genus is based partly on those specimens.

DIAGNOSIS OF GENUS.—First antenna: Sensory bristle on adult female without short proximal filament and with 7-9 terminal filaments; d-bristle of 8th joint absent or minute. Mandible: Exopodite less than one-third length of dorsal margin of 1st joint of endopodite; no long slender bristle between b- and c-bristles of 2nd joint of endopodite; 2nd and 3rd joints of endopodite separated by suture, and longer than 1st joint. Maxilla: End joint with only 1 long bristle.

COMPARISONS.—The only other genus with a short exopodite on the mandible is *Cylindroleberis*. *Polyleberis* differs from that genus in not having a



FIGURE 21.—*Polyleberis mackenziei*, new species, ♀ holotype: a, carapace, length 1.69 mm; b, part of posterior margin right valve, medial view; c, anterior part right valve, medial view; d, right 1st antenna, lateral view; e, endopodite and part of protopodite of right 2nd antenna, medial view; f, right mandible, lateral view; g, anterior part of right 5th limb, lateral view; h, anterior tip of maxilla; i, anterior tip of epipodite of maxilla; j, right 6th limb, lateral view; k, anterior part of animal; l, furca with claws 1-3 omitted; m, claw 1 of furca; n, tip of bristle of 7th limb.

short proximal filament on the sensory bristle on the 1st antenna of the adult female.

*Polyleberis mackenziei*, new species

FIGURES 21, 22

ETYMOLOGY.—The species is named for Dr. Kenneth G. McKenzie.

HOLOTYPE.—1 ♀ described herein. Appendages on slides, 1 valve in alcohol, 1 valve gold-plated, dry. In collection of Zoological Station of Naples.

TYPE-LOCALITY.—Gulf of Naples, Italy.

MATERIAL.—1 ♀ without eggs (may not be mature) from station B22, Gulf of Naples; collected by Harbans S. Puri and Gioacchino Bonaduce.

DISTRIBUTION.—Gulf of Naples.

DESCRIPTION.—Carapace oval in lateral view with height 46 percent of length (Figure 21a); inner angle of incisur acute with upper margin overlapping lower laterally (Figure 22a,d,e); inferior corner of rostrum smooth and slightly rounded; posterior evenly rounded without caudal process.

Ornamentation: Shell smooth; valves translucent, lateral eyes and muscle scars visible in external view.

Infold (Figures 21b,c; 22 d-l): Rostrum above incisur with about 25 long bristles and 9 or more short spines; Infold below incisur with about 15 long bristles and numerous short spines; Infold broadening along posterior of valve, and with ridge along inner margin with short spines and broad transparent flap-like spines; 4 processes and numerous pores present in row between inner ridge and posterior shell margin; infold along ventral margin of valve with scattered bristles.

Marginal pore canals: Numerous around free margins.

Central muscle scars: Consisting of about 12 ovoid scars.

Selvage: Fringed with long hairs along antero-dorsal margin of valve and along lower edge of incisur.

Size: Length 1.69 mm, height 0.78 mm.

Micromorphology of carapace (based on scanning-electron photomicrographs): Outer surface with scattered bristles emerging from open pores surrounded by concentric ridges (Figure 22b) and widely spaced minute rimmed pores without bristles (Figure 22c). Posterior infold with flaplike

bristles with tubelike pores at bases alternating with simple bristles emerging from open pores (Figure 22f,i-k). Infold between posterior infold and posterior valve margin with scooplike processes and pores forming row near valve margin (Figure 22f-i) (the posterior pores appear to emerge from linear raised tubes, but their raised nature may be the result of the freeze-drying process).

First antenna (Figure 21d): 1st and 2nd joints with clusters of spines on lateral and medial surfaces; 2nd joint with short bare lateral bristle without visible annulations, and spinous recurved bristle on dorsal margin near distal end; 3rd and 4th joints not separated by distinct suture. 3rd joint: ventral margin with short annulate spine; dorsal margin with 6 spinous bristles; proximal bristle of dorsal margin with basis on prominence. 4th joint with 1 spinous dorsal bristle and 2 ventral bristles, 1 spinous, 1 bare; 5th joint with stout sensory bristle having 9 long distal filaments on right appendage and 8 on left; 6th joint with slender medial bristle reaching tip of a-claw of 7th joint; 7th joint with stout a-claw about 80 percent length of joints 5-7, b-bristle with 2 short proximal and 3 long distal filaments, c-bristle with 6 marginal filaments; 8th joint with minute d-bristle, e-bristle overreaching a-claw, f-bristle with 4 spinous proximal filaments and 1 bare distal filament, g-bristle with 6 marginal filaments.

Second antenna (Figure 21e): Protopodite with short distal medial bristle; endopodite without distinct sutures delimiting joints, and with terminal bristle slightly longer than stem of endopodite. Exopodite: 2nd joint with spinous bristle reaching middle of 9th joint; joints 5-8 with 1 basal spine, joint 9 with 2; joints 2-8 with comb of short spines along distal margin; bristles on joints 2-5 with short spines along margin; bristles of joints 3-8 with long marginal hairs; joint 9 with 3 unequal bristles, shortest bristle bare or with short spines, others with long hairs.

Mandible (Figure 21f): Basale: Endite with 2 dwarf bristles, 4 triaenid bristles with 2-4 pairs of distal spines, 4 spinous terminal bristles and minute glandular peg; dorsal margin with 2 long subterminal bristles and 1 midbristle about length of dorsal margin. Exopodite less than one-third length of dorsal margin of 1st exopodite joint, with 2 short bristles and hirsute process terminally; 1st exopodite joint with 2 long bristles with long

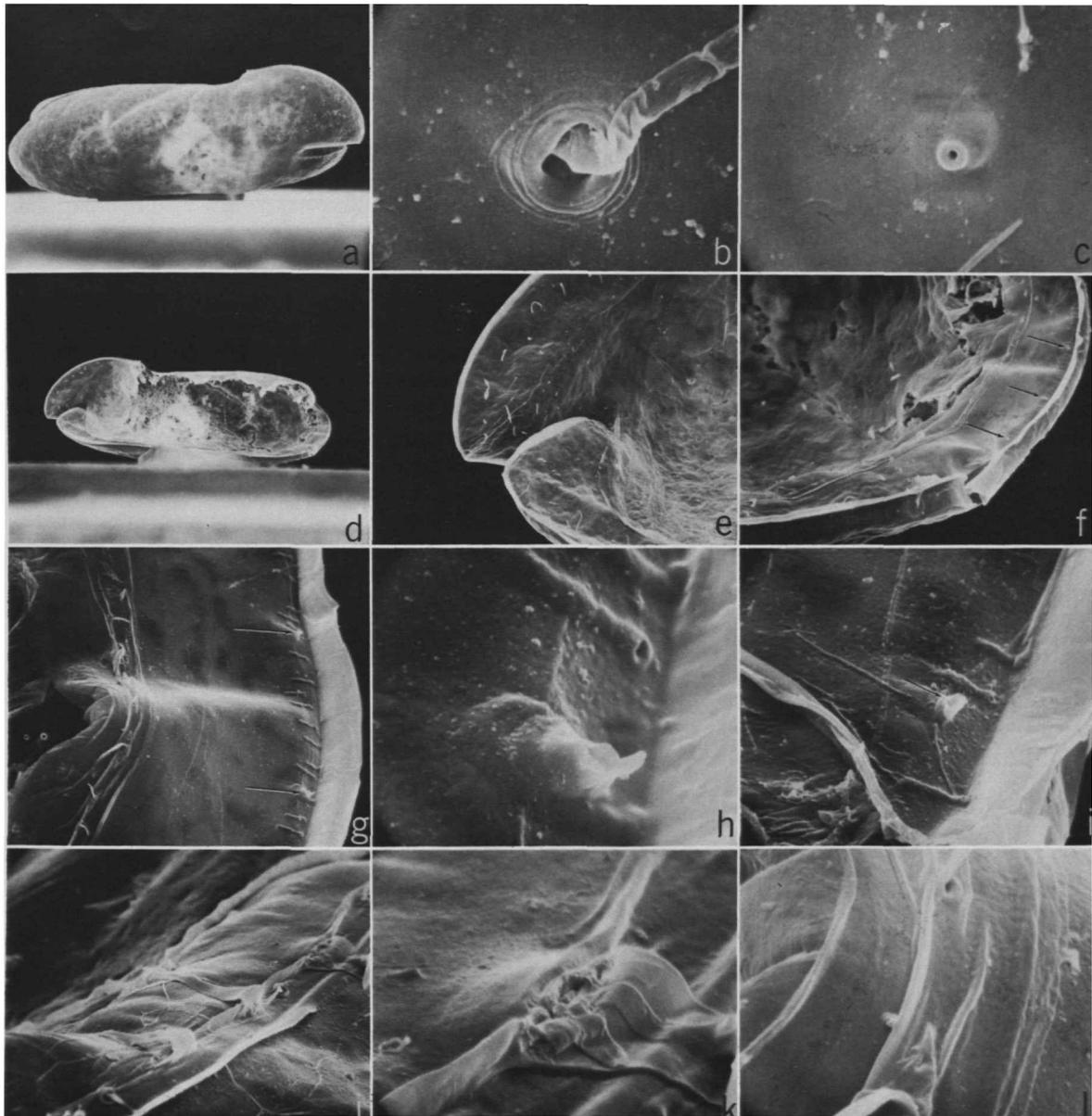


FIGURE 22.—*Polyleberis mackenziei*, new species, ♀ holotype, right valve: *a*, complete valve, lateral view,  $\times 62$ ; *b*, lateral bristle and pore with concentric ridges,  $\times 10,000$ ; *c*, simple lateral pore,  $\times 10,000$ ; *d*, complete valve, medial view,  $\times 50$ ; *e*, detail of anterior shown in "*d*",  $\times 200$ ; *f*, detail of posteroventral part of valve shown in "*d*",  $\times 150$ ; *g*, detail of "*f*" showing posterior infold (2 processes indicated by arrows),  $\times 1000$ ; *h*, detail of "*g*" showing lower process,  $\times 3000$ ; *i*, detail of "*f*" showing lower process,  $\times 2500$ ; *j*, detail of posterior list showing flaplike bristles and adjacent simple bristles,  $\times 2000$ ; *k*, detail of "*j*" showing flaplike bristle and tubes emerging from pores at base of bristle,  $\times 7500$ ; *l*, detail of posterior list showing near top a bristle emerging from simple pore, and near bottom the base of a flaplike bristle,  $\times 5000$ . (Photos reduced to 55 percent).

spines and 1 medium bristle with short spines. 2nd exopodite joint: ventral margin with 3 terminal bristles, 2 long with spines, 1 medium with faint spines distally; dorsal margin with stout a-, b-, c-, and d-bristles, 1 short proximal bristle, 1 long spinous bristle between c- and d-bristles, 1 long bristle distal to d-bristle; a-, b-, d-bristles with marginal spines, c-bristle bare; medial side near dorsal margin with short bristle near base of b-bristle; 5 short bristles in transverse row present near base of c-bristle. End joint with short dorsal claw and 5 slender-to-stout bristles. Coxale endite: short spine present near base; ventral branch with row of sharp spines (remainder obscure).

Maxilla (Figure 21*h*,*i*): Proximal endite with 4 bristles, 3 long and 1 short; distal endite with 3 long bristles; basale with 1 short ventral bristle near middle, 1 long spinous distal bristle, and 1 short dorsal bristle; Endopodite: 1st joint with short dorsal bristle and long spinous B-bristle; 2nd joint with long spinous bristle; epipodite narrow, pointed, hirsute.

Fifth limb (Figure 21*g*): Comb: Dorsal margin smooth; anterior end with long hairs; distal bristles of comb longer than others; long lateral bristle overreaching end of comb.

Sixth limb (Figure 21*j*): Anterior margin with 2 bristles and hairs; anteroventral end with 5 bristles. Posteroventral margin with 23 bristles on right appendage and 21 on left; of these, the posterior 4 bristles longer than others, the posterior 9 bristles have long marginal spines, and the anterior 12-14 bristles have long proximal spines and short distal spines. Medial surface and posterior margin hirsute.

Seventh limb (Figure 21*n*): Terminal comb with about 12 spinous teeth on each side; 6 bristles present in both proximal and distal groups, 3 on each side; each bristle with 3-5 distal bells.

Furca (Figure 21*m*): Each lamella with 9 claws; last claw pointing posteriorly; claws 1-6 only weakly spined along the anterior and posterior distal margins; margin of lamella posterior to claw 9 with comb of spines followed by space and then spines in continuous row along margin.

Upper lip (Figure 21*k*): Helmet shaped, hirsute; triangular protuberance between lip and basis of each 1st antenna.

Eyes (Figure 21*k*): Lateral eyes pigmented each

with 21-23 ommatidia. Medial eye about same size as lateral eye.

Rod-shaped organ (Figure 21*k*): Elongate, somewhat expanding near middle, tapering distally.

Dorsum: Hirsute except immediately above furca, but without dorsal process.

Gills: Elongate, about 8 on each side.

#### CYCLASTEROPINAE Poulsen, 1965

This subfamily is represented in the collections by only one genus, *Cycloleberis* Skogsberg, 1920, with one species.

#### *Cycloleberis* Skogsberg, 1920

TYPE-SPECIES.—*Cycloleberis lobiancoi* (Müller) by Skogsberg (1920:442).

#### *Cycloleberis lobiancoi* (Müller, 1894)

##### FIGURES 23-26

*Cylindroleberis lobiancoi* Müller, 1894:220, pl. 4: figs. 40, 42, pl. 5: figs. 2-3, 26, 32, 34, 40, pl. 40: figs. 36, 42, 44, [not Sharpe, 1908:424, pl. 63: figs. 1-5, pl. 65: figs. 3-7].

*Cyclasterope lobiancoi*.—Müller, 1912:48 [key, diagnosis].—Klie, 1943:49, figs. 1-4[?].—Puri, 1963:2 [listed].—Reys, 1965b:256, 258 [listed].

*Cycloleberis lobiancoi*.—Skogsberg, 1920:437, 442 [discussion].—Poulsen, 1965:238 [discussion], 245 [key].

*Cyclasterope* (*Cycloleberis*) *lobiancoi*.—Sylvester-Bradley, 1961:Q402 [revision].

Not *Cyclasterope lobiancoi*.—Barney, 1921:179, fig. 2.

MATERIAL.—One adult ♀ without eggs from station B31 Gulf of Naples; collected by Harbans S. Puri and Gioacchino Bonaduce. Presently with some appendages on slides, and remaining appendages and valves in alcohol, all in collection of Zoological Station of Naples.

DISTRIBUTION.—Mediterranean: Gulf of Naples, Gulf of Marseille (Reys, 1965b:258). Questionably in Atlantic Ocean off northwest Africa (Klie, 1943:50).

DISCUSSION.—Müller (1894:221) based his description of *C. lobiancoi* on 2 females collected in the Gulf of Naples. Unfortunately Müller's specimens have not been located and apparently are not in the collections of the Zoological Institute of Greifswald or the Zoological Museum of Berlin. The female described herein was collected in the

Gulf of Naples by Harbans S Puri and Gioacchino Bonaduce. Therefore, it is necessary to consider whether this specimen is conspecific with those described by Müller. Primarily because of the similarity of carapace size, furca, and terminal comb of the 7th limb, I have concluded that this specimen is conspecific with that described by Müller. However, differences in the morphology of the coxale endite of the mandible and especially the endopodite of the 2nd antenna leave open a possibility that the specimen described herein is new. For example, the penultimate joint of the endopodite of the 2nd antenna of Müller's specimen (1894, pl. 5: fig. 34) bears 5 bristles compared to only 2 on the specimen described herein. I have assumed that this difference is the result of variability within the species. Furthermore, the specimen described herein has a brush-shaped organ. I have assumed this organ was overlooked by Müller. Other differences are attributed to variability within the species or due to features having been overlooked or interpreted differently by Müller.

Poulsen (1965:245), in a key to species of *Cycloleberis*, distinguished *C. lobiancoi* from *C. orbicularis* (Brady, 1897) and *C. galathea* Poulsen, 1965, by *C. lobiancoi* having "the terminal bristle of the endite of the mandible coxale placed at some distance from the tip of the endite," whereas, the other 2 species have "this bristle placed on the tip of the endite." On the specimen I examined it was difficult to ascertain the exact position of the base of the terminal bristle, but I have concluded that it is probably at the tip as shown by Müller (1894, pl. 4: fig. 42), or at least close to it. It is not some distance from the tip as on the larval male illustrated by Klie (1943:51, fig. 2), whose identification I have questioned. The shallowness of the concavities between the main furcal claws of specimens identified as *Cylindroleberis lobianci* by Sharpe (1908), and the large size of specimens identified as *Cyclasterope lobiancoi* by Barney (1921) precludes their being included in *Cycloleberis lobiancoi*.

The 1st joint of the endopodite of the 2nd antenna on females of some species of *Cycloleberis* may be interpreted as having a short proximal and long distal part separated by a weak-to-strong suture. The proximal segment usually bears a few short bristles. On other species, such as *C. lobiancoi*, a few short bristles appear to be on the protopodite near the base of a 3-jointed endopodite.

Because the 1st joint of the endopodite of the male of *Cycloleberis* (Poulsen, 1965:269, fig. 90d) bears several short proximal bristles, it is expedient for comparative purposes to consider the short bristles on the protopodite of *C. lobiancoi* to be on a proximal segment of the 1st endopodial joint.

**DESCRIPTION.**—Complete carapace oval in lateral view with height 83 percent of length (Figures 23a-d, 24a, 25b); left valve overlapping right along dorsal margin; inferior margin of rostrum pointed; inner margin of incisur rounded; posterior evenly rounded without caudal process.

**Ornamentation:** Shell with frosted appearance and numerous fosse (Figure 24); valves almost opaque, with lateral eyes and muscle scars barely visible in external view; lower margin of incisur with several lateral bristles. Examined specimen with numerous microconcretions of secondary calcite.

**Infold** (Figures 23a,d, 25): Broad and vestibule deep along ventral and posterior margins, and also along anterior margin except behind incisur; infold above incisur with about 270 bristles, below incisur and along ventral margin with about 175 bristles; anterior to posterior margin with about 240 bristles in vicinity of list and about 75 small bristles between list and outer margin.

**Hinge:** Hingement extending along posterior two-thirds of dorsal margin; valve edge anterior to end of hinge with series of denticulations (Figure 23c). A longer row of denticulations on the right valve of *Cyclasterope fascigera* Brady, 1902, was said by Skogsberg (1920:542) to resemble a string of pearls.

**Marginal pore canals:** Numerous around free margins.

**Central muscle scars:** Obscured by secondary calcification. Klie (1943:52, fig. 4) shows about 39 oval-to-elongate muscle scars for *C. lobiancoi*.

**Selvage:** Lamellar prolongation of selvage on rostrum narrow with smooth edge becoming hirsute near anterior hinge element; lamellar prolongation not observed in other parts of shell.

**Size:** Length of ♀ examined 4.29 mm, height 3.53 mm. Müller (1894:221) reported length of ♀ as 4.3 mm.

**Micromorphology of carapace** (based on scanning-electron photomicrographs): Outer surface with abundant shallow fossae with reticulate flat bottom and acentric bristle with bulbous base Fig-



FIGURE 23.—*Cycloleberis lobiancoi*, adult ♀, length 4.29 mm: a, anterior part left valve, medial view; b, anterior part left valve, lateral view; c, anterior part of hinge, left valve, dorsal view; d, part of posteroventral margin, left valve, medial view; e, right 1st antenna, medial view; f, left 2nd antenna, medial view; g, coxale endite of mandible, medial view; h, left mandible, medial view; i, left maxilla, medial view.

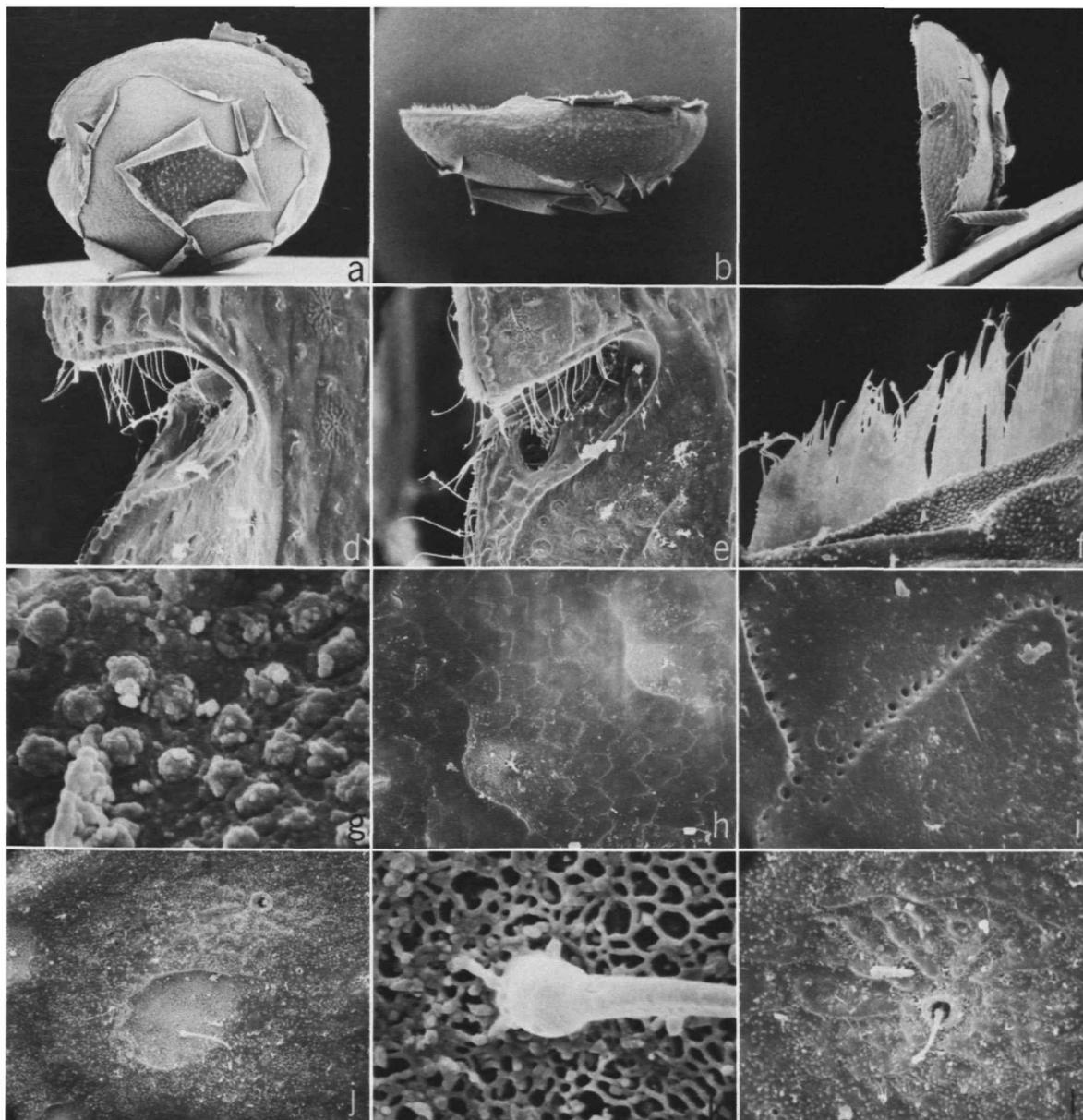


FIGURE 24.—*Cycloleberis lobiancoi*, adult female, left valve: *a*, complete valve, lateral view,  $\times 22$ ; *b*, dorsal view,  $\times 25$ ; *c*, anterior view,  $\times 21$ ; *d*, incisur, lateral view, detail from "a",  $\times 200$ ; *e*, incisur, anterior view, detail from "c",  $\times 150$ ; *f*, posterior end of lamellar prolongation of selvage along anterodorsal margin, detail from "b",  $\times 1130$ ; *g*, detail of pustulae on carapace, detail from "f",  $\times 11,300$ ; *h*, surface of valve, detail from "a",  $\times 540$ ; *i*, detail of pores on valve surface,  $\times 5600$ ; *j*, fossae with bristle and pore with bristle on valve surface,  $\times 615$ ; *k*, bottom of fossae and bristle shown in "j",  $\times 8400$ ; *l*, detail of pore and bristle, note radial ridges around pore,  $\times 1200$ . (Photos reduced to 55 percent.)

ure 24a-e,h,j,k); anterior and ventral fossae with adjacent oblique ridge anterior or anteroventral to fossae (Figure 24a,c-e,h); surface between fossae faintly reticulate (Figure 24h), pores present along margins of reticulations (Figure 24i); small bristles emerging from widely scattered open pores (Figure 24j,l); open pores surrounded by faint radial ridges (Figure 24d,j,l); surface between some fossae and along anterodorsal margin with numerous pustulae (Figure 24f,g,l). Posterior list with anterior row of bristles emerging from open pores (Figure 25g,k,l) and anterior row of bristles emerging from closed pores (on specimen examined bristles missing from many pores, Figure 25f-k); bristles from closed pores consist of a short tubelike bristle with pore at base (Figure 25g-h) alternating with a long stout bristle (on specimen examined bristles are missing but are represented by basal remnant, Figure 25i,j); where long stout bristles are missing, several pores visible at bases (Figure 25h-l); a short raised pore present between pairs of closed pores and slightly anterior to them (see middle of Figure 25k). (The knowledge that many bristles are missing from the posterior list was gained from study of a specimen of the genus collected off Mauritania (Kornicker and Caraión, 1974)). Infold between posterior list and posterior margin of valve with bristles forming row just anterior to posterior margin of valve (see arrows on Figure 25f). Lamellar prolongations fringed on selvage along anterodorsal margin (Figure 25b,f); lamellar prolongation of selvage and list along anteroventral and part of ventral margin (Figure 25a-e) probably form current channel when valve is closed.

First antenna (Figure 23e): 1st and 2nd joints hirsute; dorsal margin of second joint with 5 spinous bristles near middle and 1 terminal; lateral surface with 7 or 8 spinous distal bristles; 3rd joint with 1 short bare ventral bristle and 16 dorsal bristles, most with long or short spines; 4th joint with 1 spinous dorsal bristle and 5 spinous ventral bristles, all bristles terminal; dorsal margin of 5th joint convex, smooth; sensory bristle with 2 short proximal filaments and 14 long distal filaments, proximal of latter filaments being half length of others; medial bristle of 6th joint long, spinous. 7th joint: a-bristle claw-like, equal in length to stem of sensory bristles of 5th joint; b-bristle long, with about 14 filaments; c-bristle (broken) with about 10 filaments. 8th joint: d- and e-bristles slightly longer than sen-

sory bristle of 5th joint; f-bristle at angle to a-bristle, bearing about 9 filaments.

Second antenna (Figure 23f): Protopodite with small bare medial bristle, and with about 4 hairs medially near dorsal margin, and numerous spines along ventral margin. Endopodite 3 jointed: 1st joint with 3 short proximal and 5 or 6 longer distal bristles; 2nd joint with 2 or 3 bristles; 3rd joint with 1 long terminal bristle reaching 4th joint of exopodite, all bristles bare. Exopodite: 1st joint with distomedial spine and minute teeth along lateral side near concave dorsal margin; 2nd to 8th joints with short basal spines and hirsute bristles; 9th joint with short lateral spine and 1 short, 1 medium, and 3 long hirsute bristles; bristles on 2nd to 8th joints and 3 long bristles on 9th joint with short ventral spines on proximal half; distal margins of 2nd to 8th joints with comb of short spines.

The endopodite illustrated by Müller (1894, pl. 5, fig. 34) differs from the one described above in having a total of 16 bristles compared to only 12 on the above specimen.

Mandible (Figure 23g,h): Coxale endite with slender annulate proximal bristle; ventral margin of dorsal branch with spines in transverse rows proximally and 8 teeth distally: 1st tooth with posterior spines, 2nd-4th with posterior secondary teeth, 5th-8th with anterior spines; margin between 8th tooth and tip of branch serrate; terminal bristle long slender with few short marginal spines; dorsal margin of dorsal branch with spines distally. Ventral branch with slender spines proximally and stouter sharply pointed spines in about 4 transverse rows distally; tip of branch with 2 rounded teeth dorsally and 1 serrate tooth ventrally. Basale: endite with 6 short and about 17 long bristles, mostly triaenid type; ventral margin with 16 triaenid bristles and 1 long and 1 medium distal spinous bristle; medial surface near ventral margin with 8 short bristles; lateral surface near ventral margin with 3 short bristles; dorsal margin with 7 bristles distally, 2 long and spinous, 3 medium, 2 short; medial surface with clusters of slender spines. Exopodite reaching past distal margin of 1st endopodite joint; surface hirsute distally; ventral margin with 2 subequal bristles near middle. Endopodite: ventral margin of 1st joint with 1 short and 8 longer bristles; dorsal margin of 2nd joint with numerous bristles; ventral margin with 6 terminal bristles; distal medial surface with short spinous

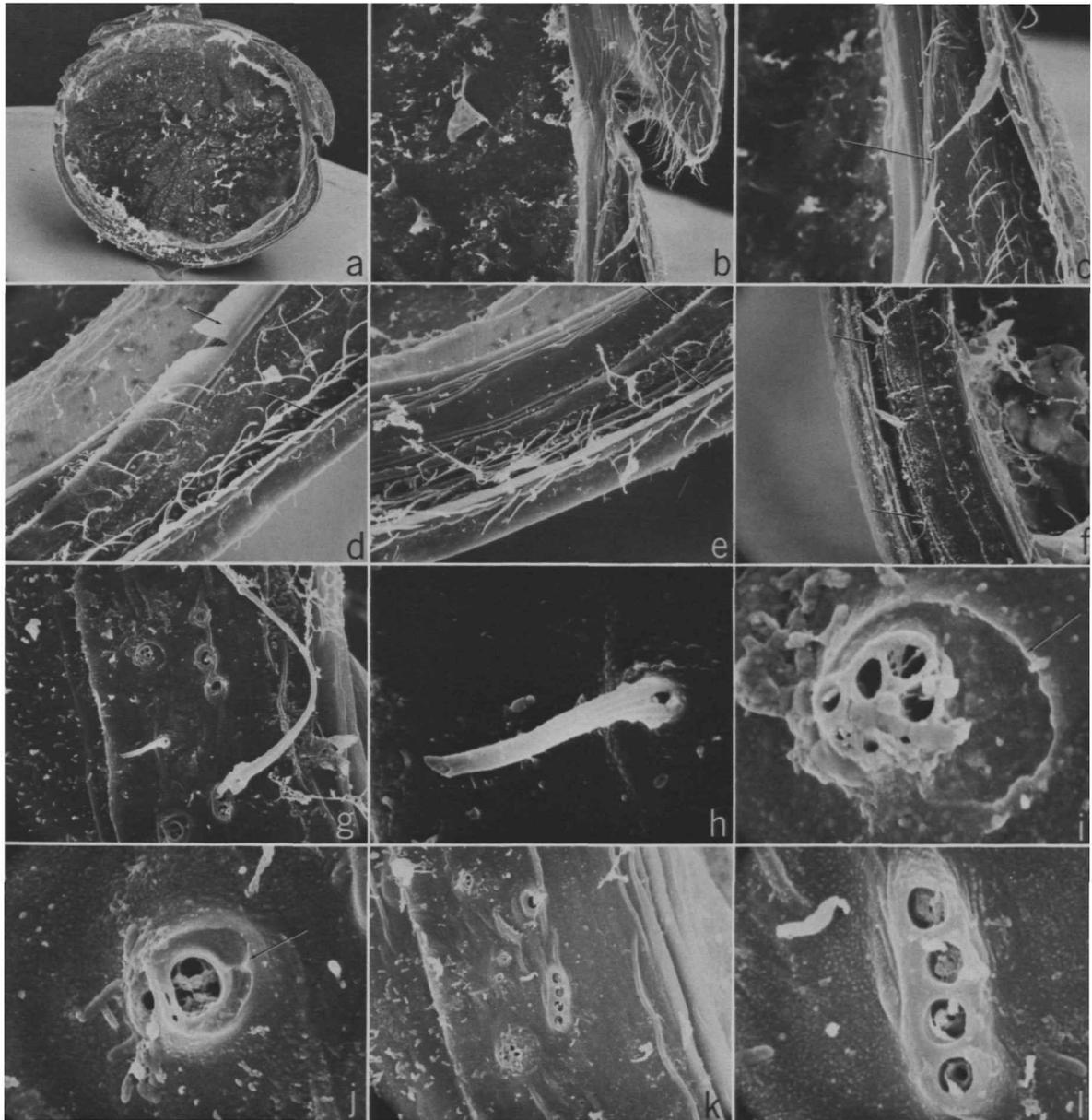


FIGURE 25.—*Cycloleberis lobiancoi*, adult female, left valve, medial view: *a*, complete valve,  $\times 20$ ; *b*, incisur and rostrum,  $\times 100$ ; *c*, detail of infold ventral to incisur, dorsal end of inner lamellar prolongation on list indicated by arrow,  $\times 200$ ; *d*, infold adjacent to that shown in "c", inner and outer lamellar prolongations on list and selvage indicated by arrows,  $\times 200$ ; *e*, infold adjacent to that shown in "d,"  $\times 200$ ; *f*, posterior edge of valve from "a",  $\times 200$ ; *g*, detail from upper end of "f" showing pores and bristles of list,  $\times 1250$ ; *h*, detail from "g" showing tubelike bristle,  $\times 6240$ ; *i*, detail of upper pore shown in "g" (arrow indicates remnant of wall of bristle that probably encircled pores),  $\times 10,000$ ; *j*, detail of lower pore shown in "g" (arrow indicates remnant of wall of bristle that probably encircled pores),  $\times 5000$ ; *k*, part of posterior list showing pores and bristle,  $\times 1250$ ; *l*, detail of 4 pores that probably contained bristles forming row in "k,"  $\times 5000$ . (Photos reduced to 55 percent.)

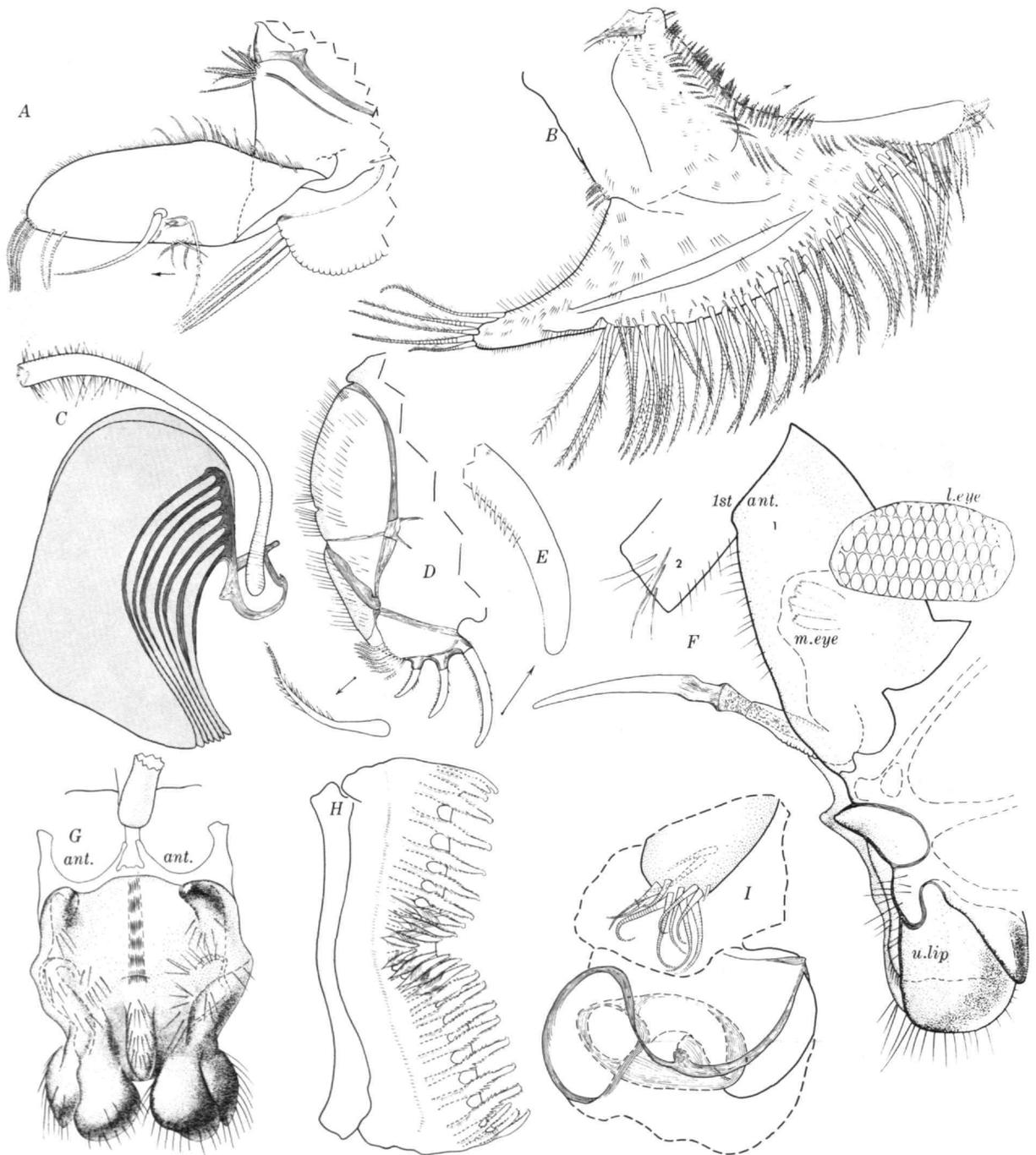


FIGURE 26.—*Cycloleberis lobiancoi*, adult female, length 4.29 mm: *a*, anterior of left 5th limb, lateral view; *b*, left 6th limb, medial view; *c*, 7th limb and gill-like structures; *d*, furca and posterior; *e*, detail of tip of claw 1; *f*, anterior part of animal, lateral view; *g*, anterior part of animal, anterior view; *h*, tip of 7th limb; *i*, brush-shaped organ and genital structure.

bristles in 5 transverse rows near dorsal margin; end joint with 3 stout claws, and 1 long, 1 medium and 1 short bristle.

Maxilla (Figure 23i): Epipodite narrow, bare, acuminate. Protopodite and basale not separated by distinct suture. Protopodite: proximal ventral margin with numerous long and short bristles on about 3 lobes, distal lobe located medially and with 6 bristles. Basale: medial surface hirsute, with 1 bristle ventral to proximal bristles on dorsal margin; lateral surface with 1 bristle near ventral margin; dorsal margin hirsute with 16 proximal and 8 distal bristles, each with a terminal papilla; ventral margin with 14 short bristles in medial row followed by 4 longer bristles; medially surface hirsute, with 5 short bristles distally. Exopodite small, with 2 short and 1 longer bristle. Endopodite: 1st joint hirsute, with short  $\alpha$ -bristle in middle of anterior margin and long spinous  $\beta$ -bristle terminal on posterior margin; end joint with 6 bristles.

Fifth limb (Figure 26a): Epipodial appendage with 102–105 hirsute bristles (only 3 distal bristles shown in Figure 26a); dorsal margin of comb hirsute, with 12 bare bristles, each with a terminal papilla; lateral side of comb with 2 slender bristles distally and 4 proximally, all near ventral margin, and 5 short bare bristles and 2 long spinous bristles near middle; stouter of latter bristles not overreaching anterior of appendage; comb margin with numerous spinous ventral bristles (only 5 distal bristles illustrated in Figure 26a); anterior vertical margin of appendage with numerous spinous bristles in row (not shown in Figure 26a) and 8 medial bristles proximally.

Sixth limb (Figure 26b): Protopodite: proximal end with 2 small bristles and several short triangular spines medially; anterior margin with spinous bristles in 2 rows medially, outer row with about 25 bristles, inner row with about 12 stouter bristles; distal posterior margin with 5 bristles on left appendage and 4 on right, bristles bare or with short spines; medial and lateral surfaces hirsute. End joint: anterior margin (between protopodite and a short suture) with continuation of 2 rows of spinous bristles present on medial surface of protopodite, outer row with 12 bristles, inner row with only 4; surface between inner and outer rows with 1 long spinous bristle; anterior margin distally of short suture with about 29 short and 3 long spinous bristles; posterior tip of joint with 1 short and 4

long spinous bristles; anterior three-fourths of ventral margin with about 80 bristles in roughly 3 rows extending onto the medial surface; of these, the more proximal rows containing shorter bristles; anterior margin of lateral flap extending only slightly and with 4–8 short hirsute marginal bristles; medial and lateral surfaces hirsute, but lateral surface with fewer hairs.

Seventh limb (Figure 26c): Length of limb 3.3 mm, width at tip 0.25 mm, width along proximal half 0.11 mm, length bearing lateral bristles 0.95 mm. Numerous bristles (about 90) on distal 42 segments, each bristle with 2–8 bells; about half of segments bearing 2 bristles on one side and 1 or 2 on other. Terminal comb with 50–55 teeth with serrate margins; proximal 9 teeth near middle of each side with chevron-like spines on outer sides (Figure 26h); tips of teeth bending inward.

Furca (Figure 26d,e): Each lamella with 3 main claws followed by 9 secondary claws; primary claws with 2 rows of teeth, 1 along concave margin, other on medial surface near concave margin; both rows composed of large teeth separated by 2 or 3 minute teeth; convex margins of main claws with hairs; concavity in lamella between bases of claws 1 and 2 with greatest depth 46–52 percent of greatest width (depth measured perpendicular to line connecting inner corners of distal ends of bases); concavity in lamella between bases of claws 2 and 3 with greatest depth 78–92 percent of greatest width; projections of lamella forming bases of claws 1 to 3 with medial hairs forming 2 rows; secondary claws 1 and 9 smaller than secondary claw 2; secondary claws with marginal teeth near middle and finer spines distally; secondary spines faintly annulate in distal half; base of secondary claw 1 very slightly offset from base of secondary claw 2; secondary claw 1 located immediately adjacent to main claw 3 on left lamella, but located about three-fourth width of base of claw 3 posterior to claw 3 on right lamella; short segment following lamellae with long hairs forming row; secondary claws 2 to 8 slightly decreasing in diameter posteriorly along lamella; secondary claws 2 and 3 slightly shorter than claws 4 to 8.

Posterior (Figure 26d): Posterior between furca and dorsum hirsute; dorsum with few minute spines; dorsal process absent.

Brush-shaped organ (Figure 26i): Short lobe

bearing 13 bristles, 1 of these being much shorter than remainder.

Genitalia (Figure 26i): Each genital organ consisting of a lobe with sclerotized components.

Lateral eyes (Figure 26f): Large, each with about 70 ommatidia in 5 rows, each row with 12–15 ommatidia.

Rod-shaped organ and medial eye (Figure 26f): Rod-shaped organ elongate with short proximal and long distal segments; proximal part of distal

segment striate with 2 expanded portions. Medial eye large, pigmented.

Upper lip and anterior (Figure 26f,g): Upper lip, with low unpaired anterior lobe and paired posterior lobes; each posterior lobe with a narrow lateral lobe at posterior, covering mouth; all lobes hirsute. Sclerotized protuberance present on anterior of body between base of each 1st antenna and posterior lobe.

Gills (Figure 26c): About 7 on each side, broad with acuminate tips.

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